Chapter 6 Management, Operation and Maintenance of the Improved Imphal Water Supply System

The provision of adequate, reliable and safe water supply services to the people of Imphal City requires an appropriate organisation and operating structure, as well as human resources that are ready, capable, and skilled to manage, operate and maintain and perform the required works during the construction stage and after project completion. For PHED Urban Circle, to become a self-supporting organisation that can achieve its legal mandates requires institutional development. This is basically an internal process that not only focuses on improving the physical infrastructure side, but also puts equal effort on enhancing the organisational infrastructure side. Because institutional processes are cyclical, dynamic and constantly changing, analysis should be on going, recognizing that how activities are performed is just as important as what they are meant to achieve.

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

The chapter concludes with the formulation of institutional / organisational improvement action plans on specific operational areas of PHED water supply functions and services. On the issue of financial self-reliance, action plans are proposed to strengthen financial and asset management, streamline tariff revision, and to improve the collection system and customer service. The preparation of financial statements and the long-term annual business plan is seen to support PHED in operating in a self-sufficient manner. Since organisational improvement involves people (human resources) and developing their capacities to perform at optimum levels, an action plan on human resources / personnel management is also proposed. Lastly, institutional improvement also necessitates having codified policies and procedures (management systems) to ensure high standards of efficiency and effectiveness, thus action plans for improving the management information system, reducing non-revenue water, and water meter installation are proposed.

6.1 Project Implementation during Construction Works

Ensuring the successful implementation of the Imphal Water Supply Improvement Project entails setting up a project implementation system that would take into consideration the mutual agreements between both the lender, the Government of Japan (GOJ) through the Japan International Cooperation Agency (JICA), and the borrower, the Government of India (GOI) with the implementing agency as the Public Health Engineering Department of the State of Manipur.

This section addresses how to set up the project implementation / organisation system during construction works by: (i) Examining and identifying the institutions / stakeholders that would be involved in project; (ii) Establishing the project organisations and the framework of project implementation; (iii) Defining and /or clarifying roles and responsibilities in project implementation; (iv) Setting up the project implementation unit, including personnel requirements to manage and/or support smooth project implementation and completion.

6.1.1 Experience in Project Implementation

The PHED Urban Circle has had its share of implementing water supply projects under the Project Construction Division (PCD). However, for the last 10 years, there has been no new construction under the Urban Circle. That is why the PCD has moved from "project construction" to operating and maintaining the plants and schemes it had constructed.[1] In this respect, it is functioning just like the Maintenance I and Maintenance II divisions, although it has kept its original division's name of "Project Construction Division."

Of late, the PHED Urban Circle is undertaking another project implementation work. However, it is the Drainage and Sewerage Division (D&S) that is involved since the undertaking is a sewerage project. This sewerage project, which is the first for the State of Manipur and the entire Northeast region, is 60% completed, and will cover / service one-third of Imphal City when fully operational. The target completion date is by the end of 2014, but according to the Chief Engineer, Mr. Sunil Singh, the project will still see completion in two years' time.[2]

(1) French-assisted Sewerage Project

The French-assisted sewerage project was proposed for implementation in 2003 at a cost of 93.21 Crores. However, when it took off in 2007, the revised cost for the project came up to 292 Crores. It is a multi-funded project since it is partially funded by the French for a total of 45 Crores, although given "in kind", in the form of machineries, equipment and technical knowhow provided by two French companies, AquaTechnique and Degremont. The remaining balance is being funded out of central government funds, at 90%, and state funds, at 10%. It was through the release of state funds that civil work on the project commenced.

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[1] Interview with Mr. O. Debendra Singh, Executive Engineer, Project Construction Division, PHED Urban Circle, 6 June 2014.

[2] Interview with Mr. Sunil Singh, (then Additional) Chief Engineer, Public Health Engineering Department (PHED), Government of Manipur, 09 June 2014.

On the project implementation side, French engineers assist when required – two engineers from AquaTechnique who assist in supervising the construction of the pumping stations and collector networks and four engineers from Degremont who supervise the construction of the treatment plant. Construction has been contracted to an Indian firm with D&S Division providing construction supervision work.

There is no formal project implementation unit or "PIU" for this project as it is the entire D&S Division that is involved. Thus, it is safe to assume, therefore, that the "PIU" is D&S Division headed by the Executive Engineer and three Assistant Engineers (AE). One AE is assigned solely for the sewerage treatment plant. Assisting the AEs are 12 section officers, with four SOs assigned to the sewerage treatment plant.[3]

(2) PHED-Constructed Water Supply Schemes

The PHED has had numerous experiences in project implementation as demonstrated in the water supply schemes and treatment plants constructed under the purview of the Project Construction Division (PCD). These are the Porompat Water Treatment Plant, Chinga Water Supply Scheme, Moirangkhom Water Supply Scheme, Irilbung Water Treatment Plant, Singda Water Treatment Plant, and the Extension of Kangchup Treatment Plant.

The experience gained from these projects by PCD technical staff is quite extensive, considering that project implementation work encompassed or ranged from survey works, to design and construction supervision. The only setback is that no new construction work has come in since the last 10 years, leaving staff with no fresh opportunity to update knowledge or skills previously practiced and honed. Considering the number of schemes and plants it has constructed, however, it can be well assumed that the technical staff of PCD does have relevant experience in project implementation, although on a smaller scale than what this project may require.

6.1.2 The Proposed Project Implementation System

There are several key stakeholder-institutions with complementary interests over the successful implementation of the Imphal Water Supply Improvement Project. It is necessary, therefore, to create formal institutional linkages through the establishment of a project organisation system that would provide coordination and policy guidance, on one hand, as well as manage the activities of project implementation, on the other, with a sharing of roles and responsibilities to mitigate managerial, technical, financial and social problems may arise in the project's implementation.

(1) Key Project Stakeholders

The key stakeholder institutions with interest in the project's implementation are: the Government of

[3] Interview with Mr. Ibotombi, Executive Engineer, Drainage and Sewerage Division, PHED Urban Circle, 28 June 2014.

India, represented by the Ministry of Urban Development (MoUD) and the Jawarharlal Nehru National Urban Renewal Mission (JnNURM), and the Government of Japan, represented by JICA Headquarters (Tokyo) and JICA India Office. There are also state-level stakeholder organisations, such as the Public Health Engineering Department (PHED), which is the project implementation unit, the Irrigation and Flood Control Department (IFCD), the Department of Housing and Urban Development (MAHUD). The urban local body-level stakeholder is the Imphal Municipal Council (IMC). In addition there is the Japan International Cooperation Agency (JICA) which is the financing insititution.

(a) The Ministry of Urban Development

The MoUD is responsible for formulating policies, supporting and monitoring programmes, and coordinating the activities of various Central Ministries, State Governments and other nodal authorities in so far as these relate to urban development, town and country planning and development issues in the country. One of the urban development issues, and also a key mandate of the Ministry, is in taking up schemes to create facilities to manage water supply as well as liquid and solid wastes (or water supply, sewage, drainage and sanitation facilities), subject to the overall national perspective of water planning and coordination assigned to the Ministry of Water Resources.

In 2008, the MoUD launched and operationalized the Service Level Benchmarks identifying basic minimum service level performance parameters for four basic urban services, namely: water supply, sewage, solid waste management, and storm water drainage. MoUD is also very active in undertaking and implementing first and second urban reforms for urban infrastructure in water supply, sanitation and drainage and implements the JnNURM, UIDSSMT, Satellite Townships program, National Water Awards, and the National Urban Awards.

Two major reforms being pursued by the MoUD that are being cascaded down to the State Governments and ULBs are: (i) The *regulatory frameworks* aimed at protecting consumers, applying environmental standards and supporting the delivery to the poor in financing and in the delivery of infrastructure at the municipal level, especially in the water and sanitation sector, together with the appropriate training programme and capacity support to regulators developed in partnership with the private sector and urban research institutions; and (ii) The introduction of *accrual basis of accounting system* for ULBs' municipal accounting systems and suggestions for model budgeting and accounting formats, including the preparation and circulation of a National Municipal Accounting Manual (NMAM) detailing the accounting policies, procedures, guidelines designed to ensure correct, complete and timely recording of municipal transactions and produce accurate and relevant financial reports.

(b) The Jawarharlal Nehru National Urban Renewal Mission

Launched in December 2005, the JnNURM aims to create productive, efficient, equitable and responsive cities by and bring about improvement in the existing service levels in a financially sustainable manner. Projects and development reforms are implemented in 63 identified cities. The focus is on integrated and planned development and renewal of infrastructure services, efficiency in urban infrastructure service delivery mechanisms, community participation, and accountability consisting of two sub-missions – urban infrastructure and governance; and basic services to the urban poor.

The Mission also implements optional and mandatory reforms implemented at the level of the States. The mandatory reforms are: (i) Adoption of modern accrual-based double entry system of accounting in ULBs and parastatal agencies; (ii) Introduction of a system of e-governance using IT applications; (iii) Reform of property tax with GIS; (iv) Levy of reasonable user charges by ULBs and parastatals agencies with the objective that the full cost of O&M or recurring cost is collected within the next seven years; (v) Internal earmarking within local bodies, budgets for basic services to the urban poor, (vi) Provision of basic services to the urban poor including improved housing, water supply and sanitation and delivery of other existing universal services of the government for education, health and social security.

One of the thrust sectors for coverage under the JNNURM is water supply, of which Manipur is supported through the funding of the *Integrated Water Supply of Imphal City* with an approved cost of Rs 8,975.19 Cr and the approval date of 21 January 2014. Expected date of project completion is on July 2015.[4] The JnNURM projects fall under Phase I and Phase II of the larger *Water Supply Improvement Project for Imphal City*, and JICA-funded improvement project falls under Phase III. Therefore, there is a need to closely coordinate work schedules between JnNURM and JICA to ensure timely completion and operation of each phase.

(c) The Public Health Engineering Department, Government of Manipur

The PHED used to be part the Public Works Department (PWD) of the Government of Manipur, until 1978 when the PWD was bifurcated, and the urban and rural water supply, sanitation and sewerage functions were given to PHED.

The PHED does not only operate and maintain urban and rural water supply schemes, but ensures that it provides safe drinking water for domestic, commercial, institutional and industrial requirements. It caters to the needs of the people of Manipur, whether urban or rural, including supplying water to the needy. It is also responsible for planning, designing and executing schemes for establishing safe water sources and water schemes and related facilities. Its objective is to make every habitation accessible to safe drinking water.

The PHED is the project implementation unit (PIU) for the Imphal Water Supply Improvement Project, and as such, will be responsible for project management activities, field supervision and monitoring and project completion and closure.

[4] http://jnnurm.nic.in/wp-content/uploads/2014/04/Manipur.pdf. Retrieved 13 June 2014.

(d) The Irrigation Flood Control Department

The Irrigation and Flood Control Department (IFCD) has the responsibility of ensuring irrigation to the State of Manipur by developing and constructing major and medium irrigation and multipurpose projects, including lift irrigation projects, all of which not only increase the irrigation potential of land, but also provide raw water supplies to the State for water supply and hydro-power. It also manages all matters that relate to flood problems, such as the construction of flood control (restoration and improvement works) as well as construction of major dams and drainages. It also takes charge of the management and preservation of the water resources of the State, as well as to the investigation of ground water resources.

IFCD is a major stakeholder in the Imphal Water Supply Improvement Project, considering that raw water for the Project will be coming from the Thoubal Dam, which is being constructed by IFCD. Therefore close coordination is required between PHED and IFCD.

(e) The Department of Municipal Administration, Housing and Urban Development, Government of Manipur

In the state of Manipur, MAHUD is responsible for all matters relating to (i) The administration of Municipal Council(s), Nagar Panchayat(s), and Small Town Committees; (ii) The administration of the State Town and Country Planning Organization; (iii) The control and supervision of the Planning and Development Authority; (iv) Housing, both urban and rural, including the administration of the Housing Board; and (v) The urban development, including urban sanitation, urban draining, urban sewerage and urban traffic and transportation.

In 2006, the JnNURM signed a Memorandum of Agreement (MOA) with the Government of India through the Ministry of Urban Development, and the Government of Manipur through the MAHUD, and the Imphal Municipal Council. Among the different state and urban reforms to be undertaken under the MOA is the implementation of the 74th Constitutional Amendment Act, particularly turning over the maintenance of water supply (domestic, commercial, and industrial), which was originally planned to be done by 2008-2009. As of the present time, however, this has still to commence, and according to the Chief Engineer, Mr. Sunil Singh, there is ample time under the 12th Plan (2017) to accomplish this.

(f) Imphal Municipal Council

Imphal is the capital city of Manipur and is the center of all cultural, commercial and political activities in the State. It is the only Class I City in the State, and is growing at a rapid pace. Being the “Gateway of North East India”, Imphal City faces the challenge of developing its basic physical urban infrastructure in order to drive the sustainable growth development processes forward without compromising its urban environment.

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

In terms of water supply, IMC's vision is "provide safe and sustainable water to all its citizens at a competitive and affordable price with the ultimate goal of reaching a 24/7 situation in a phased manner within the scheme period."[5] It wants to have projects that would ensure its people of having access to efficient, responsive, and sustainable water and sanitation services. Thus, IMC is a key stakeholder as this improvement project moves it closer in achieving its vision as laid out in the CDP.

(2) The Proposed Project Organisations and their Roles and Responsibilities

Project organisations have been proposed in the Inception Report where "close opinion exchange and smooth consensus building with the counterpart government is indispensable to efficient execution"[6] of the improvement project. The general implementation framework is as shown below:

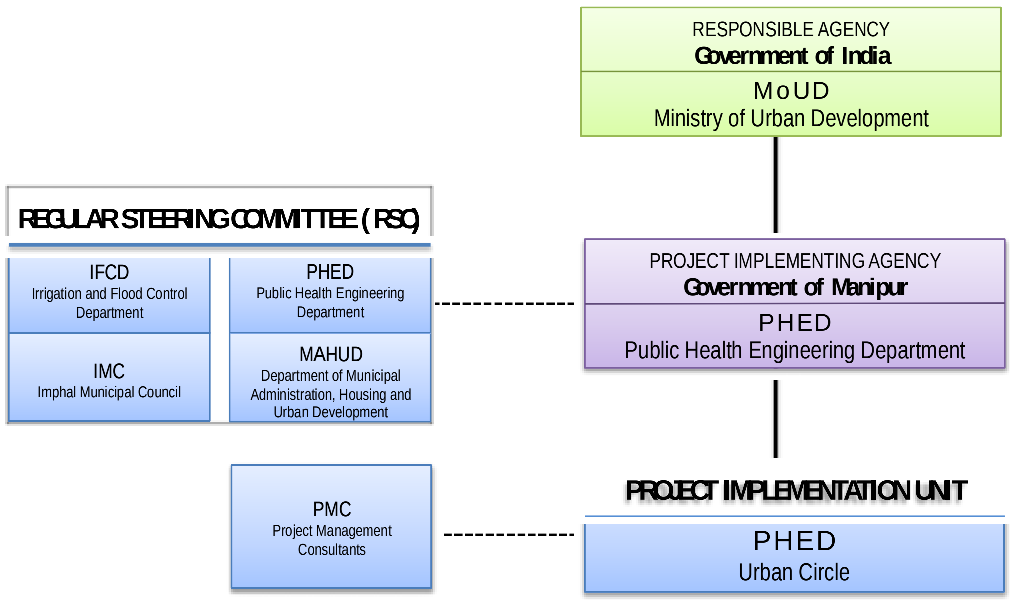


Figure 6.1 General Project Implementation Framework

5 *City Development Plan for Imphal*. Imphal Municipal Council (Government of Manipur), 2007.

6 **Inception Report**, *Preparatory Survey for Imphal Water Supply Improvement Project in the State of Manipur*, Japan International Cooperation Agency with NJS Consultants Co. Ltd, Nippon Koei, Co. Ltd, and Sanyu Consultants Inc., May 2014.

(a) The Regular Steering Committee

The Regular Steering Committee shall be composed of stakeholder organisations on the state and urban local body levels that have common interests in the efficient and effective execution of the survey works, and later on, the project implementation / construction works. The Public Health Engineering Department representative shall act as the chairman of the RSC, while the members shall be representatives from the Irrigation and Flood Control Department, the Department of Municipal Administration, Housing and Urban Development, Imphal Municipal Council. The Project Management Consultants (PMC) representative will attend the meetings of the RSC, albeit as an observer, and not as a regular member.

The RSC shall be the inter-governmental and inter-agency coordinating committee on the state/local level charged with the main role of providing or sharing data and information and for facilitative coordination particularly during the project implementation stage. As such, it has no supervisory authority, but its existence is for over-all coordination among the major project stakeholders.

a) General Responsibilities of the RSC:

- *Identifies and sets up mechanisms for systematic and coordinated delivery of services* by providing assistance and/or information to augment and support the process of project implementation based on their respective mandates;
- For the duration of the project's implementation, *identifies and ensures the inclusion and/or completion of all related facilities not covered under the loan proceeds,* but may be part of the responsibility of the GOI under the JnNURM or any other government program / initiative, *particularly those water supply facilities that have close inter-operability with the project*;
- *Ensures that the causes of delays in the implementation/ construction* of related facilities financed out of loan proceeds, central government funds, state funds or local funds *are identified and directed to the appropriate Ministry and/or Agency for resolution*;
- *Formulates and/or recommends solutions* on issues referred to it because of legal, policy or operational differences;
- *Follows up solutions to project implementation bottlenecks, problems and issues*; and/or courses these to the concerned agencies for proper resolution;
- *Facilitates timely release* of construction and other licenses and permits needed for the Project;
- *Coordinates environmental requirements* and/or considerations related to the Project;
- Should the project require it, *monitors land acquisition procedures* on their compliance to law;

- *Holds regular meetings* and calls for special meetings, if required;
- *Reports to their respective Departments* on the over-all progress of the implementation of the project.

(b) The Project Implementation Agency

The PHED is the Project Implementation Agency for the Imphal Water Supply Improvement Project. As such it will organise the Project Implementation Unit (PIU) within the Department that will work closely with the project management consultants (PMC) who will be engaged for the project implementation / construction works.

Since its recent establishment, PHED has not yet implemented a project of the scale and cost as the proposed project, nor has it experienced undergoing international loan procedures from official development assistance (ODA) sources. This means that its institutional capacity as an implementing agency and an implementing unit needs to be developed and strengthened, highlighting project execution, project coordination, project monitoring and supervision, and project management. The PHED shall also be tasked to provide the day-to-day supervision over the project at the field level; but while it shall be work alongside the project consultants, its tasks relate to the application of project management concepts, tools and techniques.

Project implementation and management must address the full range of activities from the beginning (initiating) to the end (closure) of a project and the management of multiple sub-activities within the Project. PHED shall be involved in the entire cycle of the Project as reflected in the whole range of services to be provided by the Consultant. Providing day-to-day supervision over the implementation of the Project means addressing technical skills like scheduling, cost estimating, and risk management; and also encompasses other disciplines such as scope definition, procurement management, financial management, asset management, human resource management, environmental and social considerations, and communications.

a) General Responsibilities of PIA/PIU

- The general responsibilities borne out of the Loan Agreement are to:
  - Selection and employment, negotiation with, awarding and signing the contract with the winning Project Consultant (PC) based on the *Guidelines for the Selection and Procurement of Consultants for JICA ODA Loans*, where the signatory to the contract will be the official representative from the State of Manipur depending on (i) The provisions of the Loan Agreement, and (ii) The State of Manipur's Tendering Process;
  - With the assistance of the project management consultant, perform prequalification of tender, tender calling, tender evaluation, and contract negotiation for the civil

works contractors, as well as on the procurement of goods and other services, based on the *Guidelines for Procurement under JICA ODA Loans*, where the signatory to the contract will follow the official process of the Government of Manipur;

- Undertake project compliance to covenants stipulated in the Loan Agreement.

● The disbursement responsibilities are to:

  - Since disbursement of JICA funds follow the principle of payment against invoice and other evidences, together with the certification of completed work, GOI, through the MoF, advance the funds to start the project activities, and then claim reimbursement from JICA every time a certain portion of the work is completed. The responsibilities of GOI in disbursement are specified in the Loan Agreement, and GOI will abide by the disbursement procedures such as *Commitment Procedures*, the *Reimbursement Procedure*, and *Transfer Procedures*;
  - For smooth disbursement of loan proceeds, the GOI, through the MoF, may delegate some of its authority directly to PHED, as the project implementer. This means that PHED-PIU, with the assistance of the project management consultants, will carry out the final review and approval of all documents submitted to it by the contractors and suppliers and submit the same to the Principal Secretary and/or Chief Engineer, who will affix his signature prior to its transmittal to JICA.

● The Implementation Responsibilities

  - Provide day-to-day supervision and management over the implementation of the Project;
  - Review billing and expenditure statements and prepare request for loan availment according to GOI and JICA disbursement procedures.
  - Prepare and submit comprehensive work and financial plans (WFP) and upon approval of the PHED Superintending Engineer, submits the same to the PHED Chief Engineer;
  - Undertake project implementation within the approved work plans and reports the progress of the project to Higher Offices.
  - Assist and participate in coordinating with the RSC and JCC concerning project implementation;
  - Prepare and submit to Higher Offices the appropriate supporting reports and jointly reports on the progress of the Project to the State and Central Governments;
  - Prepare and submit project completion reports, conducting closing workshop and preparing the project acceptance certificate.

6.1.3 The Organisation Structure, Personnel Composition, Roles and Responsibilities of the PIU

The PIU shall serve as the technical arm in managing, supervising and controlling day-to-day project activities, including the work of the consultants and contractors, in activities such as project planning and management, project construction supervision, environmental management monitoring and control, procurement and disbursements, and preparation of reports.

(1) General Guidelines Governing PHED as the PIU

The PHED will organise an office to be designated as the Project Implementation Unit or PIU mainly for the Project. It should be set-up as an independent office with its own personnel attached to and under the Office of the Chief Engineer. The following shall be the guidelines in setting up the PIU:

a) The PIU shall be set up as an adjunct / separate office attached to and directly under the Chief Engineer, PHED, with the Chief Engineer serving as the *de facto* Project Director. At the moment, there is no other office within PHED that can transform itself into and take on the responsibilities required of a PIU. **Figure 6.2** provides the location of the PIU within PHED.

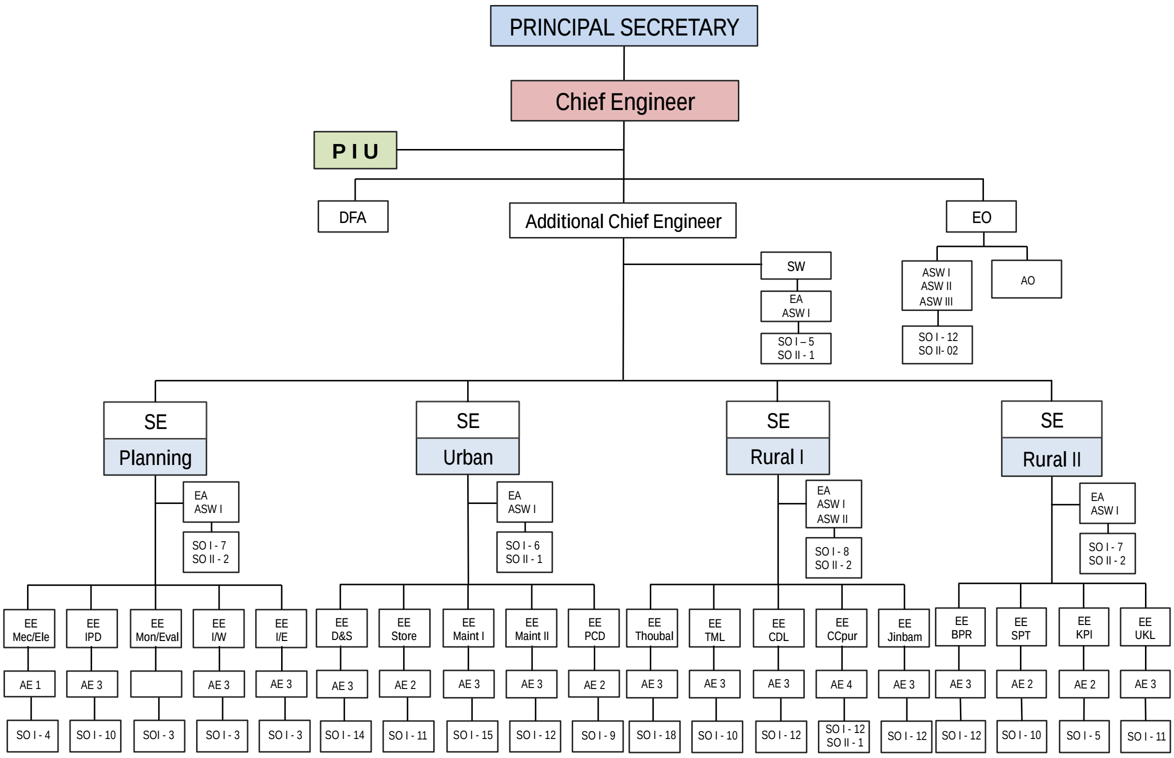


Figure 6.2 Project Implementation Unit (PIU) in the PHED Organization

b) As much as practicable, the positions for the PIU shall be filled from among the qualified PHED personnel. Positions that cannot be filled from the existing PHED ranks shall be hired on a contractual basis for the duration of the Project. Recruitment and selection, however, will follow the State government regulations on hiring based on the required qualifications and experience for the positions. **Table 6.1** gives the summary of positions and number of personnel required to man the PIU.

Table 6.1 Positions and Number of Personnel Required for PIU

SL	PIU Position	Equivalent Level /Position in PHED	Number Required
1.	Project Director	Chief Engineer (actual)	(1)
2.	Project Manager	Superintending Engineer	1
3.	Assistant Project Manager	Executive Engineer	3
4.	Project Engineer	Assistant Engineer	3
5.	Environmental Engineer	Assistant Engineer	1
6.	Assistant Project Engineer	Section Officer	6
7.	Environmental / Social Specialist	Section Officer	1
8.	Contract / Quantity Surveyor	Section Officer	2
9.	Accounts Officer	Accounts Officer	1
10.	Secretary	Secretary/Senior Clerk	1
11.	Driver	Driver	3
		Total	**22**

After the completion of the Project, PHED will have the option of retaining the PIU staff to place them in vacant technical posts, if warranted. The PIU will be organized and structured as shown in **Figure 6.3** below:

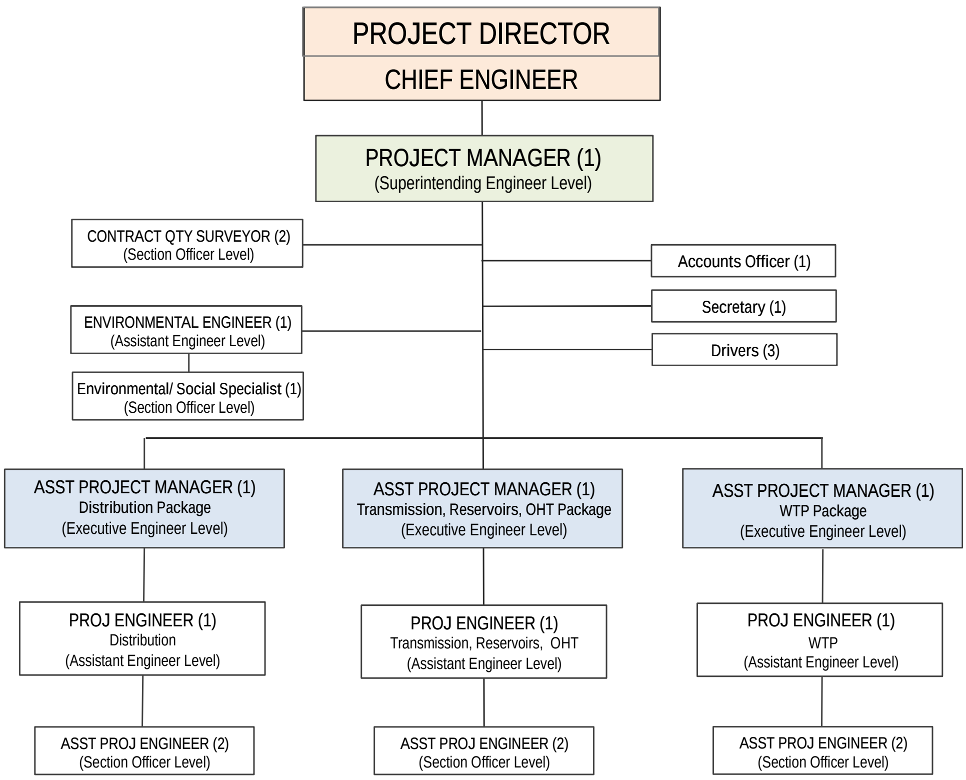


Figure 6.3 Proposed Organization Structure of PIU (Draft)

As shown in the Figure, the *de facto* Project Director will be the Chief Engineer of PHED. The Project Manager will be supported by three assistant project managers – one to supervise the water treatment plant construction package, one to supervise the distribution (pipeline) construction package, and one to supervise the transmission, service reservoirs and overhead tanks construction package. Likewise, the assistant project managers will each be supported by two assistant project engineers. Because of the breadth of the project area, there will also be a need for an environmental / social team of two specialists establish the Environmental Management System for the implementation of the Project. Although the Project Management Consultant team is there to assist the PIU in tender document preparation and evaluations, two contract quantity surveyors will assist the Project Manager on this aspect on the PIU side.

(2) Responsibilities of PHED in Project Implementation

On the strategic level, the Principal Secretary will ensure that objectives / targets of the Project are achieved efficiently and effectively and according to plan. On the monitoring level, the Principal Secretary will attend the regular meetings to be called by MoUD and JICA on the implementation of this ODA project and bring to its attention urgent issues for immediate resolution.

The *Chief Engineer* shall be the over-all in-charge of project implementation and policy coordination activities. Because of the magnitude of the project, the Chief Engineer shall have direct supervision and authority over the PIU as its *de facto* Project Director. As such, he shall (i) Approve / endorse all official documents and communications from the PIU through the Principal Secretary for inter-governmental and external offices; (ii) Approve technical studies and matters related to the detailed design of the new treatment plant, the distribution network, including distribution reservoirs and facilities for the project, including construction management activities; (iii) Bring to the attention of the Principal Secretary, RSC and JICA important implementation issues (legal, financial, and policy) that need immediate resolution and/or coordination on the level of the State and GOI. He shall ensure that the project is implemented in accordance with the schedules, plans and procedures agreed upon by JICA and the GOI.

(3) Roles, Functions and Responsibilities of the PIU Staff

The Project Manager (PM) is a position that requires ad hoc adjustments, based on moment-to-moment assessments of current conditions, within the context of a comprehensive plan created using sound and consistent methods from relevant past experience. This position also requires collaborative efforts among project stakeholders (JICA, GOI, RSC, state and local authorities, project beneficiaries, and other interested parties). The PM for the PIU is expected to perform the following tasks/responsibilities:

a) Provides direction and guidance to the key personnel of the PIU.

- Reviews and confirms the scope of work of the Consultants for the approval of the Chief Engineer, then of the Principal Secretary;
  - Defines the roles and responsibilities of each PIU team member and secure their respective commitments;
  - Defines the outputs, resource constraints, timelines and quality expectations for the submission of the outputs by each team member.
- Develops the work and financial plans of the project for approval of the Chief Engineer and determines the resource and logistical constraints to complete the objectives of the project.

b) Develops systems, policies/rules and procedures to manage and monitor the implementation of the project components that should include:

- Monitoring benchmarks to evaluate the progress of the project;
- Monitoring the progress of the Consultant and Contractors in terms of scope, time and budget using the appropriate software;
- Database and monitoring system that will enable quick and accurate online downloading of information on the progress of the project;
- Development and implementation of standards, guidelines and regulations.

c) Ensures the timeliness and quality of outputs of the Consultants, contractors and suppliers.

- Reviews all reports of the Consultant and recommends the appropriate action, where necessary;
- Recommends to the Chief Engineer the dispatch of people for field visits, coordination and inspection;
- Reviews post-field reports and identifies issues with the necessary recommendations for submission to the Chief Engineer;
- Reviews and recommends invoices, including certification of work completion/acceptance of Consultant and contractors/suppliers for billing purposes;

d) Manages and monitors all pertinent activities, like work flow and records management; administrative coordination and financial transactions.

e) Reviews and manages the monitoring plan for the natural and social environment, and other social considerations;

f) Provides regular progress and performance evaluation reports and to the Principal Secretary, the Chief Engineer, the concerned State and Central government authorities, and JICA.

The *Assistant Project Manager (APM)* will report directly to the PM, and will be responsible for supervising the assigned technical projects/ construction package and related activities of the PIU, developing various systems and procedures for the smooth implementation of the project, installing and/or developing project management processes for the PIU. The specific tasks of the APM are the following:

- Assists the PM in his responsibility for the management and supervision of technical studies to be undertaken;
- Directly oversees and supervises the implementation of field-level activities, particularly in civil works construction;
- Certifies the completion of work and payments of suppliers;
- Develops and undertakes planning activities, such as but not limited to, the work (technical) and financial plans and undertake the implementation of the approved work plan;
- Monitors project activities and accomplishments, using in part, the monitoring system designed for ODA projects;
- Prepares supporting reports on the progress of the project for the concerned offices of the State and the Central Governments, and the JICA;
- Reviews monitoring report of consultants and contractor’s work and submits this to through the PIU’s chain of command.

The *Project Engineer/s (PE)* will report directly to the APM and will have the following functions:

- Responsible for the field-level implementation and management by providing direction for the effective and efficient field implementation of the different components of the assigned project / package, while also monitoring the performance of the contractor and the field experts of the Consultant;
- Validates the progress of implementation of each activity in the work plan;
- Assists in monitoring the activities and accomplishments of the project;
- Assists in preparing regular supporting reports for various users;
- Facilitates the preparation of the work (technical) and financial plan;
- Reports and/or find solutions to problems encountered in the field.

The *Assistant Project Engineer/s (Asst PE)* will report directly to the PE for tasks on the field-level / technical side of the Project. The specific field functions are:

- Assists in monitoring the performance of the contractor and the field experts of the Consultant;
- Prepares regular field inspection reports;
- Reports any deviations and problems to the PE.

However, all delegated administrative and financial functions at the level of the project manager shall also be the responsibility of PE, such as:

- Project administration functions:
  - Develops, maintains and manages the Project’s records system, project office documents and communications system, as well as physical facilities and supplies;
  - Coordinates and processes procurement of goods and services for the PIU;
  - Processes request for payments from suppliers and reviews compliance with GOI and JICA procedures;
  - Prepares request for payment for suppliers, contractors and consultants based on the field-level disbursement procedures.
- Project finance functions:
  - Prepares the financial portion of the WFP;
  - Keeps all project accounts up-to-date while assists in maintaining project book of accounts;
  - Ensures timely preparation of report of disbursements and periodic accounting reports of the Project;
  - Processes vouchers and documents for disbursement of project funds.

The *Environmental Engineer* and *Environmental / Social Specialist* will report directly to the PM. Working as a team, their functions are the following:

- Review the contractor's monitoring report;
- Review the contractor's concrete environmental management site plans;
- Provide instruction on environmental management to Consultants and Contractors; Inspect environmental management conditions at construction site with consultant/contractors; and
- Submit necessary reports and documents to the relating agencies for environmental and social consideration.

The *Contract / Quantity Surveyor* shall report directly to the PM. His functions and responsibilities will be the following: (i) Draw up the bill of quantities and their breakdown; (ii) Prepare the tender documents for the project; and (iii) Manage cost control in terms of schedule and budget for the project.

The *Accounts Officer* shall be under the direction of the PM. He will be responsible for procurement work financial documentation for the project.

The *Secretary* shall be under the direction of the APM and will be responsible for administrative works. He/she shall also assist the Account Officer.

The *Driver/s* shall be under the APM and will ensure the safe transport of passengers and goods within the project sites. The drivers will also perform daily maintenance works on the vehicles assigned to them.

The proposed qualifications of the PIU staff are shown in the **Table 6.2** below:

Table 6.2 Proposed Qualifications of the Staff for PIU

POSITIONS	QUALIFICATIONS	
Project Manager	Academic	• BSc in Civil Engineering graduate • Masters Degree in Civil / Structural Engineering an advantage • Project Management Professional (PMP) Certification also an advantage
	Experience	• At least 15 years experience as project manager in water supply and/or sewerage projects • At least 10 years experience as project manager of water supply and/or sewerage construction projects • At least 5 years experience as project manager or senior project engineer of water supply and/or construction projects of a similar scale as this Project
Assistant Project Manager	Academic	• BSc in Civil Engineering graduate • Project Management Professional (PMP) Certification an advantage
	Experience	• At least 12 years experience as project engineer in water supply and/or sewerage projects; • At least 8 years experience as project engineer of water supply and/or sewerage construction projects; • At least 4 years experience as project engineer or assistant project engineer of water supply and/or construction projects of a similar scale as this Project
Project Engineer	Academic	BSc in Civil, Mechanical or Electrical Engineering graduate
	Experience	At least 10 years experience as project or assistant project engineer in water supply and/or sewerage construction projects
Assistant Project Engineer	Academic	At least a Diploma Course in Civil Engineering (of not less than three years) from any reputable engineering university/ college; although a graduate of a Civil Engineering Degree is preferred
	Experience	At least 7 years experience as assistant project engineer in water supply and/or sewerage projects
Environmental Engineer	Academic	BSc in Environmental Engineering graduate or related field
	Experience	At least, 10 years experiences as environmental specialist in water supply and/or sewerage construction project.
Environmental / Social Specialist	Academic	At least, Diploma Course in Civil Engineering from a reputable engineering university/college, although a graduate of environmental engineering degree is preferred
	Experience	At least, 7 years experiences as assistant project engineer in water supply and/or sewerage construction project.
Contract / Quantity Surveyor	Academic	BSc in Civil, Mechanical or Electrical Engineering graduate
	Experience	At least five years experience as materials estimator/ contract/quantity surveyor for water supply and/or sewerage construction projects
Accounts Officer	Academic	Relevant Diploma Course in management or finance (at least two years) from any reputable university/college
	Experience	At least five years experience as accounting clerk
Secretary	Academic	Relevant Diploma Course (at least two years) from any reputable university/college
	Experience	At least five years experience as office clerk
Driver	Academic	HSC or equivalent
	Experience	At least five years driving experience Must possess professional driving license

6.1.4 The Project Management Consultants (PMC)

The Project Management Consultants (PMC) shall report to the to the Chief Engineer, PHED. The PMC shall provide consulting services as prescribed in the *Terms of Reference*, in areas such as preparation of detailed design, financial studies for water tariff determination, tendering, construction and project management services, and pre-operation and maintenance. Its services include, but shall not limited to, project planning and management; project supervision; transfer of technology, and the development of appropriate implementation strategies, work processes and procedures consistent with the fundamental principles espoused by the Project.

It is apparent that PHED does not have the staff required as PIU as it has limited technical capability to take charge of the project. The Consultant, therefore, will actively participate and provide inputs to the PIU during the initial phase of project implementation. This will serve as a training medium for the PIU personnel until such time that the PIU-seconded personnel are able to handle project implementation by themselves.

Where feasible, PHED staff will be seconded to selected PIU and Consultant's positions in order for said staff to obtain actual or on-the-job training, which will prove to be very invaluable in the future. Seconding or providing counterpart personnel from PHED to that of the Consultant's will mean reviewing the existing qualifications of all PHED personnel and matching them with the requirements of each position. This "exposure-assignment" method will ensure that the PHED personnel selected is the best counterpart for the Consultant, and is technically trainable to get the utmost benefits from the transfer of technology.

At the start of the consulting activities, the PIU should undergo orientation on their roles in both the detailed design and construction management stages – including contract administration, review and due diligence roles. It is envisioned that after the consulting portion, PIU should be able to "inherit" the additional capability from the Consultant and act as the co-lead personnel during the construction supervision stage.

6.1.5 Roles of Project Organisations in Project Implementation

General project implementation and management shall be spelled out in, and governed by, the Loan Contract/Agreement between GOI and GOJ, as follows: (i) Strict adherence to the Loan Contract/Agreement specifying the mutual rights and obligations of each party; (ii) Abiding by and respect all relevant laws in the GOI; (iii) Providing for project implementation structure that includes setting up a three-tier project organization for the duration of Project implementation; and (iv) Strengthening the project implementation unit as primary consideration in all initiatives at developing project implementation processes.

Each project organisation has its own roles, as specified in the preceding sections, and is situated within the project implementation framework as summarised in **Table 6.3**.

Table 6.3 Roles of Project Organizations in Project Implementation

Responsibility	Project Organization	Level	Institution / Department	Role in Project Implementation
Project coordination	Regular Steering Committee (RSC)	State Level	1. PHED 2. IFCD 3. MAHUD 4. IMC 5. Project Management Consultants (PMC)	**Over-all responsibility for facilitative coordination** for Project implementation
Project implementation	Project Implementation Agency	State Level	PHED	Organise the PIU; Ensure compliance with Loan Agreement
	Project Implementation Unit (PIU)	State Level	PHED	Directly responsible for **undertaking actual field supervision and management** of all the aspects of Project implementation
	Project Management Consultants (PMC)	State Level	Attached to PHED	Provides PHED with consulting services in **detailed design and /or construction management** during project implementation per *Contract of Consulting Services*

6.2 Management, Operation and Maintenance System after Project Completion

The examination of PHED focuses mainly on PHED Urban Circle being the organisation directly responsible for managing available resources, for operating and maintaining existing water supply facilities, including those proposed under this Project, and for providing water supply services under its service area. Thus, the development of organisational strengthening measures and capacity development interventions is aimed at rationalizing and improving the delivery of water supply services for the people of Imphal. These comprise the establishment of the most appropriate organisation structure after project completion, with a corresponding human resources plan to manage, operate and maintain the new facilities to be constructed under this proposed Project. Organisational options for water supply services were examined based on decentralization and autonomy and three utility institutional models were compared, for setting up for the State of Manipur, if at all suitable at this point in time.

The institutional improvement interventions proposed under this Project have been borne out of close consultation(s) and discussion(s) with key officers of PHED and PHED Urban Circle utilizing the Strength-Weakness-Opportunity-Threat (SWOT) Assessment and Need-Gap Analysis, as a two-step activity required by this study in order to confirm the needs for facility provision, management and organization and maintenance.[7]

[7] Figure 1.4 “Image of Capability Strengthening Plan and Action Plan”, INCEPTION REPORT, *Preparatory Survey for Imphal Water Supply Improvement Project*, Japan International Cooperation Agency (JICA) with NJS Consultants, Co. Ltd., Nippon Koei Co. Ltd., and Sanyu Consultants Inc., May 2014, p. 7.

6.2.1 Organizational Assessment

(1) SWOT Assessment

The SWOT assessment[8] is a planning technique commonly used by organizations to evaluate key factors in both its external and internal environments that are important in achieving its objectives. The assessment was conducted for PHED, with particular focus on the PHED's Urban Department, in order to provide a current situational analysis of the organisation and eventually identify in what particular areas institutional improvements are required, given the impacts of both the internal and external environmental factors.

a) Participants to the SWOT Assessment

The main selection criterion of the participants for the SWOT assessment is that they should be in the top echelons of general management and administration of PHED, as well as the senior technical officers and/or head of the functional areas of the PHED Urban Circle. In other words, these officials were selected for their positions of authority, responsibility and accountability in terms of resource management and allocation, the over-all performance of the organization(s) / unit(s) in the achievement of goals and objectives. They not only have a macro-perspective of the workings of their divisions, but also experience and expertise as to operating environment of the organisation. (See **Appendix A6.2 (1)** for the Profile of the Key Informants).

Table 6.4 Participants to the SWOT Assessment

SL No.	Name	Position	Date of Interview /
1.	Mr. W. L. Hangsingh	Principal Secretary, PHED	04 June 2014
2.	Mr. Armstrong Pame	Joint Secretary, PHED	04 June 2014
3.	Mr. H. Sunil Singh	Additional Chief Engineer, PHED	09 June 2014
4.	Mr. Lokeshwar Singh	Superintending Engineer, PHED Urban Circle	28 June 2014
5.	Mr. H. Bigadhon Singh	Executive Engineer, Maintenance I Division	10 June 2014
6.	Mr. N. Nirmal Kumar Singh	Executive Engineer, Maintenance II Division	23 June 2014
7.	Mr. O. Debendra Singh	Executive Engineer, Project Construction Division	25 June 2014
8.	Mr. N Saratchandra Singh	Executive Engineer, Stores Division	25 June 2014
9.	Mr. H. Ibotombi Singh	Executive Engineer, Drainage and Sewerage Division	28 June 2014

b) Result of the Strength and Weakness Assessment

The key informants identified several strengths, mostly under the major factors of laws and policies, human resources management, and systems and processes and core and support functions.

The existence of national laws for water supply and water resources is cited as a source of strength. As for the Water Supply Act (1992) of the State of Manipur, while the consensus was that it needed revision and strengthening, the presence of the law remains as a positive development for the State.

[8] The acronym SWOT stands for *strengths* (internal characteristics giving the organization an advantage over others); *weaknesses* (characteristics that place the organization at a disadvantage, or internal areas that need improvement); *opportunities* (external trends or elements to be taken advantage of); and *threats* (external factors that can weaken or cause insecurity for the organization).

As for human resources, the strength lies in the quality of the workforce, with particular emphasis on the academic qualifications' criteria and work experience of its top-level managers, technical and engineering staff. The number in the senior levels is also considered to be adequate, which contributes to satisfactory staff performance.

Decision-making processes within the State government concerning procurement and construction work are considered strengths, as approvals are made by competent authority using the principle of delegation of power. Approval time takes from one to two weeks.

Under systems and processes, the treatment plants were constructed as per Manual on Water Supply and Treatment (Government of India) that is why even O&M is performed following the prescribed standards. Corollary, the experienced PHED engineers do monitoring properly.

Public information and education, as support functions, are seen as strengths.

Weaknesses, on the other hand, were found under the major factors of human resources management, financial management, information and technological resources management, physical resources, as well as core and support functions.

Under laws, policies, rules and regulations, weakness lies in the enforcement provision of the Water Supply Act of 1992, particularly that on strict penalty for those who illegally tap (steal) water from PHED mains.

It has been also observed that with the way Imphal is rapidly urbanizing and developing, industries will soon locate in the city necessitating the enactment of appropriate water supply and related laws. For example, there is no state law or policy on sewerage; neither is there a law on water resources management, or a regulatory policy for water tariff increases.

Pinpointed as the weaknesses under human resources are in human resource management, particularly recruitment, selection and placement, training and development and rewards and recognition.

The specific weaknesses are: (i) Pending retirement of experienced technical staff who will bring with them the technical and institutional knowledge acquired through the years, (ii) The shortage of field staff and office-worker levels affecting proper O&M of the water treatment plants, accounting works, as well as billing and collection; (iii) Time it takes to request for and get approval to recruit technical staff (recruitment process) citing as an example that the last recruitment for engineers was in 1985; (iv) Lack of regular performance assessments which affect motivation of staff; (v) Absence of, or "no such practice" of giving performance rewards, even if performance is assessed to be above average and/or excellent; (vi) Lack of up-to-date training, if at all. In addition, some of the training attended by higher staff were not suitable/ applicable to Manipur's local situation.

Weaknesses in area of financial management are: (i) Fund inadequacy, which hinders the efficient operation and maintenance of the water supply schemes; (ii) The lack of funds is traceable to the low tariff being charged, which does not cover even operation and maintenance costs and is aggravated by low collection efficiency, high non-revenue water and pilfering of water through numerous illegal connections; and (iii) Absence of a Divisional Accountant to manage financial issues.

Under support functions / processes, finance and accounting processes, billing and collection processes, human resources management system and legal administration were rated "poor"; while general administration needs improvement.

The physical resources, such as water supply facilities, buildings and were rated inadequate (for which the proposed project will address). Grounds have limited weakness in the sense that there is land available but much upgradation is required.

The same was noted for technological resources, where there is a dire need for basic management information systems' (MIS) technology, including geographic information system for water supply assets. Even paper-based technical as-built drawings are almost non-existent.

The summary of the assessment strength and weakness by the PHED's key informants is shown in **Table 6.5**.

Table 6.5 Summary Matrix of Strength-Weakness Assessment

Area	Strength	Weakness
Laws and Policies	There is a water supply act; but needs revision	• The "Manipur Water Supply Act 1992": - Law needs more "teeth"; Is limited in terms of penalties - Needs revision to include management and O&M of sewerage facilities/ services to be more effective • Need more policies to address pollution, sewerage services • Central government laws on water supply/ resources management generally cater to all states but Manipur has its own peculiarities
Human Resources *Quality of Workforce*	• The qualifications and experience of its top management and technical staff: (i) 25 years for top management positions: (ii) years for senior to middle management • Staff performs at least satisfactorily	• Experienced engineers are retiring soon • Shortage of field level staff
Human Resources • *Number in Workforce* • *Recruitment, Selection, Placement*	• There is sufficient number of administrative support staff and labour grades • Approval of recruitment of more engineers	• Exam result of the recruitment of 25 engineers has been withheld. • Length of time involved in recruiting new staff as last recruitment was in 1985. • Number of technical personnel needs augmentation • Recruitment and selection is seldom performed • Rotational placement and posting is not regularly done
Human Resources • ***Motivation of Workforce*** • ***Rewards and Recognition*** • ***Training and Development***	• Self-motivated staff	• No regular staff assessment • Assessment called "Annual Confidential Report" done only when there is a vacancy; for promotion purposes • Recognition reflected in ACR, but reward never awarded
Financial Resources Adequacy		• Water bill nor reflective of cost for O&M • Tariff system not based on O&M costs, metering or actual consumption • Collection efficiency is much to be desired
Organisation Organisation Design		• Can be improved in terms of organisation design and structure
Systems and Processes	• Conventional treatment plants are constructed as per manual in water supply and treatment of the Government of India	
Core and Support Functions	• Performs core engineering and technical services (planning design and construction) • Performs O&M of water supply schemes	• Weakness in finance and accounting, billing and collection, human resources and administrative and legal functions
Physical Resources		• Facilities are inadequate; maintenance poor • Equipment non-functioning and lacking
Technological Resources		• No digitization of assets management or inventory management system • Lack of as-built drawings of the water system and pipelines • No computerization of financial management, human resources management or even billing and collection system

c) The Opportunity and Threat Assessment

The key informants in the SWOT assessment viewed the elements and/or trends external environment political, economic and technological elements and/or in the external environments more as opportunities. However, the “changes occurring in the environment” was the only one among the external elements that was identified as a threat to PHED.

Cited as an opportunity in the political environment is the new government, which has made the convergence of ministries as a way to streamline the bureaucracy.

The external economic setting is also looked upon favourably, especially with the availability of external funding and national government assistance and subsidies, which are seen to increase rather than decrease in amount or in the number of projects.

The introduction of new technology was favourably looked upon, especially for new water and sewerage treatment technologies.

Changes in social patterns were both viewed as an opportunity and a threat.

The impact of climate change on the environment is a threat to PHED, as experienced in the longer drought period in the last five years, with this year as being the worst dry season in recent history, affecting water supply in Imphal. This urged the PHED to look for and start developing more sustainable sources of water supply supplemented by tree planting activities especially in deforested hills and forest areas.

The summary of the assessment of the opportunities and threats by the PHED’s key informants is shown in **Table 6.6**.

Table 6.6 Summary Matrix of Opportunity-Threat Assessment

Area	Opportunity	Threat
Political Elements	Convergence of ministries in the Central Government Level Any change in laws are for the better	Perceived law and order / security problems
Economic Elements	• Funding increases every year; does not decrease • NE with long history of security problems has had no other external fund sources except government subsidy • External fund sources now coming in	
Social Trends	• Manipuris value education – people speak well and are educated • Changes in social patterns have made Manipuris go out of the State; but now have come back	• Some changes in social patterns can constitute a threat to Manipuri’s way of life, such as “unplanned growth of the population”.
Technological Trends	• New technologies bring new ways of doing things	
Environmental Trends		• Disturbances in weather patterns due to climate change • Longer dry season; stronger rainfall during wet season • Mountains, while still having forest cover, are getting denuded • Pollution

(2) Need-Gap Analysis

The need-gap analysis[9] was used to determine the factors that define the current state of PHED and PHED Urban Circle given their mandates and in the context of the current reforms and service standards. Used in conjunction with the SWOT assessment, it enables the identification of factors required to reach the target state, and then plan on how to fill in the gap between the two states.

The results of the need gap analysis, therefore, present areas where institutional development interventions can directly address identified weaknesses by leveraging on PHED and PHED Urban Circle's strengths (internal) and opportunities (external). It provides the path to reach the desired state (end or target state) complementing current reforms and initiatives rather than duplicate what is on the drawing board or are already being implemented. It specifically identifies the responsibility of the State government, through PHED as its water service provider, to implement service delivery policies and principles, such as clarifying its mandates, improving governance, financing and developing infrastructure, regulating services and building capacity.

a) Firstly, there is urgent need to ***strengthen the water supply sector policy framework area***. The key officers of PHED have been unanimous on the weak policy regime that has not fully addressed the needs of the water supply sector, thus stunting its development. It cannot be overemphasized that strong national laws and policies are vital to the water supply sector, where State laws take off to clarify the mandates for the *water service provider* – be this the PHED (state-level) or the IMC (ULB-level) – in terms of service delivery and accountability. Well-enunciated policies, which are aligned with State laws, are the bases of rules, regulations and guidelines. A strong and responsive policy framework not only gives overall direction to the water supply sector ensuring that whatever gains are sustained; but also creates convergence and coherence in planning and implementation of water supply services by bringing together the water service provider and the consumers on the same wavelength.

   The following laws and policies are direly needed: (i) New *law on water resources management* taking into consideration unique facts and features of Manipur, one of which is its total dependent on rainfall; (ii) New *law on water pollution control* aimed at protecting and conserving this precious resource; (iii) New *law on sewerage* to define the responsibilities of the State and those receiving sewerage services; (iv) Revision or amendment to the *Water Supply Act of the State of Manipur 1992* to strengthen it especially on the penalty imposed on water theft.

b) Secondly, the context within which the amendments are to be undertaken ***should be premised on improving governance of the water service provider***. The governance structures need to be geared towards improving the quality and efficiency of service delivery. This requires improving the financial and managerial autonomy of the state level or ULB-level water service provider along with incentives for improving customer orientation and service efficiency, for which

[9] Need gap analysis is an assessment tool for ascertaining and comparing the actual status and performance of an organization with potential performance.

different models can be explored. As a minimum this would include ring fencing the assets, staff and accounts of the water service activities within the state or the ULB. Beyond that, establishing independent utilities, including corporatization of public sector service providers would be basic prerequisites for promoting a virtuous cycle of efficiency and sustainability of services, including the achievement of Service Level Benchmarks.[10]

Governance measures should pervade three areas of change, where: (i) Change should relate to the stakeholders within themselves, which will be inclusive of the mode in which water supply personnel perceive their own roles and functions as well as the nature of relationship between themselves, the water supply institution and the consumers at large; (ii) Change should relate to the water services internal organizational environment especially the way in which the organisation relates to the public who are being identified as consumers / customers of the services offered by the water supply utility with the licence of rejecting the services of the utility by not taking the water connection, and thus not paying the water tariff; and (iii) Change should be within core stakeholders correlating to the modification which will incorporate changes in the way external stakeholders and the public at large perceive the relevance and importance of the water supply utility and the services it offers.

c) Thirdly, ***financing the requirements for water services should start moving towards immediate recovery of O&M costs***. This will solve the perennial problem and excuse of "lack of financial resources" to properly operate and maintain the system. In the short term, the finances for capital investments may continue to be granted by the States or the central government. However, in the medium term, the goal should move to 100% sustainability in both O&M and capital investments with implementation of reforms in municipal accounting, including double entry book-keeping for improving transparency and financial management systems.

d) Fourthly, ***there has to be autonomy given to the water service provider to implement a tariff structure***, based on transparent accounting and auditing of financial statements. A realistic tariff structure will strengthen the financial position of the water service provider and will give to it funds required to operate and maintain the system. The Detailed Project Reports (DPRs) for schemes should lay down the specific components of O&M cost, including staff, structures and consumables. It should also specify the suggested rates for user charges, which should lead to regular recovery of O&M expenses and recovery of CAPEX through installments, leading to full recovery of the capital investment (including major repairs) over the project period, depending on agreements / contracts.

e) Lastly, there is a need ***to start developing a modern and professional water supply (and sewerage) sector***. This requires the transition from the being a state-centric to being local body-centric in service provision as defined in 74th Amendment Act that favours decentralisation. When this materialises, the State can start rethinking its role and responsibility as an organization

[10] Advisory Note: Improving Water Supply and Sanitation Services, Ministry of Urban Development, April 2012.

with the technical resources to advise the ULB / IMC on water supply policy aspects, guidelines on standard designs and specifications, schedule of rates, recruitment and staff training programs, construction and supervision of new assets, O&M of assets, along with capacity building for improving professional competence and monitoring and evaluation of the sector program. The local body, once given the decentralised responsibility to manage, operate and maintain the facilities, can then focus on improving services, increasing financial sustainability, and becoming more accountable with greater customer orientation.

f) On the **issue of amending the *Water Supply Act of the State of Manipur 1992***, the amendments should be forward-looking and should highlight some of the more central procedural changes for the water supply system processes, such as:

- Addressing the issue on financial strengthening, revision should relate to the greater financial independence of the water supply utility or water service provider. For example, a separate budget for water supply operations would strengthen the working of the water supply utility. Another should also include the provision of having to ring-fence the budget for the water supply operations;
- Incorporating the rights of citizens, as not only being merely customers served by the water delivery system, but key stakeholders with a right to safe, sufficient and 24X7 water supply. By acknowledging the right of the citizen, the water department will recognize and endorse a shift in the role, from being sole determinants of all water related policies, planning and implementation, to being one of important, players in the water services operational area;
- Reflecting accountability of the water service provider to especially taking the onus of responsibility for the outcomes for delivery of services. The managers of the water utility should be accountable for the effectiveness with which they perform and ensure, in the process, competency in delivery of the water supply services;
- Scaling up the communication channels with all other stakeholders both internal and external with the objective of strengthening relationships based on the recognition of the inherent responsibility all persons and groups who have to collaborate in the task of preserving water sources and water supply systems for future generations;
- Encouraging and facilitating synergistic partnerships between the state government departments, local bodies, primary stakeholders and representatives of Manipuri people with a shared goal of building sustainable water service systems;
- Including tactical usage of technology and managerial capability of the water services organization as the focal point to convert the water supply systems into a more people-oriented, responsible and transparent/ethical organisation.

g) Still on the issue of amending the Water Supply Act, it is ***timely to push for a "one-time big time" revision that will tackle strengthening the water supply side of the Act, while drafting/ enacting new legal provisions on the sewerage side***. PHED requires a formal or legal mandate to manage, operate and maintain soon-to-be-completed sewerage facilities for the Imphal area from which sewerage policies, rules and regulations shall be based. The proposed law that integrates both services can be called the “Water Supply and Sewerage Act of 2014.”

h) *The other areas where weaknesses have been observed by the key officers, and the where specific action plans have been prepared, are discussed in detail in Section 13.4 “Institutional Improvement”*. These are (i) Self supporting organisation management; (ii) Formulation of long-term and annual business plan; (iii) Provision of asset ledger; (iv) Improvement of management information system; (v) Streamlining the water tariff revision and improvement of collection system; (vi) obligation of water meter installation and reduction of public faucets; (vii) Preparation of financial statements; (viii) Improvement of customer service; (ix) Human resource development and improvement of personnel system; (x) Preparation of improvement plan for non-revenue water.

6.2.2 Organisational Options for Water Supply Services

Under the Indian Constitution, water supply is a State responsibility. In the rural or municipal areas, the State may give the responsibility to the Panchayati Raj Institutions (PRI); while in the urban area, responsibility is given to the Urban Local Bodies (ULB). At present, States generally plan, design and execute water supply schemes, and often operate them, through their State Departments, such as the Public Health Engineering Department (PHED) or the Rural Development Engineering Department, or even the State Water Boards.

(1) Decentralisation of Water Supply Services to the ULB

For urban water supply, policy changes and amendment in the laws have pushed efforts to decentralize decision making down to the lowest practical level and responsibilities are now being given to the ULBs as enshrined in the 74th Amendment Act. However, there is concern regarding the institutional capacity of ULBs in managing the functions proficiently, a situation being faced by the State of Manipur, where the transfer of operation and maintenance of the Imphal water supply facilities to the Imphal Municipal Council has been stalled even with the signing by is in the Memorandum of Agreement (MOA) signed by and between JnNURM and State of Manipur in 2006.[11] Experience shows that the smaller ULBs may take a longer time to develop adequate institutional capacity in the short term compared to the larger ones, necessitating the retention of the State Level WSS Departments as knowledge repositories, or as provider of technical support, or as facilitator of operational services to the ULBs.

[11] Memorandum of Agreement (MOA) between Government of India and Government of Manipur and Imphal Municipal Council, under the Jawaharlal Nehru National Urban Renewal Mission (JnNURM), November 2006.

(2) Typical and Non-Typical Institutional Arrangements

Institutional arrangements for service provision water supply in Indian cities vary greatly. Typically, a state-level agency is in charge of planning and investment, while the ULB is in charge of operation and maintenance. Some of the largest cities have created municipal water utilities that are legally and financially separated from the local government. In spite of decentralisation, ULBs remain dependent on capital subsidies from state governments. Tariffs are also set by state governments, which often even subsidise operating costs. Furthermore, when no separate utility exists, there is no separation of accounts for different activities within a municipality.

Some states and cities have non-typical institutional arrangements. For example, in Rajasthan the sector is more centralised and the state government is also in charge of operation and maintenance, while in Mumbai the sector is more decentralised and local government is also in charge of planning and investment. In 2012 the Delhi Jal Board contracted out operations and management in three zones of the city to private companies under performance-based contracts to reduce non-revenue water. The Vasant Vihar-Mehrauli zone is operated by SMPL Infrastructure of India, Malviya Nagar by Suez Environment and the Nangloi zone by Veolia Environment.

Successful public water utilities as envisioned in India combines performance incentives and standards, as well as gets the customers to pay for water and services provided through tariffs, which in turns leads to the recovery of operation and maintenance costs, and/or even the full cost of capital improvements, resulting in a self-sustaining and vibrant organisation. Indian state governments are now making headway with their efforts in ensuring water supply utilities to perform and achieve their mandates, particularly where it means shedding power or granting more autonomy in either setting tariff mechanisms, in allocating resources, or even a change in organisational form. The critical step for the state governments is to recognize their role as owners, as distinct from the policy makers and the financial risks they have to bear as owners of the water supply utilities. **Table 6.7** shows three types of water organisations under the government's purview.

Table 6.7 Three Types of Water Organizations under Government Purview

Characteristics	**Type of Government Body**		
	Ministry or Department	**Statutory Body / Parastatal**	**Company**
Legal Basis	An executive order	A statute	A memorandum and /or Articles of Association and/or Articles of Incorporation
Status as Legal Entity	Generally unincorporated, and is without legal status separate from that of the government	Either incorporated or unincorporated	Incorporating its own legal entity
Basis of Ownership	Owned by the government as it is the creator	Owned by the government as it is the creator of the body	Owned by the government as creator and shareholder
Legal Framework	Operating under public law	Operating under public law	Operating under private (company) law

Adapted from: Thynne (1994) (Braadbaart, Blockland and Schwartz, 1999).

It is the public ownership and management aspects that shape the character of the utility and how it interacts with its external environment. As shown in the table above, the “public” aspects of a water utility relate largely to the legal basis of the organization, ownership, and management of the service. The ministry-owned department type of organization relates to the typical municipal water works departments present in most of the Indian states.

The “statutory body” can be correlated with what has been referred to as parastatals or corporatized utilities. The essence of the statutory body is that the utility has an autonomous corporate status under a special act enacted for the utility in question. Finally, government-owned utilities are incorporated as a company under company law, but the shares are owned by local, provincial, or, less frequently, national government agencies. The organizational structure of the government-owned company does not differ from that of a privately owned company. The only difference relates to the ownership of the shares.

6.2.3 Current Organizational Structure, Function and Personnel Composition

The Public Health Engineering Department provides the water supply and sanitation requirements of State of Manipur and ensures each Manipuri in the urban and rural area is supplied with safe and adequate water supplies. It conducts planning, designing and execution of both urban and rural water supply and sanitation schemes, as well as their operates and maintains these after completion. The objective of the government is to make every habitation accessible to safe drinking water.

PHED is led by the Principal Secretary, who, as the administrative head of the department, performs administrative works, financial management and budget control, as well as works related to internal vigilance, parliamentary affairs and cadre management. Reporting to him is the Chief Engineer, who, as the professional head of the department, is responsible for the proper and efficient management and operation of PHED. He is also called to provide professional advice in all matters relating to departmental operations. The Chief Engineer is assisted by the Additional Chief Engineer in the management and supervision of the work allotted to the department. There are four circles in the department, namely Planning, Urban, Rural I and Rural II, and each circle is headed by a superintending engineer. Presently, there are 19 divisional offices headed by an Executive Engineer. The present organisation structure of PHED is as shown in **Figure 6.4**.

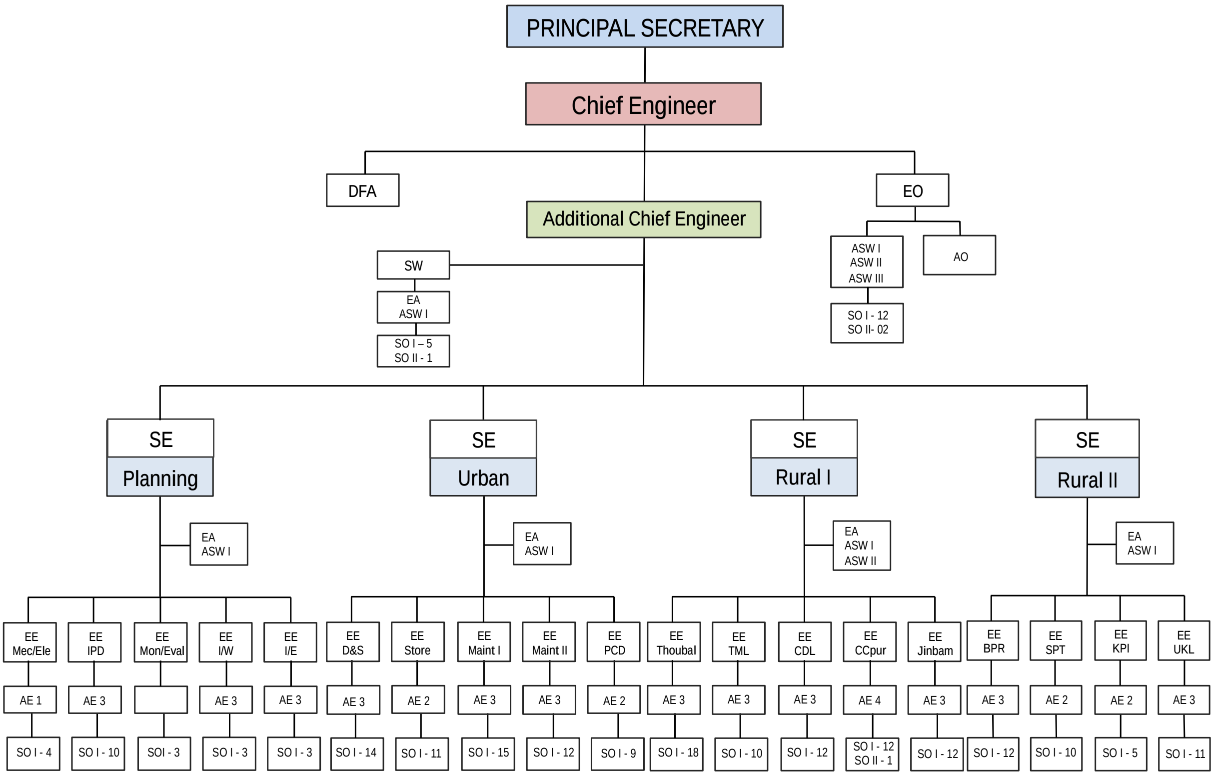


Figure 6.4 Organisation Structure of PHED

(1) Existing Organisation Structure and Functions, PHED Urban Circle

The circle responsible for urban water supply is the PHED Urban Circle and is headed by a Superintending Engineer. There are five divisions under the circle namely, Maintenance I, Maintenance II, Project Construction, Drainage and Sewerage, and Stores divisions, and each division is headed by an executive engineer, as shown in **Figure 6.5.**

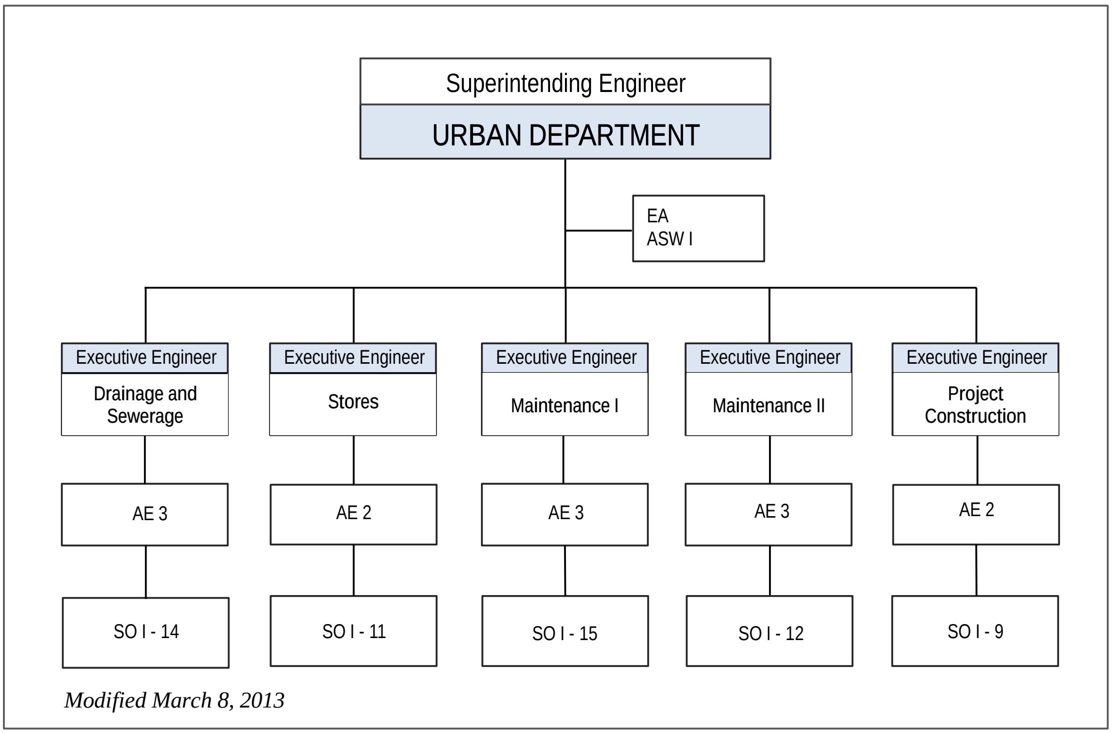


Figure 6.5 Organisation Structure of PHED Urban Circle

The functions and powers of the PHED Urban Circle, which has jurisdiction over Imphal City, plus its immediate environs, are as follows:

a) Exercises overall supervision, management and monitoring over the entire urban water supply systems of the State of Manipur, particularly Imphal City;

b) Operates and maintains all urban water supply schemes, water treatment plants and related facilities;

c) Executes engineering works, such as planning and development, related to urban water supply system;

d) Ensures the quality of water through sample testing, quality monitoring and surveillance;

e) Provides water services such as water supply connections to its various consumers in the urban and peripheral areas;

f) Bills and collects water revenue;

g) Prepares project reports in connection with water supply system augmentation, operation and maintenance and monitoring; and

h) Supervises construction over and O&M of the sewerage project of Imphal City.

(2) Current Personnel Strength Per Division, PHED Urban Circle

The total personnel strength of the PHED Urban Circle, as on May 2014, is 596 broken down into 492 staff occupying sanctioned posts, and 101 staff occupying non-sanctioned posts such as work charged staff, contract basis or casual staff and master roll staff, and three staff whose posts have been regularised but are neither in the sanctioned or non-sanctioned category. The summary breakdown is as shown in

Table 6.8; while the detailed distribution of the current personnel strength of PHED Urban Circle is found in **Appendix A6.2 (2)**.

Table 6.8 Summary of Personnel Strength of PHED Urban Circle

	Unit	Sanctioned Post	Non-Sanctioned Post	Regularised (but not sanctioned) Post	Total
1.	Office of the Superintending Engineer	34	0	0	**34**
2.	Maintenance I	181	41	0	**222**
3.	Maintenance II	102	32	0	**134**
4.	Project Construction	81	23	0	**104**
5.	Drainage and Sewerage	48	3	0	**51**
6.	Stores	46	2	3	**51**
	TOTAL	**492**	**101**	**3**	**596**

As on May 2014

(3) The Need for an Enhanced Organisation Structure

The completion of the Project will provide PHED Urban Circle with a new water treatment plant and over 900 kilometres of transmission and distribution pipelines, including reservoirs and overhead tanks. This will require an enhanced organisation structure designed take on the responsibility of serving a bigger service area and a growing number of customers more efficiently and effectively. Its present urban customer base of 20,056 service connections is expected steadily increase, such that the completion of Phase I and II (JnNURM-funded) in 2018 will enable PHED to accommodate 30,052 additional service connections, while the completion of Phase III (JICA-funded) will allow for 70,110 new service connections. These total 120,218 new service connections in a matter of seven years, or an increase in over 500 percent of the existing number of service connections.

Parallel to the physical facilities' improvement is the implementation of institutional improvement measures for which Action Plans have been prepared. These action plans translate into new activities, functions / tasks for PHED Urban Circle and its staff (present and new) which its organisation structure should make adjustments for as these functions / tasks were not previously performed, or given the proper impetus.

- The first set of new functions / tasks revolves around transforming PHED Urban into a financially self-reliant water utility, for which action plans have been prepared, to wit: (i) Having a self-supporting organisation; (ii) Preparing long-term and annual business plans; (iii) Preparing financial statements; and (iv) Revising water tariff to cover initially O&M expenses in conjunction with Improving water tariff collection. This necessitates emphasizing on the financial management function in the new PHED structure to emphasize which the PHED should have the capacity to perform.

- The second set of new functions / tasks involves paying equal attention to customer service functions as it does operation and maintenance. The saying "the customer is the reason for our business" has never been so true especially for PHED whose mandate is in the provision of essential public services, such as water supply. Action plans have been prepared to wit: (i) Improvement of customer service and (ii) Mandatory water meter installation for which the organisation structure must be ready to implement.
- The third set of new functions / tasks includes utilizing information technology to deliver essential water services for efficiently and effectively. Action plans have also been developed: (i) Improvement of Management Information System; (ii) Asset Management; (iii) NRW Reduction through water audit among other measures.
- The last set of new functions is in the area of human resources / personnel management for which an action plan has also been prepared.

All these new institutional improvement action plans require PHED Urban Circle to put in place the appropriate or suitable organisation structure designed to address and accommodate the above-mentioned functions and responsibilities as it evolves / transforms into a modern, service-oriented, and self-reliant water utility.

(4) Provision of Water Supply Services through Zonal Organisation Structure

The PHED Urban Circle will continue to provide water supply services through a zonal structure. Currently, the zonal structure is being followed by Maintenance I and II Divisions, but this has "spilled over" to Project Construction Division, with the latter functioning as the "maintenance" division. It is recommended that PHED will retain the same number of divisions, which is currently at five. However, Store Division will be subsumed as a function (section) of each zone division. The PCD will now officially operate as the third zonal division. A new division will be created which will handle vital utility functions not earlier performed and will be called the Information Management and Development Division. See **Figure 6.6** for the proposed organisation structure of PHED Urban Circle upon completion of the project.

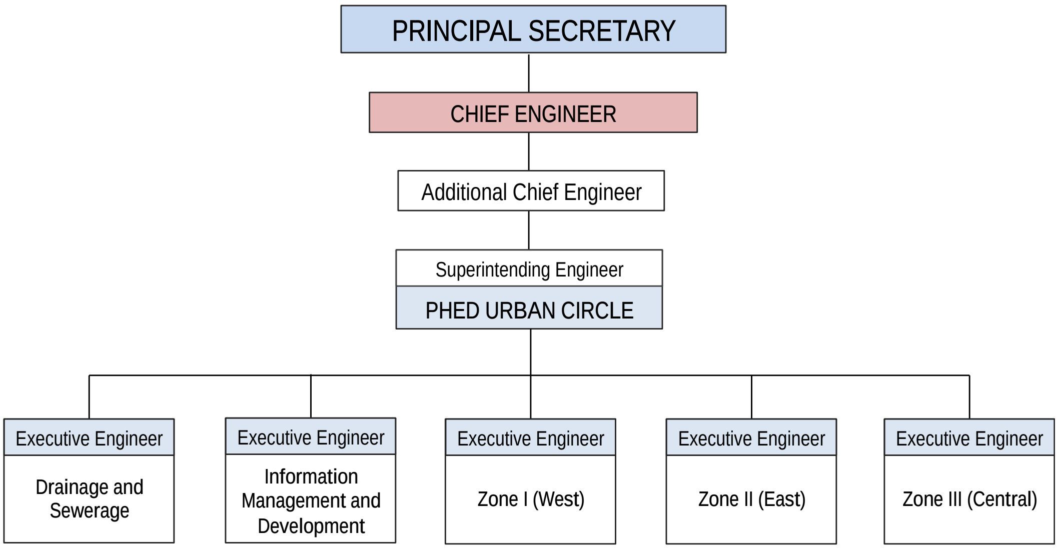


Figure 6.6 Proposed Structure of PHED Urban Circle upon Project Completion

(5) Reorganizing and Expanding the Zone Divisions' Structure

The existing zonal division functions, which are operation and maintenance of both production (intake and WTP) and distribution facilities (network, reservoirs, tanks), will be retained. However, in the proposed zonal division structure, the important function of customer (commercial) services, such as service connections, metering, billing and collection, and public information / grievance redressal, which are minimally attended to at present, shall be strengthened. This move will enable PHED Urban Circle to bill and collect water tariff on a regular basis, and to build its financial strength towards self-reliance and viability by covering at least its operation and maintenance costs. By doing so, PHED will level up – from being a production and distribution utility to a self-supporting utility that has been mandated to provide the water supply service to the satisfaction of its customers.

(6) Advantages of Zone Division Structure

There are several advantages of retaining albeit expanding. Firstly, as a compact operational unit, zonal structure can achieve more efficient O&M due to economies of scope and scale. Secondly, as a customer service area, it can perform more effective and rapid customer service response as the zone operations are closer to the customer. Thus, each zone division shall manage and merge operational and commercial activities in a specific area with the goal of offering continuous improvement of customer service. Lastly, it will achieve the benefits of the management principles of (i) *span of control* in terms of supervision and control over human resources; (ii) *equity* in terms allocation of resources; and (iii*) staff productivity* in terms of number and categories of staff assigned per zone.

(7) Guidelines in Zone Division Re-demarcation

The following will be the guidelines in re-demarcating the service and operational areas of the proposed three zones:

- Each zone division will be re-demarcated and will be re-named after the geographic location which appropriately describes the area and the location of the facilities. It should be noted that the current divisions' name of "Maintenance I" or "Maintenance II" is quite limiting since it does not reflect that entire functions of the zone, which are (i) both operation and maintenance (O&M) of process (production) and network (distribution) facilities, and (ii) management of customer services.
- When re-demarcating the operational and geographic limits of each of the three zones, PHED shall integrate the technical features of the distribution system (zone as basis of water distribution) in relation to the contiguous aspects of the service area (zone area assignment based on source and water treatment plant consisting of a few wards).
- The boundaries in the re-demarcation of each zone should be very clear to avoid overlaps or gaps in meter reading, billing and collection and in the provision of other customer services.
- Re-demarcation of the zones be made in the medium term (by 2016-2018) before the commissioning of Phase II improvements and the start of Phase III project. This will give PHED ample time to plan for the area-wise re-demarcation and the administrative and human resource arrangements required for approvals with regard to personnel movements and recruitment.

6.2.4 Structure and Functions of the Zones' Divisions

(1) Details on Future Operation and Maintenance Regime by Zones' Divisions

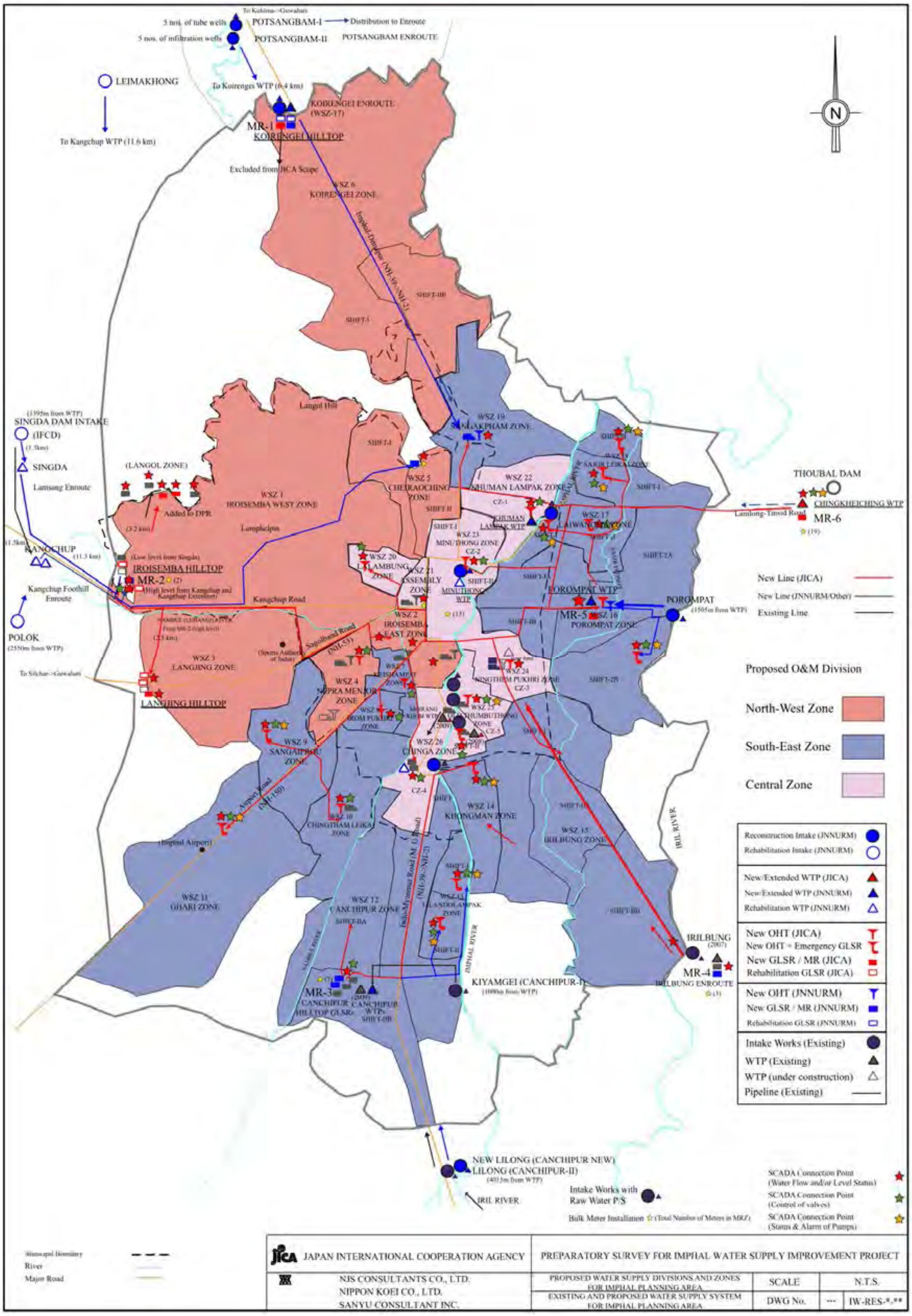
As earlier indicated, there will be three zone divisions, which will do operation and maintenance works. The ideal future boundaries of the three Zone Divisions were considered following these factors:

a) To keep the general area wise concept of the current divisions as much as possible
b) Basically, each zone division will take charge of intake to distribution
c) To keep the balance of areas and population
d) The zones should have simple, not scattered, contiguous boundaries

From the guidelines provided and above factors, and west zone would be Zone-1 Division, mostly the same with present MD-I; the east zone would be Zone-2 Division similar to present MD-II, and central zone will be Zone-3 expanded from present PCD zone (Chinga).

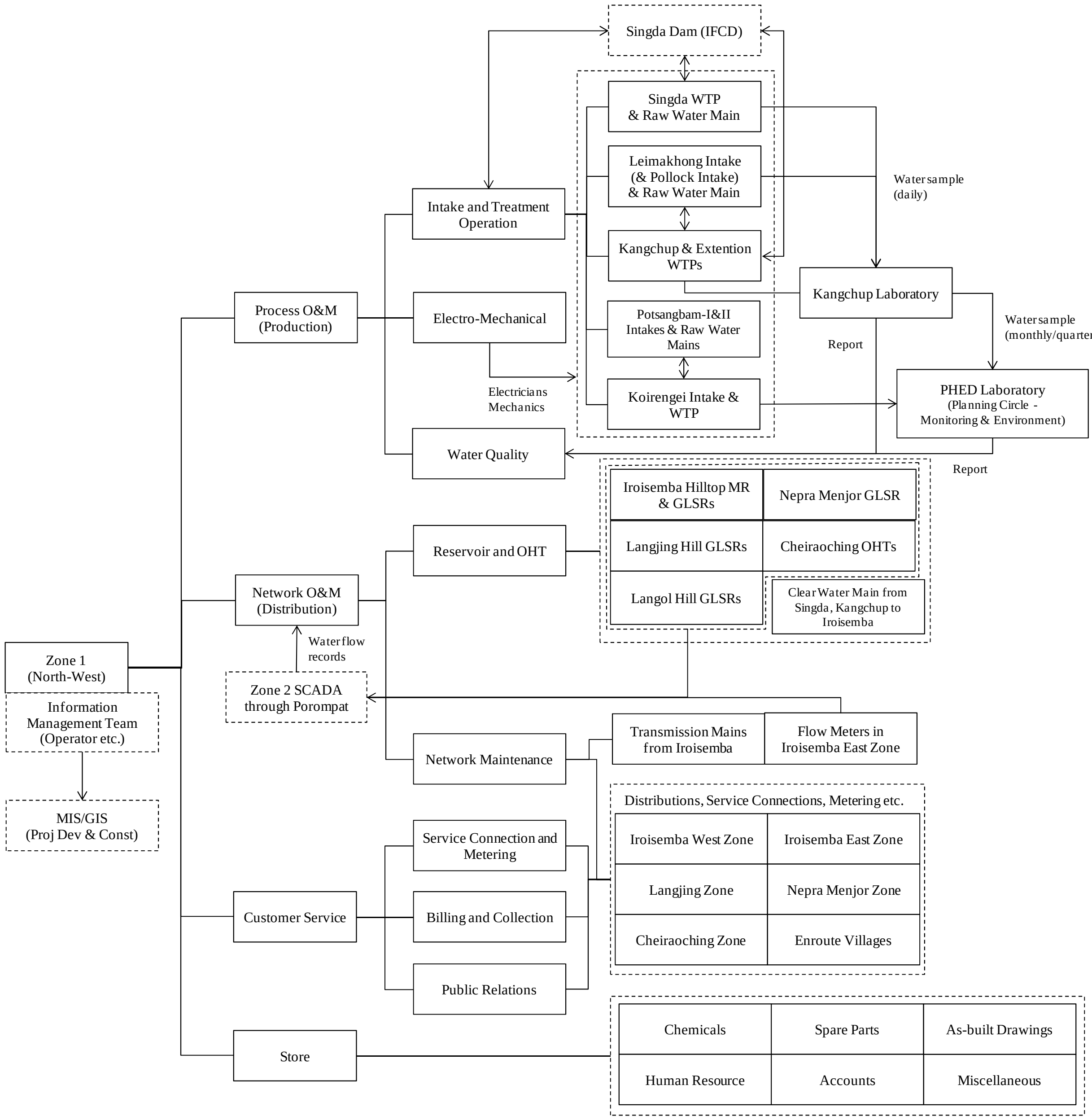
However, for the awareness of above c) and d), the following areas should have to be adjusted: (i) Since Ghari zone should belong to Zone-2 Division as a part of Thoubal Water Supply Scheme, Koirengei Zone as an independent zone belongs to Zone-1 Division: (ii) Since Zone-1 Division should be basically separate from Thoubal Water Supply System, Lalambung and Assembly Zones which will be supplied from Thoubal belong to Zone-3 (Central) Division.

From the considerations above, **Table 6.7** with proposed the operation and maintenance divisions and zones was prepared. The detailed organization structures of each Zone Division showing the internal flows of information are given in **Figure 6.8** to **Figure** 6.10. The number of required staff in each facility is shown in the cost estimate of personnel expenditure in the following subsection.



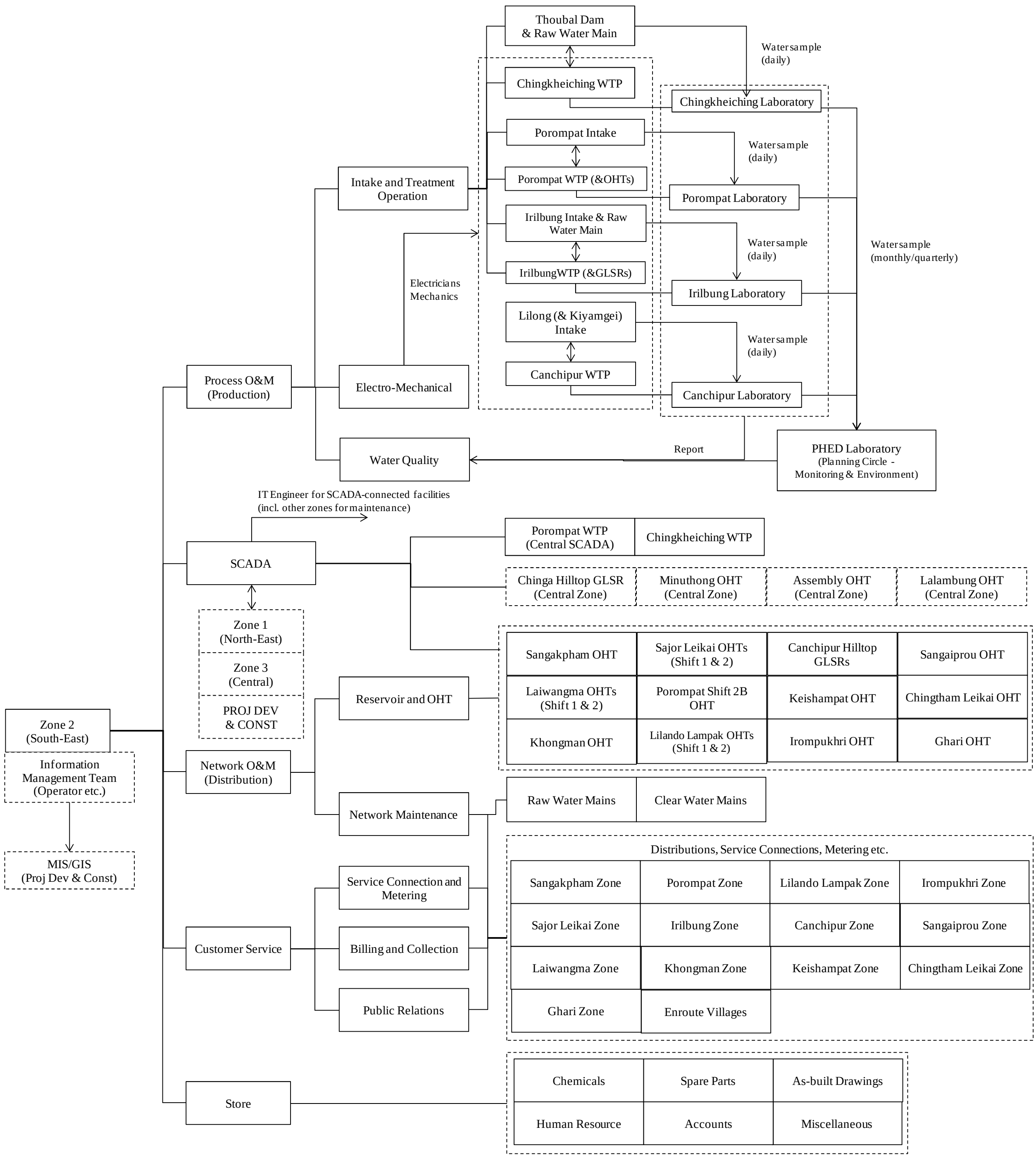
Source：Consultants, 2014

Figure 6.7 Proposed Zone Divisions' Demarcation



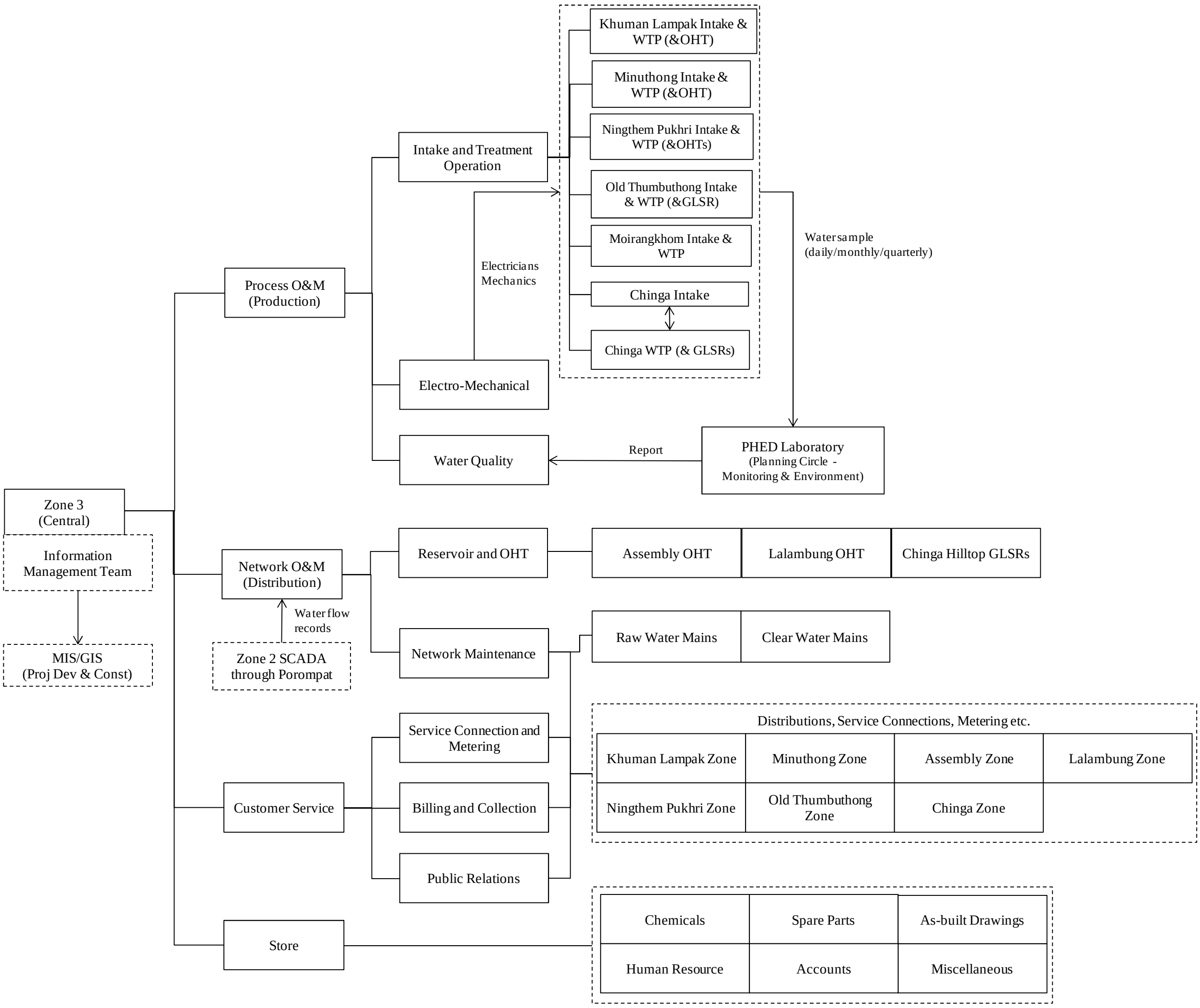
Source：Consultants, 2014

Figure 6.8 Proposed Organization and Information Flow of Zone 1 (Northwest) Division



Source：Consultants, 2014

Figure 6.9 Proposed O&M / Information Flow of Zone 2 (Southeast) Division



Source：Consultants, 2014

Figure 6.10 Proposed O&M / Information Flow of Zone 3 (Central) Division

(2) Structure and Functions of the Three Zonal Division

With the O&M and information flow presented, the proposed organization structure and the functions of the three zonal divisions are presented as shown in **Figure 6.11** for the proposed structure for Zone I (Northwest) and Zone III (Central) and **Figure 6.12** for the proposed structure for Zone II (Southeast).

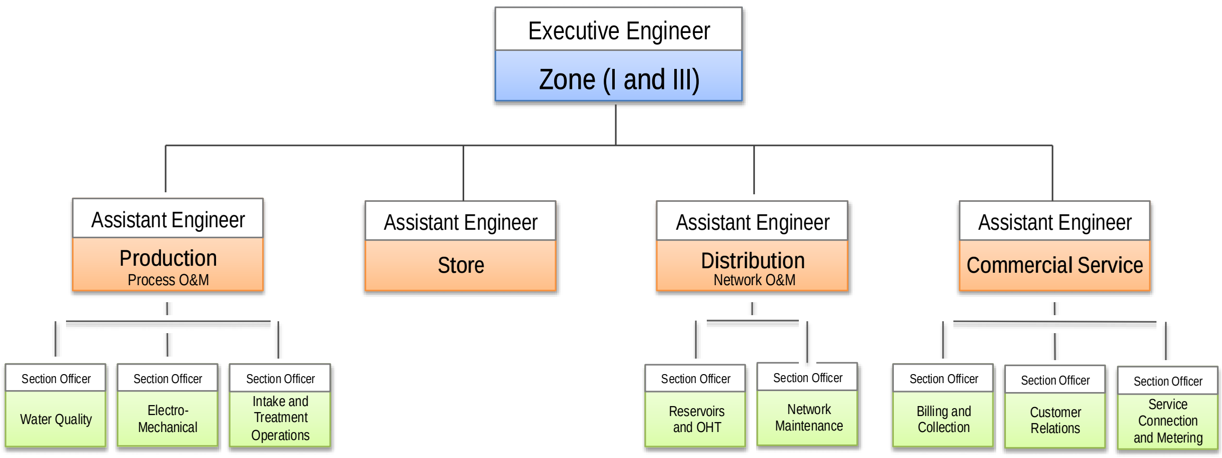


Figure 6.11 Proposed Structure for Zone I (Northwest) and Zone III (Central)

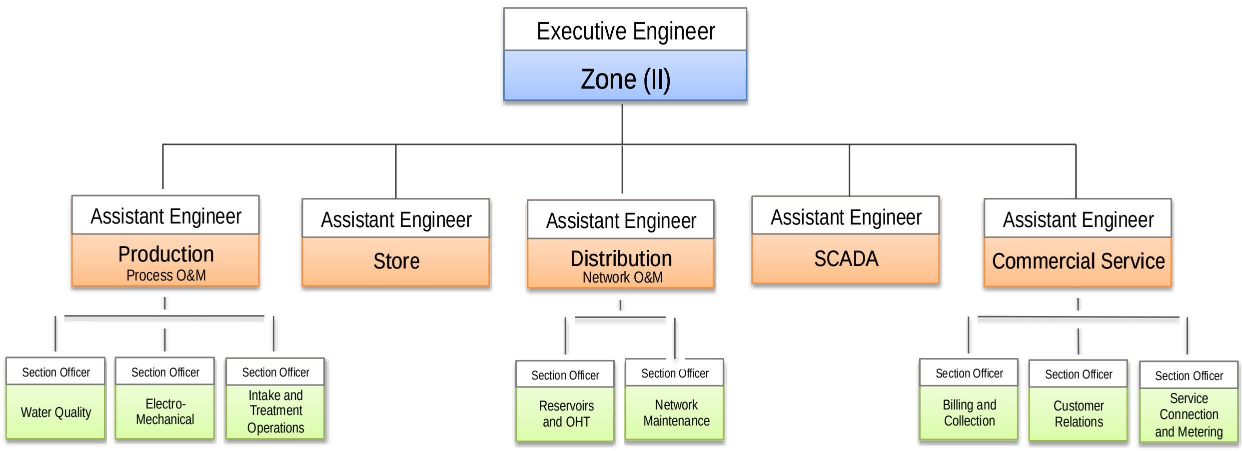


Figure 6.12 Proposed Structure for Zone II (Southeast)

(3) Functions of each Zone Division

Each Zone Division shall manage, operate and maintain potable water supply facilities in the areas under its zonal jurisdiction, including the management of commercial services aimed towards the satisfaction of the customers' needs and requirements in an environmentally sound manner.

Under each Zone Division are four sections – Production Section, Distribution Section, Commercial Section and Store Section, except for Zone II, which will have a SCADA Section.

(a) **Production Section:** The main responsibility of the Production Section is to operate and maintain production facilities and treatment systems in a manner that quality, quantity and continuity of services to its assigned geographic area are assured. As such, it shall:

- Manage processes required to maintain and guarantee the functioning of the water systems according to established CHPEEO standards, rules and regulations.
- Ensure that water produced conforms to the Indian Drinking Water Standard.
- Develop policies, plans, procedures and standards to improve operation and maintenance.
- Create and execute predictive, preventive and corrective maintenance of the water treatment system / facilities, as well as evaluate the results.
- Participate in the process of updating the water supply inventory of assets.
- Execute any other function related to its main objective.

Under the Production Section are three sub-sections – Water Treatment Plants, Electro-Mechanical and Water Quality.

(i) *Water Treatment Plants:* This sub-section is responsible for producing water according to current standard regulations. As such, it shall assess the quality of production processes through quality indicators; apply established techniques, procedures, protocols and regulations to achieve the ideal operation and maintenance of the treatment systems; maintain a continuous monitoring of water quality in both initial and final processes of production.

(ii) *Electro-Mechanical:* This sub-section is responsible for assuring the continuous operation of the water production processes through operation and maintenance of electro-mechanical equipment such as pumps, and special equipment such as telemetry links for the SCADA system. As such it plans, performs and controls needed activities and resources to execute maintenance for various pumping systems; creates and applies corrective, preventive and predictive maintenance plans regarding the electromechanical aspects of pumping systems; and optimizes electromechanical and infrastructure systems through application of energy savings measures.

(iii) *Water Quality Laboratory:* This sub-section is responsible for performing water quality analysis both in the water supply system and in the production process on a regular basis. As such, it ensures compliance to the Indian Drinking Water Quality Specifications and Standards. It observes and monitors the water production systems and processes, and submit conclusions and recommendations to the executive engineer in charge of the Zone Division for solutions and adjustments.

(b) **Distribution Section**: The main responsibility of the Distribution Section is to assure the efficient and effective operation of the water distribution systems by providing regular and standard maintenance to the entire network of transmission, distribution, service reservoirs and overhead tanks and related distribution facilities in the assigned geographic area. As such, it shall:

- Operate and maintain transmission and distribution networks, reservoirs and overhead tanks according to established CPHEEO standards, rules and regulations.
- Monitor and evaluate water supply distribution performance.
- Install and maintain water supply connections; monitor the distribution system and/or take appropriate measures against illegal connections.
- Create and execute predictive, preventive and corrective maintenance of the network system and facilities, as well as evaluate the results.
- Be involved in updating the distribution systems' inventory in its specific geographic area.
- Perform any other function related to its main objective.

There are two sub-sections under the Distribution Section – Network Maintenance Water Treatment Plants, Electro-Mechanical and Water Quality.

(i) *Network Maintenance:* This sub-section is responsible for guaranteeing the quality of water produced by ensuring proper maintenance of transmission pipelines and water distribution network under the geographic area under its coverage. It is also responsible for the installation and monitoring of metered service connections, as well as carrying out disconnection and reconnection orders.

(ii) *Reservoirs and Overhead Tanks:* This sub-section is responsible for guaranteeing the quality of water produced by ensuring proper operation and maintenance and breakdown control of service reservoirs, overhead tanks and other potable water systems and its component parts under the geographic area under its coverage

(c) **Commercial Section:** The main responsibility of the Commercial Section is to guarantee excellence of commercial services provided, contribute to PHED's objective of self-reliance and sustainability through regular billing and collection, and ensure the satisfaction of current and potential customers in its assigned geographic area. As such, it shall:

- Perform customer service quality investigations in order to define their specific needs and requirements in its assigned geographic area.
- Propose and apply regulations, policies, procedures and standards regarding commercial and customer service matters such as, but not limited to, billing and collection, metering and installation of service connections, as well as regulations against fraud and illegal connections.
- Establish as system of redressal of customer complaints and monitor the efficiency on the compliance of regulations, policies, procedures and standards in providing timely remedial action and resolution of the customer complaints.
- Process applications from current and potential customers for service connections, metering of service connections and other customer requests.
- Manage PHED's defaulting customer portfolio by performing effective and timely actions in order to recover default accounts, including uninstalling and installing of the services. If needed, prepare required documentation to process legal collection.
- Assess the adequate functioning of meter readings, in order to guarantee fair charges of the provided services.
- Schedule, perform and supervise tasks related to meter reading, bill delivery and collection of tariff.
- Perform any other function related to its general objective.

There are three sub-sections under the Commercial Section – Billing and Collection, Customer Relations, and Service Connection and Metering.

(i) *Billing and Collection:* This sub-section is responsible for ensuring the satisfactory fulfillment / performance of the billing and collection cycle according to established standards, policies and regulations, and for managing the billing collection and billing staff (or agents) in performing effective and timely actions for the payment registry in PHED accounts.

(ii) *Customer Relations:* This sub-section is responsible for designing and applying strategies to manage relationships with customers; developing awareness programs with organized groups which facilitate activities to regulate service provision, both technically and legally; establishing adequate media to assure timely disclosure of events which affect or modify conditions under which the service is provided both for the PHED's internal public and external customers; developing activities to collect past due accounts and socio-educational programs regarding rational water usage and payment responsibilities in its assigned geographic area; and being a bridge between the PHED and communities / wards which expect to be managed by it or those which do not yet receive proper service.

(iii) *Service Connection and Metering:* This sub-section is responsible for implementing and monitoring compliance to regulations, policies and procedures regarding service connections and meter reading; processing with dispatch service connection and/or metering applications from current and potential customers and closely coordinate with the Distribution Section / Network Maintenance Unit regarding scheduling and performance of service connection / metering installation; managing customers' service portfolio to assure real collection of consumption, timely water meter reading and personalized customer services; and managing inactive services portfolio by applying adequate actions to avoid illegal connections from defaulting clients.

(d) **Store Section:** The main responsibility of the Store Section is to develop, supervise and manage the procurement process of goods and services which assure the proper civil maintenance of the zone's infrastructure and customer services in the geographic area of its responsibility, according to established State / PHED rules and regulations. As such it shall:

- Coordinate with various sub-sections / units under the Zone Division on their requirements for goods and services relating to performance of its functions.
- Plan and implement procurement process taking into consideration cost effectiveness, economies of scale, value propositions in order to guarantee effective maintenance programs and customer services.
- Provide for and ensure the safety and security of all equipment, spares' inventories and O&M supplies.
- Develop and maintain and inventory management and stock control system for judicious use of spares and supplies.
- Perform any other function related to its general objective.

(e) **SCADA Section**: The main responsibility of the SCADA Section is to control and monitor physical processes of water production and distribution. As such it shall:

- Manage the operational computing systems that are used for real-time monitoring and control for the water treatment plant, transmission main, reservoirs and overhead tanks.
- Maintain the functionality of the overall SCADA system (computers and software) at the Central SCADA Room at Porompat WTP and local SCADA system at Chingkheiching WTP.
- Periodically check and maintain the communication system at each facility that is connected to SCADA system including those in other Zones.
- Process the data taken from SCADA system into monthly/yearly records that are to be utilized for reporting and Management Information System (MIS).

- Distribute the water and equipment operation records taken by SCADA system to the concerned sections in the other divisions.
- Administer passwords and system access; plan and implement software refinements; oversee SCADA archiving and reporting.
- Perform any other function related to its general objective.

The SCADA section can be promoted into a higher level unit should the SCADA system be expanded to include the other WTPs (or even the sewage treatment plant) in the other Zone Divisions' areas in the future.

6.2.5 Proposed Structure and Functions for Information Management and Development Division

After the completion of the Project, information technologies such as management information system (MIS) and geographic information system (GIS) are going to be drivers of efficiency in the provision of services and will be performed by the newly organised Information Management and Development Division. MIS will be utilised in billing and collection, complaint redressal, financial management and human resources management. In addition, GIS will form the backbone in the functions of asset management and water audit. Information collected and generated shall guide both management and technical decisions so that interventions result in proper development of the water system and its operation. See **Figure 6.13** for the proposed structure of the Information Management and Development Division.

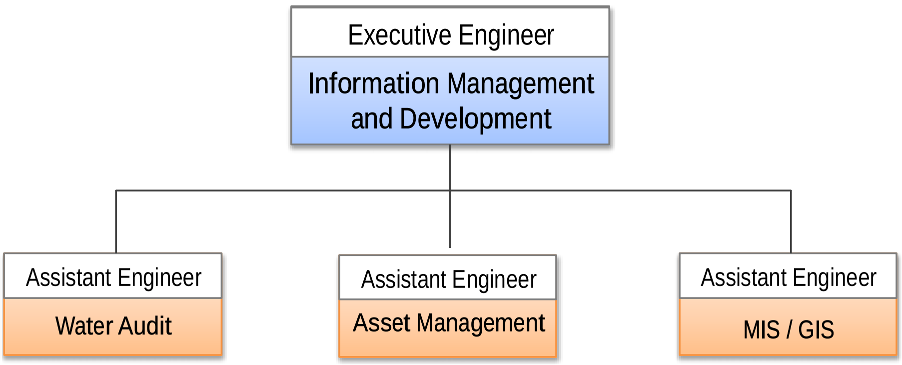


Figure 6.13 Proposed Structure for the Information Management and Development Division

(1) Functions of the Information Management and Development Division

The Information Management and Development Division shall assure the quality, continuity and sustainability of production and distribution systems and services utilizing appropriate information technologies aimed at developing and improving services. As such, it shall:

- Permanently maintain the updated and detailed system inventory, its components and condition of the entire PHED Urban Circle infrastructure and coordinate all updates with the Zone Divisions / sections and units concerned.

- Conduct needed investigations to establish capacity, vulnerability and current condition of the potable water and distribution systems in specific areas, through water audits.
- Maintain and update the management information system module(s), the geographic information system module(s) as well as all computing hardware.
- Research and develop the introduction of technologies that will benefit the optimum functioning of potable water systems.

Under the Information Management and Development Division are three sections – MIS /GIS Section, Water Audit Section, Asset Management Section.

(a) **Water Audit:** The main responsibility of the Water Audit Section is to protect the system from water losses which translate to financial losses, as well as threats to public health through the reduction of entry points for disease-causing pathogens. As such, it shall:

- Perform regular water audits, energy audits and other studies for the entire water supply infrastructure, including equipment, to prevent and correct imbalances, inaccuracies and failures.
- Monitor the on-off status of pumps and valves of main facilities; the water flow volumes at major nodes including the intake, WTP, reservoirs, major gate valve nodes within the distribution networks, and water quality at the intake and WTP outflows on real-time basis.
- Identify and quantify the water supply system's operation in order to avoid unnecessary losses due to unauthorized consumption (theft), as well as administrative, data handling and metering errors.
- Control, evaluate and develop timely recommendations to improve the system's operation and maintenance in order to reduce or eliminate water losses.
- Prioritize and implement water efficiency projects and operational changes directed towards continuously improving system performance.
- Keep all records of water audit examinations, such as billing records, flow monitoring, master meters readings, etc. to use in conjunction with traditional visual inspections and hydraulic modeling.
- Perform any other function related to its general objective.

(b) **Asset Management:** The main responsibility of the Asset Management Section is to establish, update and maintain the condition of all water supply assets and how these are performing, as decisions regarding maintenance, rehabilitation, and renewal revolve around clear knowledge and information of these assets. As such, it shall:

- Manage, maintain and update all information relating to asset creation, operation and maintenance, asset condition, performance monitoring, asset renewal/ rehabilitation and disposal.
- Define the level of service provided by PHED Urban Circle wherein the system cannot go below requirements (minimum level of service the system provides) and the system cannot go above the maximum capabilities of the asset (the maximum the system can provide).
- Ascertain from the system what assets are likely going to fail based on asset age, condition assessment, failure history, historical knowledge, and experiences with that type of asset in general.
- Be the central document and digital depository of assets' documents, digital asset maps, and ensure integration of data with GIS to further add value to the system by enabling spatial analysis.
- Proactively coordinate updating of assets information through the use of management / geographic information systems (MIS and GIS) including intra and inter institutional coordinative approaches with users within the Circle.
- Create, manage and maintain the entire distribution and treatment systems' geodatabase (GIS) and update this every time a new system / scheme / equipment is received.
- Perform any other function related to its general objective.

(c) **MIS / GIS:** The main responsibility of the MIS / GIS Section is to apply information technology to provide PHED management with adequate information for decision-making and its users with real-time data and information to accomplish their tasks better. As such, it shall:

- Manage and maintain the database that was developed to collect (i) geographic information of distribution network facilities and service connections, (ii) asset information, (iii) customer data, (iv) management information with regard to water supply operations, such as water flows, pump operations, water quality, water consumption, (v) bill issuance and recovery, (vi) customer redressal, and (vii) financial management records.
- In storing, retrieving, processing and transmitting data, it shall implement physical and information technology infrastructure monitoring and put in place strict / foolproof security measures.
- Provide periodic system maintenance and upgrades to both the software and hardware components of the information technology system.

- Be the system administrator for the PHED website and ensure that all information are current.
- Perform any other function related to its general objective.

6.2.6 New Sections for Administration and Finance and Accounting

Given the direction of the Urban Circle to improve and enhance its water utility operations towards financial viability and organisational self-reliance, two new sections are proposed under the Superintending Engineer. These are the Administration Section and the Accounting and Finance Section, as shown in **Figure 6.14.**

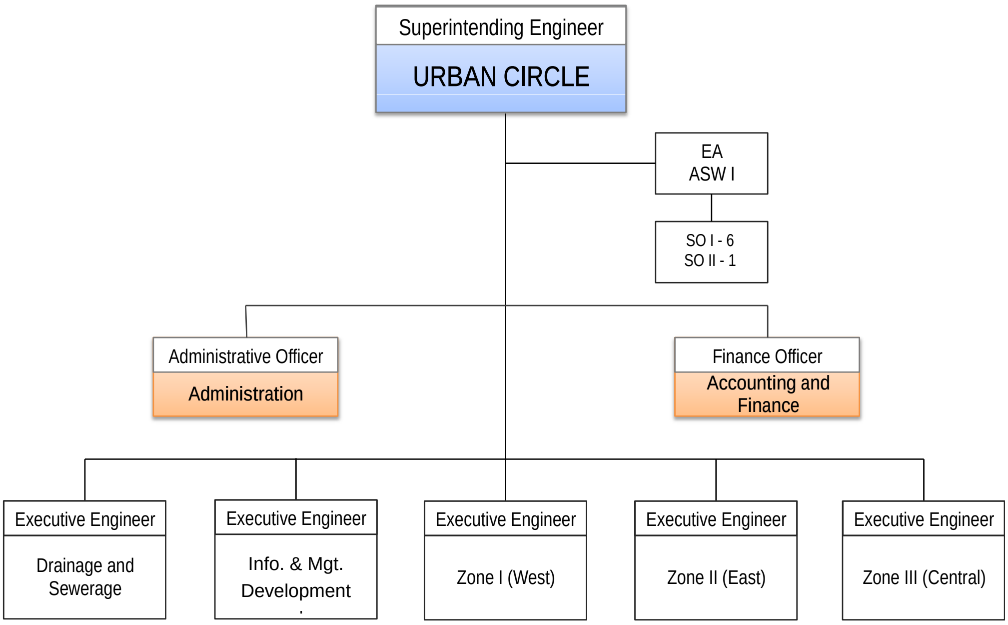


Figure 6.14 Administration and Accounting and Finance Sections (Under the Superintending Engineer)

(1) Functions of Administrative Section

The main responsibility of the Administration Section is human resource management, to include training and development to respond to the Urban Circle's present and emerging needs; consolidation and processsing of procurement requests from the Zone Divisions' Store Section; providing essential general services to support the efficient functioning of PHED Urban's water supply system; and implementation of health and safety measures in the workplace. As such, it shall:

- Implement PHED human resource management policies, service rules and regulations with regard to selection and recruitment, training and development, promotion and performance management.

- Prepare the Circle's human resource plan based on current and future demands for efficient and effective functioning.
- Conduct training assessment, prepare and implement the short term, medium term and long term training and development plan aimed at enhancing the capacities of the Circle's human resources.
- Manage the HR database/s, its physical and electronic security.
- Provide the following general services: (i) transport, (ii) security, and (iii) general maintenance of facilities.
- Perform any other function related to its general objective.

(2) Functions of Accounting and Finance Section

The main responsibility of the Accounting and Finance Section is managing PHED Urban Circle towards sustained financial viability. As such, it shall:

- Accept payments from customers, consolidate the water fees collected by the three water supply zones (service connection / reconnection, water tariff, fines) and prepare regular collection reports.
- Prepare official financial reports on water supply operations for PHED Urban Circle management for information and decision-making purposes based on generally accepted accounting policies and standards of the State.
- Prepare the yearly PHED business plan in coordination with the division heads / executive engineers.
- Carry out tariff studies based on PHED service policies.
- Maintain the financial record of all water supply assets and determines asset life in coordination with the Asset Management Section.
- Assist in the preparation of O&M budgets in coordination with the division heads and consolidate these for the PHED Urban Circle water supply operations.
- Assist in the preparation of the procurement plan for supplies and consumables in coordination with the division heads and consolidate and monitor the inventory together with the Store Section of each zone division.
- Perform any other function related to its general objective.

As a summary, there are five divisions under PHED Urban Circle, 20 sections and 24 sub-sections as shown in **Table 6.9**.

Table 6.9 PHED Urban Circle according to Division, Section and Sub-sections

UNIT / DIVISION			SECTION		SUB-SECTION	
No.	Current Name	Proposed Name				
	Superintending Engineer	Superintending Engineer	1	Administration		-
			2	Accounting and Finance		-
1	Maintenance I	Zone I (West)	3	Production	1	Intake and Treatment
					2	Electro-Mechanical
					3	Water Quality
			4	Distribution	4	Network Maintenance
					5	Reservoirs and OHT
			5	Commercial Service	6	Billing and Collection
					7	Service Connection and Metering
					8	Customer Relations
			6	Store		-
2	Maintenance II	Zone II (East)	7	Production	9	Intake and Treatment
					10	Electro-Mechanical
					11	Water Quality
			8	Distribution	12	Network Maintenance
					13	Reservoirs and OHT
			9	Commercial Service	14	Billing and Collection
					15	Service Connection and Metering
					16	Customer Relations
			10	SCADA		-
			11	Store		-
3	Store	Zone III (Central)	12	Production	17	Intake and Treatment
					18	Electro-Mechanical
					19	Water Quality
			13	Distribution	20	Network Maintenance
					21	Reservoirs and OHT
			14	Commercial Service	22	Billing and Collection
					23	Service Connection and Metering
					24	Customer Relations
			15	Store		-
4	Project Construction	Information Management and Development	16	Asset Management		-
			17	Water Audit		-
			18	MIS / GIS		-
5	Drainage and Sewerage	Drainage and Sewerage	19	Sewerage		-
			20	Drainage		-

6.2.7 Staffing Considerations

Effort should be given to human resource planning to ensure that the enhanced organisation structure of PHED Urban Circle has the right number of staff, equipped with the right skills and competencies to do the job, and engaged/ hired at the right time. In this connection, the human resources plan should be anchored on the operational requirements and functions of each division and its subordinate units. The human resources plan should determine the types of positions and the number of human resources required, assess these against human resources' availability based on the quantity and quality of the current staff complement, and the benchmark the staff numbers with comparable Indian water supply and sewerage utilities. Once determined, revision to the employee service rules and regulations of PHED, as it affects the Urban Circle's ability to discharge its functions, should be urgently undertaken.

(1) Staff Productivity of PHED Urban Circle

Staff productivity is one of the main considerations when planning for the optimum number and level of staff. In 2007, the Ministry of Urban Development (MoUD) together with the Asian Development Bank (ADB) prepared a study, the *Benchmarking and Data Book of Water Utilities in India*, that provides information from water utilities in 20 JNNURM cities based largely on 2005–2006 data. According to the Data Book "the most important resources of a utility are its management and staff"[12] and the measure used for human resources management is staff/1,000 connections (staff productivity index).

Shown in **Table 6.10** are the number of staff in each zone division, the number of service connections and the computed staff per 1,000 connections ratio. As gleaned from the table, each division exhibits different staff productivity ratios, with Maintenance I having 19 staff per 1,000 connections (lowest ratio) and PCD having 40 staff to 1,000 connecitons (highest ratio) or double that of Maintenance I.

Table 6.10 Comparison of Staff Productivity among (Zones) Divisions according to Number of Employees and Service Connections

SL	Indicator	Maint I	Maint II	PCD
1	Number of Employees	222	134	104
2	Number of Service Connections	11,687	5,763	2,606
3	No. of Staff per 1,000 Connections Ratio [1/]	18.99	23.25	39.90

[1/] Staff/1,000 connections ratio = [number of utility staff] / [number of utility connections/1,000] is a management performance indicator used to assess staff productivity. This is computed in this table per division, rather than using the entire number of staff for PHED Urban Circle.

Under the MoUD and ADB study, the average staff/1,000 connections is 7.4 staff ratio, while the average ratio for developing countries in an earlier Water and Sanitation (WSP) World Bank study is 5.0. The indicator is generally used to measure the efficient use of human resources in a utility as manifested by low staff/1,000 connection ratio. However, two thirds of the utilities studied have contracted out some of its operations resulting to lower staff ratios. In the study, those with high staff/1,000 connections ratio are Bhopal (20.7), Indore (18.7), Mumbai (17.2), Kolkata (14.7), Chennai (13.3), and Chandigarh (8.6), with Kolkata and Chandigarh contracting out some services; while those with the lowest ratios are Jabalpur (0.4), Rajkot (1.1), Surat (1.7), Ahmedabad (2.2), Nagpur (3.2), and Nashik (3.4).

The staff/1,000 connection ratio for the entire PHED Urban Circle is shown in **Table 6.11.**

[12] ***2007 Benchmarking and Data Book of Water Utilities in India***, A Partnership of the Ministry of Urban Development, Government of India and the Asian Development Bank, p. 13.

Table 6.11 Staff per 1,000 Connections for PHED Urban Circle

	Indicator	PHED Urban Circle	
1	**No. of Service Connections**		
		2014	**20,056**
		Phase II (2018) Add: 30,052	50,108
		Phase III (2022) Add: 70,110	120,218
2	**Population Served** [1]		
		2014	**94,463**
		Phase II (2018)	236,918
		Phase III (2022)	565,025
3	**No. of Staff**		
		2014	**596**
		Assuming 20% increase by Phase III	**715**
4	**Staff per 1,000 Connections Ratio**		
		2014	**29.7**
		Phase III (2022)	**6.0**

[1] For this Project, the population served is computed as the number of service connections multiplied by household size (4.7 persons per household).

(2) Recruitment of Staff for New Posts

The number of staff of PHED has recently been increased with the infusion of 22 assistant engineers and 30 section officers. The new recruits have been assigned to the different circles under the Department.

As earlier mentioned, the completion of the Project will require for staff with appropriate qualifications to discharge or perform “new” functions in areas such as MIS / GIS, water audit, asset management, cpmmercial services, administration, accounting and finance. However, there presently is a ban on the recruitment of new staff. But with the completion of the project still to be by the year 2022, the partial lifting of the ban can be justified to accommodate posts not previously sanctioned for PHED Urban Circle, but required in the proper functioning of the new and rehabilitated system. In addition, strategies such as outsourcing certain functions (meter reading and security) can be considered. There can also be re-assignement or cross-assignment of staff, which will, however, require re-training. Actual staff to be retrained can be pinpointed after the conduct of training needs analysis.

(3) Proposed Staffing for New Units

The proposed staffing for the new units/ sections under the superintending engineer is in **Table 6.12**.

Table 6.12 Proposed Staffing for the Administration Section and the Accounting and Finance Section (2021)

SL	Section	Proposed Post	Grade	Number	Comment
1	Administration	Administrative Officer	2	1	• Head of Section • Direct recruitment from Manipur Administrative Services
		HR Assistant	3	1	Contract
		Training Assistant	3	1	Contract
		UD Clerk	3	1	Contract
		Database Operator	3	1	Contract
		Driver	4	6	To be consolidated under Administration but distributed to other units
		Mechanic	4	2	Contract
		Maintenance Foreman	4	1	Contract
		Labour	4	4	For Headquarter’s building and grounds
		Security	4		• Consolidated under Administration but distributed to other units • Can be outsourced.
		Total		**18**	
2	Accounting and Finance	Accountant	2	1	• Head of Section • Direct recruitment from Manipur Finance Services
		Finance Officer	2	1	Direct recruitment
		Cashier	3	4	• One at Headquarters, one for each Zone • Contract
		Accounting Clerk/ Assistant Cashier	3	7	• One at Headquarters, two for each Zone • Direct recruitment
		UD Clerk	3	1	Contract
		Database Operator	3	1	Contract
		Total		**15**	

The proposed staffing for Zone I, II and III Division is found in **Appendix A6.2 (3)**.

The proposed staffing for Commercial Section under Zones I, II and III is in **Table 6.13** below:

Table 6.13 Proposed Staffing for the Customer Service Section (2021)

SL	Unit	Proposed Post	Grade	Number	Comment
	Commercial Service Section	Commercial Officer	3	3	• One for each Zone; • Direct recruitment
		LD Assistant	4	3	• One for each Zone • Contractual
		Peon	4	3	• One for each Zone • Contractual
	Billing and Collection	Billing Officer	3	3	• One for each Zone • Contractual
		Cashier / Collection Officer	3	3	• One for each Zone • Contractual
		Billing Assistant	4	6	• Two each for each Zone • Contractual
		Collection Clerks	4	9	• Three for each Zone
	Customer Database	Customer Database Officer	3	3	• One for each Zone • Contractual
		Data Entry Operator	4	1	• One for each Zone
	Customer Service	Customer Service Officer	3	3	• One for each Zone • Contractual
	Service Connection	Customer Service Assistants	4	3	• One for each Zone • Contractual
	Metering	Meter Readers	4	96	• Eight per 10,000 connections (projected 120,000 connections) • To be distributed to the three Zones • Can be outsourced
		Meter Technician	4	6	• Two per Zone
	Call Center Operations	Call Center Operator / Customer Service Clerk	4	4	• One for each Zone • One for PHED main office
			Total	**146**	

6.3 Streamlining the Decision Making Process

This section examines the current approval process in the State of Manipur as it concerns the procurement of goods and services, including that of construction works. It presents the committee membership, meeting frequency, and the formulation of the Terms of Reference (TOR), among others. It provides for a proposal to streamline the decision-making process, which involves the decentralization of agreed-upon matters to the project implementing agency (PIA) in this case the State Government of Manipur through its Public Health Engineering Department and/or to the project implementation unit (PIU) based on a consensus with the agencies concerned so that the bounds of authority will be clearly defined between the state government and the implementation agency.

6.3.1 E-Procurement

In 2006, the GoI approved the National E-Governance Plan (NeGP), which was to lay the foundation and provide the impetus for long term growth of e- governance in India by setting up institutional mechanisms, core infrastructure and policies, and implement these in the Central, State and integrated service levels to create a citizen-centric and business-centric environment for governance.

In the spirit of good governance and in compliance with national policy, effective October 1, 2013, the Government of Manipur, through its Finance Department, issued an order that all call open tenders for construction / engineering / technical work for all Engineering and Non-Engineering Departments (and other state government undertakings, societies, agencies and autonomous bodies) worth Rs 1 (one) crore and above and procurements worth Rs 20 lacs and above shall be processed through the e-Procurement Solution of National Informatics Center (NIC) of the Government of India.

Thus, all Expressions of Interest (EoI), Request for Proposals (RFP) for consulting services and construction works, and notifications for inviting tenders are electronically uploaded / published in the website of the State Government of Manipur under “Tenders”. The EoIs, RFPs and invitations contain the name of specific project, the eligibility criteria, terms and conditions, deadline for the submission as well as the standard forms to be filled out, such as (i) Letter of Invitation; (ii) Information to Consultants (including Data Sheet); (iii) Technical Proposal; (iv) Financial Proposal; (v) Terms of Reference; and (vi) Contract.

As for the bidding for works, the information requirements are (i) Invitation to bid; (ii) Guideline to bidders; (iii) Contractor’s bid / tender and letter of acceptance; (iv) Information regarding tender; (v) Conditions of contract (general and specific); (vi) Particular project instruction; (vii) Description of work and bill of quantities; (viii) Technical specifications; (ix) Drawings; (x) Bidding data; (xi) Safety code; (xii) Rules for the protection of health and sanitary arrangements for workers; (xiii) Contractor’s labour regulations; (xiv) Bid security; and (xv) Guidelines to purchaser.

6.3.2 The System of Approval of Tender for Supplies and Works

The system of approval for tender of supplies for Engineering Departments, for which the PHED falls under, is spelled out under the Order by the Governor: Manipur No. 1/1/2003-FD, issued by the Expenditure Section of the Finance Department, Government of Manipur. It specifies the following: (i) The value of the tender; (ii) The name of the supply; (iii) The composition of the Tender Committee; and (iv) The accepting authority. See **Table 6.14**.

Under the Departmental Tender Committee, the nominated officer for PHED is the Joint Secretary (Home/RD and PR) by virtue of orders issued by the Finance Department, Government of Manipur, on January 11, 2013 for proposals for tender values of Rs10,00,001 to Rs 1,00,00,000. (The tender values were increased to the stated level with a Corrigendum issued dated January 28, 2013.)

For supplies and works that fall under the Higher Tender Committee, the Administrative Department shall prepare a summary file / report indicating the necessity of the proposal, the availability of fund, the details of the NIT, the eligibility of the participating firms, a comparative statement, the tender documents and so forth and submit these to the Finance Department to enable it to convene the meeting. Frequency of meetings for the tender committees is as required.

Table 6.14 Levels of Approval for Supplies' Tender according to the Value of Tender

	Value of Tender	Name of Supply	Composition of Tender Committee	Accepting Authority
1.	Up to Rs. 1,00,000/-	No tender committee is necessary. Quotations shall be invited by the HOD and processes on file		Administrative Department
2.	Rs. 1,00,000/- to Rs. 10,00,000/-	Lower Tender Committee (LTC)	• Concerned HOD as Chairman • Jt Secy/ Dy Secy/ Under Secy of the concerned Deptt • Jt Secy/ Dy Secy/ Under Secy of any other Deptt nominated by the Administrative Secy	Administrative Secretary
3.	Rs. 10,00,001/- to Rs 1 crore	Departmental Tender Committee (DTC)	• Administrative Secy as Chairman • Head of concerned Deptt • Jt Secy/ Addl Secy (Finance) • Any officer not below the rank of Jt Secy nominated by the Secretary / Commissioner (Finance)	Minister-in-Charge
4.	Above Rs 1 crore	Higher Tender Committee (HTC)	• Finance Secy Chairman • Administrative Secy • Head of concerned Deptt • Jt Secy / Addl Secy (Finance)	Minister-in-Charge

Source: Order of the Governor: Manipur No. 1/1/2003-GD (EXP) dated 24 December 2011.

In September 17, 2011 the State Government's order dated 7-9-2011 was issued. This is a partial modification of the Government's order dated 7-9-2011 where tender of works of value exceeding Rs 3.00 crore only shall be placed before the Higher Tender Committee in respect of all Engineering Departments, where no other Tender Committees in respect of works applicable to Engineering Departments shall be applicable. The financial ceiling, composition and accepting authority of the Central Tender Committee for Engineering Departments are as shown in **Table 6.15**.

Table 6.15 Financial Ceiling, Composition and Accepting Authority of Central Tender Committee of Engineering Departments

Sl No.	Value of Tender	Name of Supply / TC	Composition of Tender Committee	Accepting Authority
1.	Above Rs 3 crore	Higher Tender Committee	• Finance Secretary as Chairman • Administrative Secretary • Head of Concerned Department • Joint Secretary / Additional Secretary (Finance)	Minister-in-Charge of the Concerned Department

6.3.3 Proposed Decentralization with Legal Authority

Decentralization of decision making processes will entail the need for legal authority from the State to a particular government body, or the creation of an appropriate body to fulfill a certain objective or task in relation to the Imphal Water Supply Improvement Project (the "Project"). This need not require any revision of amendment of State regulations, but rather only a supplementation by the issuance of a *Notification by the State* decentralizing certain decisions to a specific unit / body.

It is proposed that five decision-making processes on procurement be decentralised: (i) Preparation of procurement-related documents; (ii) Technical evaluation; (iii) Approval of technical evaluation; (iv) Cost / financial evaluation; and (v) Approval of tenders.

(1) Preparation of Documents

Procurement-related documents to be prepared are the following: (i) Request for Proposal (RFP); (ii) the Prequalification Documents (PQ), and (iii) the Tender Documents for each of the packages under the Project. The legal authority comes from the Government in the form of a NOTIFICATION granting / empowering the Project Implementation Unit (PIU) for the Project to prepare the above-named documents.

In view of the limited experience on the scope of the project and its packages of the PIU in said domain, the Project Management Consultants (PMC) shall actively assist the PIU with the preparation of said documents. Therefore, the Terms of Reference for the PMC shall include such stipulation as part of their tasks.

(2) Technical Evaluation

It is proposed that the same Notification as described above shall include a section that the evaluation of all technical proposals received for the various packages under the Project will be performed by the PIU with the assistance of the PMC.

(3) Approval of Technical Evaluation

It is proposed that the approval of tenders for various packages shall be by the Tender Evaluation Committee (TEC), which is to be legally created, constituted and given authority in the form of a Notification from the State Government for the establishment of a Tender Evaluation Committee under the Chief Engineer, PHED.
The notification shall include the list of committee members, set the quorum for meetings, and specify the objective and scope of work of the TEC, which is to approve the technical responsiveness of the bidders for all the packages and recommend for the opening of the Financial Bids of the Substantial Responsive Bidders. Further, every meeting of the TEC shall be fully documented to form part of Project files and for submission to JICA, as required. The proposed members of the TEC and their positions are as shown in **Table 6.16**:

Table 6.16 Proposed Membership to the Technical Evaluation Committee

S.L	Official Post	Office	Position in TEC
1	Chief Engineer	PHED	Chairman
2	Representative	State Finance Department	Member
3	Superintending Engineer	Urban Circle, PHED	Member
4	Superintending Engineer	Planning Circle, PHED	Member
5	Project Manager	PIU	Member
6	Team Leader	PMC	Special Invitee

(4) Cost / Financial Evaluation

The same Notification (for Items 1 and 2) shall also include the evaluation of all cost / financial proposals received for the various packages under the Project to be performed by the PIU with the assistance of the PMC. The PIU, upon examining all financial proposals received from the responsive bidders, shall send its recommendation to the Tender Approval Committee (TAC).

(5) Approval of Tenders

The approval of tenders for the various packages shall be by the Higher Tender Committee as per State Government's order. **Table 6.17** provides the final decision making authority/ies in the five procurement processes. The composition of the Higher Tender Committee is shown in **Table 6.17**.

Table 6.17 Decision Making Authority per Procurement Process

S.I.	Procurement Processes	Final Decision Maker	
		Current	Proposed
(i)	Preparation of procurement-related documents	PHED	PHED-PIU
(ii)	Technical evaluation	Higher Tender Committee	PHED-PIU
(iii)	Approval of technical evaluation	Higher Tender Committee	PHED Tender Evaluation Committee
(iv)	Cost / financial evaluation	Higher Tender Committee	PHED-PIU
(v)	Approval of tender	Higher Tender Committee	Higher Tender Committee

Approving Authority (above 3 Crore)

6.4 Institutional Improvement

After a situational assessment of the Imphal water supply services, there is an urgent need for an integrated improvement (action) plan covering various institutional aspects, such as management, operation and maintenance, finance, legislation, natural and social conditions. **Figure 6.15** shows the arrangement of problems and issues to be addressed by subject area.

There are ten issues where action plans have been prepared, which will be undertaken by PHED with the assistance of the Project Management Consultants. These are:

(1) Self-supporting organizational operation
(2) Preparation of long-term and annual business plans
(3) Provision of asset ledgers
(4) Improvement of information management system
(5) Water tariff revision and improvement of water tariff collection
(6) Mandatory water meter installation
(7) Preparation of financial statements
(8) Customer service
(9) Human resources / personnel management
(10) NRW reduction

In parallel, an awareness campaign should be undertaken to support the main action plans. The topics to be taken up for the information / awareness campaign are:

- Marketing and promotion of service connections for new connections
- Information and education on importance of water metering for new and existing connections
- Benefits received in regularization of illegal connections
- Marketing and promotion of the necessity of payment of water tariff
- Information and education on water conservation measures

Field	Organisational/Institutional Issue	Strategy for Organizational/Institutional Improvement	
		Measures to Be Taken	Action Plan
Decision-making process	Streamlining of decision-making process	Independent operation of Imphal water supply	① Self-supporting management system
HR & personnel management system	Training is rarely done (almost no training in past 5 years)	HR development	⑨ HR development and personnel management system
	Lowering of staff motivation	Improvement of staff motivation	
Management information	No management plan	Clarification of management policy and plan	② Preparation of long-term & annual business plans
	Lack of data required for decision-making	Provision of management and O&M data	
			⑦ Preparation of financial statements
Asset ledger provision and O&M	No exsiting pipe ledger	Provision of asset ledgers for water supply facilities	③ Provision of asset ledgers for water supply facilities
	No reliable data on water volume	Data recording, arranging & keeping	
	No daily record on operational status	O&M of WTP	④ Imp. of information management system
Financial conditions	Low tariff revenue (66% to O&M cost)	Increase of water tariff	⑤ Adequacy of water tariff & imp. of tariff collection system
	Application of a flat rate system	Introduction of a metered rate system	
	Low efficiency in tariff collection (19.8%)	Promotion of water tariff payment	
	Low meter installation (2.8% of total connections)	Mandatory meter installation and its promotion	⑥ Mandatory meter installation
	Low quality of water supply service (supply hour, pressure, etc.)	Improvement of supply hour and pressure	⑧ Imp. of customer services
	Invonvenience in tariff payment due to limited payment place	Customer-friendly diversification of tariff payment	
NRW	High NRW ratio (Approx. 70%)	Practice of leakage detection	⑩ Preparation/implementation of NRW reduction plan
	Many burst accidents in distribution network		
	Low population coverage by water supply (18.3%)	Promotion of connection to water supply system	Extension of awareness campaign
	Many open-end pipes		
	Many illegal connections	Strengthening of penalty for illegal connection	
Water Act	Inadequate provision in Manipur Water Act	Amendment of Manipur Water Act	Amendment of Munipur Water Act
O&M status of water supply facilities	Significant deterioration of water supply facilities	Replacement of water supply facilities	Implementation of the project
	No dosing control of coagulants in WTP O&M	Guidance for WTP O&M	Guidance of WTP O&M
Natural & Social conditions	High percentage of BPL people (Urban: 32.59%, worst in India)	Consideration in water tariff	
	Limited water resources	Promotion of water-saving	

Note:
BPL: Below Poverty Line

Figure 6.15 Problems, Measures and Action Plans

Table 6.18 Summary of Action plans for Organizational and Institutional Improvement

	Item	Responsible Official	
	Preparatory survey		
	Submission of preparatory survey report		
	Establishment of PIU (Project Implementation Unit)		
	Conclusion of Loan Agreement (L/A)		
	Consultant selection		
	Detailed Design		
	Tendering assisstance		
	Construction Supervision		
	Construction Works		
	Phase-I Work (JNNURM)		
	Phase-II work (JNNURM)		
	Phase-III Work (JICA)		
	(Meter Installation Work)		
	Public Awareness Campaign	Admin. Officer	
	① Connection to Water Supply System		
	② Illegal Connection Regularization		
	③ Water Saving		
	④ Water Tariff Payment		
	⑤ Meter Installation & Metered Tariff		
(1)	**Self-supporting Organization Management**	**Chief Engr.**	
	Short-term Action Plan (During the Project implementation)		
	① Situational analysis of organizational operation & problems detection		
	② Arrangement of relationship between PHED Urban Circle & other external organizations		
	③ Review of ideal situation for foramation of self-supporting organizational operation		
	④ Introduction of self-accounting system		
	⑤ Monitoring & evaluation of the accounting system		
	Long-term Action Plan (After the Project implementation)		
	① Est. of self-management system without subsidy from the State		2036
	② Discussion with other agencies toward self-supporting organizational operation		2036
	③ Est. of self-supporting organizational operation		2037
(2)	**Formulation of Long-term and Annual Business Plan**	**Finance Officer**	
	Short-term Action Plan (Before Loan Agreement)		
	① Data arrangement & analysis on past O&M & finacial data		
	② Est. of basic policies for water supply business plan		
	③ Setting of long-term targets & strategy		
	④ Setting of annual target and scope of work		
	⑤ Preparation of draft long-termbusiness plan		
	⑥ Preparation of draft annual business plan		
	⑦ Finalization of Long-term and Annual Business Plans		
	⑧ Approval by assembly (if necessary)		
	Long-term Action Plan (After the Project implementation)		
	① Preparation of annual business plan		
	② Evaluation of ling-term business plan		2026, 2031, 2036
(3)	**Provision of Asset Ledgers**	**Zone I: EE**	
	① Conceptual design of asset ledgersfor water supply facilities using GIS		
	② Selection of basic map & software for preparation of asset ledgers		
	③ Review of input data for GIS database		
	④ Data collection of existing water supply facilities		
	⑤ Provision of IT devices for GIS database preparation		
	⑥ Training of GIS database operators		
	⑦ Construction of GIS database		
	⑧ Operation of asset ledgers		
(4)	**Improvement of Information Management System**	**IMD: EE**	
	Before Loan Agreement		
	① Procurement of PC data server for data sharing in the offices		
	② Connect the Porompat Office (M-II, PCD) to internet		
	③ Procurement of new PCs		
	④ Training of basic computer skills & CAD skills for staff		
	⑤ Initiation of data entry of various hand-writing records & reports		
	⑥ Initiation of preparing ledgers by CAD in each division on latest maps & arrangement of existing drawings		
	After Loan Agreement		
	① Procurement of new PCs for divisions		
	② Nomination of the staff who will be in charge of IMS & MIS in each division		
	③ Detailed selection of MIS modules with the help of PMC		
	④ Tendering on IMS/MIS for concerned staff (soft component)		
	(Remodeling of organizational structure)		
	⑤ Start of MIS operation		
	⑥ Training on IMS/MIS for concerned staff		
	(Remodeling of organizational structure)		
	⑦ Update/improve of IMS/MIS with the metering, GIS & SCADA data after the ptoject completion		
	⑧ Continue PC & software operation traings for staff every year		

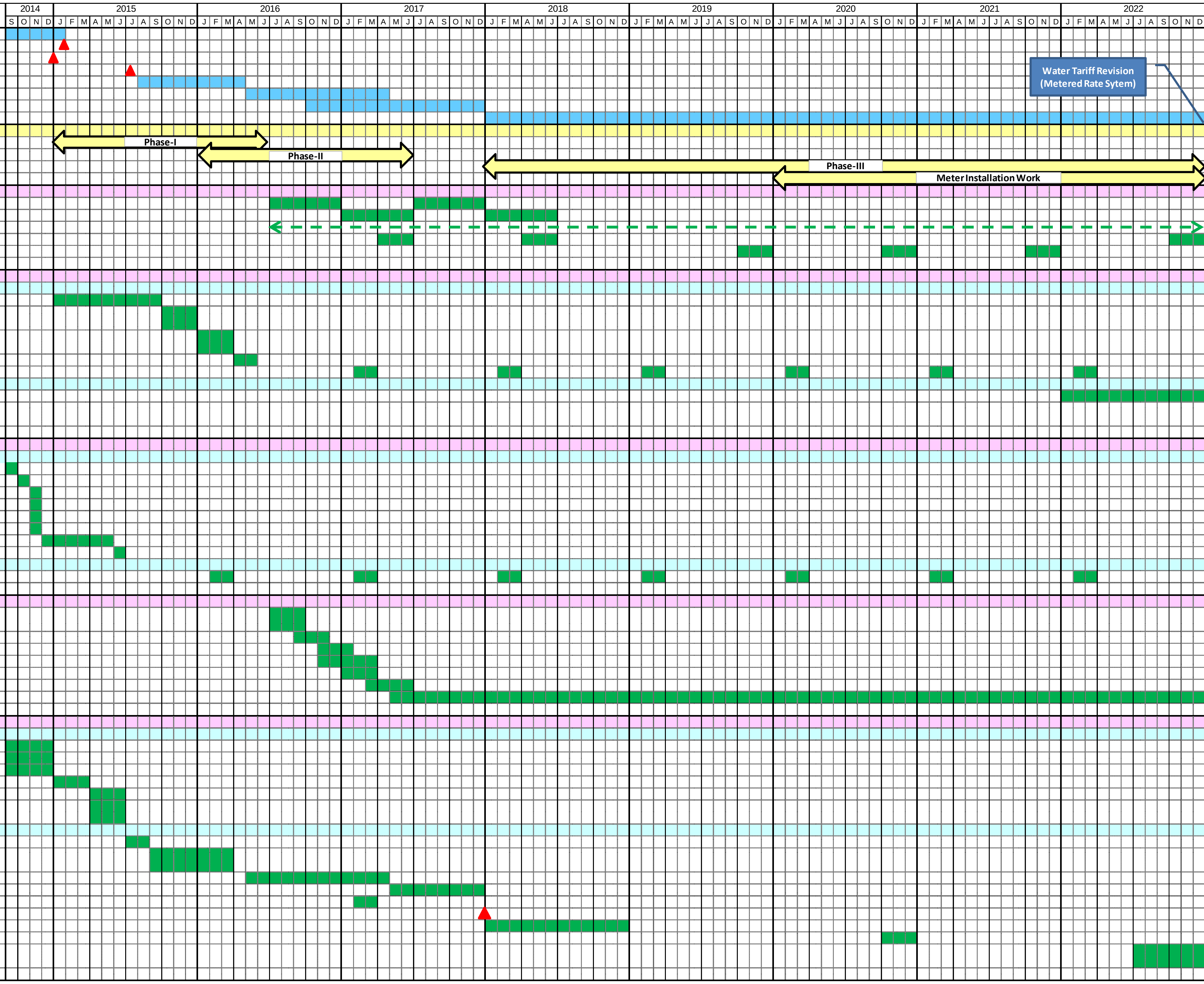
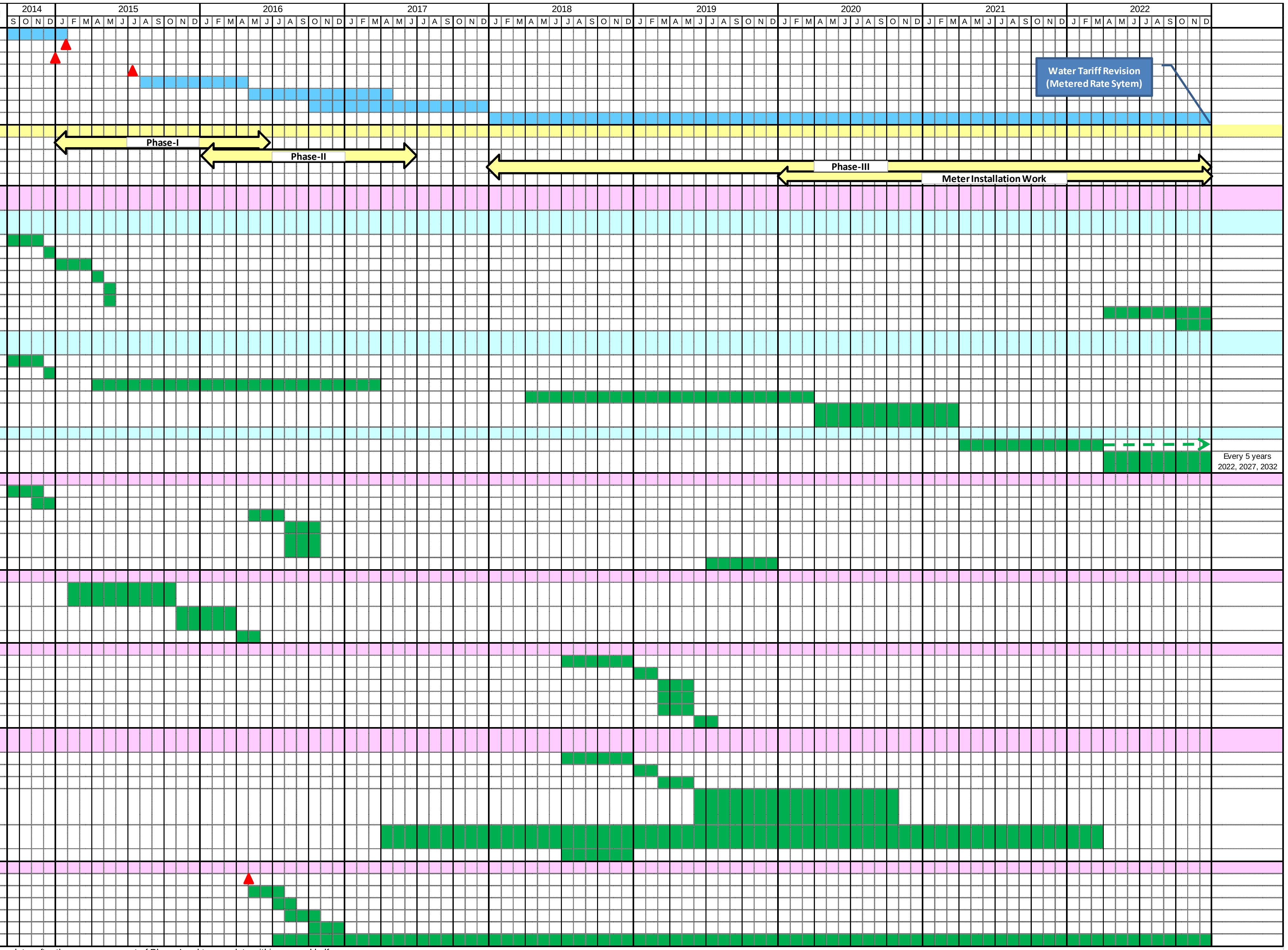


Table 6.19 Summary of Action plans for Organizational and Institutional Improvement (Cont'd)

	Item	Responsible Official
	Preparatory survey	
	Submission of preparatory survey report	
	Establishment of PIU (Project Implementation Unit)	
	Conclusion of Loan Agreement (L/A)	
	Consultant selection	
	Detailed Design	
	Tendering assisstance	
	Construction Supervision	
	Construction Works	
	Phase-I Work (JNNURM)	
	Phase-II work (JNNURM)	
	Phase-III Work (JICA)	
	(Meter Installation Work)	
(5)	**Streamlining of Water Tariff Revision and Improvement of Tariff Collection System**	**Finance Officer**
	Short-term Plan for Water Tariff Revision (During the Project Implementation)	
	① Problem identification in current tariff	
	② Est. of basic principles for tariff revision	
	③ Study on tariff rivision methodologies	
	④ Study on management efficiency improvement effots	
	⑤ Setting of new water tariff	
	⑥ Short-, mid- and long-term cash flow analysis	
	⑦ Revision of new tariff rate based on the updated information	
	⑧ Negotiation with organizations concerned toward revision of new tariff rate	
	Short-term Plan for Improvement of Collection Efficiency (During the Project Implementation)	
	① Situation analysis in current tariff collection	
	② Study on diversification of tariff collection methodologies	
	③ Implementation of pilot project	
	④ Implementation of social awareness campaign	
	⑤ Negotiation with organizations concerned toward realization of new tariff collection system	
	Long-term Plan (After the Project Implementation)	
	① Start of new tariff collection system	
	② Periodical revision of water tariff rates	
(6)	**Mandatory Water Meter Installation**	**Zone II: EE**
	① Situation analysis in service pipe installation work	
	② Clarification of responsibility & obligation between PHED & customers	
	③ Est. of licensed plumber system for service pipe installation work	
	④ Training of applicants for licensed plumber qualificationon	
	⑤ Training of PHED staff for final inspection of service pipe installation works	
	⑥ Study on meter reading and bill issuance method	
(7)	**Preparation Financial Statements**	**Finance Officer**
	① Present situation & problem identification in financial and accounting data processing	
	② Study on arrangement & classification method offinancial & accounting data	
	③ Preparation financial statements	
(8)	**Improvement of Customer service**	**Admin. Officer**
	① Institutionalize customer service functions in PHED Urban Circle	
	② Review staffing plan for Commercial Service Section	
	③ Review training plan for customer service staff	
	④ Review and (re)formulation of customer service policies	
	⑤ Formulate PHED Citizen's Charter	
	⑥ Est. complaint redressal system	
(9)	**Human Resource Development and Improvement of Personnel Assessment System**	**Sup. Engr.**
	① Institutionalize customer service functions in PHED Urban Circle	
	② Review staffing plan for Commercial Service Section	
	③ Review training plan for customer service staff	
	④ Implement the Induction / In-House Training for personnel of new sections as well as on new policies, rules and regulations after their release	
	⑤ Implement proposed training programmes during project implementation	
	⑥ Formulation of PHED performance appraisal system	
(10)	**Preparation of Non Revenue Water (NRW) Reduction Plan**	**Zone III: EE**
	① Est. of NRW reduction Committee	
	② Situation analysis on Non Revenue Water (NRW)	
	③ Study on measures/solutions	
	④ Review of present legal framework and amendment, if necessary	
	⑤ Regularization of illegal connections	
	⑥ Provison of GIS-based asset ledgers [**See (3)**]	



Note: The construction schedule of Phase-II has not yet been fixed at this moment, but assumed to start one year later after the commencement of Phase-I and to complete within one and half years.

6.4.1 Self-supporting Organizational Management

The current water supply management of PHED falls in a vicious cycle. Due to low level of water supply services, including intermittent water supply and low quality of piped water, the people are reluctant to pay water tariff resulting to a collection rate that is chronically quite low. As a consequence, the revenue of PHED remains at a low level and budget for operation and maintenance of the Imphal water supply system is always insufficient. Due to shortage of budget and human power, maintenance work is also inadequate, and replacement of degraded facilities and new investment are difficult to undertake, which, in turn, results in the low level of water supply services.

Figure 6.16 Current Situation: Vicious Cycle

Figure 6.17 shows revenue and expenditure of the Imphal water supply in 2013-14. Expenditure consists of non-plan expenditure (41%), operation and maintenance cost (11%), and capital investment (48%), whereas revenue includes tax and other income which covers only 7.4% of total expenditure. On a business management perspective, the Imphal water supply operates at a serious deficit.

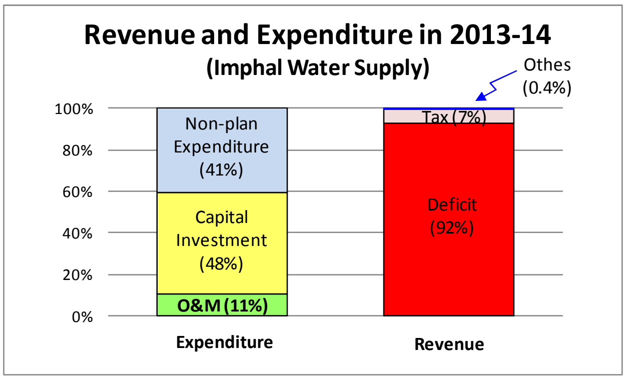


Figure 6.17 Revenue and Expenditure of the Imphal Water Supply (2013-14)

At present, all budgets for daily operation and maintenance of the Imphal water supply system comes from the State, and tax revenue and other income of PHED goes directly to the state account. The accounting system of the water supply service is not financially independent, negatively affecting PHED's ability to perform operational improvements based on its own financial plan. This inefficient management is due both to the lack of a business insight as it is due to the existing governmental system. To convert the curernt vicious cycle situation into the preferable virtuous circle, improvement of financial conditions through establishing the self-supporting management system is of considerable importance.

Figure 6.18 Future Situation: Virtuous Cycle

(1) Cost allocation for financially self-supporting organizational management

Among the factors to achieve the sustainable and self-reliant organizational operation, financial self-reliance is especially important. It is necessary to decide on the distinction of cost allocation between public and private revenue sources, and to set the rule on the use of subsidy among the public revenue sources.

The cost to be covered of the self-supporting organization includes operating cost, replacement cost, and capital investment. The operating costs, often called operation and maintenance expenses, are the costs from regular operation of water supply services, including routine maintenance (minor repairing) of the facilities. Replacement cost is the depreciation cost of the capital replacement of existing facilities, whereas capital investment includes costs of developing assets for water production, office building, and ground.

At present,the entire budget of the Imphal water supply system comes from the State, which denotes that all costs generated in daily operation in addition to periodical replacement and future capital investment is covered by the State. After the project completion, however, it is recommended that at least a) annual O&M cost and b) replacement cost of existing facilities, and preferably c) a part of the debt service obligations for the future capital investment be covered by PHED through tariff charges on the beneficiaries. **Table 6.19** shows recommended cost allocation after project completion.

Table 6.19 Cost Allocation for Imphal Water Supply System

Costs	Present	After the Project
a) Operating Costs	PHED (State)	PHED (Consumers)
b) Replacement Costs	PHED (State)	PHED (Consumers)
c) Capital Investment	PHED (State)/ Central Govt	PHED (Consumers)/ State/ Central Govt

(2) Ideal Situation for Formation of Self-Supporting Organizational Operation

Under the decentralization policy, it is possible for the State government to give a part of responsibility of to the Panchayati Raj Institutions in the rural or municipal areas, and to the Urban Local Bodies in the urban area. As for the State of Manipur, the management transfer of the Imphal water supply system to the Imphal Municipal Council was reached by an agreement between JNNURM and the State in 2006. However, the agreement has been suspended due to lack of management capacity of the Municipal Council. According to PHED officials, it may be a long way off to decentralize management of the Imphal water supply services to the local level.

There is another type of self-supporting organizational management including performance-based contract or management contract with private firms, just like the case of Delhi Jal Board. However, under the current condition of the Imphal Water Supply System, privatization is quite difficult since financial management is not independently practiced. Therefore, the separation of financial account from other accounts of the State is the first step toward the self-supporting organizational management.

In this regard, “Ring-fencing” is an ideal method to establish self-accounting system of the water supply service. According to the *Guide to Ring-Fencing of Local Government-Run Water Utilities* issued by the Water and Sanitation Program (World Bank), ring-fencing is defined as a “legal or financial arrangement of separating the activities, assets, liabilities, revenues and costs, generated by a specific business from the general business of an entity”. In the context of the Imphal water supply service, the objective to introduce the ring-fencing is to separate financial accounts of the water supply from other accounts of the State toward achieving financial self-reliance. By doing so, ring-fencing will generate more accurate information that can be utilized in decision making on resource management, operational improvement, and financial management, resulting in better water supply services to the customers. The procedure to introduce this innovative financial concept is as follows:

- Affirmation of legal basis and the State’s commitment
- Mapping of system and procedures
- Organizational review and realignment
- Account reconstruction

Account reconstruction includes: i) Setting up the books of account, ii) Establishment of the beginning balance for the balance sheet account, iii) Determination of revenue and expenditure for the year, iv) Preparation of income statement, v) Preparation of balance sheet, vi) Preparation of cash flow statement, and vii) Closing the temporary account balance. Through ring-fencing, it is expected that more efficient management of expenses could be made and tariff rates could be determined more adequately. In addition, collection rate would increase and accountability would be improved since the result of making efforts by field staff would be more visible.

(3) Short-term and long-term plan for Self-supporting Organizational Management

Ring-fencing will enable PHED to make more efficient resource management, operational improvement, and financial management, which may result in PHED’s positive formulation of future management plan. Followings are the short-term and long-term plan toward the PHED’s self-supporting organizational management, and details are shown in **Table 6.20** Action Plan for Establishment of Self-supporting Organizational Management.

【Short-term Plan】

1) Improvement of water supply service in Imphal Water Supply System (materialization of 24×7 water supply, revision of water tariff and billing system, reduction in NRW)
2) Establishment of the self-accounting system (Ring-fencing) of Imphal Water Supply System

【Long-term Plan】

3) Establishment of self-management system without subsidy from the State
    a) O&M cost →after completion of the project
    b) O&M cost + Depreciation→ after 10 years
    c) O&M costs + Depreciation + a part of Capital cost→ after 15 years
4) Establishment of the self-supporting organization

Table 6.20 Action Plan for Establishment of Self-supporting Organizational Management

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
(1) Short-term Action Plan (During the Project Implementation)					
1-1	Situational Analysis of Organizational Operation and Problem Detection	Activity: - Gather basic information (subscribers' information, tariff collection data, personnel, organizational structure, fixed assets, financial indicators, etc.) - Map the process of key financial and commercial activities - Conduct problem analysis and identify ideal solutions	30/09/2015	Nil	CE/ACE/ EE
1-2	Arrangement of Relationship between PHED Urban Circle and Other External Organizations	Activity: - Enumerate all activities related to the water supply service - Identify office or organization that performs the activity - Identify necessary arrangement between PHED Urban Circle and other external organizations	31/12/2015	Nil	CE/ACE/ EE
1-3	Review of Ideal Situation for Formation of Self-Supporting Organizational Operation	Ideal Situation: - Ring-fencing - Performance-based contract/ management contract - Management transfer to the Imphal Municipal Council	31/03/2016	Nil	CE/ACE/ EE
1-4	Introduction of Self-accounting System	Ideal Steps of Introducing Ring-fencing: - Affirmation of legal basis - Affirmation of the State's commitment - Mapping of ideal system and procedures - Account reconstruction	31/05/2016	Nil	CE/ACE/ EE
1-5	Monitoring and Evaluation of the accounting system	Subject: - Monitoring system - Performance indicators	2017～	Nil	CE/ACE/ EE
(2) Long-term Plan (After the Project Implementation)					
1-5	Establishment of self-management system without subsidy from the State	Long-term Objective for Cost Recovery: - O&M cost → after 5 years - O&M cost + Depreciation→ after 10 years - O&M costs + Depreciation + a part of Capital cost→ after 15 years	2022-2036	Nil	CE/ACE/ EE
1-6	Discussion with Other Agencies toward Self-Supporting Organizational Operation	Subjects: - Within PHED (Urban, Rural, Sewage) - External Organizations (Municipal Council, etc.)	2036	Nil	CE/ACE/ EE
1-7	Establishment of Self-Supporting Organizational Operation	Subjects: - Capacity development of the Imphal Municipal Council - Condition of the management transfer - Management transfer to the Imphal Municipal Council	2037	Nil	CE/ACE/ EE

6.4.2 Preparation of Long-term and Annual Business Plan

A business plan is a guideline or a roadmap for the future water supply management, outlines goals and details how to achieve those goals. In order to show the direction that water supply service of PHED should aim for, it is recommended to develop a long-term and annual business plan of the Imphal Water Supply Service.

(1) Scope of the Business Plan

The PHED deals with planning, execution and operation and maintenance of both rural and urban water supply, and sewage and sanitation schemes for the people in the State of Manipur. Among various services provided by PHED, it is recommended that the scope of the business plan focuses on the Imphal water supply service, since long-term projection and detailed activities of other sectors are not planned at present and it will take long time to complete the general business plan of PHED.

Therefore, the business plan developed before the implementation of the Project focuses on the Imphal water supply service, and shows the long-term plan and annual action plan of the PHED.

(2) Contents of the Business Plan

The following are ideal contents of the business plan.

1) Executive Summary
2) Introduction (background, national water policy, legal background, organization)
3) Vision, Mission, Goals
4) Strategy and Long-term Action Plan (target, strategy, activities)
5) Annual Action Plan (target, scope of work)
6) Financial Plan (tariff revision, investment plan)
7) Organizational Plan (self-supporting organizational management)

(3) Establishment of Basic Policies for Water Supply Business Plan

At present, PHED in the State of Manipur does not have clear Vision, Mission and Goals for the Imphal water supply services. However, the PHED website published PHED’s operational objective / mandate of operation as follows;

“In view of the necessity and importance of providing safe drinking water, the Public Health Engineering Department, Manipur is catering the needs of the public in general and rural public in particular by designing and executing schemes for creating safe water sources and supplying the water to the needy. The objective of the government is to make every habitation accessible to safe drinking water.”

Using this statement as a basis, it is recommended that PHED sets out to establish own Vision, Mission and Goals for providing water supply services to Imphal City and its immediate environs.

(4) Setting of Long-term Targets and Strategy of the Business Plan

One of the ideal long-term targets of the Imphal water supply service is to break through the current vicious cycle into the virtuous circle and become a self-supporting organization. The strategy to achieve this is as follow.

1) Improvement of water supply service in Imphal Water Supply System (materialization of 24×7 water supply, reduction in NRW, improvement of O&M, improvement of administrative efficiency)
2) Establishment of the self-accounting system (through ring-fencing) of Imphal Water Supply System
3) Establishment of self-management system without subsidy from the State
    a) O&M cost →after completion of the project
    b) O&M cost + Depreciation→ after 10 years
    c) O&M costs + Depreciation + a part of Capital cost→ after 15 years
4) Establishment of the self-supporting organization

(5) Activities to Achieve Long-term Target of the Business Plan

The improvement of water supply service needs various efforts including materialization of 24×7 water supply through the project implementation, reduction in NRW, improvement of O&M efficiency, improvement of administrative efficiency, and etc. The following table shows the ideal activities to achieve target of the long-term business plan.

Table 6.21 Activities to Achieve Target of the Business Plan

#	Activity	Detail Action	Target
1	Establishment of Self-supporting Organizational Management	- Situational analysis of organizational operation and problem detection - Arrangement of relationship between PHED Urban Circle and other external organizations - Review of ideal situation for formation of self-supporting organizational management - Introduction of self-accounting system - Establishment of self-management system without subsidy from the State - Discussion with other agencies toward self-supporting organizational operation - Establishment of self-supporting organizational operation	- Establish self-accounting system by 2016 (including financial statements) - O&M cost recovery by 2026 - O&M cost and depreciation cost recovery by 2031
2	Revision of Water Tariff	- Problem identification of current tariff - Establishment of basic principles for tariff revision - Study on tariff revision methodologies - Study on management efficiency improvement efforts - Short-term, mid-term, and long-term cash flow analysis - Setting new tariff rates based on volumetric way - Revision of water tariff rate based on the updated inventory and pilot project experience - Negotiation with organizations concerned toward realization of new tariff and collection system - Starting new tariff system and collection system - Periodical revision of water tariff rates	- Setting new tariff rates by 2016 - 1st revision of new tariff system by 2021 - 2nd revision of new tariff system by 2026 - 3rd revision of new tariff system by 2031
3	Increase in Water Tariff Collection Rate	- Situation analysis on current tariff collection - Study on diversification on tariff collection methodologies - Implementation of the pilot project - Make detailed implementation plan - Monitor the activities of the detailed implementation plan - Monitor performance indicator on the water tariff collection rate	- 100% by 2021
4	Reduction in Non-revenue Water	- Study the current situation and causes of the NRW - Set the quantities target for the reduction in NRW - Make the strategies for the reduction in NRW - Make detailed implementation plan for the reduction in NRW - Monitor the activities of the detailed implementation plan - Monitor the performance indicator on the reduction in NRW	- 2% reduction per annum
5	Improvement of Operation and Maintenance Efficiency	- Study the current situation and causes of inefficient operation and maintenance of facilities - Set the target of the improvement of the operation and maintenance efficiency of facilities (cost reduction of power, chemical, repaire and maintenance through improving efficiency) - Make the strategies for the improvement of the operation and maintenance efficiency of facilities - Make detailed implementation plan - Monitor the activities of the detailed implementation plan - Monitor the performance indicator on the improvement of the operation and maintenance efficiency of facilities	- 2% reduction per annum
6	Improvement of Administrative Efficiency	- Study the current situation and causes of inefficiency of administration and staff deployment - Set the target of the improvement of efficiency of administration and staff deployment (administrative work includes information management and documentation works through computerization, for example) - Make the strategies for the improvement of efficiency of administration and staff deployment - Make detailed implementation plan - Monitor the activities of the detailed implementation plan - Monitor the performance indicator on the improvement of efficiency of administration and staff deployment	- 2% reduction per annum

(6) Preparation of Annual Business Plans

Annual business plan is basically a breakdown of the long-term business plan. The short-term (the first five years) target of the long-term business plan is to achieve cost recovery of operation and maintenance cost, and the first five year's activities in the annual business plan have to be corresponding to this target.

The business plan is aimed at coordinating efforts of the various departments to achieve a common purpose at the least possible human, material, and financial cost and to ensure that policies, program, and project support and reinforce each other. In drafting the annual business plan, the respective taskforce teams will be organized to schedule activities taking into consideration, the strategies, milestone and deliverables specific to the plan.

The activities of the annual business plan will be implemented based on the duly prepared and approved annual budget. The preparation of the annual business plan and the annual budget will be interactive and properly coordinated to ensure that the both are well synchronized. Ideal activities and detailed action of the annual business plan are shown in table below.

Table 6.22 Annual Breakdown of the Business Plan (2015-2019)

Activities	Detail Action	2014	2015				2016				2017				2018				2019				Remarks
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
1 Establishment of Self-supporting Organizational Management	1) Situational Analysis of Organizational Operation and Problem Detection				■																		
	2) Arrangement of Relationship between PHED Urban Circle and Other External Organizations					■																	
	3) Review of Ideal Situation for Formation of Self-Supporting Organizational Operation						■																
	4) Introduction of Self-accounting System							■															
	5) Monitoring and Evaluation of the accounting system									■				■				■				■	
2 Revision of Water Tariff	1) Problem Identification of Current Tariff	■																					
	2) Establishment of Basic Principles for Tariff Revision	■																					
	3) Study on Tariff Revision Methodologies		■																				
	4) Study on Management Efficiency Improvement Efforts			■																			
	5) Setting New Water Tariff (Volumetric Tariff)			■																			
	6) Short-term, Mid-term, Long-term Cash Flow Analysis			■																			
	7) Implementation of Pilot Project				■	■	■	■	■	■	■	■											
	8) Revision of New Tariff Rate based on the updated information																						Target: 2020
3 Increase in Water Tariff Collection Rate	1) Situation Analysis on Current Tariff Collection	■																					
	2) Study on Diversification of Tariff Collection Methodologies	■																					
	3) Implementation of Pilot Project				■	■	■	■	■	■	■	■											
	4) Negotiation with Organizations Concerned toward Realization of New Tariff and Collection System																						Target: 2020
4 Reduction in Non-revenue Water	1) Study the current situation and causes of the NRW	■																					
	2) Set the quantities target for the reduction in NRW		■																				
	3) Make the strategies for the reduction in NRW			■																			
	4) Make detailed implementation plan for the reduction in NRW			■	■																		
	5) Monitor the activities of detailed implementation plan					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	6) Monitor performance indicator					■				■				■				■				■	
5 Improvement of Operation and Maintenance Efficiency	1) Study the current situation and causes of inefficient operation and maintenance of facilities	■																					
	2) Set the target of the improvement of the operation and maintenance efficiency of facilities		■																				
	3) Make the strategies for the improvement of the operation and maintenance efficiency of facilities			■																			
	4) Make detailed implementation plan			■	■																		
	5) Monitor the activities of detailed implementation plan					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	6) Monitor the performance indicator					■				■				■				■				■	
6 Improvement of Administrative Efficiency	1) Study the current situation and causes of inefficiency of administration and staff deployment	■																					
	2) Set the target of the improvement of efficiency of administration and staff deployment		■																				
	3) Make the strategies for the improvement of efficiency of administration and staff deployment			■																			
	4) Make detailed implementation plan			■	■																		
	5) Monitor the activities of detailed implementation plan					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	6) Monitor the performance indicator					■				■				■				■				■	

(7) Financial Plan

The financial plan provides a framework for policy makers and implementing bodies to collaborate with producing the water supply service program that is clear, consistent, sustainable and financially feasible. The financial plan also shows the revenue and expenditure of future services and how they are to be funded. The objectives of the financial planning are: [13]

- Providing a structure to enable a policy dialogue to take place, involving all relevant stakeholders, with the aim of producing a consensus on a feasible future WSS
- Illustrating the impact of objectives and targets in a long term perspective
- Facilitating external financing by providing clear and transparent data on financing requirements

To see a balance of revenue and expenditure and assure the sustainability of the PHED's water supply management, cash flow statements for short-term, mid-term, and long-term operation are developed. The cash flow statement shows the movement of PHED's revenue and expenditure during a certain period. Cash inflow comes from PHED's daily operation and includes the tax revenue and other revenue including connection fee and penalty fee, whereas cash outflow includes operating expenditure and replacement cost. Cash flow analysis will help PHED set a relevant water tariff level to cover operational costs from water supply services, and help PHED foresee potential problems in the future. The result of the cash flow analysis is shown in **Table 9.31** Short-term, Mid-term and Long-term Cash Flow Analysis.

Also, financial plan enables policy makers to have a more objective discussion of tariff policy. The water tariff is the main source of water supply management and a key ingredient for successful and sustainable operation of the services. To achieve the long-term target of the water supply business plan, adequate revision of water tariff is required and is discussed in 6.4.5 Water Tariff Revision and Improvement of Tariff Collection System.

(8) Action Plan for Developing Business Plan

An action plan for developing long-term and annual business plans are shown is the table below.

[13] "Strategic Financial Planning for Water Supply and Sanitation", OECD 2009.

Table 6.23 Action Plan for Preparation of Long-term and Annual Business Plan

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
(1) Short-term Action Plan (Before Loan Agreement)					
1-1	Data Arrangement and Analysis on Past O&M and Financial Data	Subject: - Data collection (subscribers' inventory, population projection, demand projection, production projection, financial data) - Problem analysis	30/09/2015	Nil	CE/ACE/ EE
1-3	Establishment of Basic Policies for Water Supply Business Plan	Subject: - Basic policy establishment - Vision, Mission, Goal of the Imphal Water Supply Services	31/012/2016	Nil	CE/ACE/ EE
1-4	Setting of Long-term Targets and Strategy	Subject: - Long-term target setting - Long-term strategy to achieve the target - Cash flow analysis	31/03/2016	Nil	CE/ACE/ EE
1-5	Setting of Annual Target and Scope of Work	Subject: - Short-term target setting - Strategic actions to achieve the target	31/03/2016	Nil	CE/ACE/ EE
1-6	Preparation of Long-term Business Plans	Contents: - Executive summary - Vision, Mission, Goals - Strategy and Long-term Action Plan - Financial Plan - Organizational Plan	30/05/2016	Nil	CE/ACE/ EE
1-7	Preparation of Annual Business Plans	Contents: - Key issues - Strategic action - Responsible person - Budget requirement	30/05/2016	Nil	CE/ACE/ EE
1-8	Approval of Assembly (if necessary)	Subject: - Chief Engineer's approval - Chief Minister's approval - Assembly's approval	30/06/2016	Nil	CE/ACE/ EE
(2) Long-term Action Plan (After Implementation of the Project)					
1-9	Preparation of Annual Business Plans	Subject: - Periodical monitoring - Annual evaluation	End of fiscal year	Non	CE/ACE/ EE

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
		- Achievement of operational indicators			
1-10	Evaluation of the Long-term Business Plan	Timing: - Mid-term evaluation (1): after 4 years - Mid-term evaluation (2): after 9 years - Final evaluation: after 14 years	2026, 2031, 2036	Nil	CE/ACE/ EE

6.4.3 Provision of Asset Ledgers

The mapping system for water supply is basically composed of (i) automated mapping (AM) system, (ii) geographical information system (GIS), and (iii) facility management system (FM), out of which a geographical information system (GIS) is to process and analyze the information on the geographical information, while a facility management system is to construct the database integrating the geographical location and its relevant information and to search and process the geographical information and attribute information.

Figure 6.19 shows the conceptual image of a mapping system for water supply.

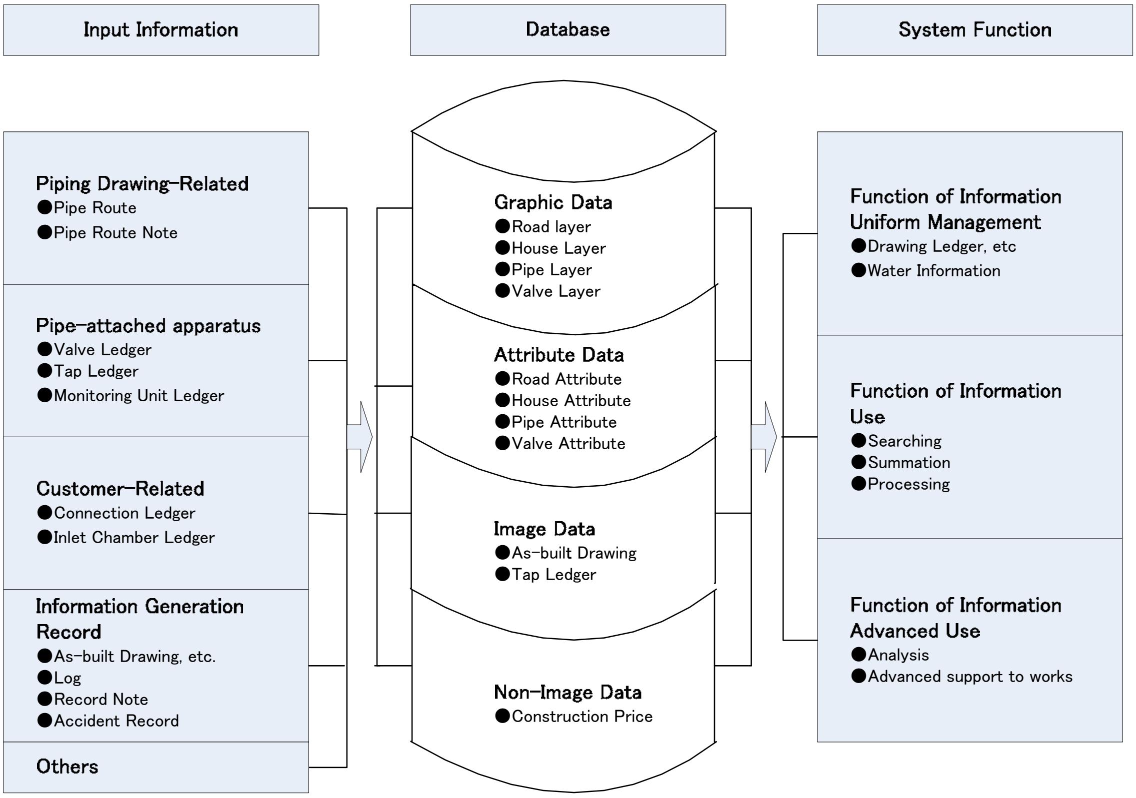


Figure 6.19 Conceptual Image of a Mapping System for Water Supply

The construction of a mapping system for water supply makes the following possible:

(1) Uniform management of the information

The uniform management of information means that information sources on the particular pipe will be concentrated in only one location. Therefore, when the particular information is inputted, the relevant drawing ledger, etc. will be simultaneously corrected or added and there will be no risk that another section / unit will get the different information.

(2) Rapid information use through searching, etc.

Up to now, it takes a lot of manpower to search, retrieve, summarize and process information. However, with the use of computer-based programs, these activities can be done more accurately and with more speed.

(3) A variety of analysis linked to supporting the work

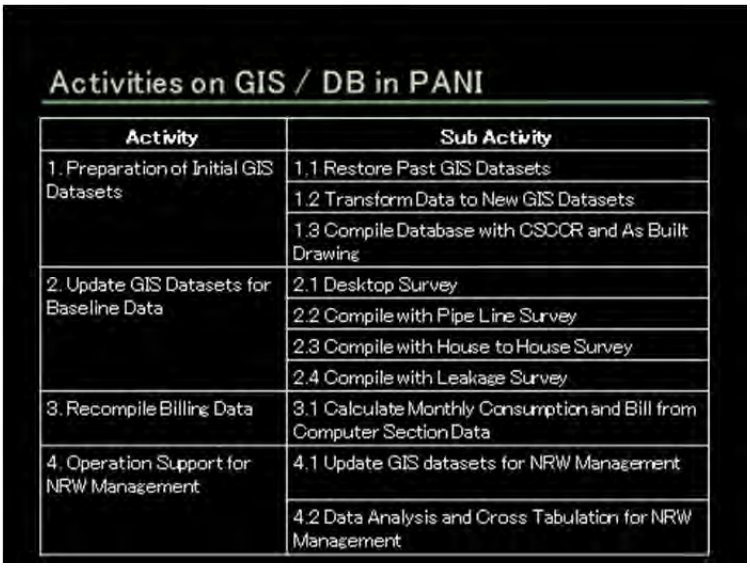
Through the development of database contents and the application of a variety of analytical methodologies, such as a hydraulic analysis, earthquake damage projection and so on, the linkage and integration between routine works and planning works can be easily achieved.

(4) Linkage with other systems

The database of a mapping system for water supply can be linked with another system enabling the exchange of the data between different mapping systems.

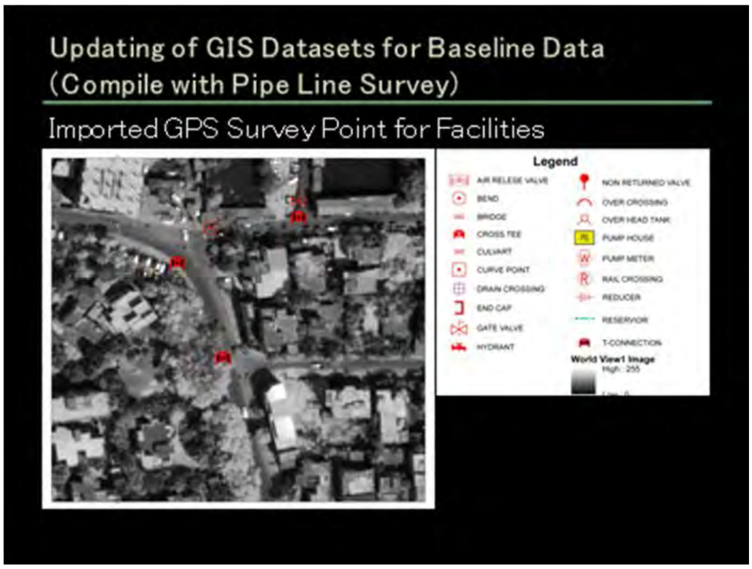
A mapping system requires a database (data arrangement and inputting) which is composed of the graphic information such as pipes, roads, houses, letters, etc. and attribute information such as piping material, diameter, etc.

Figure 6.20 shows the course of data addition to a mapping system for water supply.

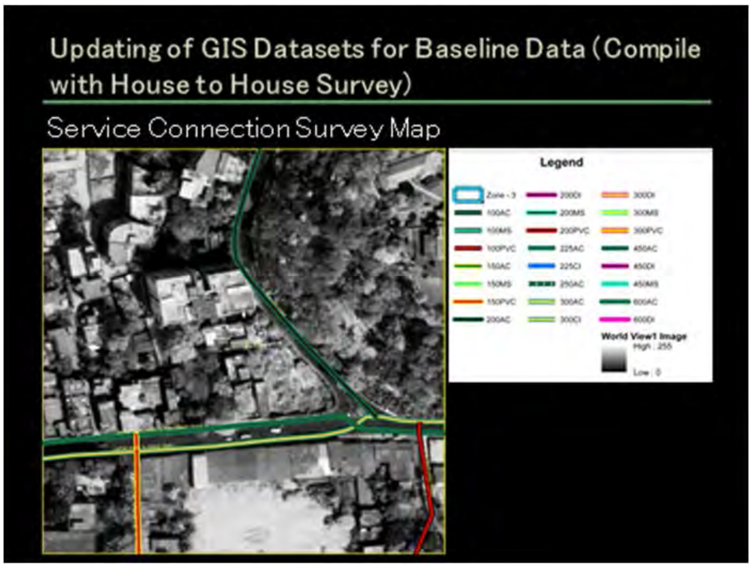

Activities on GIS / DB in PANI

Activity	Sub Activity
1. Preparation of Initial GIS Datasets	1.1 Restore Past GIS Datasets
	1.2 Transform Data to New GIS Datasets
	1.3 Compile Database with CSCCR and As Built Drawing
2. Update GIS Datasets for Baseline Data	2.1 Desktop Survey
	2.2 Compile with Pipe Line Survey
	2.3 Compile with House to House Survey
	2.4 Compile with Leakage Survey
3. Recompile Billing Data	3.1 Calculate Monthly Consumption and Bill from Computer Section Data
4. Operation Support for NRW Management	4.1 Update GIS datasets for NRW Management
	4.2 Data Analysis and Cross Tabulation for NRW Management

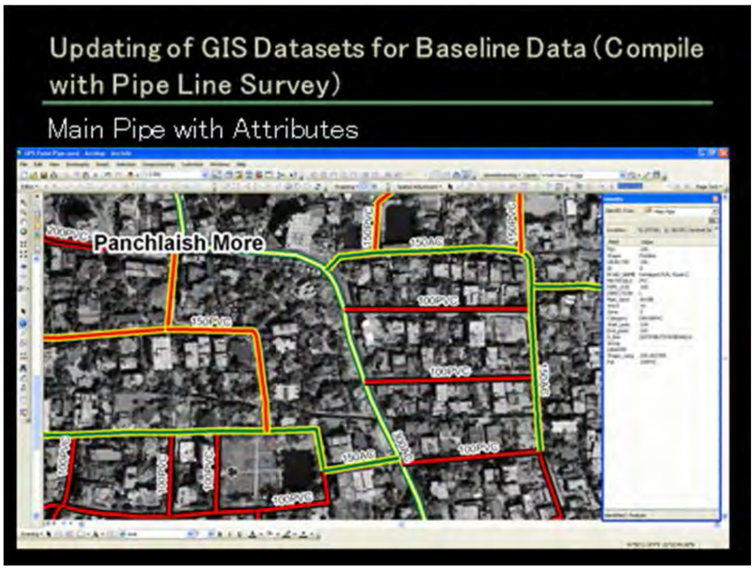
(a)



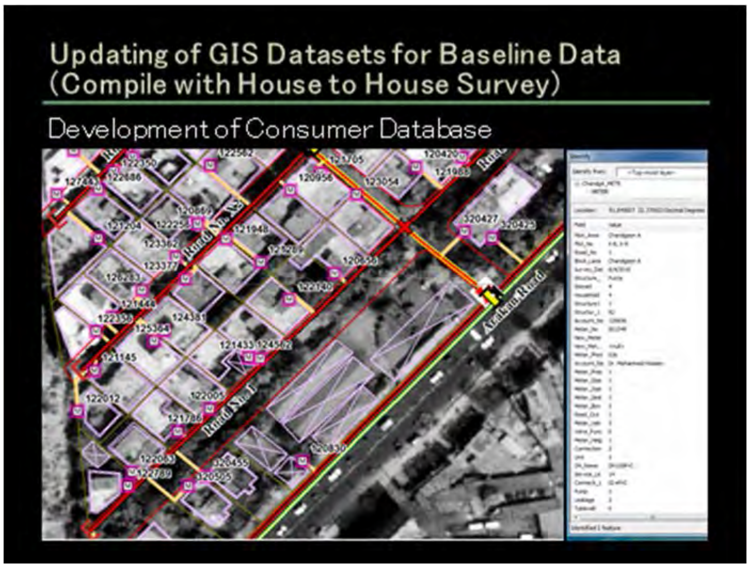
(b)



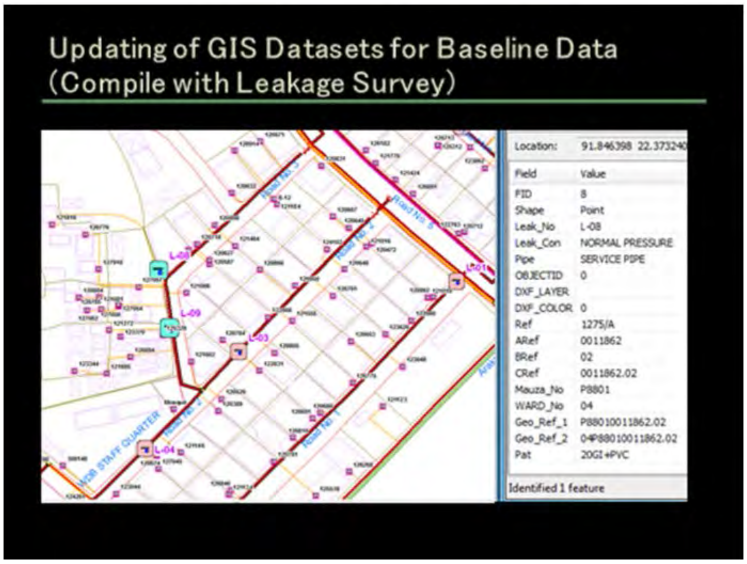
(c)


Updating of GIS Datasets for Baseline Data (Compile with Pipe Line Survey)
Main Pipe with Attributes
Panchlaish More
100PVC

(d)


Updating of GIS Datasets for Baseline Data (Compile with House to House Survey)
Development of Consumer Database
Road No. 1
Arakan Road

(e)


Updating of GIS Datasets for Baseline Data (Compile with Leakage Survey)
Location: 91.846398 22.373240
Field Value
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Leak_Con NORMAL PRESSURE
Pipe SERVICE PIPE
OBJECTID 0
DXF_LAYER
DXF_COLOR 0
Ref 1275/A
ARef 0011862
BRef 02
CRef 0011862.02
Mauza_No P8801
WARD_No 04
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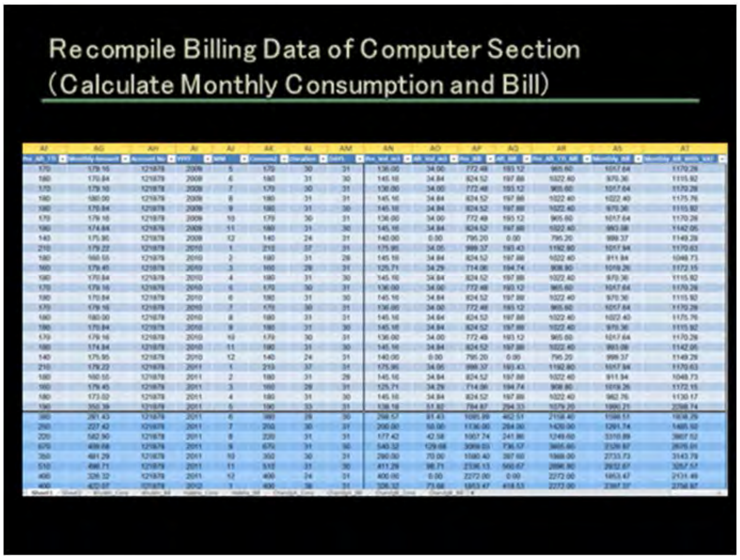
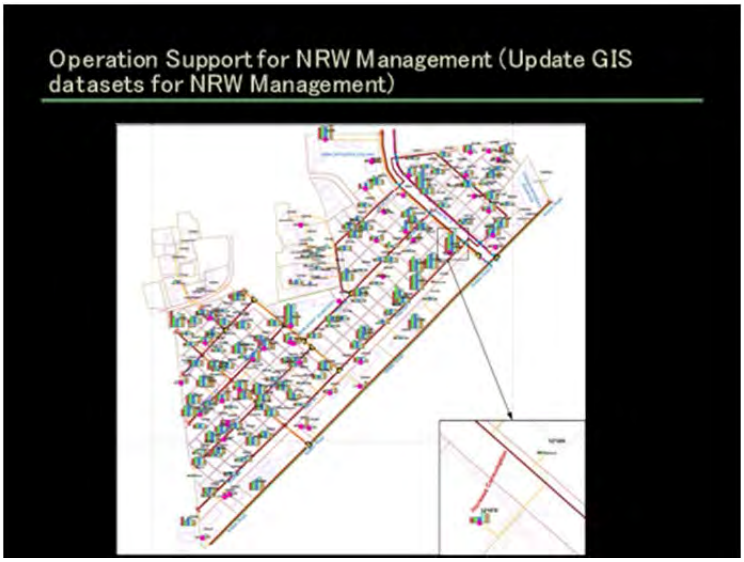
L-08
L-09
L-03
L-04
L-01

(f)



(g)



(h)

Figure 6.20 Course of Data Addition to a Mapping System for Water Supply

Table 6.24 Action Plan and Monitoring Sheet for Provision of Asset Ledgers

Sr. No.	Action	Contents/Outputs Expected Hints to Be Included	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official	Monitoring		
						Date (DD/MM/YY)	Status	Remarks
1	Conceptual design of asset ledgers for water supply facilities using GIS	**Subjects:** ·Scope of system ·Graphic data ·Attribute data ·Image data ·etc.	31/09/2016	–	Zone I: E.E.	xx/xx/xx	·Not started ·On-going (xx%) ·Completed (DD/MM/YY)	
2	Selection of basic map & software for preparation of aseet ledgers	**Subjects:** ·How to use the information ·Type of analysis ·Type of output	30/11/2016	–				
3	Review of input data for GIS database		31/01/2017	–				
4	Data collection of existing water supply facilities		31/03/2017	–				
5	Provision of IT devices for GIS database preparation		31/03/2017	–				
6	Training of GIS database operators		30/06/2017	–				
7	Construction of GIS database		31/12/2023	–				
8	Operation of asset ledgers for watersuply facilities		01/01/2024	–				

6.4.4 Improvement of Information Management System (IMS)

(1) General Description on IMS

Looking at the challenges brought about by the rapid growth of Imphal city, there is an urgent need to put in place a comprehensive, integrated, GIS-based MIS model at PHED. The system will ensure that the reform agenda / action plan for implementation under the JICA project will be maintained and sustained. The reform agenda shall:

- Promote people / citizen centric administration: Common citizens should get the benefits of the system of accurate billing and collection and the provision of services using different service delivery channels
- Move from process accountability to productivity accountability and from transactional to transformative governance.
- Reduce delays and ensure promptness in delivery of services: Computerization would ensure timely delivery of accurate service.
- e-Administration: Improve administrative processes by cutting cost, managing performance, making strategic connections within the local bodies and creating empowerment.

It is proposed to leverage strength of information technology for the creation of authentic baseline data and support utilities and use IT to enable business processes at PHED. The creation of IT infrastructure under JICA fund will enable PHED to integrate other business processes such as GIS, MIS, Water auditing, SCADA systems, among others.

The Information Management and Development Division (IMDD) will be responsible for providing all the technical and managerial information needed for strategic planning as well as daily operation decision making. The department will be comprised of three main sections of which the roles were explained in **6.2.6**. As well, SCADA data is managed in SCADA Section in Zone-2 Division of which the roles was explained in **6.2.4** and the necessary data for MIS will be transferred to IMDD.

(2) Proposed MIS Modules

The MIS should be established as the core of planning function. The database should be developed to collect all the management information regarding operations (water flows, pump operations, water quality, water consumption etc), staff work records, bill issuance and recovery, and financial management on a real-time basis. So that there will be sufficient information to meet planning needs. Various functional modules to be covered under MIS are given below:

- Finance and Accounting Module
- Human Resource Module
- Asset Management Module
- Consumer Billing and Metering Module

- Customer Grievance Module/Call Center Module
- Water Auditing and NRW Analysis Module

(3) Utilization of SCADA System

SCADA System, which will be established in the Project, is as follows; (see **Figure 6.21** for the locations and **Appendix 6.4 (1)** for facility-wise monitored contents)

- Local SCADA System in Chingkheiching WTP
- Central SCADA Room at Porompat WTP
- WTPs, GLSRs, OHTs, and Clear Water Mains of which the data is sent to Central SCADA Room

The raw data of automatic measurement results such as influent and effluent flows, and water qualities will be processed to daily, monthly, and annual reports in Porompat (Central SCADA Room or SCADA Section in proposed Zone-II Division Office). The reports will be utilized for MIS, out of which particularly Water Auditing and NRW Analysis and Customer Service, along with the water quality examination results at laboratories in State Laboratory and WTP laboratories.

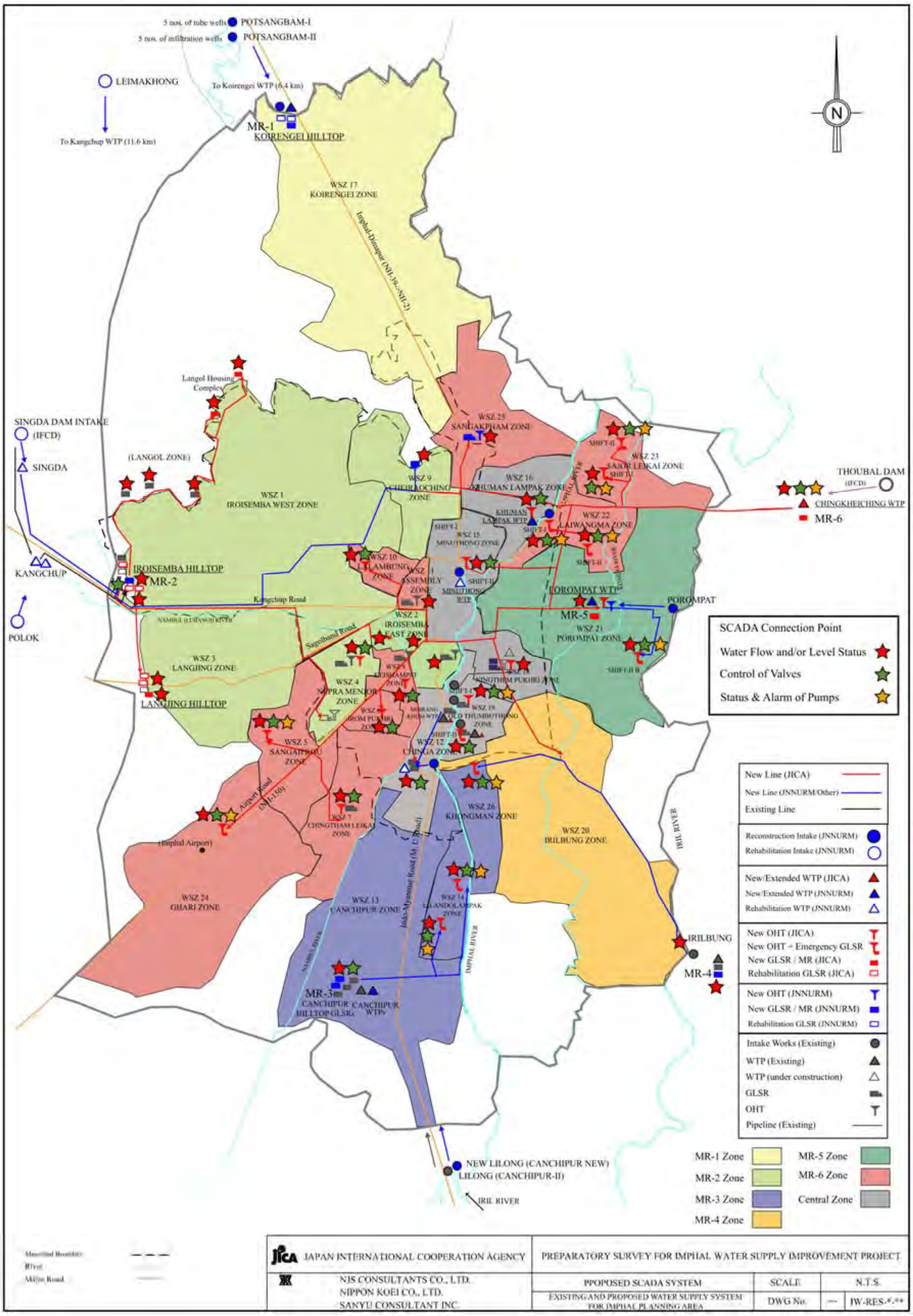


Figure 6.21 Proposed SCADA System

(4) Action Plan for introducing Information Management System

As mentioned above, much data in computer files should be prepared to initiate the Information Management System but as explained in “3.9 Present Status on Utilization of Information Management System”, the computers, equipments for data sharing and computer operators are insufficient in PHED at present. Therefore, the inputting the technical and management data in computer files should be improved at the start of IMS and MIS implementation.

The proposed Action Plan for IMS and MIS is listed as follows:.

a) Before Loan Agreement

- Equipment for data sharing such as data server should be procured for each Zonal Division
- Porompat office should be connected to the Internet for data sharing with Office Superintendent and MD-I offices.
- Adequate number of PCs should be procured and delivered to each Zone Division for work sharing, preparation of computer files, and to the IMD Division for databasing and networking.
- Training on basic computer skills and Auto CAD for staff should be conducted to increase not only the number of staff who can operate computers and but also to improve on the quality of computing skills, such as in the preparation / updating of drawings for the ledgers.
- The staff who can/ will be able to operate the computers should start to input the necessary data such as 1) consumer list with billed and paid amounts, 2) meter reading data, 3) staff list with salaries, 4) monthly power cost, 5) summary us of water quality examination results, 6) water production and supply records, 7) repair/maintenance record of facilities/equipments and 8) ledgers as base data of MIS as soon as possible before the loan agreement.
- The maps for technical ledgers should be updated with the latest official topographic data and the supplemental land survey if possible.

b) After Loan Agreement

- Procurement of more PCs is required with the utilization of JICA project fund, if necessary. Apart from PCs for PIU members for implementation of the project, at least 40 PCs are necessary compared to present number as shown in **Table 6.25.** For more effective and efficient O&M records, one PC should be allocated to each WTP apart.
- Nomination of staff for IMS/MIS is necessary for the Information Management and Development Division (IMDD) and also in each Zone Division..
- PHED staff for IMS/MIS should master how to process the required data under the guidance of PMC during the time developing the system and operate it independently after being delivered.

- Detailed selection and tendering of MIS modules is required as mentioned in (3) Implementation Approach with the help of project consultant. In the course of the selection, the coordination with present (and upgraded) Water Billing System is necessary.
- Trainings on new MIS module should be conducted after the procurement with the help of vendor and soft component consultant in the project.
- With the progress of the project such as meter installation and GIS/SCADA data, the input data for IMS/MIS should be added/updated in a timely manner. The proposed reports and/or monitoring sheets to be prepared are listed in **Table 6.26** and the items should be increased as necessary for the analysis of trends. A part of information should be disclosed in PHED's website in the future as part of periodic management reporting.
- Procurement of PC and trainings for staffs should be continuously and regularly undertaken.
- Based on the contents above, **Table 6.27** is proposed Action Plan for IMS and MIS with the preliminary budgets and responsible officials in PHED.

Table 6.25 Number of PCs Required for Future Information Management

No.	Position	Zone-I (North-West)		Zone-II (South-East)		Zone-III (Central)		Project Development & Construction		Total	
		Desktop	Laptop	Desktop	Laptop	Desktop	Laptop	Desktop	Laptop	Desktop	Laptop
1	Executive Engineer (or private secretary)		1		1		1		1	0	4
2	Assistant Engineer		3		3		2		2	0	10
3	Section Officer (team)		1		1		1			0	3
4	GIS/Mapping Operator	1		1		1		1		4	0
5	Draftman team		1		1		1		1	0	4
6	CAD Operator	1		1		1		1		4	0
7	Operator (Word/Excel)	1		1		1		1		4	0
8	IT engineer (SCADA)	1			1					1	1
9	Electrician/Mechanic/IT engineer		1		1		1			0	3
10	Water leakage detection/fitting team		1		1		1			0	3
11	Meter reading team		1		1		1			0	3
12	Bill distributor, tariff collector team		1		1		1			0	3
13	Accountant		1		1		1		1	0	4
	Total	4	11	3	12	3	10	3	5	13	38
	Present	4	0	3	0	1	2	1	0	9	2
	Required									4	36

Source：JICA Survey Team

Table 6.26 Proposed Reports and/or Monitoring Sheets to be Prepared in Future

No.	Report/Monitoring Sheet	Frequency/Update				
		Daily	Monthly	Quarterly	Yearly	Timely
(A)	Chemical					
	Procurement				X	X
	Consumption/Stock	X	X		X	
(B)	Spare parts					
	Procurement			X	X	X
	Consumption/Stock			X	X	X
(C)	Construction and expansion works				X	X
(D)	Operation					
	Power supply	X	X		X	X
	Operation time of equipments	X	X		X	
	Operation time of facilities	X	X		X	
	Supply time to areas	X	X		X	
(D)’	Water Flow/Consumption					
	WTP (Influent)	X	X		X	
	WTP (Effluent)	X	X		X	
	Reservoirs	X	X		X	
	Clear water mains	X	X		X	
	Consumer meters			X	X	
(D)’’	Water quality					
	Raw water	X	X		X	
	Effluent from WTPs	X	X		X	
	Discharge point				X	X
(E)	Maintenance					
	O&M works in facilities					
	Leakage detection record				X	X
(F)	Repair works					
	Repair of equipments				X	X
	Pipe fitting record				X	X
(G)	Billing & tariff collection				X	X
	Consumer list				X	X
	Meter installation records				X	X
	Disconnection and illegal connection record				X	X
	Ledger (consumer)					X
	Billing record			X	X	X
	Tariff collection record			X	X	X
(H)	Customer Service					
	Claims		X		X	X
(I)	Human Resource					
	List of staffs and monthly salaries				X	X
	Attendance record		X		X	
(J)	Cost					
	Chemical		X		X	
	Power		X		X	
	Personnel expense		X		X	
	Spare parts			X	X	
	Others (fuel, office equipments etc.)		X		X	
	Budget-Cost Monitoring		X	X	X	
(K)	Asset management					
	Ledger (pipeline) based on GIS					X
	Design/as-built drawings					X
	Estimation of total assets				X	X
(L)	Water loss		X		X	
	Leakage volume assessment (UfW)			X	X	
	Total loss assessment (NRW)			X	X	

Source：JICA Survey Team

Table 6.27 Action Plan for Information Management System (IMS) and Management Information System (MIS)

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
(1) Before Loan Agreement					
1-1	Procurement of PC data server for data sharing in the offices	Subjects: - Security of information - Most efficient way of data sharing	31/12/2014	150,000 (3 servers)	CE/ACE EE
1-2	Connect the Porompat Office (M-II, PCD) to internet	Subjects: 1) Future offices of each division, 2) Method (Cable/Wifi), 3) Cost	31/12/2014	Initial: 100,000 Monthly: 2,000	CE/ACE EE
1-3	Procurement of new PCs (at least one each for each division)	Subjects: - Number and type of required PC as first stage before JICA project - Budget allowance	31/12/2014 (30/6/2015)	150,000 (3 desktop PCs)	CE/ACE EE
1-4	Training of basic computer skills and CAD skills for staffs	Subjects: - External or internal - Staffs who attend the training in external training case Example - E-mail, Word/Excel - Auto CAD	31/3/2015	External: 300,000 Internal: 0	CE/ACE EE
1-5	Initiation of data entry of various hand-writing records and reports	Example: 1) Staff List, 2) Monthly Power charges, 3) Water quality examination results, 4) Consumer list with zone/ward numbers	30/6/2015	0 (PHED HR)	EE
1-6	Initiation of preparing ledgers by CAD in each division on latest maps and arrangement of existing drawings	Example: - Arrange the detailed consumer connection ledgers on the latest maps - Arrange and update the design/as-built drawings	30/6/2015	0 (PHED HR)	EE
(2) After Loan Agreement					
2-1	Procurement of new PCs for divisions (separate from ones for PIU)	Subjects: - Number of required PC as second stage as PHED's expense (or project cost) - Budget allowance Example 1) Section Officers, 2) Head Clerk, 3) Operators	1/8/2015	1,000,000	CE/EE
2-2	Nomination of the staffs who will be in charge of IMS and MIS in each division	Example: 1) MIS Engineer, 2) SCADA maintenance specialist 3) GIS specialist, 4) Database / Systems Administrator	31/3/2016	Internal: 0 External: 100,000/month	CE/EE
2-3	Detailed Selection of MIS modules with the help of project management consultants	Subjects: - Adjustment with current customer service through website	30/4/2017	To be determined (Project cost)	CE PM of PIU

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
		Examples: 1) Finance & Accounting Module, 2) Human Resources Module 3) Asset Management Module			
2-4	Tendering of MIS modules with the help of project consultant	Subjects: - Number and mode of contract with supplier(s) for all the modules - Training after installation by supplier(s)	31/12/2017	To be determined (Project cost)	CE PM of PIU
	(Remodeling of organization structure)	Subject: - Establish Project Development & Construction Division including Water Audit & Asset Management Section	31/3/2017	Nil	CE
2-5	Start of operation of MIS System	-	31/12/2017	-	-
2-6	Trainings on IMS/MIS for concerned staffs (soft component)	Each module for concerned staff	31/12/2018	To be allocated (Project cost)	PM of PIU
	(Remodeling of organization structure)	Subject: - Establish SCADA section in Zone-2 Division before starting operation of Chingkheiching WTP	31/12/2020	Nil	CE
2-7	Update/improve of the IMS/MIS with the metering, GIS and SCADA data after completion of project		31/12/2022	Nil	EE of Project Dev. & Const. Div.
2-8	Continue PC and software operation trainings for staffs every year	Example: 1) Microsoft Office, 2) CAD	N/A	Internal: 0 External: 500,000/yr	CE/EE

Source : JICA Survey Team

Note: Chief Engineer (CE), Assistant Chief Engineer (ACE), Executive Engineer (EE), Project Implementation Unit (PIU), Project Manager (PM)

6.4.5 Water Tariff Revision and Improvement of Tariff Collection System

One of the Project's objectives is 100% metering of all service connection, whether domestic, business or institutional. This means that metered tariff will be fully introduced in the service area. At present, PHED adopts flat rate at INR150/month for domestic connections, but will soon start with metered tariff in a pilot area. Here we propose steps to revise water tariff rates and to improve tariff collection system.

(1) Water Tariff Revision

1) Affirmation of Legal Grounds

According to Article 11 of the Manipur Water Supply Act, 1992 (Manipur Act No. 1 of 1993), the government of Manipur can revise water tariff rate from time to time by notification in the official gazette. By this legal ground, PHED has readjusted the tariff rate based on actual production cost of water. The Act also stipulated that PHED can fix any type of water tariff including flat rate and metered rate.

2) Basic Principle for Water Tariff Revision

The objective of the tariff revision is to promote rational use of water resources, thereby providing better water supply to all consumers. In this regard, the following basic principles for the tariff revision have to be satisfied.

- Water tariff should cover at least 1) annual O&M cost and 2) depreciation for replacement of existing facilities, and desirably 3) a part of the future capital investment costs.
- Water tariff should be fair and reasonable. The price per unit consumption should be the same for all users. However, price differentials are acceptable when the corresponding costs to provide services for different users vary.
- The tariff level should send a clear signal to water economization to users as well as efficiency improvement of PHED. Users will adjust their water consumption based on monthly tariff charge, and the tariff would be a function of the consumed volume. Also, the tariff should be periodically readjusted to maintain their real level.
- The demand side condition including user's willingness to pay and affordability to pay for water supply service should be properly taken into consideration, when tariff level is revised.
- Poverty consideration is taking into account in the volumetric charging method. Usually, the BPL household uses less water and the tariff rate is low when consumption is low.

Regardless of the methodologies of the tariff revision, the key concept for establishing the appropriate tariff level is cost recovery. The major cost items of water supply operation include operating costs, replacement costs, and capital investment. However, full cost recovery cannot be attained in the short term, when we look at current situation of Imphal water supply operation. Therefore, step-by-step achievement toward the full cost recovery is required. In relation to the time framework for the tariff revision, the road map includes 3-step tariff revisions as follows.

- 1^{st} Step: the operating cost will be covered by the total revenue.
- 2^{nd} Step: the operating cost and the depreciation for replacement of existing facilities will be covered by the total revenue.
- 3^{rd} Step: the operating cost, the depreciation for replacement of existing facilities, and a part of new capital investment will be covered by the total revenue.

3) Tariff Revision Methodology (Introduction of Metered Tariff System)

There are three basic approaches for regulating the overall tariff level, including 1) rate of return regulation or total cost regulation, 2) price cap regulation, and 3) yardstick regulation. Details are summarized in table below.

Table 6.28 Three Approaches of Incentive Regulation

Approach	Description	Remarks
Rate of Return Regulation	Rate of return regulation adjusts overall tariff levels so the operator's total accounting costs and cost of capital. (Pt = Total Cost ÷ Production volume)	Traditional and the most common way for regulating the overall tariff level
Price Cap Regulation	It allows service operator to change tariff level according to an index that is typically comprised of inflation rate and productivity offset.	It has been used as regulatory rule for limiting abuse of market power of monopolistic firms after the service provider obtaining sufficient operating profits.
Yardstick Regulation	Water service operator's performance is compared to other operator's performance, and awards or penalties are assessed based on the operator's relative performance.	Yardstick regulation depends on a wide range of data to provide indicative information on relative performance of similar water operators.

4) Structure of Metered Tariff

Structure of the metered tariff is usually composed of two parts, including basic tariff and volumetric tariff. The former is the tariff rate that levy on all consumers regardless of water consumption volume, whereas the latter is the tariff rate being charged based on water consumption volume. Cost to be covered by each tariff is summarized in the table below.

Table 6.29 Structure of Metered Tariff

Item	Definition	Cost to be covered
Basic Tariff	Tariff rate regardless of water consumption volume, but fixed based on volume grade	Fixed Cost (employment cost, repair and maintenance cost, depreciation cost, asset management cost, etc)
Volumetric Tariff	Tariff rate based on water consumption volume	Variable Cost (chemical cost, power cost)

Imphal: Basic Tariff = Rs.150/- + Recovery Cost of Water Meter (Rs.10/month)
Volumetric Tariff = Rs.10/1000 litter (over 30,000 litter/month consumption)

5) Setting New Water Tariff

Through the project implementation, water meters shall be installed in all service connections in the PHED-Imphal service area. The new tariff rate shall correspond to the volumetric system. At present, trial run of water meter installation is ongoing, and a metered tariff rate, a combination of the basic tariff (INR150/month) and the volumetric tariff (INR10/m^3, from over 30m^3/month consumption), will be charged to the pilot connections in the near future.
However, after the project implementation, the establishment of new tariff rates is required based on the O&M costs and the depreciation costs generated by the Project. For this purpose, a new tariff schedule corresponding to the volumetric system is estimated based on the proposed project costs and O&M costs of new facilities. Procedure for developing the new tariff schedule is as follows.

- Affirmation of legal ground
- Affirmation of basic principle and methodology
- Clarification of basic condition (projection of population, number of connection, water demand and water production)
- Allocation of total cost (operating expenses and capital costs of the Imphal Water Supply Project)
- Initial estimation of water tariff rates
- Adjustment of the tariff rate based on the willingness to pay and the affordability to pay

The proposed tariff schedule is shown in Chapter 10 (10.3 Water Tariff revision and Timing of Implementation) with detail guidance of the metered tariff estimation.

6) Short-term, Mid-term and Long-term Cash Flow Analysis

The cash flow developed in the study shows stream of revenue and expenditure of the Imphal water supply service of PHED. Duration of the cash flow analysis starts from year 2022, the first year of water supply produced by the project facilities, until year 2036, and the duration is divided into three periods, short-term (the first 5 years), mid-term (the second 5 years), and long-term (the third 5 years). The revenue from the water supply service includes water tariff charge and other charges such as connection fee, penalty fee and etc., whereas the expenditure includes operation and maintenance costs and depreciation cost of the project facilities and equipment. The water tariff rates applied in the cash flow analysis is metered tariff which is proposed in this study.

The result of cash flow analysis is shown in Chapter 9 Financial and Economic Analysis, **Table 9.31** Short-term, Mid-term and Long-term Cash Flow Analysis.

(2) Improvement of Water Tariff Collection System

1) Problem Identification of Current Tariff Collection

One of main reason of low water tariff revenue from the Imphal water supply service is low tariff collection rate. The water tariff collection rate of PHED in 2014 is 19.8% in total. Among three divisions, Maintenance Division 1 is the highest (46.6%), followed by Project Construction Division (11.9%), and Maintenance Division 2 (9.9%). Main reasons of the low tariff collection rate are low service level of water supply, low billing rate, shortage of collection staff, and people's mind that water is free. Following table shows current tariff collection method and issues to be solved.

Table 6.30 Present Tariff Collection Method and Issues to be Solved

Type of Connection	Collection Method			Issues to be Solved to Increase Collection Rate
	Frequency to issue bill	Method to issue the bill	Method of Payment	
Domestic Connection	Basically Quarterly-base	Paper-based, door to door visit	Visit the collection center	- Number of collector is limited - Awareness campaign is needed - Service level is still low
Hostel	Yearly-base (Before fiscal yr.)	Paper-based	Challan & Check	- Number of collector is limited
Hotel	Quarterly-base	Paper-based	Cash	- Number of collector is limited
School/ Collage	Quarterly- or Yearly-base (Before fiscal yr.)	Paper-based	Challan & Cash	- Number of collector is limited - Awareness campaign is needed - Service level is still low
Office	Yearly-base	Paper-based	Challan	- Number of collector is limited
Industries/ Workshop	Quarterly-base	Paper-based	Cash	- Number of collector is limited
Public Hydrant	Quarterly-base	-	Cash	- Number of collector is limited
Tanker Supply	Pre-paid system: (1) buy coupon by cash from PHED, (2) pay the coupon when needed, and receive receipt			- Number of collector is limited
Bulk Supply	Monthly-base	Paper-based	Challan & Cash	- Number of collector is limited

Source: PHED

2) Study on Diversification of Tariff Collection Methodologies

PHED has made effort to improve the low tariff collection rate and collection amount increased as explained in Chapter 4 (4.5 Water Charge Collection System). Recently, PHED enhanced water tariff collection system by changing the responsible person(s). Until last year, the main responsible person for tariff collection had been the Assistant Engineers, but now the Section Officers take on the responsibility for collection in their own areas of operation.

In addition, PHED is now preparing introduction of Internet billing system, which will start from next year, according to PHED officials. The following table shows the outline of the new tariff system and issues to be solved to make the system more effective.

Table 6.31 Outline of the Internet Billing System

Item	Description
Outline of the Internet Billing System	(1) PHED sends bill over the Internet (2) Customers download their bill and pay at the water tariff collection counter (3) In future, E-banking system will be introduced under cooperation with National Information Center (NIC)
Person in charge of the internet billing system	Section Officer (SO)
Frequency to Issue Bill	Monthly based
Payment method	(1) Cash (visiting the water tariff collection counter) (2) Coupon (visiting the water tariff collection counter) (3) Bank Transfer (4) In future, Internet
Issues to be solved to make it effective	(1) Many people still don't have computer with printer in their home (2) It is very difficult to identify who have PC and who do not have (3) Door-to-door visit to issue water bill is still necessary (4) Many people are reluctant to pay fees for public services, and do not want to access to the billing site in Internet (5) Public awareness campaign is necessary

The Internet billing system can be an alternative manner of billing. It is true that the system can reduce work force for billing. However, the door-to-door visit to issue water bill is still necessary. What is important is to diversify water tariff collection methodology through consideration of demand side conditions and requirements. At the time of the project implementation, it is recommended to discuss following issues, including billing method and payment system.

a) Some options to improve billing system

- SMS billing system through mobile phone is more effective since most people nowadays use mobile phone.
- Introduction of automatic reading machine, so that meter reader can issue the bill immediately after reading.
- Introduction of Pre-paid system with corresponding meter installation (EDM).

b) Some ideas to improve the payment system

- Introduction of KIOSK payment system
- Increasing the water tariff collection counters of PHED
- Increasing the water tariff collection point (e.g. tie-up with bank, EMD counter, retail shops)
- Diversification of payment method (including automatic transfer payment from bank account)
- Without "No Due Certificate", the government officials cannot get their salary (EDM)
- Set in motion of penalty system (cutting connection of the heavily indebted customers)
- Privatization of billing and tariff collection (PPP): e.g. management contract with private firm

The KIOSK payment system was introduced in the Bangalore water supply system and contines to contribute to successful water tariff collection. The KIOSK is unmanned, full automated and 24 hour operating cashing machine, just like a automated-teller machine (ATM). The machine can read water bill, accept cash and cheque for the payment and issue on-the-spot receipts. Besides the water bill, the KIOSK accepts bills of Electricity Board, mobile phone Company including BSNL (Bharat Sanchar Nigam Limited) and other private telephone companies. Customers can pay anytime and anywhere at the KIOSK-installed areas. It increases the consumers' convenience and reduces the time for paying tariff at PHED counters. In addition, the KIOSK contributes to the replacement of current manual cash counters. In Impphal, an idea is that, in addition to the increasing number of water tariff collection counter of PHED, introducing the KIOSK system in pilot area to see effect and validity of the system.

Figure 6.22 KIOSK System in Bangalore Water Supply System

3) A Proposal on Pilot Project (a suggestion for a more strategic implementation)

PHED started water meter installation at selected domestic connections and number of installed meter was 584 as of July 2014. The new water tariff corresponding for the trial has been recently established, and the rate is INR150/month for the basic tariff and INR10/m^3 for the volumetric tariff. The volumetric tariff will be charged to the over 30m^3 consumption. In addition, consumers have to pay INR10/month as water meter installation fee.

However, the trial run seems not systematic since meter readers have not yet been trained, and the meter billing system is not yet functioning. It is a good opportunity for PHED to acquire experience on the metered billing system, because once the project will be completed, they will have to implement the metered billing system on a full scale in the service area. Before the project completion, therefore, PHED has to establish volumetric charging system.

In this regard, based on the current trial run, a pilot project is proposed. The objective of the pilot project is to establish water meter charging system and draw lessons learned for future full-scale implementation, and to develop accurate record of unit consumption of each users including domestic, residential, institutional, commercial and industrial users. The accurate records are utilized when metered tariff rates will be established in 2021. A proposed activity of the pilot project is shown in table below.

Table 6.32 A Proposal for Pilot Project During Implementation Period

Item	Details
Objective	- Establishment of water meter charging system and draw lessons learned for future full-scale implementation - Taking accurate record of unit consumption of each users
Target Area/ number	(How do you decide target area/ household?)
Duration	2 years (2015- 2017)
Billing method	- Paper-based, door-to-door visit
Activities (Preparation)	- Pilot planning (scope, budget allocation) - Training on meter reader - Setting water tariff based on volumetric system - Establishment of calibration (accuracy control) system of water meter
(Implementation)	- Initial guidance to the pilot household - Installation of water meter in the pilot household - Periodic meter reading and recording - Issuing bills based on the metered tariff - Periodic calibration of water meter - Monitoring and evaluation - Modification of tariff billing and collection system
Budget	To be estimated

4) Social Awareness Campaign

To achieve the cost recovery objective, an increase in water tariff collection rate is necessary. For this purpose, a public awareness campaign is proposed, since most customers in Imphal water supply service area do not have a habit to pay water tariff on a regular basis. The objective of the Social Awareness Campaign is to promote a better understanding of beneficiaries for PHED's water supply service including "Water is Not FREE" principle. The campaign has to be implemented before starting water supply services using newly constructed facilities under the Project. Detailed activities of the campaign are shown in table below.

Table 6.33 A Proposal for Social Awareness Campaign

Item	Details
Objective	- Promotion of better understanding of water supply service including "Water is Not FREE" principle.
Target Area/ number	Service Area
Duration	2 years (2018- 2020)
Campaign method	- Paper-based, door-to-door visit
Activities (Preparation)	- Planning of social awareness campaign (scope, budget, schedule): - Identification of campaign methodology (public hearing, public event, school education, mass media, poster, stickers, etc.) - Development of campaign materials - Capacity development of PHED field officials
(Implementation)	Implementation of Social Awareness Campaign: - Introduction of Imphal Water Supply Project - Efforts of PHED to improve water supply services - Cost recovery principle and tariff payment ("Water is Not FREE" campaign) - New tariff structure and the rate - Understanding and prevention of waterborne disease
Budget	Total INR 1,500 thousand

(3) Action Plan for Water Tariff Revision and Improvement of Collection Efficiency

Action Plan for Water Tariff Revision and Improvement of Collection Efficiency is shown in table below. The action plan includes the proposed pilot project to establish water meter charging system and draw lessons learned for future full-scale implementation.

Table 6.34 Action Plan for Water Tariff Revision and Improvement of Collection Efficiency

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
(5) Short-term Plan for Water Tariff Revision (During the Project Implementation)					
1-1	Problem Identification of Current Tariff	Subject: - Balance of revenue and expenditure - Low collection efficiency - Low connection rate (illegal connection) - Accurate inventory of subscribers	30/11/2014	Nil	CE/ACE/ EE
1-2	Establishment of Basic Principles for Tariff Revision	Subject: - Cost recovery, Type of tariff system, Tariff adjustment period, User's willingness to pay and affordability to pay, Fairness and poverty consideration	31/12/2014	Nil	CE/ACE/ EE
1-3	Study on Tariff Revision Methodologies	Selection: - Rate of return regulation or total cost regulation - Yardstick regulation - Price cap regulation	31/03/2015	Nil	CE/ACE/ EE
1-4	Study on Management Efficiency Improvement Efforts	Subject: - NRW reduction, Illegal connection, O&M efficiency improvement, Energy saving, Administrative efficiency improvement and staff development	31/05/2015	Nil	CE/ACE/ EE
1-5	Setting New Water Tariff (Volumetric Tariff)	Subject: - Necessity of legal clarification - Development of subscribers' inventory during the project implementation	30/6/2015	Nil	CE/ACE/ EE
1-6	Short-term, Mid-term, Long-term Cash Flow Analysis	Subject: - Balance of customers payment ability and cost recovery requirement - Step-wise cost recovery objectives	30/6/2015	Nil	CE/ACE/ EE
1-7	Revision of New Tariff Rate based on the updated information	Subject: - Updated subscribers' information - Experience of the pilot project	2022	Nil	CE/ACE/ EE
1-8	Negotiation with Organizations Concerned toward Realization of New Tariff System	Subject: - Chief Minister's approval - Assembly approval	2022	Nil	CE/ACE/ EE
(6) Short-term Plan for Improvement of Collection Efficiency (During the Project Implementation)					
1-9	Situation Analysis on Current Tariff Collection	Subject: - Limit payment place, No issuance and delivery of bills, Penalty for nonpayment	30/11/2014	Nil	CE/ACE/ EE
1-10	Study on Diversification of Tariff Collection Methodologies	Example: - Direct payment at the designated place	31/12/2014	Nil	CE/ACE/ EE

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
		- Automatic transfer payment from personal bank account - "No Due Certificate" system - SMS billing system - Introduction of automatic reading machine - Privatization of tariff collection			
1-11	Implementation of Pilot Project	Activity: - Training of meter readers - Establishment of calibration system - Periodic meter reading - Billing and collection of water charge - Modification of tariff billing and collection system	2015-2017 (two years)	To be estimated	CE/ACE/ EE/ SO/ Field Staff
1-12	Implementation of Social Awareness Campaign	Activity: - Planning of social awareness campaign (scope, budget, schedule) - Identification of campaign methodology (public hearing, public event, school education, mass media, poster, stickers, etc.) - Development of campaign materials - Capacity development of PHED field officials - Implementation of Social Awareness Campaign	2018-2020 (wto years)	INR 1,500 thousand	CE/ACE/ EE/ SO/ Field Staff
1-13	Negotiation with Organizations Concerned toward Realization of New Tariff Collection System	Example: - PHED office, Post office, Bank	2020	Nil	CE/ACE/ EE
(7) Long-term Plan (After the Project Implementation)					
1-14	Start of New Tariff Collection System	Subject: - Periodical recording/ updating subscribers' information	2022	Nil	CE/ACE/ EE
1-15	Periodic Revision of Water Tariff Rates	Subject: - Periodic update of subscribers' inventory - Periodic review of cash flow statement	Every five years (2027, 2032)	Nil	CE/ACE/ EE

6.4.6 Mandatory Water Meter Installation

In Imphal, water meters have been installed at 584 households on the pilot basis since July 2014. However, the reading of water meters has not been done regularly. This can be due, in part, to the fact that PHED charges a flat rate for its water tariff and meter reading is a new activity. Although available data is limited, the per capita water consumption is calculated at 120.5 Lpcd from the meters installed at 10 households. The water consumption data was taken from 213 to 514 days after meter installation in Irilbung WSZ which was in the range of 90~173 Lpcd after validation / checking of the number of people in each household. Another data shows the water consumption was 261.5 lpcd as an average of one day consumption at six households in Chinga WSZ which was in the range of 162～372 Lpcd and the per household population assumed at 6.0 persons. Therefore, the data in Irilbung WSZ seems more reliable than that in Chinga WSZ. The per capita consumption is below the national benchmark of 315 Lpcd but is still unexpectedly high, an evidence of wasteful water use under a flat rate system. If this figure presents the trend of the entire service area, the public campaign for water conservation is necessary before both meter installation and the adoption of a metered rate system.

It is recommended that the PHED starts monthly meter reading and checks the number of household population to have basic data for the per capita consumption and enable it to develop appropriate measures in the future.

Under the Phase-II using the JNNURM fund and Phase-III using the JICA loan, the water meter will be installed at 35,490 units, 70,110 units or a total of 105,600 units. The installation of water meters in each service connection will also be a condition to receive water supply service from the PHED. The project covers the service pipe installation from the branch of the distribution main to the meter; while that downstream of the meter outlet to the tap shall fall under the cost responsibility of each customer. The measures to be addressed are as follows:

(1) Decision on categorizing by customer type

The customers shall be classified into four types with each classification having strategies in terms of meter installation fees. These strategies, which have to be established before the start of service pipe installation works, are designed to help each customer type to cope with shouldering the cost involved. The people within the service area should also be thoroughly informed of this important activity through a well-planned and executed public awareness campaign.

Table 6.35 Expense Burden by Type of Customer

Type of Customer	Meter Installation Fee	Other expenses
(1) Existing customer	• Installment payment	—
(2) Meter-installed existing customer	Is an existing meter replaced or used continuously? • Installment payment in case of replacement • Free in case of continuous use	—
(3) New customer	• Installment payment	
(4) New customer regularized from illegal connections	• Installment payment	• Penalty for illegal connection

What is important is to assure the quality of service pipe installation works from a branch to tap. As shown in **Photo 11.1**, the quality of service pipe installation works is very poor in the pilot area. It should be noted that even in developed countries, the last portion of leakage protection comes to the service pipe installation works.

The following action should be taken before the commencement of service pipe installation works which will take place in 2021.

1) Extension of Campaigns

Since its establishment, water services in Imphal were on a flat rate basis and water rate is the fixed sum regardless of water consumption. As stated earlier, there is a sign of wasteful water use. Under the metered rate system, water charge is made on the basis of water consumption and it is important to educate the people on the proper use of water before the actual shifting from a flat rate system to a metered rate system, expected around 2022 when the project will be completed. This shall be done through a massive public information, education, communication campaign to ensure that the people are conditioned and ready for metering.

2) Introduction of licensed plumber system for service pipe installation works

There is no provision in the Manipur Water Supply Act 1992 regarding the qualification of plumbers to undertake service pipe installation works. It is absolutely necessary therefore, to introduce the licensed plumber system for service pipe installation works in order to maintain the quality of work with the inspection by the PHED staff at the time of completion.

The outline of the licensed plumber system for service pipe installation works are as follows:

- Preparation of standard drawings and specifications for service pipe installation works
- Implementation of service pipe installation works by the PHED licensed plumber
- Compliance to standard drawings and specifications for service pipe installation works by the PHED licensed plumber
- Preparation of working drawings for service pipe installation works and its submission to the PHED

- Use of the PHED-tested meter
- Inspection by the PHED personnel at the time of completion
- Cancel of the qualification of the PHED licensed plumber who has received three rejections at the PHED inspection
- Cancel of the qualification of the PHED licensed plumber who is concered with illegal connection
- Implementation of the qualification test for the PHED-tested meter
- Establishment of the water meter calibration centre

The following training and test shall be done by the commencement of service pipe installation works.

- Training for plumbers who are engaged in service pipe installation works
  - Understanding and practice of standard drawings and specifications for service pipe installation works
  - Thorough education on illegal connection matters
  - Preparation of working drawings for service pipe installation works and its submission to the PHED with positioning using GPS
- Implementation of the qualification test for the PHED-tested meter
- Training of the PHED personnel who are concerned with the inspection of service pipe installation works

The drawing for service pipe installation works submitted by the PHED-licensed plumber shall be kept at the PHED division concerned and the data shall be put together with the customer’s information in the GIS mapping system to be provided in the future.

Table 6.36 Action Plan and Monitoring Sheet for Mandatory Water Meter Installation

Sr. No.	Action	Contents/Outputs Expected Hints to Be Included	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official	Monitoring		
						Date (DD/MM/YY)	Status	Remarks
1	Situation analysis on current illegal connections	**Subjects:** •Survey of meter reading at existing metered connections •Estimation of per capita consumption •Regularization of illegal connections •etc.	30/11/2014	—	Zone II: E.E.	xx/xx/xx	•Not started •On-going (xx%) •Completed (DD/MM/YY)	
2	Clarification of responsibilities and obligations between customers and PHED	**Subjects:** •Ownership •Management responsibility •Cost sharing	31/12/2014	—				
3	Establishment of licensed plumber system for connection works	Legal clarification with penalties	31/07/2016	—				
4	Training of applicants for licensed plumber qualification		31/10/2016	—				
5	Training of PHED staff for final inspection of connection works		31/10/2016	—				
6	Study on meter reading and bill issuance method		31/12/2019	—				

6.4.7 Preparation of Financial Statement

The financial statements, such as balance sheet, income statement, cash flow statement etc., are necessary to manage/ control the business condition. However, the problem is that financial records in PHED are not organized systematically and are not filed in an orderly manner. To make matters worse, the financial statements themselves have not been properly developed to the level required. In addition, computers are not used for the financial accounting purposes hampering the development of financial statements. In this regard, a guideline to establish the ring-fencing accounting system[14] is useful for developing the financial statements for the Imphal water supply service. In this section, ideal procedure on how financial statements are developed following the concept of ring-fencing is introduced.

(1) Scope of the Financial Statement

Among various services provided by PHED, it is recommended that the scope of the business plan focuses on the Imphal water supply service, since long-term projection and detailed activities of other sectors are not planned at present and it will take long time to complete the general business plan of PHED. In this connection, financial statement developed for the successful implementation of the project also focuses on the Imphal water supply service.

(2) Objective of the Financial Statements

Financial statements are formal record of financial activities of the water supply services. The purpose of developing financial statements is to provide information on financial position and activities of PHED that is useful to beneficiaries to understand PHED’s activities, and to external funding sources in making financial decisions. Also, discloser of the financial statements demonstrates PHED's commitment to transparency. The financial statements typically include following financial documents.

- Balance Sheet: A report on an organization's assets, liabilities, and ownership equity at a given point in time.
- Income Statement: A report on a company's income, expenses, and profits over a certain period of time.
- Cash Flow Statement: A report on a company's cash flow activities, particularly its operating, investing and financing activities.

(3) Procedures to Establish the Financial Account

Establishment/ reconstruction of the financial account for the Imphal water supply service consists of following major steps.

- Set up the books of accounts for the water utility
- Establish the beginning balance for the Balance Sheet accounts

[14] “Guide to Ring-Fencing of Local Government-Run Water Utilities”, PPIAF and WSP, February 2009.

- Determine the Revenues and Expenses for the Year
- Determine the Bad Debts Expenses for the Year
- Prepare a Trial Balance
- Prepare the Income Statement
- Determine the balance of Retained Earnings Surplus account for the Year
- Prepare the Balance Sheet
- Close the temporary account balances and transfer the payment account balances to the succeeding year

(4) Action Plan for Preparation of Financial Statement

Action Plan for Preparation of Financial Statement is shown in table below.

Table 6.37 Action Plan for Preparation of Financial Statements

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official
(8) Short-term Plan for Water Tariff Revision (During the Project Implementation)					
1-1	Present Situation and Problem Identification in Financial and Accounting Data Processing	Subject: - Gather basic information - Conduct an activity analysis of the water utility - Map the process of key financial and commercial activities - Problems identification on financial and accounting processing	31/10/2015	Non	CE/ACE/ EE
1-2	Study on Arrangement and Classification Method of Financial and Accounting Data	Data Collection: - Billing and collection report - Customer accounts receivables - Staffing list and salary schedules - Operation and maintenance expenses reports - Subsidiary records or ledgers for property, plant, and equipment	31/03/2016	Non	CE/ACE/ EE
1-3	Preparation of Financial Statements	Procedure: - Set up the books of accounts for the water utility - Establish the beginning balance for the Balance Sheet accounts - Determine the Revenues and Expenses for the Year - Determine the Bad Debts Expenses for the Year - Prepare a Trial Balance - Prepare the Income Statement - Determine the balance of Retained Earnings Surplus account for the Year - Prepare the Balance Sheet - Close the temporary account balances and transfer the payment account balances to the succeeding year	31/05/2016	Non	CE/ACE/ EE

6.4.8 Customer Service

In 2008, the Service Level Benchmarks was issued by the Ministry of Urban Development (MoUD) which identified basic minimum service level performance parameters for four basic urban services, including water supply. The national government, through the Ministry, operationalized said framework by disseminating the service level performance parameters, defining a common minimum framework for monitoring and reporting on these indicator; and setting out guidelines to operationalize this framework in a phased manner by encouraging urban local bodies / utilities to integrate the benchmarking process and its outputs into their decision processes.

After a pilot initiative in the 2009 involving 28 pilot cities across 14 states, the SLB has moved Indian water utilities away from just being "production and supply" organisations to one that provides an essential and critical social and civic service to its various types of customers. As such, water utilities are now expected to perform their mandates based on a specified level of performance with respect to providing their constituents with safe, adequate, continuous and reliable of water supply services. The SLB for water supply is as shown in **Table 6.38**.

Table 6.38 Service Level Benchmarks for Water Supply

S. No.	Indicator	Benchmark
1.	Coverage of water supply connections	100%
2.	Per capita supply of water	135 lpcd
3.	Extent of metering of water connections:	100%
4.	Extent of Non-Revenue Water	20%
5.	Continuity of water supply	24 hours
6.	Efficiency in redressal of customer complaints	80%
7.	Quality of water supplied	100%
8.	Cost recovery in water supply services	100%
9.	Efficiency in collection of water supply related charges	90%

Source: Handbook on Service Level Benchmarking, Ministry of Urban Development, 2009.

(1) Existing Customer Service Practices

Customer (commercial) services in the PHED Urban Circle, such as billing and collection, connection, reconnection and disconnection of water services, redressal of customer complaints, metering of service connections (if any) are managed by three divisions – the Maintenance I Division, the Maintenance II Division and the Project Construction Division.

a) Service Area, Types and Number of Service Connections

Each division has its own defined coverage / service areas as indicated in **Table 6.39**. As gleaned from the table, each division has its own performance standard and coverage indicators.

Table 6.39 Water Supply Coverage

Water Supply Coverage		Maint I	Maint II	PCD
PHED standard / target for water supply coverage (%)	Service area	100	40	75
	Population	85	40	55
Current water supply coverage in area of operations (%)	Service area	90	40	75
	Population	85	40	55
Difference from the PHED standard (%)	Service area	10	None	None
	Population	None	None	None

There are a total of 20,056 service connections. The types of service connections are domestic, commercial and institutional. See **Table 6.40** for the breakdown.

Table 6.40 Types and Number of Service Connections

Types of Service Connections	Maint I	Maint II	PCD	Total
Domestic	11,467	5,565	2,602	19,634
Commercial	27	-	-	27
Institutional	84	35	4	123
Other Categories (Office/Pubic Hydrants)	109	163	-	272
Total	**11,687**	**5,763**	**2,606**	**20,056**

The following annexures provide the actual service areas of the three divisions: A6.2: *Water Supply Coverage Areas under Maintenance I*; A6.3: *Water Supply Coverage Areas under Maintenance II*; and A6.4: *Water Supply Coverage Areas under PCD*.

b) Water Availability / Continuity

Water availability / continuity is an indicator of good customer service for a water supply utility. Under the national SLB, the target/ indicator is the provision of water supply on 24 hours per day (24/7 basis).

Table 6.41 shows the actual water availability for each division in their particular service area.

Table 6.41 Water Service Availability / Continuity according to Division

Water Availability / Continuity (hours/day)	Maint I	Maint II	PCD
PHED standard for water availability / continuity	24 hours/ day	4 hours/ day	24 hours/ day
Current water availability / continuity	2-3/hours/day	2 hours/day	2 hours/day
Average	**2 hours/day**		

As shown in the table above, two divisions have indicated that 24 hours per day is the PHED standard for water availability, while one division answered that four hours per day is PHED's standard. All the divisions provide water to its service area for an average of two hours per day, a poor performance compared to the 24/7 service standard indicator.

c) Billing and Collection

In terms of billing and collection, all three divisions stated that bill preparation is still paper-based and not computerized. Collection is mainly done through visits by the customer to the PHED divisional offices. Because of the lack of office personnel and shortage of field level staff, bills are sent out quarterly and collection efficiency is also reckoned on a quarterly basis. See

Table 6.42 below for a summary of billing and collection indicators per division.

Table 6.42 Personnel Assigned to Customer Service Functions

Personnel Assigned to Customer Service Functions	Maint I	Maint II	PCD
Supervisory			
- Assistant Engineer Rent	-	1	1
- Section Officer	-	1	1
Billing and Collection			
- Accountant	-	1	-
- Cashier	1	1	-
- Bill Clerk	8	2	1
- Collection Clerk	2	1	1
Service Connections			
- Meter Reader	-	-	-
- Technical Jugali	37*	-	3
- Fitter Helper	2	-	-

** Number of Technical Jugali utilised for the entire Maintenance I Division, not only for customer services.*

For Maintenance I, as a matter of practice, one Assistant Engineer in the division is in charge of customer services and is referred to as “Assistant Engineer Rent” or AE Rent, although there is no sanctioned post with this actual nomenclature. The AE Rent, however, is the de facto person in-charge of customer services, particularly functions of billing and collection, under which there are three sanctioned posts – Cashier, 1 employee; Bill Clerk, eight employees, and Collection Clerk, two employees. The latter are actually from the Bill Clerk post, but perform collection functions. The sanctioned post of Technical Jugali, of which there are 37 in number, is tasked with service connection work, including disconnections and reconnections, as well as leak repair and others O&M related functions in the division.

Maintenance I has the most number of customers at 11, 687 among the three divisions, has the highest collection efficiency at 70%, and with more or less 13 personnel (not counting the Technical Jugali called upon when the need arises) performing customer services work.

As for Maintenance II, there are a total of seven personnel assigned to perform customer service tasks. It is the only division that has an accountant to ensure proper billing and collection. However, its collection efficiency has much to be desired at 35% for 5, 763 service connections.

As for PCD, there are a total of seven personnel assigned to perform customer service tasks, which include billing and collection of its 2,606 service connections with a collection efficiency of 12%.

Table 6.43 Summary of Billing and Collection Indicators

Billing and Collection Indicators	Maint I	Maint II	PCD
Billing System	Paper-based	Paper-based	Paper-based
Payment Method	• Visit at office • Bill collector	• Visit at office • Bill collector	Visit at office
Number of bills sent	3,900	Not indicated	2,600
Frequency of billing	Quarterly	Quarterly	Quarterly
Collection efficiency	70%	35%	12%

d) Water Quality

The PHED adopted the Central Public Health and Environmental Engineering Organisation (CPHEEO) standards of water quality as published in the Manual on Water Supply and Treatment. All the divisions comply with the physical and chemical standards and therefore consistently supply water within the permissible standard of quality to its customers.

e) Service Connections

Within its coverage area, requests for new connections and disconnections are attended to with dispatch by each division. But in spite of the increasing number of connections, the divisions are also faced with the problem illegal connections, the extent and prevalence of which are alarming, especially for Maintenance I Division, as revealed in **Table 6.44**.

Table 6.44 Average Number of Connections and Disconnections and Illegal Connections Discovered and Legalized Per Month

Division	No. of Connections Per (Average/Month)	No. of Disconnections (Average/Month)	No. of Illegal Connections Found (Average/Month)	No. of Illegal Connections Legalized (Average/Month)
Maintenance I	26	8	51	17
Maintenance II	20	1	1	1
Project Construction	5	0	5	5

f) Complaint Redressal

All the divisions keep an official record of customer complaints. Most complaints are received by telephone / mobile, or through a visit made by the customer at the divisional office. Complaints number around 10 on a monthly average and the most common complaints are “no water”, “insufficient quantity” and “low pressure” on the side of water availability. On the water quality, complaints are usually on “bad smell” and “bad color”. Customers also call the divisional office to report leakages observed.

g) Metering

Metering of service connections is not fully implemented as a matter of policy in PHED Urban Circle, but is only on a trial basis. Initial feedback received is that customers are willing to have water meters installed.

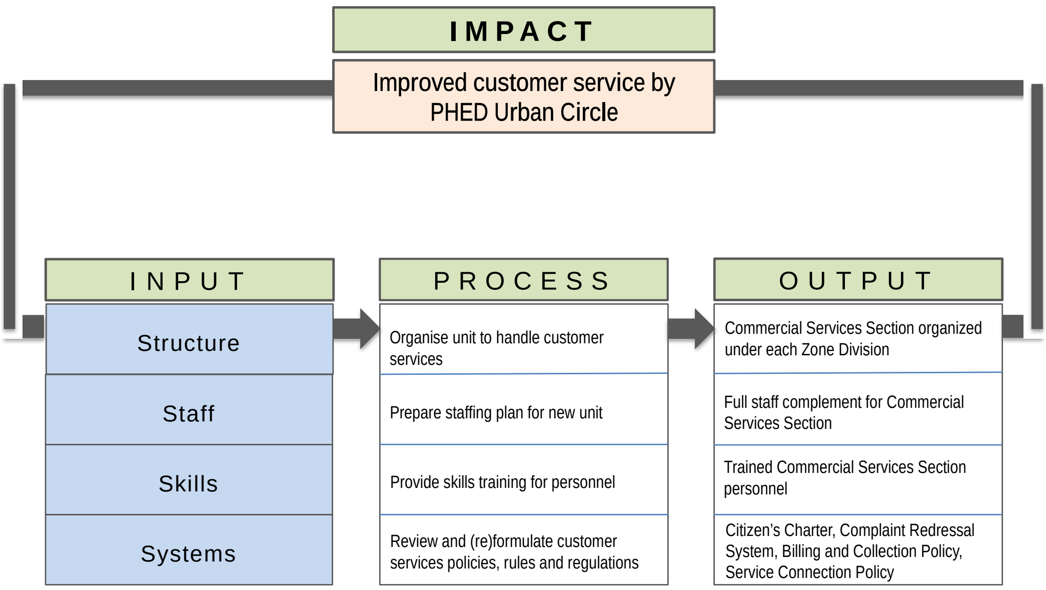
h) Public Information and Education

The regular public information, education and communication (IEC) programs on water, sanitation and waste management utilizing print and electronic media are handled by the Community Capacity Development Unit (CCDU) under the Office of the Chief Engineer, PHED. Public information dissemination is also conducted by each division on specific topics and issues such as water usage, health, illegal connections and their regularization, regular payment of water bills, non-tampering of the main pipes, and judicious use of water / water conservation.

(2) Action Plan for Customer Service

The improvement of customer service is a form of downward accountability of the State government as a response to its residents or customers in terms of services provided. PHED, being a State Department, is mandated to provide an essential public service – potable, adequate water supply and reliable water service.

The action plan for customer service shall have to look at a larger institutional framework – that of having in place the right structure that will discharge the customer service functions, staffed with qualified and trained personnel, and backed up by proper policies and systems to guide the staff in accomplishing their tasks. **Figure 6.23** presents the framework for customer services in PHED Urban Circle.



JICA Study Team for Imphal Water Supply Improvement Project, October 2104.

Figure 6.23 Customer Service Framework

The Input-Process-Output-Impact framework identifies the important input elements of structure, staff, skills and systems. “Structure” to deliver customer service is embodied not only in the new and rehabilitated system, but also in the reorganized organisation structure of PHED Urban Circle, where the Commercial Services Section is to be established in each Zone Division. This section will have three sub-sections – Customer Relations, Service Connection and Metering, Billing and Collection. Together with the newly established section is the “Staff” who will bring with them their “Skills” which can be further developed through training. (The Staffing Plan and Training Plan are contained in **Section 6.2.8**.)

a) The Formulation of PHED Citizen’s Charter

The Action Plan for Customer Service focuses on putting in place the “System” to achieve customer service objectives. The first among the major activites in the action plan is the formulation of the “PHED Citizen’s Charter”, defined as “the expression of an understanding between citizens and the provider of a public service with respect to the quantity and quality of services the former receive in exchange for their taxes.”[15] It is essentially about the rights of the public (the water consumers) and the obligations of the public servants, in this case PHED Urban Circle.

As a written, voluntary declaration by the service provider, the Citizen’s Charter defines PHED’s service standards; discusses choice, accessibility, and non-discrimination; and ensures transparency and accountability standards in accordance with the expectations of its citizens. Therefore, it is a useful way of defining for the customers the nature of service provision and explicit standards of service delivery, which is actually the duty of each public official in spending the public money that are collected through taxes, rent or water tariff / fees. It is also an effective tool to help deliver good governance. In other words, the Citizen’s Charter contributes tremendously in the improvement of service delivery, provides the public with greater resposnsiveness from the public officials, and results in greater public satisfaction with services.

The components of the PHED Citizen’s Charter are the following: (i) Vision and mission statements; (ii) Details of business transacted by PHED, in general and PHED Urban Circle, in particular; (iii) Related legislation; (iv) Information about PHED; (v) List of services provided to each client / consumer group; (vi) Quality standards; (vii) Citizens’ duties; (vii) Rights and compensation of the citizens; (viii) Details of grievance redressal mechanisms and how to access it; (ix) Citizen friendly measures; and (x) Expectations from the clients.

A good citizen’s charter focuses on the requirements of the customer. It should be written in a language that is easily understood by them where effective remedies to problems they face can be easily be accessed. It should provide a feedback mechanism where close monitoring is part of the process. Citizens

[15] India’s Citizen’s Charters: A Decade of Experience, Public Affairs Center, Bangalore, 2007, p. 16.

expect service providers to provide reliable, responsive and consistent service performance and should attend to customer needs with empathy, courtesy and care.[16] It is important, therefore, that the citizen's charter publishes the standards of service as a show of openness and transparency. It should be participative in the sense that the customers can openly consult on choices they have to make. It should also provide redress to the customers when things go wrong.

The steps in formulating the PHED Citizen's Charter, including the timetable for completing the process, are detailed in **Table 6.45.**

Table 6.45 Steps in the Formulation of the PHED Citizen's Charter

SL	Actions	Timetable / Remarks
1	Organize the "PHED (Manipur) Citizen's Charter Task Force" within the Department	One week with formal Notification on task force membership
2	Identify all stakeholders and major services with whom consultations will be made	One week
3	Conducr consultations across major customer groups, cross section of the community and stakeholders:	• Three months for total of 10 consultations or one consultation per week. • Each consultation meeting should be well documented. • Secretariat will come from the Task Force.
	• Domestic, business, institutional consumers	Three types of consumers
	• Government stakeholders	Two sets of stakeholders
	• Cross sectional representative associations from small and medium sized business, civic, educational, religious, professional groups	Four sets of representative associations
	• PHED Staff	One set of mixed level staff
4	Prepare the draft of the "PHED Citizen's Charter"	Two months in total
	• Circulate for comments/ suggestions	• One month to circulate and receive comments
	• Modify to include suggestions	• Two to three weeks
5	PHED Citizen's Charter to be reviewed by the "core staff" of the Task Force	One to two weeks
6	Modify the PHED Citizen's Charter by the Department on the basis of suggestions/ observations by the "core staff" of the Task Force	One to two weeks
7	Seek approval from the PHED Minister	One week to get formal approval
8	Submit a copy of the approved PHED Citizen's Charter to the Department of Administrative Reforms and Public Grievances	One week
9	Formally issue and release the PHED Citizen's Charter and put it up on PHED Website	One week
10	Send copies to people's representatives and all stakeholders who were consulted	One week to circulate the copies
11	Appoint a Nodal Officer within PHED Urban Circle to ensure effective implementation and monitoring of the PHED Citizen's Charter	One week to make the appointment

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[16] *Citizen's Charters: A Handbook.* Ministry of Personnel, Public Grievances and Pensions, Department of Administrative Reforms and Public Grievances, Government of India.

b) Development of Complaint Redressal System

The second major activity in the action plan is the development of a complaint redressal system. This is really an inherent part of the Citizen's Charter. It is also one of the yardsticks of providing good customer service. Not all the time are services up to the expectation of the customer. It is important, therefore, to establish both the complaint procedure and the performance standards for the system. **Table 6.46** sets forth the checklist regarding complaint procedures to guide PHED in developing its complaint redressal system.

Table 6.46 Complaint Procedures' Checklist in the PHED Citizen's Charter

	Complaint Procedure in the Citizen's Charter	Yes	No
1	Is there an established procedure for dealing with complaints?		
2	If so, does the complaints procedure contain the following features?		
	• That consumers can complain informally to any member of staff with whom they have contact, who then tries to resolve the problem on the spot.		
	• That consumers can make a formal complaint?		
	• That there is a complaints officer identified (name and contact details) and how to make contact is explained?		
3	Does it guarantee that a full investigation of a complaint will be carried out and a full reply provided?		
4	Does it specify target times within which they will:		
	• Acknowledge the complaint		
	• Provide a full response		
	• Give an interim reply, explaining by when a full response will be provided		
5	Does it set out a procedure by which, if consumers are dissatisfied with the initial response, they can take the matter further?		
	• To what extent is the complaints procedure, or any stage in that procedure, 'independent'?		
	• If there are separate procedures for dealing with different types of complaints?		
6	Does it insist or imply that all formal complaints must be in writing?		
	• Or does it allow complaints to be made in person or over the telephone?		
7	Does it invite consumers to make constructive comments and suggestions in addition to complaints and does it suggest how to do so?		
8	Does it say that if consumers are dissatisfied with the organization's complaints procedure, there are external and fully independent avenues for taking the complaint further (Lok Adalat, Ombudsman, and Regulatory Commission)?		
9	Does it tell consumers how to get independent advice on, or assistance with, their complaint (for instance, from a consumer group or felicitation counter)?		

Adapted from: *Citizen's Charters: A Handbook*. DARPG, Government of India.

According to the Department of Administrative Reforms and Public Grievances (DARPG), grievance redress mechanisms are part and parcel of the machinery of any administration. "No administration can claim to be accountable, responsive and user-friendly unless it has established an efficient and effective grievance redress mechanism. In fact, the grievance redress mechanism of an organization is the gauge to measure its efficiency and effectiveness as it provides important feedback on the working of the administration."[17] It identifies DARPG as the nodal agency central with respect to policy initiatives on public grievances redress mechanism and citizen centric initiatives, but calls for central,

[17] http://darpg.nic.in/darpgwebsite_cms/Document/file/PGR_Guideline.pdf

state and local governments and government organisations to set up their grievance redress mechanisms for the public, based on guidelines that have been issued.

Currently at PHED, complaints are received (logged) and attended to, however, the present approach can be vastly improved and brought to the level required by DARPG. Grievance redressal must, therefore, be systematized within PHED, with focus on the following areas of concern:

- **Developing norms and standard operating procedures** in accepting, acknowledging, processing and investigating complaints.
- **Designation of a location and staff** to receive complaints, including the identity (names and designations) of the assigned staff, their office locations and contact numbers / email addresses.
- **Developing a system for record-keeping**, using information technology to create a database that not only contains vital customer information, but also provides easy access to historical data to track similar complaints. Information required are:
    - Name of customer and details of customer account
    - Exact nature of complaint
    - Manner complaint was filed, date and time, name of staff who received the complaint
    - Analysis of complaint
    - Name of unit and staff to whom complaint was forwarded for resolution,
    - Action taken and timelines, including regular feedback to customer
    - Disposal of grievance
- **Developing target time for feedback response**, including monitoring of complaint solution.
- **Making periodic analysis of complaints**, how these were solved or not solved, with the aim at improving services and/or streamlining grievance mechanism / processes further.
- **Achieving measure of efficiency in redressal of customer complaints** of not lower than the service level benchmark of 80%.

Table 6.47 gives the important characteristics that the complaint redressal mechanism that PHED should address.

Table 6.47 Important Characteristics for the Proposed Grievance Redressal System for PHED

<table>
<tr><th>SL</th><th colspan="2">Characteristics</th><th>Remarks</th></tr>
<tr><td rowspan="7">1.</td><td colspan="2">Accessibility</td><td rowspan="7">• Ease by which customers can access ways to lodge a complaint
• Accessibility modes should be well publicized
• Access modes should be simple to understand and use by customers
• Use “customer care” or customer service” desks / officers instead of “complaint” desk / officer</td></tr>
<tr><td>Face-to-Face</td><td>Customer Service Desk(s)</td></tr>
<tr><td></td><td>Customer Service Officer(s)</td></tr>
<tr><td>Remote</td><td>Telephone / Call Centre</td></tr>
<tr><td></td><td>Online</td></tr>
<tr><td>Mail</td><td>Regular Mail</td></tr>
<tr><td></td><td>Email</td></tr>
<tr><td rowspan="4">2.</td><td colspan="2" rowspan="4">Response time</td><td>• Speed in acknowledging complaint</td></tr>
<tr><td>• Time limits established for acting on a complaint</td></tr>
<tr><td>• Informing the complainant of the proposed action</td></tr>
<tr><td>• Feedback time at keeping people informed of progress of action</td></tr>
<tr><td>3.</td><td colspan="2">Investigative methods</td><td>• Fairness
• Comprehensiveness
• Impartiality
• Time bound</td></tr>
<tr><td>4.</td><td colspan="2">Confidentiality</td><td>Complaint protocol must ensure the confidentiality of both the staff investigating and the complainant</td></tr>
<tr><td rowspan="3">5.</td><td colspan="2" rowspan="3">Communication (Upward and Downward)</td><td>Provide information to top management regarding major grievances so that services can be improved</td></tr>
<tr><td>Issue booklets/ pamphlets about the schemes/services available to the public indicating the procedure and manner in which these can be availed and the right authority to be contacted for service as well as for grievance redress</td></tr>
<tr><td>Publish yearly the numbers and types/categories of complaints, the speed of response to the complaints received, and the action taken as a result of complaints to improve services.</td></tr>
<tr><td>6.</td><td colspan="2">Complaint recording and analysis</td><td>• Record the number of complaints and the type / categories of complaints
• Analyse frequency of the occurrence of each type of complaint / area to identify grievance prone areas where modification of policies and procedures may be undertaken to make delivery of services more expeditious
• Analyse response time and reasons behind problems encountered</td></tr>
<tr><td>7.</td><td colspan="2">Disposition and disposal of complaints / cases</td><td>• Aim not only for quantity, but also for quality
• Satisfaction of complainant should be achieved
• Complainant should feel that grievance was addressed
• Redress options could be in the form of an apology, explanation, assurance that the same thing will not happen again backed up by action to correct the wrong, monitoring and financial compensation.</td></tr>
</table>

JICA Study Team for Imphal Water Supply Improvement Project, October 2104.

c) Review and Reformulation of Customer Service Policies in Billing and Collection

While the aforementioned are functions performed by the Commercial Services Section, these directly contribute to PHED becoming a financially viable utility and will be elaborated by the action plans on Self-Supporting Organizational Operation and Mandatory Water Meter Installation. However, it is absolutely necessary for PHED to review policies, rules and regulations with regard to billing and collection, metering, and service connections (new connections, disconnections, reconnections).

Effective billing and collection systems are a critical component for ensuring the organisational viability and sustainability of PHED, as it has an immediate impact on enhancing the revenue streams / revenue base required to improve services. The reverse is also true – that poor billing and collection practices prevent PHED from recovering sufficient costs to properly operate and maintain facilities and, therefore, provide adequate service to the customer.

According to a study by the World Bank, successful billing and collection practices "depend on many internal factors and this is where proper institutional arrangements have to be established"[18] and suitable policies framed in areas as the extent of metered service provision, water tariff structures including service to the poor, billing cycles, delivery of bills, facilities for customer payments, use of technology, and customer databases. Needless to say, efficient billing and collection practices become the incentives for PHED to charge and collect water bills while also fulfilling a commercial / customer service orientation to its clients.

Measures for improving billing and collection are in the areas of: (i) Accurate, complete listing / recordkeeping of customers served, (ii) Clear billing procedures, (iii) Regularly updated customer databases, (iv) Using improved technology in billing activities; and (v) Encouraging and incentivizing staff to undertake billing and collection functions more diligently. The latter is related to PHED's having an institutional arrangements' approach to water supply service delivery as a commercial endeavor, aiming for independent financial management that includes setting its own revenue targets.

Improvements in billing and collection practices results in lower costs per unit of billing and collection and make such practices worth the resources that are allocated and spent. Ineffective and poorly managed billing and collection practices impact on staffing costs and staff efficiency levels. **Table 6.48** proposes action steps to review and reformulate billing and collection policies as the basis for the billing and collection system.

Table 6.48 Proposed Action Steps for Billing and Collection System

	Action	Remarks
1.	Collect and collate the current policies, rules and regulations on billing and collection	One week
2.	Review and revise the policies taking into consideration the institutional arrangements' approach on the following:	• Set review meetings once a week (one month) • Draft revisions for approval (one to two months)
	a) Metering	Policy is 100% metering
	b) Tariff	Tariff structure per customer category
	c) Cost recovery	Degree of cost recovery (O&M or partial or full)
	c) Financial management	Ring fencing for self-supporting organisation
	d) Service connection	Policy review may be required for new connections, reconnections, disconnections
	e) Mapping of existing and potential customers	House-to-house survey may have to be done
	f) Customer database	Transition from manual records, to computerized records, to full customer database for billing and collection system and financial management information system
	g) Information technology software for billing and collection	Select technology that integrates with other in MIS /GIS
3.	Submit revisions for approval	One week
4.	Implement and disseminate policies, rules and regulations	After approval of revisions

18 Water and Sanitation Program (South Asia), Field Note on "Performance Improvement Planning: Developing Effective Billing and Collection Practices", April 2008.

Monitoring Sheet of Action Plan for Implementation for Customer Service is shown is **Table 6.49**

Table 6.49 Monitoring Sheet of Action Plan for Implementation for Customer Service

SL Nr	Action	Content / Outputs Expected	Target Date (DD/MM/YY)	Budget	Responsible Official	Monitoring Date (DD/MM/YY)	Status	Remarks
1	Institutionalize customer service functions in PHED Urban Circle	• **Structure:** Commercial Service Section officially established and organized	01/01/2019	Nil	Superintending Engineer, PHED Urban Circle	Monthly after start date	Not started	-
2	Review staffing plan for Commercial Service Section	• **Staff:** Human resources for Commercial Service Section recruited and in place as per plan	01/03/2019 (two months before project completion)	INR 26,679,840 (See ***Appendix A6.4 (2)*** for break-down)	Superintending Engineer, PHED Urban Circle	Monthly after start date	Not started	-
3	Review training plan for customer service staff	• **Skills:** Reformulated training plan for customer service staff	01/06/2019	Nil	Executive Engineer, Zones I, II and III	Monthly before and after training	Not started	-
4	Review and (re)formulation of customer service policies	• PHED Billing and Collection Policy *(See action steps in* Table 6.48 *Main Report)* • Service Connection Rules and Regulations (including metering)	Mid-2019 or one year before metering program and marketing for new service connections	Nil	Superintending Engineer and Executive Engineer of Zones I, II and III	Six months before review and monthly after implementation	Not started	-
5	Formulate PHED Citizen's Charter	• Published *PHED Citizen's Charter* • Better customer service delivery *(See action steps in* Table 6.48 *Main Report)*	01/06/2019	• 10 consultations @ 10,000.00 per consultation for total of INR 100,000.00 • Publication cost @ lump-sum 50,000.00	Chief Engineer / Superintending Engineer	Monthly after start date	Not started	-
6	Establish Complaint Redressal System	• *Customer Redressal System* in place and functioning • Achieve service level benchmark for complaint redressal • *(See action steps in* Table 6.48 *Main Report)*	01/08/2019	Nil	Chief Engineer / Superintending Engineer	Monthly after start date	Not started	-

6.4.9 Human Resources / Personnel Management

One of the critical drivers for the success of any public or private organisation is the quality of its human resources – their knowledge (from education and experience), skills (from training and development), and abilities (character, work ethic and competencies). Human resources management, as an important functional area in public or private organisations, is primarily concerned with how people are managed within organizations, focusing on policies and systems. The aim is to maximize staff performance and productivity in order that the organisation can achieve its mandates / strategic objectives.

(1) Current Human Resources Profile and Practices at PHED

The current human resources profile and the personnel management practices of PHED Urban Circle were examined in areas as selection, recruitment, placement; compensation and benefits; training and development; and work systems and performance management.

A human resources survey was undertaken for human resources / personnel of PHED Urban Circle with the objective having baseline information on the profile of the staff, in terms of age, educational attainment, employment status number of years working with PHED. The personnel of the five divisions, including the office of the superintending engineer were distributed survey questionnaires to as shown in

Table 6.50. The head of the division, or the executive engineer, was ensured that the questionnaires were distributed to the different staff groups to have a good representation of the staff, as follows: professionals (engineers), technical staff (section officers), administrative staff, office workers-level and skilled level. See **Appendix A6.4 (3)** for the *Human Resources Profile Questionnaire*.

Table 6.50 Distribution of HR Survey Questionnaire

S.L.	PHED Urban Circle Office / Divisions	No. of Questionnaire Distributed	No. of Questionnaire Retrieved
1.	Superintending Engineer’s Office	23	1
2.	Maintenance I	56	52
3.	Maintenance II	53	62
4.	Project Construction	49	4
5.	Drainage and Sewerage	55	13
6.	Store	36	36
	TOTAL	**282**	**168**

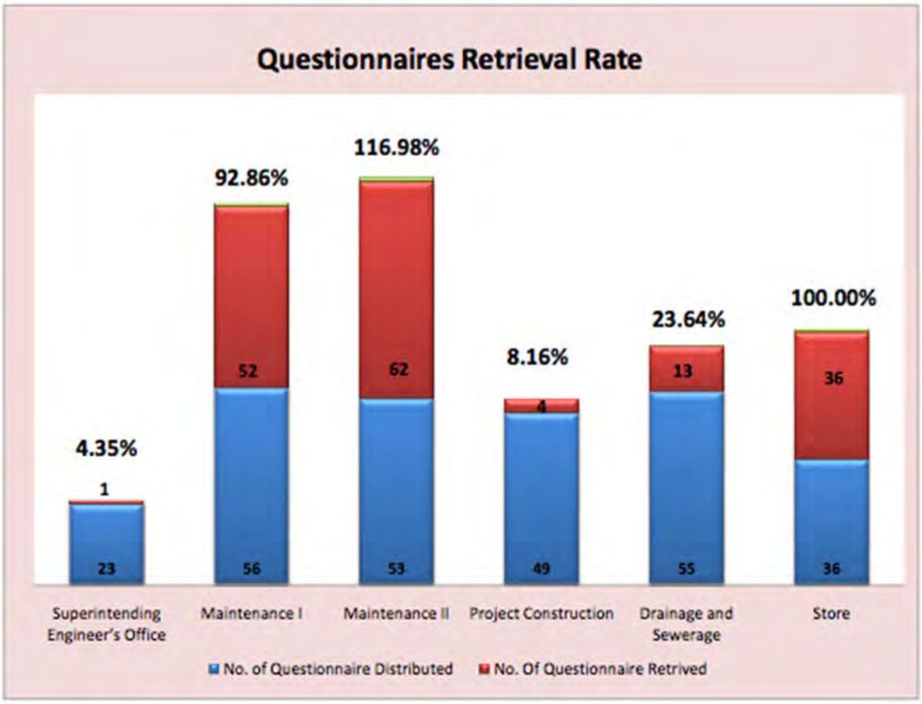

Figure 6.24 Retrieval Rate for HR Questionnaire

a) Age Profile

The majority of the personnel surveyed in PHED Urban are in the 50-60 year old bracket, at 65 percent. Next are those in the 40-49 year old category, at 25 percent. This means that 90 percent of the staff are 40 years old and above, as shown in **Figure 6.25**.

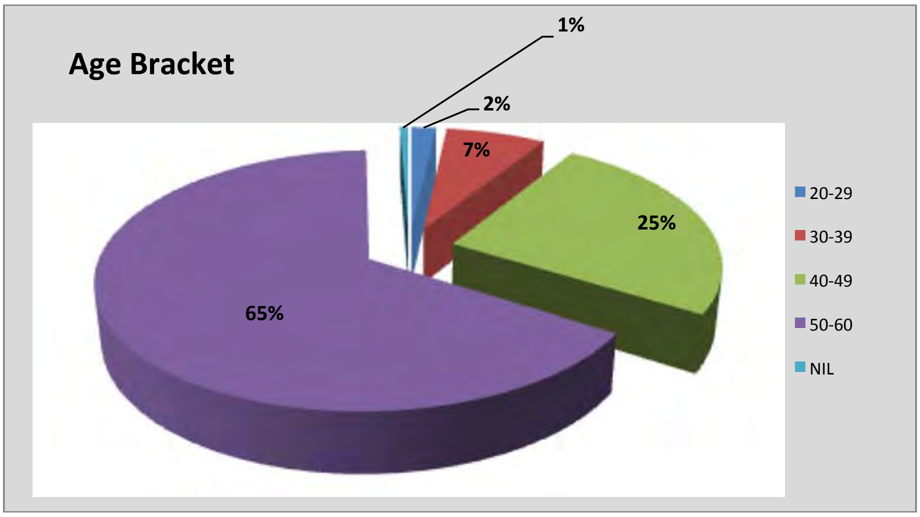

Figure 6.25 Age Profile of PHED Urban Circle

The age profile of PHED Urban Circle can be both a boon and a bane. The top and senior officers have acknowledged this problem early on, as revealed in their responses as key informants in the SWOT assessment, which have been discussed in an earlier section (Chapter 6.2). Since many of the senior technical managers are due to retire in the next two to five years, they will be bringing with them the wealth of water supply experience gained through the years. Thus, PHED has to "double time" not only in engineer recruitment, but also in training the next generation of managers.

b) Educational Qualifications' Profile

Shown in **Table 6.51** is the educational profile of the respondent-PHED Urban Circle personnel. A large majority of the staff, at 45 percent, belonged or completed primary level of education. Most of those holding section officer post reached university level, although some graduated from the university. All the assistant engineers and executive engineers surveyed were university graduates.

Table 6.51 Educational Profile

SL	Educational Level	Number	%
1.	Primary	76	45
2.	Secondary	9	5
3.	High School	3	2
4.	University (not Graduate)	29	17
5.	University (Graduate)	38	23
6.	Master/ Doctorate	8	5
7.	No Answer	5	3
	Total	**168**	**100**

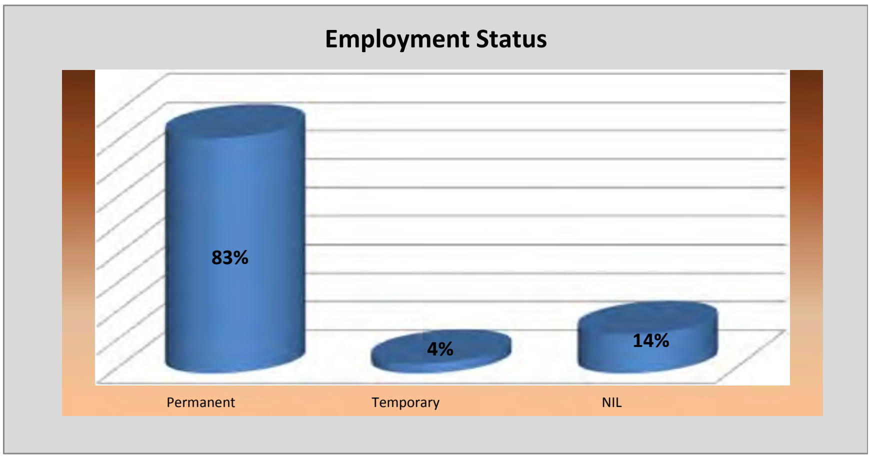

Figure 6.26 Employment Status of the Respondents

c) Employment Status Profile

As shown in **Figure 6.26**, 83 percent of those surveyed are regular employees, or are those holding sanctioned posts. Four percent are temporary, under master roll, contractual or casual. The rest or 14 percent, did not indicate their employment status.

d) Number of Years in PHED

Consistent with the age profile, 20 percent and 29 percent of the employees have been with PHED for 31 to 40 years and 21-30 years, respectively. Half, or 50 percent, have been with the Department for less than 20 years. See **Figure 6.27**, 83 percent of those surveyed are regular employees, or are those holding sanctioned posts. Four percent are temporary, under muster roll, contractual or casual. The rest or 14 percent, did not indicate their employment status.

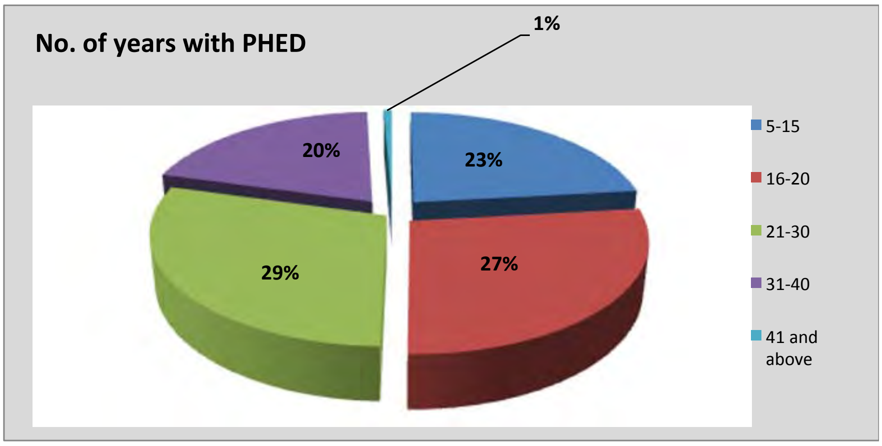

Figure 6.27 Number of Years in PHED

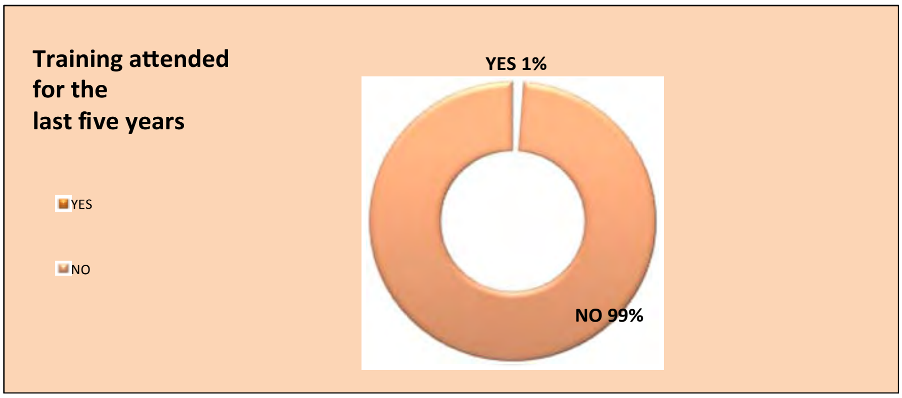

Figure 6.28 Employment Status of the Respondents

e) Status of Training Activities

Staff training and development activities are virtually non-existent in the PHED Urban Circle. An overwhelming majority of the 168 respondents, or 99 percent, did not receive any training in the last five years. Only two of those surveyed, or one percent attended training programs in connection with central and state government projects. The reason for the glaring lack of training was the past financial condition of the State of Manipur where the scarcity of funds put training activities in the backburner, so to speak.

f) Existing Performance Evaluation System

According to the key informants in the PHED SWOT Assessment, the Annual Confidential Report is a regular undertaking, as this one requirement for promotion. However, the objective of rewarding excellent performance is not achieved, as “rewards are not awarded”.

Based on the results of the HR survey, out of 168 surveyed, 20, or 12 percent said that they have received performance assessment, while 148 or 88 percent said otherwise. See **Figure 6.29** below:

As revealed in **Figure 6.30**, of the 20 who received performance assessments, 13 respondents or 65 percent do not remember when the assessment was made, a clear indication of the low commitment to the performance appraisal system. The major reasons for its low institutionalization in PHED could be attributed to the lack of accountability and the seeming disconnectedness between objectives and the actual result. There is no direct link to rewards or to training except for promotions, that the process is a “forgotten” part of the supervisors’ responsibility, thus defeating the noble objectives of the whole exercise.

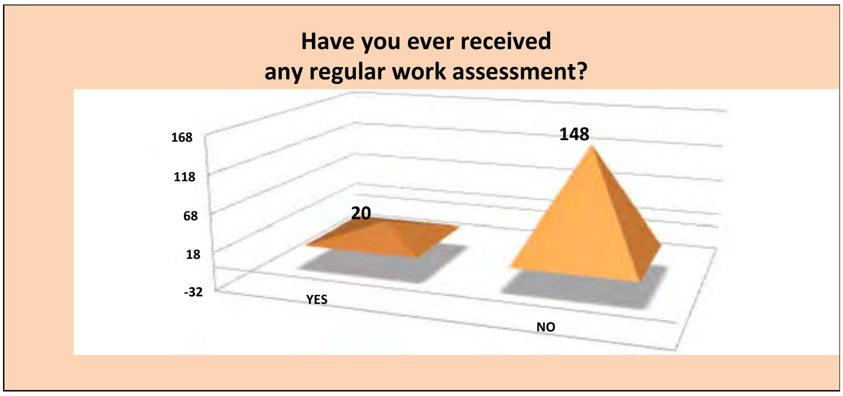

Figure 6.29 Number of Respondents That Received Regular Work Assessments

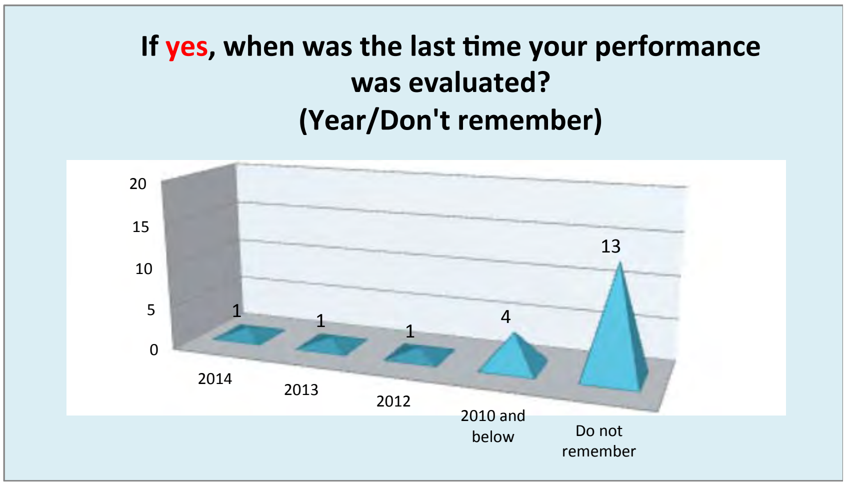

Figure 6.30 Year of Performance Evaluation according to the Respondents

Major discrepancies have been found in the performance appraisal processes being followed at the government organizations in India. These are (i) Most of the indicators used for measuring the performance the employees are not quantifiable in nature, making it difficult to measure the performance; (ii) Due to the lack of accountability and job security, most government employees have a *laissez faire* attitude towards their work; (iii) Unavailability of the job descriptions for many employees; (iv) Most of the objectives in government organisations are unchallenging, unrealistic and not timely reviewed and updated; (v) It is difficult to measure the average performance of the government employees; (vi) Unprofessional and unstructured approach towards the process; (vii) There is often a lot of bias and subjectivity involved in the ratings given by the superiors; (viii) Lack of complete information on appraisal forms due to expertise and relevant training, such that oftentimes the appraisals are not conducted on a regular basis.[19]

g) Job Descriptions

Of the 168 respondents surveyed, 134 or 80 percent indicated that they have written job description, although a closer look shows that those holding the same positions had a different take on what they believed their job entailed.

According to the CPHEEO *Manual on Operation and Maintenance of Water Supply Systems*, O&M jobs are performed by operating staff and supervisory staff. The manual does not provide the exact name or category of the posts required, so it follows that there are no details or particular description(s) of the job that needs to be performed. What is says, however, is that there should be a plan or programme containing procedures to be adopted or actions to be taken for each piece of equipment, and that the person who carries out this action is to be identified. Thus, the person's job description should contain reference to the maintenance plan/programme".[20]

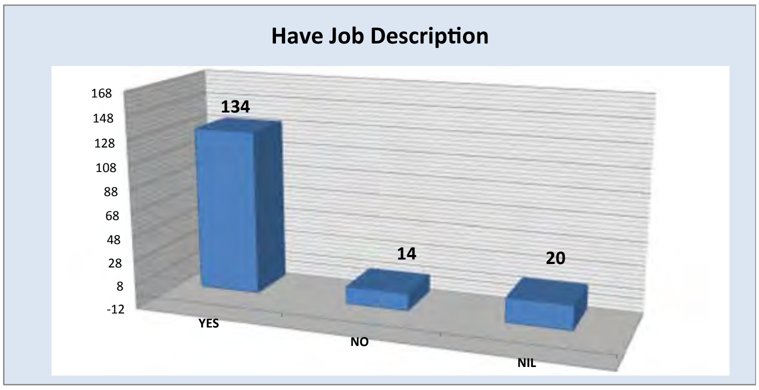

Figure 6.31 Number of Respondents with Job Descriptions

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[19] http://www.naukrihub.com/appraisals/government-organisation.html#sthash.8QlaHGpW.dpuf

[20] *Manual on Operation and Maintenance of Water Supply Systems.* Central Public Health and Environmental Engineering Office, Ministry of Urban Development in collaboration with the World Health Organisation, 2005.

(2) HR Action Plan Focused on Training /Capacity Development

The action plan for human resource will be undertaken by the Consultants during the project implementation stage and consists of two two aspects in the human resources management cycle – training and development and performance management.

PHED will require robust skills to manage, operate and maintain the newly constructed and rehabilitated system. This is where training and capacity development becomes a critical activity given the fact that there had been little to no training in the past years of its existence, that the experienced and seasoned senior staff face retirement in the years prior to project completion, and that the newly recruited staff have to fast track their learning curve in water supply / public health engineering.

There is an expressed need for the preparation of a PHED training and development plan based on a comprehensive training needs assessment. However, during the implementation of the Project, general training and capacity development programs can and should be undertaken in anticipation of requirements to manage, operate and maintain the water supply system. The objectives of the capacity development program are two fold:

- To enhance the capacity/ ability of the PHED as an institution to realize organisational goals and objectives;
- To enhance the existing knowledge and skills of key staff, as well as identified group(s) of personnel with the competencies required to manage, operate and maintain the new and existing facilities/ system thereby transforming organizational and individual potentials into actuality with each one contributing their share towards the achievement of PHED's mandate. The training should bring about the correct attitudinal change as well as professionalize and improve the efficiency of personnel in the performance of their tasks.

(3) General Approach

a) The general approach to enhancing staff capacity is to acknowledge that all personnel will require various types of training in the immediate, short and medium term. Thus, training should not be designed as an intermittent separate activity, but rather should address the specific, current and emerging needs.

b) For PHED, this approach provides for training that will cover:

- *Unit-Wide Training:* Considering that the PHED is proposed to be strengthened / restructured, it is vital that unit-wide trainings are conducted for the staff members – to reorient them on the expanded role PHED. Focus should not only be by PHED functions and responsibilities, but also on the importance of coordination and linkages between and among its divisions, if only to highlight unity of effort and cohesion as ingredients to efficiency and productivity and the need to foster a culture of cooperation and coordination.

- *Functional Grouping/ Area Training*: This type of training addresses specific functions where the level of competence may be inadequate, or where skills need to be enhanced. PHED requires several "functional" training because the reorganization will result to the establishment of new units with new and/ or expanded responsibilities. There is also training to enable staff to utilize and apply proficiently new technologies.

- *Individual Level Training*: The training for selected/-identified employees commences only after more detailed training needs assessment is conducted. Individual training must be matched with the proposed trainee's qualifications, the job presently held, and the skills needed for the job-holder to perform at the minimum acceptable standards of the particular job.

(4) Training Objectives

a) The long term objectives are to: (i) Bring qualitative changes in the technical, administrative and finance, and commercial / customer service skills at all hierarchical levels with emphasis on decentralized governance in urban water supply; (ii) Improve the quality in the water supply service delivery system in consonance with service delivery benchmarks for managing, operating and maintaining the water utility; and (iii) Sustain the operation and maintenance of the systems by embracing and introducing new technologies.

b) The short term objectives are to: (i) Provide the entrant employees training on induction to grasp organization as a whole and understand their place / position vis-a-vis the role of their unit / section / department; (ii) Familiarize the employees about service conditions, such as, but not limited to, administrative rules and regulation, financial procedures; (iii) Enhance knowledge and skills of the engineers and other professionals in their respective functional areas both technically and managerially in relation to performance of their duties and the achievement of organisational goals; (iv) Update the skills and knowledge of in-service employees from time to time, to keep pace with the changing technologies and latest government policies and laws.

(5) Specific Approach

The training plan utilizes a mix of training interventions and approaches to enhance the staff capacity of PHED:

- The first will be the traditional approach where the training staff (with the assistance from experts) designs the objectives, contents, techniques, and evaluation for the participants, with the training staff providing the intervention to skills development.
- The second is the experiential approach where the trainer/ expert provides learning experiences, thus making the learner an active partner in the training process. This approach emphasizes real job situations or can simulate conditions in which the trainee(s) currently operate(s) or will eventually operate. Thus, the trainers and the trainees jointly determine the training objectives and other elements of training with the trainers primarily serving as facilitators, catalysts, or resource persons.
- The third approach is the competency-based or performance-based approach where the emphasis is given to the trainees' acquiring a specific observable skill for a task, and then attaining the skill by demonstrating it with a given level of competency or proficiency. This demonstration-based learning approach is mostly task or skill centered and is applicable for on-the-job training.

(6) Training Mix

Lecture / classroom-based training can take place in institutions located outside the state of Manipur; these training centres are specially equipped and staffed for the purpose of imparting customized training to participants from different organizations. The training centres apply methodical training techniques, use special equipment and have trained trainers to strengthen the capacities of the trainees.

In-house training and workshops include specific tailor-made programs, clear learning objectives and an appropriate mix of effective training methods. In-house training imparts specific managerial/ technical/administrative skills needed in operation and maintenance of the water supply system. The trainee works, learns and develops expertise at the same time concepts and theory are put into practice immediately. In-house trainers give training to water supply supervisors and instructs new employees in performing their tasks. It is considered to be an acceptable means to train officials in new developments and new systems when they are introduced. For in-house training, faculty can be arranged from within Department i.e. senior engineers like the Superintending Engineers and Executive Engineers who have the aptitude for imparting training. Guest Resource Persons or even consultants may be used for this purpose with experience and knowledge of fieldwork. The in-house trainers skills can be enhanced by sending them to various refresher courses organized by MoUD.

Local study visits have proven to be an effective way for trainees to understand and learn practical solutions and management approaches, with the opportunity to visit similar water supply utilities within the country and observe their actual operations. It also helps in initiating contacts and liaison with counterpart professionals, at the same time is instrumental in getting useful management information from people engaged in parallel activities.

International study visits are an effective means to understand and learn advanced practical solutions, emerging management approaches, which are being carried out in related water supply utilities in different parts of the world. Overseas study tours give an opportunity to observe concrete operations of water supply project activities in other parts of the world. These would provide a forum for Manipur water supply professionals to engage in discussions with counterpart professionals and to learn from global experiences. The major output of these study visits would be to draw future plan of actions, incorporating, adopting or adapting some of the technological advances, management approaches within the programmes.

(7) Training Organizations

Training will be undertaken by the following: consultants-experts, the training centers of related national, state and local government agencies, professional organizations and technical, vocational and academic institutions. See **Appendix A6.4 (4)** for the *List of Training Institutions in India*, which may be tapped to provide training to PHED.

(8) Proposed Training Programs

The training programs proposed herein are borne out of the expressed needs and requirements of PHED. Training can either be conducted and/ or supervised by foreign and local professionals as well as content and subject matter experts. The proposed training shall be implemented within the first year of Project implementation up to three months before commissioning of the Project.

a) Overseas Training Programs for PHED

The general approach for the training of top to senior level management will be overseas visits and observation studies in countries practicing advanced water supply and water supply technologies and for senior officials and manager(s) PHED study visits will be made to utilities recognised for best practices and by their strategic and innovative utility management approaches and operational excellence. The details of the training, such as training objectives, methodology and location(s) of overseas training will be coordinated with the selected training institutions/ agencies, to ensure that training goes on smoothly and is completed according to the objectives.

Table 6.52 Proposed Overseas Training Programme and Schedule

	Title of Training	Proposed Participants	Duration	Proposed Period
1.	International Study Visit: “Advanced Water Supply and Sewerage Technologies” • *Tokyo, Japan*	**Total Participants:** *From PHED* – 04 participants • Chief Engineer • Additional Chief Engineer • Superintending Engineer ×2 (Excl. Urban Circle)	Seven days (including travel time)	Start of project implementation during detailed design stage (2017-2018)
2.	Strategic Water Supply Utility Management for Senior Water Supply Managers (any of the following locations) • *Tokyo, Japan* • *Public Utilities Board, Singapore* • *Manila Water, Philippines* • *Phnom Penh Water Supply, Cambodia*	**Total Participants** *From PHED Urban Circle* – 05 • Superintending Engineer • Executive Engineer, Zone I • Executive Engineer, Zone II • Executive Engineer, Zone III • Executive Engineer, Information Management and Development	10 days (including travel time)	Mid Project implementation during the construction stage (2019-2020)

b) Unit Wide and Functional Training

- *The Enhanced/ Strengthened PHED Organization:* Since PHED is proposed to be reorganized, it is important that each employee is apprised of the new structure, his/ her function, roles and responsibilities. This type of training will impact in promoting organizational pride and understanding how one’s job affects and relates to another person’s. Topics to be taken up shall be PHED service rules and regulations; the restructured PHED organization, broad and specific functions (sections and units); Citizen’s Charter and Complaint Redressal and Performance Appraisal Reporting.

- *Occupational Health and Safety:* The training will focus on the importance of health and safety, based on the system of laws, regulations and compliance codes which set out the responsibilities of PHED and the workers to ensure that safety is maintained at work. The training will describe how health and safety can be promoted by explaining the role, responsibility and accountability of PHED and each staff member in health and safety, and how health and safety control component is integrated into the management of all water supply system activities.

- *Distribution System O&M (with emphasis on NRW Control).* The theoretical approach to training will be through topics – theory of water distribution in a water supply system; PHED’s distribution network system, diameter of pipe, pipe material and hydraulic capacity; NRW control, measurement and reduction program and methodology of investigation for leakage volume; methodology of distributing the required water amount into each distribution block; Installation method of consumer flow meter; operating the tools for installation of consumer flow meter/ bulk meter; and mapping, record keeping and reports’ preparation.

This training should be based on the PHED O&M manual in conjunction with the O&M manual prepared by the Central Public Health and Environmental Engineering Organization under the MoUD. The practical aspects will include operating and maintaining water distribution systems, emphasizing role and duties of water distribution system operators, procedures for operating and maintaining water towers, components and characteristics of distribution system facilities, operating and maintaining distribution systems, maintaining water quality in the system, disinfecting new and repaired facilities as well as water delivered to consumers, and techniques for recognizing hazards and developing safe procedures and programs.

- *Water Loss Management and Leak Detection.* This training, with theoretical and practical approaches, is necessary as PHED ventures into metering of all service connections. Theoretical topics include: Introduction to leakage detection, sources of leakage and its influencing factors; principles of hydraulics and network analysis; district meter area management and network structure. Practical application of the training shall be on: Leak detection identification; localisation techniques for trunk mains and distribution network; use of detection equipment; and leakage location and confirmation.
- *Water Treatment Process.* This training will be a refresher on water treatment with topics on: overview of water treatment facilities; primary, secondary and tertiary treatment; primary and secondary sedimentation tank management; operation of activated sludge process; aerated lagoon process, moving bed reactor, up-flow anaerobic sludge blanket reactor, waste stabilization pond, secondary sedimentation tank, advanced treatment processes, disinfection facility operation and maintenance.
- *O&M of Electro-Mechanical Equipment.* Training will be on the preventive and corrective operation and maintenance of electro-mechanical and instrumentation facilities in the WTPs and distribution system facilities. It will also include safety in the performance of the duties of the operators.
- *MIS / GIS (Network and Asset Management:* This most basic training will be on basics of ArcGIS and AutoCAD, with emphasis on network management. Training begins with basic cartography, remote sensors or raster images, datum and geographic projections, moving on to familiarity with the peripheral equipment management of information both in and out (global position system, total stations, databases, plotting, etc). It is important that a topic on computer equipment is included so that problems generated by servers supporting the database can be solved.

  A second training will be on complementary software such as advanced techniques using ArcGIS, ArcFM, Civil, Erdas, Acces, and Oracle, etc. particularly on the interpretation of aerial photos and satellite images; on geodatabase elaboration and editing in Arc Map, specifically regarding service networks, to enable changes in the geodatabase, according to the aspects required for its adequate functioning.

- *Public Information, Education, Communication (IEC).* The participants will learn the Information, Education and Communication Framework and the different ways by which PHED can convey its message(s) and policies across its various stakeholders. This is important because PHED is moving towards tariff reform and metering of all service connections, which will involve public consultations. By this training, the participants will be able to classify its messages, develop IEC strategies that would be appropriate for its various publics/ audiences, and learn to use the most suitable media to deliver its message. The ultimate objective is getting the target audience not only to be aware of PHED's important messages, but to have a deeper understanding of its meaning, and to act positively based on this understanding.

  The training will include topics such as the Introduction to Information Education and Communication Processes, Public Relations, Public Consultations, Media Relations, Advocacy, Public Awareness, Events Management, Communication Infrastructure, and Evaluation of Communications Programmes. Messages that can be used for the IEC programme(s) are: water conservation and the preservation of the environment; water, health and hygiene; water quality and water borne diseases. Others topics can fall under customer services, such as the conduct of consumer surveys; water service coverage to the poor and disadvantaged; handling customer services and customer accounts, new connections, reconnections, disconnections and customer complaints.

Table 6.53 Summary of Proposed Local Training Programs for PHED

	Training	Objective	Participants	Duration	Schedule
	UNIT-WIDE TRAINING				
	The Enhanced/ Strengthened PHED Urban Circle Organization	To apprise the PHED managerial levels (EEs, AEs and select SOs) of the enhanced and strengthened organization structure, unit and individual objectives and functions, roles and responsibilities. Said training will be immediately cascaded by the managers to their own staff.	***Total: 30*** *(All EEs, AEs and senior-level SOs and professional staff by division / functional area.)*	One day	First quarter 2020
	Occupational Health and Safety	To promote health and safety in the workplace by examining the system of laws, regulations and compliance codes and how these can be integrated into the management of all water supply and water supply system activities. Includes, explaining the role, responsibility and accountability of PHED and each staff member in health and safety.	***Total: All personnel*** *(600+)* *(All personnel of PHED Urban Circle by batches of 50 or by functional area.)*	• One day • Pre-arranged schedule until all personnel are covered.	First quarter 2021
	FUNCTIONAL AREA TRAINING				
	Distribution System O&M (emphasis on NRW Control)	To safely and effectively manage, operate and maintain the distribution facilities and network of pipelines through basic classroom (theoretical) learning, and practical (job-site) learning activities.	***Total: 65*** Zone 1: 20 Zone II: 20 Zone III: 20 Info Mgt & Dev: 5 *(Section officers and O&M team leaders of water supply zones)*	10 days	Second quarter 2019
	Water Loss Management and Leak Detection	To manage water loss through hydraulic and network analysis, district meter area management and proper leak detection techniques.	***Total: 35*** Zone 1: 10 Zone II: 10 Zone III: 10 Info Mgt & Dev: 5 *(AEs SOs, Survey and inspection crews)*	10 days	Third quarter 2019
	Water Treatment Process	To provide a refresher of both basic and advanced water treatment process operations and facilities maintenance.	***Total: 44*** New WTP: 8 Other WTPs: 2 x 18 36 *(Assistant Engineers and Section Officers)*	Five days	Last quarter 2019
	O&M of Electro-Mechanical and Instrumentation Equipment	To ensure the efficient operation of all electro-mechanical equipment through proper and standard preventive and corrective operation and maintenance practices.	***Total: 40*** New WTP: 4 Other WTPs: 2 x 18 36 *(Electrical and Mechanical AEs, SOs and operators in charge of electro-mechanical equipment)*	Five days	First quarter 2020
	MIS / GIS (Network and Asset Management	To ensure efficiency and effectiveness in network management through the proficiency in ArcGIS and extension ArcFM applications, complementary use of AutoCAD, Civil, Erdas, Acces, and Oracle software.	***Total: 8*** *(Staff to be assigned to Information Management and Development Division)*	10 days (total) Basic - five days Advanced – five days	Second quarter 2019
	Public Info,	To enable PHED to effectively convey	***Total: 15***	Five days	Second

	Education and Communication	its messages to target public using the appropriate media of communication, important as PHED moves towards tariff reform and metering of all service connections, which will involve public consultations. Will include customer service strategies.	*(AE and SOs and operating staff to be assigned to the customer relations unit)*		quarter 2019

Appendix A6.4 (5) provides the training budget for overseas training and **Appendix A6.4 (6)** for and local training.

(9) HR Action Plan Focused on Personnel Evaluation System

There is a performance evaluation system in place followed by PHED which is through the Annual Confidential Report (ACR) with the twin objectives of "improving the performance of subordinates in their present jobs, to assess their potentials and to prepare them for the jobs suitable to their personality." In other words, the ACR is an important document, being the basis in making decisions on matters of selection and placement, training and development, promotion, and even in premature retirement. This is also the basis on which annual increases in pay called "increment" is processed.

The ACR is basically is a two-step assessment – first is a self-rated assessment (self-appraisal) by the officer or employee him/herself, and the second is the rating by the immediate supervisor of the officer or employee. There is a prescribed action time schedule followed in the submission of the ACR by the "Reporting Officer" to the "Reviewing Officer" who, in turn, sends the completed report to the "Accepting Authority."

Note that the State of Manipur still uses the "Annual Confidential Reports" (ACR) as the performance evaluation tool for gazetted and non-gazetted officers and employees. However, the Government of India and many states have moved to using the "Annual Performance Appraisal Reports" (APAR). In actuality, both are basically the same, except that the latter connotes openness and transparency, which are needed in improving employee performance.

Based on the result of the HR survey, PHED exhibits low commitment and consistency in implementing the system, thus defeating the objectives of the ACR. As an important organisational function, performance management is designed to maximize employee performance, and is primarily concerned with how people are managed within organisations, focusing on policies and systems. It should be done in systematically and periodically to objectively assesses employee's job performance and productivity in relation to certain criteria and organizational objectives. There is also the documentation (appraisal report) as basis for employee decisions such as rewards, promotions, training and transfers and tracks the employee's potential for future improvement.

It is proposed that PHED produce and publish the "PHED Brochure on Performance Appraisal", the preparation and publication of which shall be at the start of the implementation of the project (2017-18). Its publication should also be given the widest dissemination among staff and employees. Table 6.53 gives a rundown of the brochure's proposed contents:

Table 6.54 Proposed Contents of the "PHED Brochure on Performance Appraisal" (Confidential Reports)

Chapter Number	Title	Description of Content
I.	Performance Appraisal: Philosophy and Approach to the System	Explains the organisational and performance objectives of appraisal as a continuous and participative process and a tool for human resource development.
II.	General Principles	States the historical and legal bases of performance appraisal.
III.	Contents of and Guidelines in the Performance Appraisal Report	• Describes each part in the report format • Provides the responsibilities of all those involved in the process – the staff being reviewed, the reporting officer and the accepting officer
IV.	Timely Completion of the Performance Appraisal Report	Gives not only the time schedule for the appraisal's completion, but also the reasons why timely completion is important in personnel administration
V.	Special Provisions	• On Adverse Remarks • On government servants covered or not covered by the performance appraisal under deputation • On those on training, or working in technical/ academic institutions
VI.	Miscellaneous	Any other provisions not covered in any of the chapter above, but may need clarification
VII.	Annexures	
	1. Guidelines in filling up of APAR Annual Performance Assessment Report with numerical grading	
	2. Assessment of work output	
	3. Time schedule for preparation / completion of APAR in terms of reporting year – financial year	

Monitoring Sheet of Action Plan for Implementation for Human Resources is shown is **Table 6.55.**

Table 6.55 Monitoring Sheet of Action Plan Implementation for Human Resources (Training and Capacity Development)

SL Nr	Action	Content / Outputs Expected	Target Date (DD/MM/YY)	Budget	Responsible Official	Monitoring Date (DD/MM/YY)	Status	Remarks
1	Institutionalize customer service functions in PHED Urban Circle	• **Structure:** Commercial Service Section officially established	01/01/2019	Nil	Superintending Engineer, PHED Urban Circle	Monthly after start date	Not started	Can be started with present organisation
2	Review staffing plan for Commercial Service Section	• **Staff:** Human resources for Commercial Service Section recruited and in place as per plan	01/03/2019 (two months before project completion)	Nil	Superintending Engineer, PHED Urban Circle	Monthly after start date	Not started	-
3	Review training plan for customer service staff	• **Skills:** Reformulated training plan for customer service staff approved	01/06/2019	Nil	Executive Engineer of Zones I, II and III	Monthly after start date	Not started	-
4	Implement the Induction / In-House Training for personnel of new sections as well as on new policies, rules and regulations after their release	• **Induction Training** undertaken for Customer Service Section staff; Asset Management, GIS MIS; Administration Section; Accounting and Finance Section	01/11/2020 Induction training two months before actual project completion	In-House	Superintending Engineer and Executive Engineers of Zones I, II and III	Month before start date	Not started	-
		• **Billing and Collection** training upon release of the *PHED Billing and Collection Policy* • *(See action steps in* Table 6.48 *Main Report)*	01/11/2020 Induction training two months before actual project completion	In-House	Customer Service Section Head Accounting and Finance Section Head	Month before start date	Not started	-
		• **Marketing for New Connections** training upon release of *Service Connection Rules and Regulations*	01/11/2020 Induction training two months before project completion	In-House	Executive Engineer of Zones I, II and III Customer Service Section head	Month before start date	Not started	-
5	Implement Proposed Training Programmes during project implementation	• Individual and group skills enhanced • More efficient delivery of service • More effective organisation (See ***below*** for Proposed International and Local Training Programs)	2017-2021	7,095,018.53 (Including service tax and contingency)	• Chief Engineer for Overseas Training • Superintending Engineer for Local Training	Four months before start date	Not started	-
	Overseas Training	Advanced Water Supply and Sewerage Technologies	2017-18 Within three months upon start of	2,257,000.00	Chief Engineer	Four months before start date	Not started	-

			project implementation					
		Strategic Water Supply Utility Management for Senior Water Supply Managers	2018-19 Mid-project implementation	4,010,000.00		Three months before start date	Not started	-
	Local Training	The Enhanced/ Strengthened PHED Urban Circle Organization	First Quarter, 2020	2,161,250.00	Superintending Engineer	Three months before start date	Not started	-
		Occupational Health and Safety	First Quarter 2021	1,163,750.00		Three months before start date	Not started	-
		Distribution System O&M (emphasis on NRW Control)	Second Quarter 2019	913,000.00		Three months before start date	Not started	-
		Water Loss Management and Leak Detection	Third quarter 2019	830,000.00		Three months before start date	Not started	-
		Water Treatment Process	Last quarter 2019	166,000.00		Three months before start date	Not started	-
		O&M of Electro-Mechanical and Instrumentation Equipment	First quarter 2020	166,000.00		Three months before start date	Not started	-
		MIS / GIS (Network and Asset Management	Second quarter 2019	311,250.00		Three months before start date	Not started	-
		Public Info, Education and Communication	Second quarter 2019	2,161,250.00		Three months before start date	Not started	-
6	Formulation of PHED Performance Appraisal System	Brochure on PHED Performance Appraisal System • Staff performance duly evaluated per cycle	01/01/2019	Nil	Chief Engineer	One month before and after evaluation cycle	Not fully implemented	Can be started with present organisation

6.4.10 Preparation of NRW Reduction Plan

In Imphal, the water supply coverage is estimated at 17.2% based on the number of domestic connections. Although water production capacity has been decreasing, the amount of water being distributed far exceeds the estimated water consumption coming from domestic connections. This brings the present NRW to an estimated 78% of the present nominal production capacity. The staggering NRW is caused by commercial loss, such as illegal connections, and the physical loss like leaks. The actual status is unknown for both types of losses; however PHED strongly believes that there are many illegal connections. It should be noted that the sustainability of water supply services cannot be achieved without reducing NRW.

The number of connections was once counted at about 25,000 units; but now there are less than 20,000 units in spite of an increase of the number of WTPs during that period and an increase in the city's population.

	
Open-end pipe without any cock or tap	Open-end pipe without any cock or tap
	
Leaks from an existing public hydrant	Open-end pipe without any cock or tap

Photo 6.1 Conditions of Existing Faucets

The social conditions survey for 322 households (from 34 areas of the Municipality Ward and Greater Imphal) revealed that many households were found to have open-end pipes without any cock or tap as well as badly installed service pipes. This is shown in **Photo 6.1**.

Faced with this situation, NRW reduction should be focused on either shutting down illegal connections, or regularizing these while imposing appropriate penalties, closing open-end pipes, and repairing pipe leaks. The latter, however, will be dealt with the replacement of distribution pipes under the JnNURM and JICA projects. Therefore, the NRW reduction shall address the problem of illegal connections and open-end pipes.

(1) Open-end Pipe

The open-end pipes suggest two problems as follows:

- The cause why the open-end pipes are allowed should be clarified. Was it done by a plumber or by the customer intentionally, did the PHED staff inspect the service pipe installation work, or what kind of measures has been taken by PHED against such open-end pipes (exposure or connivance)? The Manipur Water Supply Act, 1992 provids that “iii) If there is any water-pipe situated within the premises to which no tap or other efficient means of turning the water off is attached” in “Clause 23. Disconnection of water supply”.
- **Photo 6.1** shows that the service pipe installation works were done very roughly.

The work quality of plumbers doing service pipe installation works is very poor, and shows no consideration in supplying safe drinking water. The licensed plumber system for service pipe installation works should be introduced in the future as mentioned in “Action Plan for Meter Installation”.

It is recommended that, the situational survey for selecting the pilot area should be carried out thoroughly – meticulous in checking the number and locations of illegal connections, as well as the number and locations open-end pipes and leaks. This basic information will be important to plan countermeasures in the future.

(2) Illegal connections

Although the Manipur Water Supply Act, 1992 provides that “a) Any person authorized in this behalf by the prescribed authority may enter into any premises for the purpose of inspecting any water installation.” in “Clause 22. Power to enter premises”, it is not sure whether this clause is applicable to the survey for illegal connections. If not applicable, the amendment of the Act is required.

There are three approaches for dealing with illegal connections as shown in **Table 6.56,** all of which have merits and demerits. Taking into account the size of planned service area, time and money to be required and so on, the regularization of illegal connections is advisable.

Table 6.56 Approaches for illegal connections

Method	Contents	Problems	Example conducted	Remarks
Thorough survey mobilizing internal manpower or through outsourcing	Decide the priority of areas and put the time and M/M to check the site one by one thoroughly	• Revelation accuracy is high • Takes time and cost • By being received as a powerful approach by the residents, trouble may occur frequently	•	
Outsourcing under the performance-based remuneration contract	By deciding the remuneration per an illegal connection, the payment is done on the performance basis	• High performance in the short-term • Illegal connections may be easily found if the ways by which this is done are better understood • Being doubtful whether the present Act gives such kind of entry to survey team for illegal connections • High omission rate	• Lahore • (Pakistan)	
Regularization of illegal connections	By giving a certain period to illegal connections for voluntary registration for regularization	• The extent of penalty mitigation for illegal connections should be studied taking into account the balance with the present burden borne by legal connections • Those with illegal connections are prepared to regularize their service connections, there will be less trouble and they will be cooperative • To clarify that severe penalty will be imposed on illegal connections not regularized, including the legal suit.	• Hyderabad • Nagpur • Rajkot • (India)	The campaign will be extended prior to regularization of illegal connections stressing that if this chance will be lost, they will suffer disadvantages. If more people can be mobilized on the first days of regularization procedure, other people also with illegal connections will be pushed to do the same

*1 Lahore WASA contracted with four companied and succeeded to find about 5,000 illegal connections within 15 days (”The Nation”, October 12, 2009) but the final number was reported as 6,935 (“Pakistan Today”, June 7, 2012). It means that the remarkable results were obtained in the initial stage but the number has not expectedly increased thereafter.

In the regularization of illegal connections, how to take the balance with legal connections that have paid the water tariff honestly up to now is the biggest issue. By removing the feeling of unfairness, it depends on the presentation of conditions for the penalty mitigation which make those with illegal connections join the voluntary disclosure scheme. In this case, those with illegal connections who do not take the regularization procedure during the campaign, it is essential to threaten that severe penalty will be imposed including the legal fine and punishment.

Table 6.57 Examples of Regularization of Illegal Connections

City	Current Water Tariff	Regularization Period	Regularized (Nos.)	Regularized Charge	Disconnected (Nos.)	Fine for not regularized
Rajkot	Rs.840/yr	15/07/2014 – 15/09/2014	4,000	Rs.2,000	1,800	Rs.3,000
Hyderabad	Rs. 300 plus normal connection charge as per plot area	05/02/2014-31/03/2015	11,000 Applied	One year at tariff applicable from time to time		

(3) Leakage Protection

For leakage protection, the actual status of leakage could not be clarified due to unavailability of reliable data on water flow. However, with the implementation of the Phase-I to Phase-III Projects, the water production and transmission amounts at respective WTPs and water consumption amount at respective WSZs will be better clarified, together with the WSZ-wise leakage status. With the Phase I to Phase III projects the existing distribution pipes will be replaced and new pipes will be installed. This is in addition to the improvement of service pipe installation through the introduction of the licensed plumber system. All these activities will greatly improve the pipe leakage problem. Therefore, after project completion, measures for leakage prevention should be laid out after ascertaining the leakage status.

(4) GIS Mapping System

The pipe distribution ledger will be containted in the GIS Mapping System. However, PHED will require having staff trained in AutoCAD and have the requisite number of PCs (hardware and software) in order to get this done. By the project's implementation, the data on newly-installed distribution pipes, including water meter installation will be delivered to the PHED in digital format. Therefore, it is recommended that one year after the project commencement, or in 2018, the preparation period for the GIS Mapping System shall commence, and data input of the project shall start on trial basis, with the completion of the data inputting within one year after project completion.

The monthly meter reading data which will be started after the project completion will be also be integrated in the system, together with other customer information, utilizing a variety of methods which will be developed in the future.

Table 6.58 Action Plan and Monitoring Sheet for Preparation of NRW Reduction Plan

Sr. No.	Action	Contents/Outputs Expected Hints to Be Included	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official	Monitoring		
						Date (DD/MM/YY)	Status	Remarks
1	Est. of NRW reduction Committee	**Members:** · Two from each division	30/04/2016	—	Zone III: E.E.	xx/xx/xx	· Not started · On-going (xx%) · Completed (DD/MM/YY)	
2	Situation analysis on Non Revenue Water (NRW)	**Subjects:** · Pilot survey · Illegal connection · Leakage · Nonpayment of water tariff · etc.	31/07/2016	—				
3	Study on measures/solutions	**Example :** · Door-to-door survey · Strengthening of legal penalty · Setting-up of leakage detection units · Budgetary arrangement for repairing · Issuance of demand letter · Delinquent charge · Provision of Asset Ledgers · etc.	31/08/2016	—				
4	Review of present legal framework and amendment if necessary		31/10/2016	—				
5	Study on identification method of illegal connections	Door-to-door survey Performance-based illegal connection survey	31/12/2016	—				

Sr. No.	Action	Contents/Outputs Expected Hints to Be Included	Target Date (DD/MM/YY)	Budget (INR)	Responsible Official	Monitoring		
						Date (DD/MM/YY)	Status	Remarks
		Regularization of illegal connections						
6	Provision of GIS-based asset ledgers (see **6.4.3**)		31/12/2023	—				

Chapter 7 Environmental and Social Consideration

7.1 General Conditions on Environment and Social Consideration

7.1.1 Legal Framework on Environment and Social Consideration and Its Organization

(1) Laws and Regulations on Environment and Social Consideration

Laws and regulations related to environment and social consideration are shown in **Table 7.1**.

Table 7.1 Laws and Regulations Related to Environment and Social Consideration

Environmental Laws	Contents
Environmental (Protection) Act, (1986)	This Act regulates the principal items on responsibility ministry, mandate, purpose of environmental protection, etc.
EIA Notification (S.O.1533), (September 14, 2006)	Based on the rules of the Environmental (Protection) Act, 1986, the EIA Notification regulates the agency responsible for all projects, the procedures for environmental clearance, implementation process and appraisal methods for public consultation.
Manual on Norms and Standards for Environment Clearance of Large Construction Projects, Ministry of Environment and Forest, Government of India	On construction projects where the EIA report is required, based on EIA Notification (S.O. 1533), the manual describes site selection method, reduction of water demands during construction, solid waste management, and mitigation measures against environmental impact, environmental items to be considered for environmental impact assessment and to be reported in EIA report.
Forest (Conservation) Act, (1980)	The Act regulates forest conservation by the State government, penalty for contravention of the provisions, and constitution of advisory committee.
Forest (Conservation) Rules, (2003)	The Rules regulate the provisions on submission of proposal seeking approval for convention of forest lands to non-forest lands, period for procedures, constitution and roles of advisory committee, and application formats.
Forest (Conservation) Rules, (2004)	The Rules regulates the application for conversion of forest lands to non-forest lands in more detail on proposed land area and procedures and its period in comparison with the former rules, (2003).
Wildlife (Protection) Act, (1972)	The regulation for protection of mammals, reptiles, forest and wetland birds including migratory, orchids; hunting in a protected area or altering the boundaries of protected areas or a national park. The Act regulates punishment for violation against the above items.
Regulations on Social Consideration	Contents
The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	The Act regulates the registration of contractors, the working hours of construction workers, the wages of overtime work, the amenity for restof construction workers at construction sites, the notification of starting time of construction, the employment rules of construction workers, the minimum wages etc.
Manipur Land Revenue and Land Reform Act, 1960	The Act regulates land revenues, rights of tenants, ownerships, etc.
National Rehabilitation and Resettlement Policy, (2007)	In cases of land acquisition by development projects, the Policy regulates the necessity of compensation accompanied by resettlement of residents and compensation contents.
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	The Act regulates general conditions including administration organizations for land acquisition, their jurisdiction, procedures for land acquisition.
Environmental Standards	Contents
National Ambient Air Quality Standards (November 2009), Central Pollution Control Board	The standards categorized project areas into five – industrial, residential, rural, other area, and ecologically sensible area and regulates ambient air quality standards for each area.
Indian Standards Specifications for Drinking Water, Bureau of Indian Standard (BIS)	Drinking water standards in India.
Water Quality Requirement for Different Users, Central Pollution Control Board	The requirement regulates the quality of water sources for drinking water and irrigation.

(CPCB)	
Noise Pollution (Regulation and Control) Rules, 2000	The rules divide the four categorized areas into industrial area, commercial area, residential area, and silent zone and regulates ambient air quality standards with respect to noise in day and night times.
General Standards for Discharge of Environmental Pollutants: Effluents, 1993, Environment (Protection) Rules	General Standards on effluents for inland surface water, public sewers, land for irrigation, marine coastal areas.

(2) Relating Agencies and Its Organization on Environment and Social Consideration

The lead agency on environmental management in India is the Ministry of Environment and Forest and Climate Change. On the State government level, there is a minister in charge of environment agency, under whom a secretary is allocated, in charge of supervising the Department of Environment and Forest (DEF). The DEF is divided into the Directorate of Environment and Ecology and the Department of Forest and Wildlife. These offices carry out their tasks based on the Environment (Protection) Act and Forest (Conservation) Act. The agency concerned with the environment is the Directorate of Environment and Ecology and its organization chart is shown in **Figure 7.1**.

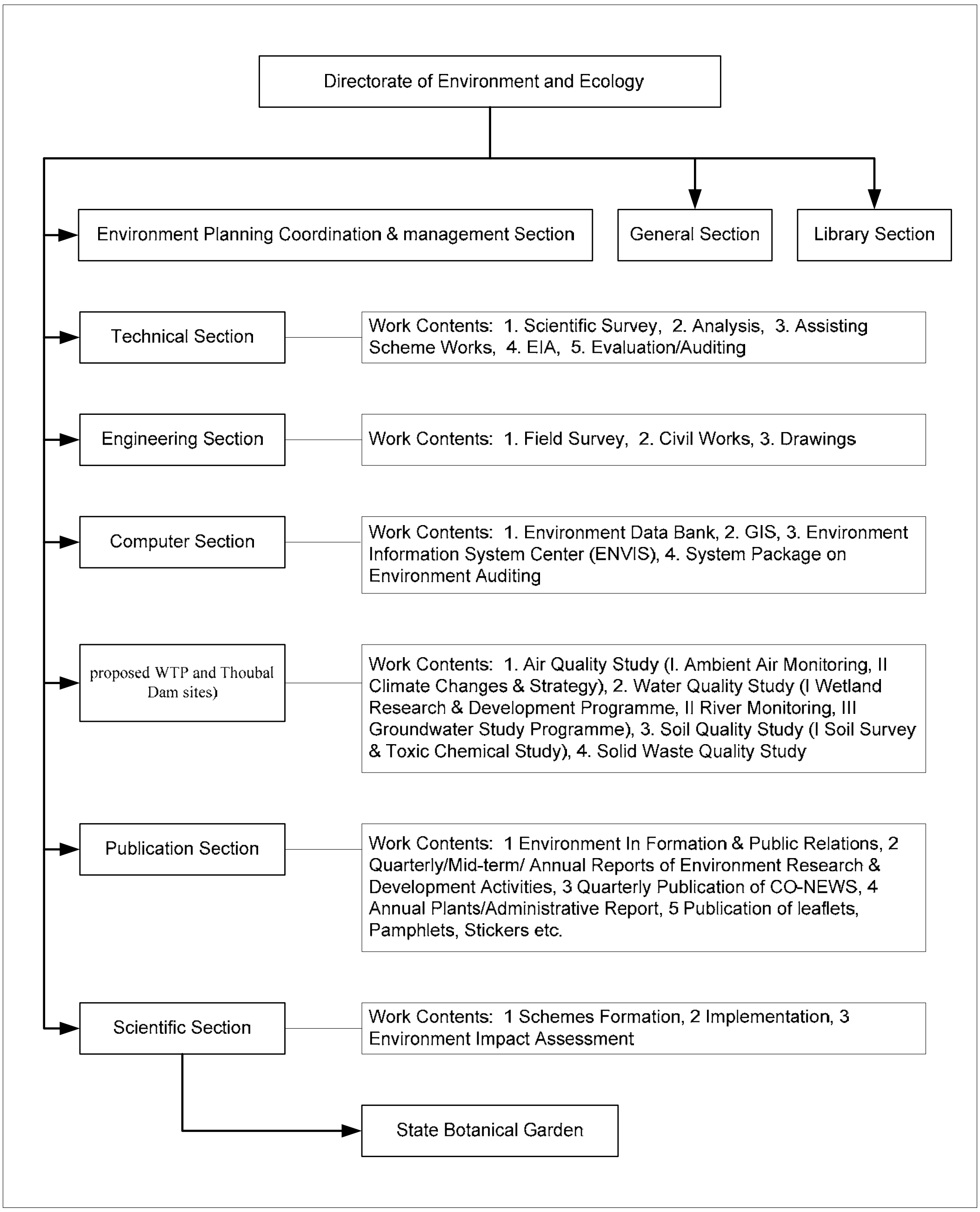


Figure 7.1 Organization Chart of the Directorate of Environment and Ecology, the Manipur State

(3) Necessity of EIA

The EIA Notification, (1994) under jurisdiction of Environmental Protection Act, (1986) was enacted and the EIA procedures were set aligned with environmental regulations. The most recent notification was S.O.1533 dated on September 14, 2006. The supplemental schedule of this order regulates categorization A and B depending on impact grades, kinds of projects, the EIA procedures, and implementation manners of public consultation. The projects which have especially large adverse impact or are located adjacent to environmental protection areas are categorized as Category A and the EIA procedures are carried out by the Ministry of Environment and Forest of the central government. On the other hand, the projects which have not so large adverse impact to environment are categorized as Category B and are appraised by the Directorate of Environment and Ecology under the Department of Environment and Forest of the state government.

In the schedule for categorization for the necessity of the EIA report, the projects are not classified by each class of business and water supply projects are categorized as building and construction projects. According to information from the Directorate of Environment and Ecology, when considering building and construction projects, the necessary facilities of the EIA report relate to only the planned WTP. Laying of pipelines and construction of elevated tanks and ground reservoirs are excluded because pipeline laying is not building construction and the construction scale of each elevated tank and ground reservoirs is very small.

Furthermore, the necessity of the EIA report differs from the scale of building construction. The necessity of EIA report is limited to projects with land areas more than 20,000 m^2 and building construction areas of more than 150,000 m^2. Governmental land where the new WTP is to be constructed is 20,000 m^2 and the proposed and designed land area for a new WTP is somewhat less than this land area. **Table 7.2** shows outlines of categories of projects requiring the EIA.

Table 7.2 Outline of Project Categories for which EIA Procedures are necessary

Project		Categorization with threshold limit	
		Category A	Category B
1		Mining, extraction of natural resources and power generation	
I(a)	Mining	≧50 ha. of mining lease area,. Asbestos mining irrespective of mining area	< 50 ha, ≧5 ha of mining lease area
I(b)	Offshore and onshore oil and gas exploration, development and production	All Projects	
I(c)	River Valley Projects	i) ≧50 MW hydroelectric power generation ii) ≧10,000 ha of cultivable command area	i) < 50 MW, ≧ 25 MW hydroelectric power generation ii) < 10,000 ha cultivable command area
I(d)	Thermal Power Plants	≧ 500 MW（coal/lignite/naphtha& gas based） ≦ 50 MW（pet coak/diesel and all other fuels）	< 500 MW（coal/lignite/naphtha& gas based） < 50 MW & ≧ 5 MW（pet coke, diesel and all other fuels）
I(e)	Nuclear power projects	All Projects	
2		Primary Processing	
2(a)	Coal Washer	≧ 1 million ton/annum throughput of coal	< 1 million ton/annum throughput of coal
2(b)	Mineral beneficiation	≧ 0.1 million ton/annum mineral throughput	< 0.1 million ton/annum mineral throughout
3		Material Production	
3(a)	Metallurgical Industries	i) Primary metallurgical industry All projects	i) Sponge iron manufacturing < 200 ton/day

		ii) Sponge iron manufacturing ≧ 200 ton/day iii) Secondary metallurgical processing industry All toxic and heavy metal producing units ≧ 20,000 ton/annum	ii) Secondary metallurgical processing industry All toxic and heavy metal producing units < 20,000 ton/year All other non-toxitic secondary metallurgical processing industries < 5,000 ton/year
3(b)	Cement Plants	≧ 1.0 million ton/annum production capacity	< 1.0 million ton/annum production capacity. All stand alone grinding units
4		Material Processing	
4(a)	Petroleum Refining Industry	All Projects	
4(b)	Coke Oven Plants	≧ 250,000 ton/year	< 250,000, ≧ 25,000 ton/year
4(c)	Asbestos Milling and Asbestos Based products	All Projects	
4(d)	Chlor-alkali Industry	≧300 ton/day production capacity or a unit located outside the notified industrial area/estate	< 300 ton/day production capacity and located within a notified industrial area/estate
4(e)	Soda Ash Industry	All Projects	
4(f)	Leather/Skin/Hide Processing Industry	New projects outside the industrial area or expansion of existing units outside the industrial area	All new or expansion of projects located within a notified industrial area/estate
5		Manufacturing/Fabrication	
5(a)	Chemical Fertilizers	All Projects	
5(b)	Pesticides Industry	All units producing technical grade pesticides	
5(c)	Petro-chemical Complexes	All Projects	
5(d)	Manmade fibers Manufacturing	Rayon	Others
5(e)	Petrochemical Based Processing	Located outside the notified industrial area/estate	Located in a notified industrial area/estate
5(f)	Synthetic Organic Chemicals Industry	Located outside the notified industrial area/estate	Located in a notified industrial area/estate
5(g)	Distilleries	i) All Molasses based distilleries ii) All cane juice/non-molasses based distilleries ≧30 KLD	All cane juice/non-molasses based distilleries < 30 KLD
5(h)	Integrated Paint Industry		All Projects
5(i)	Pulp and Paper Industry	Pulp manufacturing and pulp/paper manufacturing industry	Paper manufacturing industry without pulp manufacturing
5(j)	Sugar Industry		≧ 5,000 tcd cane crushing capacity
5(k)	Induction/Arc Furnaces/Cupola Furnaces		All Projects
6		Service Sectors	
6(a)	Oil and Gas Transportation Pipeline	All Projects	
6(b)	Isolated Storage and Handling of Hazardous Chemicals		All Projects
7		Physical Infrastructure including Environmental Services	
7(a)	Air Ports	All Projects	

7(b)	All Ship Breaking Yards	All Projects	
7(c)	Industrial Estate/Parks/Complex, Export processing Zone	If at least one industry in the proposed industrial estate falls under the Category A, entire industrial area shall be treated as Category A, irrespective of the area. Others shall be treated as Category B Industrial estate with area greater than 500 ha	Industrial estate < 500 ha
7(d)	Common Hazardous Waste Treatment, Storage and Disposal Facilities	All integrated facilities having incineration & landfill or incineration alone	All facilities having landfill only
7(e)	Ports、Harbours	≧5 million TPA（cargo handling capacity）	< 5 million TPA (cargo handling capacity）
7(f)	Highways	i) New National Highways ii) Expansion of National Highways greater than 30 km	i) New National High ways ii) Expansion of National/ State Highways greater than 30 km
7(g)	Aerial Ropeway		All Projects
7(h)	Common Effluent Treatment plants		All Projects
7(i)	Common Municipal Solid Waste Management Facility		All Projects
8		Building/Construction Projects/Area Development Projects	
8(a)	Building and Construction Projects		≧ 20,000 m^2（land area） < 150,000 m^2（built–up area）
8(b)	Township and Area Development Projects		≧ 50 ha (covering area） < 150,000 m^2（built-up area）

(Note) This is based on Government Notification (14th Sept. 2006) by Environment (Protection) Act, 1986
Category A: EIA procedures conducted by Central Government, Ministry of Environment and Forest
Category B: EIA procedures conducted by State Government, Department of Environment and Forest

(4) EIA Procedures

There are no classifications such as the IEE and the EIA for environmental impact assessment in the environmental laws in India, and what is conducted is only the EIA. As mentioned in the above clause "Necessity of the EIA," the projects are categorized to the necessity projects or non-necessity ones and it is categorized to Category A and B in accordance with the magnitude of its environmental impact. The appraisal for the EIA is conducted by both the central and state governments.

The EIA procedures starts with the submission of application form to the Directorate of Environment and Ecology, the State Government of Manipur by the proponent (the PHED in this project). The application form includes the outline of the project, project cost, and checklist consisting of many items on environmental impact assessment. The Directorate proceeds with the appraisal process and decides the TOR for the EIA report to be submitted by the proponent. The project proponent then carries out the EIA survey and submits the EIA report.

After that, State Pollution Control Board (SPCD) conducts a public consultation and the SPCD reports its results to the State Level Expert Appraisal Committee (SEAC). From the result, it is decided whether the Environmental Clearance is issued with imposed conditions or is rejected with reasons.

The procedures of EIA appraisal processing take 270 days, and in that process, a public hearing is conducted after which another 45 days processing time is taken. **Figure 7.2** shows the appraisal procedures of EIA.

(5) Necessity of EIA for the Project

The EIA application forms including the outline of the Project and simple appraisal report on environmental assessment were submitted by the PHED to the Directorate of Environment and Ecology (mid-August 2014). Since the land area of construction sites for the main portion of the WTP was less than 2 ha, the Directorate issued the Environmental Clearance (EC) that explained the non-necessary EIA procedures dated on October 10, 2014. The EC is attached in the Appendix. In the EC, two items are described as the recommendations:

- The project should not have any adverse environmental impact to the ecosystem of the Chingkeiching hill and the Yaral Pat Wetland which are located in the nearby area of the project site.
- The project proponent should prepare a detailed environmental management plan (EPM) for the project.

To comply with these recommendations, the detailed EPM was finalized. In addition, the ecosystem of Chingkeiching hill and the Yaral Pat wetland shall be conserved by the mitigation measures at the construction and operation stages such as replanting on bare land and preventing the discharge of water with high turbidity from the construction site by constructing a sedimentation pond.

Yaral Pat Wetland is located in the eastern suburb of Imphal East district with an enchanting hillock surrounding it from three directions-North, East and South. The western side of the lake has a catchment area of cultivated fields and there are relatively spare settlements on the eastern bank of the Iril River.

There is limited source of water recharge due to disconnection to the Iril River and lesser rainfall coupled with increasing demand for cultivation purpose.

The wetland has not been internationally recognized and is not a Ramsar site. However, the state government has identified it as an important wetland due to a temporary habitat of migratory birds which at times visit the wetland and endemic fish resources pool, habitat of resident and migratory birds, reptilian biodiversity (snakes) and eco-tourism. **Figure 7.3** shows the location of Yaral Pat wetland.

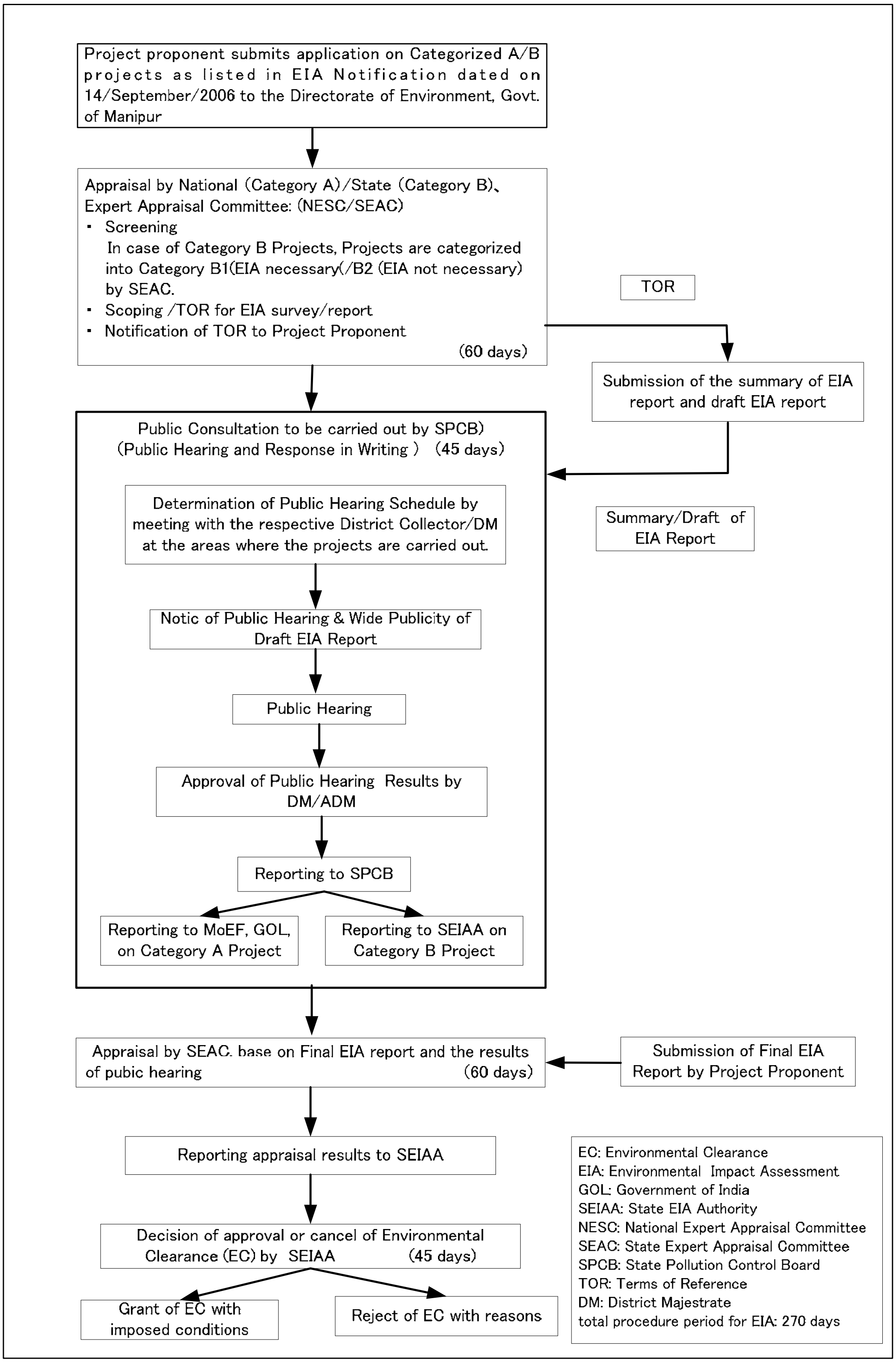


Figure 7.2 Flow Diagram of EIA Appraisal Procedures

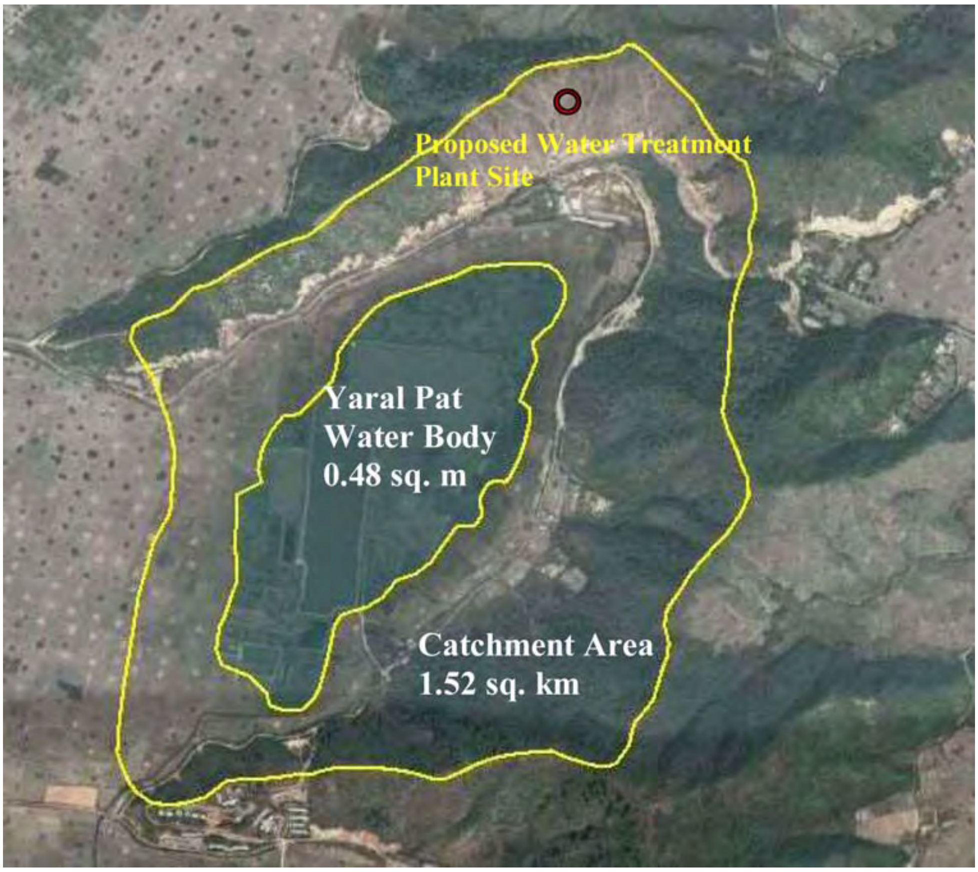


Figure 7.3 Location of Yaral Pat Wetland

7.1.2 Alternative Plan (including Zero Option)

Alternative plans (including zero option) were examined. Since distribution facilities are not large facilities, the need for construction sites for these will not pose environmental impact or land acquisition problems, therefore, no alternatives will be presented. However, this is not the case on the site locations for the WTP, where facility size is very large and the construction works can cause a bigger impact on the environment, necessitating alternative plans. The three following plans are considered.

- A plan: Zero option
- B plan: Construct the WTP on a flat land of Imphal City area.
- C plan: Construct the WTP on a part of Chingkheiching hill.

In the three alternative plans above, the conditions (including environment and social status), environmental impacts by the construction of the WTP facility, ease of land acquisition, and construction cost were evaluated.

(1) A plan: Case that the project does not get implemented. (Zero option)

According to DPR-II, the total population of Imphal City is estimated at about 500,000 in 2011 and its water demand is 123,090 m^3/day. On the other hand, the amount of water supplied is 103,250 m^3/day. Thus, gap between demand and supply is 18,840 m^3/day and the people living in the city suffer from water shortage. This situation has prevailed in the recent past years up to the present time, with bouts of heavy water shortage during the dry season where the use of unsanitary pond water is often resorted to. The water scarcity generates a shortage of water treatment capacity in the existing WTPs and precious water is again lost to water leakage from the distribution pipelines. The city population is estimated to increase about 2 % every year, or to about 610,000 in 2021, and about 994,000 in 2046.

If left unabated, water shortage is anticipated to continue into the future. To improve this situation, the Government of India has started implementing the rehabilitation of the existing WTPs (Phase I and Phase II) under the JNNURM programme. In addition, the construction of a new WTP and the installation of new transmission and distribution pipelines by the Project are planned in order to improve the existing dismal water supply condition and services. If the Project (Phase III) is not implemented, the situation will go from bad to worse. Thus, the zero option is not recommended.

(2) B plan: Construct the WTP on a flat land of Imphal City area.

The second alternative plan examined is constructing the WTP in the Imphal City area. However, to acquire a construction site including the WTP and a sun drying bed is fairly difficult. It will require compulsory land that falls under the purview of the Land Acquisition Act. This will take a long period to process and will also entail bigger financial resources. Furthermore, in the case that the WTP is located in Imphal City area, the land where it will be constructed is farm land, requiring a support base for the WTP for foundation strength, thus piling works may generate noise problems. In addition, treated water must be always boosted up to overhead tanks and ground reservoirs of distribution facilities. This will need booster pumps, increase operation and maintenance cost due to electricity tariff. With these reasons, B plan to set up the WTP in the low land area in Imphal City is not recommended.

(3) C plan: Construct the WTP on a part of Chingkheiching hill.

To construct the WTP on the hilly area, land formation works is necessary. However, sending treated water to overhead tanks and ground reservoirs for distribution in the city area will cost less as treated water will be distributed by gravity. Since electric power failure frequently occurs, this fact is an advantage. In addition, the acquisition of land will not undergo compulsory land acquisition and involuntary resettlement of inhabitants because the entire hill area is owned by the State government. Furthermore, noise caused by the operation of a booster pump, the blower for the backwashing of sand filter and a standby generator will not be an issue. Thus, C plan is recommended on the point of view of environmental considerations and operation and maintenance cost.

A comparative table on merits and demerits for the three plans is shown in **Table 7.3** Comparative Table for Alternative plans (including zero option).

Table 7.3 Comparative Table for Alternative Plans (Including Zero Option)

Category for comparison	(1) A plan		(2) B plan		(3) C plan	
	Zero option	Evaluation	Construct WTP on a flat land of Imphal City area.	Evaluation	Construct WTP on a part of Chingkheiching hill.	Evaluation
(a) Topography	Existing WTPs are mostly located on hills	B	Large scale of land formation is not needed because the proposed WTP is constructed on flat land. However, construction of support base is necessary.	C	As the proposed WTP is located on hilly area, a fairly large scale of land formation is needed.	C
(b) Vegetation and ecology	The neighboring area of the existing WTP, has no important vegetation and ecolo-gical protection areas.	B	Proposed construction sites in the city area have no important vegetation and ecological protection areas.	B	In the proposed hilly area, there are no important vegetation and ecological protection areas.	B
(c) Urbanization	Some existing WTPs are located in urbanized areas.	C	Proposed construction sites in Imphal City area are mostly located in semi-urbanized areas where land use is accelerated. Environmental adverse impacts by urbanization are assumed.	C	In the proposed hill area, there are no residences and in the low land area of the hill, there is almost no housing area except for paddy fields. The construction work will not cause environmental adverse impacts.	B
(d) Culturally and historically important heritages and monuments	In the neighboring area of existing WTPs, there are no important cultural and historical heritage and monuments.	B	In the proposed land areas of Imphal City, the project shall acquire lands without important cultural and historical heritage and monuments.	B	In the proposed hilly area, there are no important cultural and historical heritage and monuments.	B
(e) Adverse impact to hydrology	As existing WTPs use river water which is stored by dams, it does not affect hydrology.	B	As the proposed WTP uses river water which is stored by dams, it does not affect hydrology.	B	Same as B plan.	B
(f) Facing to general roads	Many existing WTPs are located on hills and do not generally face the road.	B	The proposed WTP faces general roads and can cause/ disturb traffic flow.	C	As the proposed WTP is located on hilly area, it does face the road.	B
(g) Water supply condition	Without the Project, water supply shortages will continue, water leaks will worsen, nore people will suffer because population will increase.	C	Water supply conditions in the present and future shall be improved by the rehabilitation and development of water supply system.	A	Same as B plan.	A
(h) Acquisition of land	Land acquisition is not required.	A	There will be land acquisition and involuntary resettlement issues as the proposed lands are in flat urbanized or semi-urbanized areas.	C	There will be no land acquisition issues as the proposed hilly land is owned by the State government and has no residential area.	A
(i) O & M cost	As existing WTPs will not be functioning, O M cost	C	As booster pumps are necessary to send clean water to distribution	C	As transmission from the WTP to distribution facilities (OHTs and	A

	is same or will increase due to deterioration of facilities.		facilities (OHTs and GLSRs), O&M cost for electricity tariff will be high.		GLSRs) is conducted by gravity, electricity cost will be minimal; O&M cost will also be lower.	
(J) Construction cost	No construction cost	A	Rs. 493,000,000	C	Rs. 390,300,000	B
Comprehensive appraisal	Zero option does not solve improvement of water supply capacity and water shortage. Though investment cost is zero, all the present problems will not be solved but will actually worsen in the future. Thus, this plan cannot be recommended.	C	• Natural and social conditions are almost the same if urbanization conditions are excluded. • B plan is about constructing the WTP in flat land at urbanized or semi-urbanized areas. As land uses of those areas are generally highly developed, compulsory land acquisition and involuntary resettlement will be undertaken. • Booster pumps to send treated water to distribution facilities are necessary resulting to high tariff for electricity and high O&M cost. • In case of electric power failure, treated water cannot be transmitted to the WTP without a standby generator. • In addition, construction cost is more expensive compared with C plan. • Thus, B plan is not recommended as implementation plan for the Project.	B	• Natural and social conditions are almost the same if urbanization conditions are excluded. • C plan is about constructing the WTP in the hill areas, requiring land formation. • Proposed site is owned by the State government and has no residential houses. Thus, compulsory land acquisition and environmental adverse impact such as noise will not cause a big problem. • The WTP can send treated water to the distribution facilities by gravity even at the time of electric power failure. • Electric tariff is minimal, and O&M cost is comparatively cheaper. • Construction cost is cheaper than that of B plan. • C plan has more advantages than that of B plan. Thus, C plan is evaluated to be the most superior and is recommended as implementation plan for the Project.	A

(Note) A: Good, B: Fair, C: Worse

From the above reasons, the natural and social conditions are almost the same and have no serious issues if urbanization conditions are excluded. Thus, comprehensive appraisal was carried out by environmental adverse impacts relative to urbanization caused by implementation of construction works, the possibility of compulsory land acquisition and involuntary resettlement, O&M cost, construction cost etc. The result on the order of implementation priority is C plan, B plan, and A plan.

7.1.3 Scoping

The results of scoping are shown in **Table 7.4** Scoping List.

Table 7.4 Scoping List

Category	No	Impact Items	Evaluation		Evaluation Reasons
			P-Const* U-Const*	Operating*	
Pollution Countermeasure	1	Air pollution	B-	D	U-Const：Degradation of air quality is assumed with the operation of construction machines and vehicles. Operating：Degradation of air quality will not be caused because pumps and motors are usually operated by commercialized electric power.
	2	Water pollution	B-	D	U-Const：High turbidity water may be discharged to the river adjacent to the construction site with the construction of the access road to the proposed WTP site on small hill. There will be land leveling and cutting of hill slope at uneven land by using heavy construction equipment such bulldozers and loading shovels. Though river water generally has high turbidity because of much siltation, the turbidity may become worse. High turbidity water derived from construction site has possibility to provide adverse impact against river channel by directly flowing to river. Operating：After discharging water from the WTP, soil and sludge from backwashing is stored in sedimentation pond and is planned to be disposed in the solid waste dumping site. Only the supernatant solution in the pond is discharged to the river, and at the same time, the chlorine included in backwashing water is released to the air. Then water quality pollution not be generated.
	3	Waste	B-	B-	U-Const：Construction waste soils and scrap woods will be produced. Operating：General waste will be produced by workers at completed Water Treatment Plant. Sludge generated in the WTP is planned to be disposed in the city garbage dumping site so special issues are not expected to come up.
	4	Soil contamination	B-	D	U-Const：Soil contamination which be caused by oil spill of construction machines is assumed. Operating：Adverse impact on environment is not assumed.
	5	Noise and vibration	B-	B-	U-Const：Noise and vibration caused by construction works, operation of construction machines and vehicles are assumed. Operating：Noise etc by operation of pumps and generator is assumed.
	6	Land subsidence	D	D	Construction works which may cause land

					subsidence are not assumed.
	7	Bad odor	D	D	Operating：Facilities which cause bad odor are not assumed.
	8	Bottom sediment	D	D	U-Const：Though mud sedimentation may increase in the river due to discharge of high turbidity water from the proposed WTP site during construction stage, it will not affect the bottom sediment of river to a large extent because the current turbidity of river water is already very high Operating: Adverse impact to bottom sediment is not assumed.
Natural Environment	9	Protected area	B-	B-	U-Const：Since the proposed WTP forms a part of protected forest, the project proponent has to get forest clearance and pay reforestation fund or plan the transplantation of plants. On the other hand, in Imphal City area where distribution pipelines and elevated tanks and service reservoirs are constructed, there are no protected areas and national parks. Thus, adverse impact during construction stage is not assumed. Operating: About 25 km south of Imphal City is Loktak Lake, declared as Ramsar Site, with the southern area designated as national park. All the rivers flowing in Imphal City area empty into the Lake. Though the construction works don't directly affect the environment of the Lake, after completion of the WTP, in case of discharge of backwashing water including chlorine and mud water, may relatively affect the ecology of the Lake.
	10	Ecosystem	D	B-	U-Const: The proposed WTP site is located on the low hill covered by low and thin forest. Thus, there are no rare animals, and adverse impact is not assumed. The City area, excluding old palace (Kangla) located in the City center and designated as the protected area of plant and animals, is an urban area or cultivated and paddy fields. Thus, adverse impact against ecosystem is not assumed. Operating: About 25 km south of Imphal City is Loktak Lake, declared as a Ramsar Site, with the southern area designated as national park. All the rivers flowing in Imphal City area empty into the Lake. Though the construction works do not directly affect the environment of the Lake, after completion of the WTP, in case of discharge of backwashing water including chlorine and mud water, may relatively affect the ecology of the Lake.
	11	Hydrology	D	D	Operating: Water source for the water supply for the project will be abstracted from Thoubal Dam, which is to be used for hydropower generation, irrigation and water supply. The dam is under construction and is located about 18 km away from the center of Imphal City and in the mountainous area. The intake amount for water

					supply is very small compared with storage capacity of the dam. Thus, adverse impact against hydrology is not assumed.
	12	Topography/geology	B-	D	U-Const: The construction works of the project will change the topographic shape of the small hills because it includes large scale cutting of land, embankment and land arrangement with height difference of about 60 m. The geology of Manipur is of tertiary formations but the land cutting and the land arrangement of the hill will not affect its geology.
Social Environment	13	Resettlement	D	D	New water supply facilities such as water treatment plant and ground storage tanks etc. are to be constructed on public lands and distribution pipelines are installed along public roads. Thus, there will be no resettlement involved.
	14	Poverty group	D	D	Though a gap between the rich and the poor exists in Imphal City area, there is no poverty area like slum. Improvement of water supply conditions targets all the people of the City. Water supplied by the PHED will still be cheaper than that from private water vendors, giving positive impacts to the City's people.
	15	Ethnic minorities and indigenous people	D	D	Ethnic minorities, tribal and indigenous peoples are living in hilly areas around Imphal City. On the other hand, Imphal City area where the project targets is located in the flat alluvium plain. Several tribes such as Meitei/Pangal (Muslims)/Naga/Kuki/Zomi/Garkhali (Nepali) live in the city areas. However, all have equal rights, and water will be supplied under equitable conditions.
	16	Local economy of employment and livelihood	B+	B+	U-Const: Employment will increase with the implementation of construction works and positive impact for local economy is assumed. Operation: Number of employees is expected to increase as well. Thus, positive impact against local economy is expected.
	17	Land use and utilization of local resources	D	D	The project objective is to construct new water supply system. It will not have much effect on land use and utilization of local resources.
	18	Water Use	D	B+	P-Const & U-Const: Water supply conditions in Imphal City area unsatisfactory because of intermittent supply, and inadequate supply of treated water. Operating: Implementing the project will improve and have positive impact on the living conditions of the residents.
	19	Existing social infra and social service	B-	D	U-Const：Roads may be dirtied by tires of construction vehicles with soils, and soils that fall from transporting equipment, materials and surplus soils. Operating：Only transportation vehicles for sludge, bleach powder, and coagulation chemicals occasionally pass the roads. It is not assumed to dirt the roads by dirtied ties with soils

					and to fall objects on roads..
	20	Social organization such as social capital and local authority	D	D	Water supply system forms a part of social infrastructure. Augmented water supply system will be operated and managed by the PHED.
	21	Bias distribution of damage and benefit	D	D	The construction site for the new WTP is located on small hill with no residential houses. There is no perceived special damage to the environment such as the generation of bad odor. On the other hand, the improvement of water supply conditions will provide benefits to the people. There will be no issues on bias distribution of damage and benefit.
	22	Conflict of interest in the project area	D	D	The project's water supply area covers the entire Imphal City area and there are no special water supply areas. Thus, the project will not generate conflict of interest.
	23	Cultural heritage	D	D	In the City area, there are 23 historical and cultural monuments and ruins. These are within an old palace surround by a moat and stone monuments. Adverse impact will not be assumed, as the construction and pipeline laying works are not conducted in their close proximity.
	24	Landscape	D	D	Main buildings for the project are the new WTP planned on small hill with thin forest and no residential houses and are ground reservoirs and elevated tanks located in urban areas. Planned facilities for the new WTP are low in height compared with surrounded hill height and its periphery area, there are fairly high hills. On the other hand, as in the flat areas, there are public and private buildings with higher or similar heights with the elevated tanks. There is also, no recreation area which will be affected. Therefore, adverse impact on the landscape is not assumed.
	25	Gender	D	B+	Operating: The project aims at improving water supply conditions by strengthening water supply capacity. Thus, it will have positive impact on women who fetch water for domestic use especially in times of drought and severe water shortage in the dry season.
	26	Children's right	D	B+	During the dry season, children help in fetching water for domestic use from ponds. The project will alleviate the children's tasks giving, positive impact for children's right.
	27	Infectious diseases of HIV/AIDS	B-	D	U-Const: A lot of construction workers from another states in India may come to construction sites in Manipur State. Thus, chances to be infected by HIV/AIDS may be increased.
	28	Work environment (Including safety control)	B-	D	U-Const：It is necessary to make an arrangement for work environment (including safety control) of the construction workers. Operating：It is necessary to train operators for handling of operation equipment.
Others	29	Accidents	B-	B-	U-Const：It is necessary to make safety arrangement to avoid construction accidents and

					handling accidents of construction machines and vehicles., and to prevent the fall down of workers from high portion. As pipeline laying works are conducted at road sides of urban areas with heavy traffic and high population density, it is necessary to control traffic to avoid traffic congestion and to pay enough attention to pedestrians. Operating：It is necessary to make a plan and to implement for safety arrangement on handling accidents from operating equipment.
	30	Trans-boundary impact and climate change	D	D	U-Const： There is no trans-boundary impact. Operating：Implementation of the Project does not directly affect climate change. However, as operation of the new facilities consumes commercial electric power, the generator owned by commercial electric company will release bicarbonate to generate its consumable electrical charge to environment.

(Note) P-Const*: Pre-construction stage, U-Const*: Under construction stage, Operating*: Operating stage
A+/-: Significant positive/negative impact is expected.
B+/-:Positive/negative impact is expected to some extent.
C+/-:Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progress.)
D: No impact is expected.

7.1.4 TOR for Environment and Social Consideration Survey

Based on the scoping results for survey on environment and social consideration, the TOR for environment and social consideration survey was finalized. The TOR is shown in **Table 7.5**.

Table 7.5 TOR for Environment and Social Consideration Survey

Environmental Item	Survey Item	Survey Method
Air Pollution	a) Confirmation of environmental standards	a) Collection and review of existing information
Water Pollution	a) Confirmation of environmental standards b) Field survey River water quality analysis Analysis item：Turbidity and TSS	a) Collection and review of existing information b) Measurement of baseline data Planned sampling points (proposed discharge point backwashed water for new WTP at the Iril River), Water quality analysis items: Turbidity and TSS
Waste	a) Disposal manners of construction waste b) Handling manner of water treatment plant's sludge	a) Hearing with related authorities b) Dumping sludge quality standards, information on location, owner, and space of dumping site, dumping fee, dumping permission, etc.
Soil Contamination	a) Protection manners survey of oil spills during construction stage	a) Review of protection method
Noise and Vibration	a) Confirmation of environmental standards	a) Review of existing information b) Confirmation of land cutting, embankment, land

	b) Construction method	arrangement c) Confirmation of pipeline laying method
Protected Area	a) Confirmation of reserved forests, national parks, and convention sites of Ramsar	a) Hearing with related authorities
Ecosystem	a) Confirmation of ecological system to be protected.	a) Collection and review of existing information
Topography/geology	a) Confirmation of topography by aerial photos b) Confirmation of topography and geology by site visit	a) Confirmation of location and design of land formation at the proposed WTP site by aerial photos and site visit
Existing social infra and social service	a) Confirmation of Traffic control regulation (at the construction stage)	a) Hearing with concerned agencies b) Collection of existing rules and regulations relating to traffic control
Cultural heritage	a) Confirmation of sorts and distribution of cultural heritages	a) Hearing with concerned agencies b) Data collection on cultural heritages and their protection regulation.
Infectious diseases of HIV/AIDS	a) Preventive measures on infectious diseases of HIV/AIDS which may be caused by the inflow of construction workers into the city area	a) Investigation of preventive measures on infectious diseases of HIV/AIDS
Labor Environment (Including work safety)	a) Survey on work safety conditions and regulations	a) Control agencies on work safety, and regulations, etc.
Accidents	a) Survey on accidents countermeasures during construction and operation stages	a) Hearing with concerned agencies b) Collection of existing rules and regulations relating to traffic control c) Survey on work safety law and safety regulations.
Impacts to Trans-boundary and Climate Change	a) Survey on release of CO_2 gas to the atmosphere	a) Investigation of releasing volume of CO_2 gas to the atmosphere by consumption of commercial electricity by operation of the planned WTP

7.2 Survey Results of Environmental and Social Consideration (Including Prediction Results)

7.2.1 Necessary Other Approvals and Licenses Excluding EIA

(1) Forest Clearance

1) Forest clearance for construction of Thoubal Dam and transmission pipeline

The transmission pipeline route from Thoubal Dam to the proposed WTP is planned to pass through Nongmaiching Reserved Forest. The deforestation of reserved forests is regulated by Forest

(Conservation) Act, 1980; Forest (Conservation) Rules, 2003 and Forest (Conservation) Amendment Rules, 2004 as described in the following: the proposal involving forest land up to 40 hectares shall be forwarded to the chief conservator of forest or the conservator of forests of the concerned regional office of the Ministry of Environment, Forest, and Climate Change, the Government of India through the concerned state government to acquire Forest Clearance. The proposal must include the following subscriptions: (a) Project contents, (b) Extent of forest area to be diverted, (c) Legal status of forest land, (d) Density of vegetation, (e) Species-wise (scientific name) and diameter class-wise enumeration of trees, and any rare/endangered/unique species of flora and fauna found in the area, (f) Compensatory afforestation scheme, “Compensatory afforestation shall be done over degraded forest land twice in extent of the forest area for deposits for compensatory afforestation, and the state government shall create a special fund.” Figure 7.4 shows the locations of Nongmaiching Forest Reserve, Thoubal Dam, outline of the conduit pipeline route, and the proposed WTP.

According to the IFCD, the EIA for Thoubal Dam was not needed because there was no EIA regulation (namely, EIA notification, 2006) at the time of dam construction in 1989. The Forest Clearance (F. No.8-98/88-FC) for the construction of Thoubal Dam was issued in December 31, 2013 by the Central Government and in January 2, 2014 by the Department of Forest and Wildlife in the Government of Manipur. As the imposed conditions for the approval for Forest Clearance, (a) the forest land diverted shall not used for any purpose other than that specified in the proposal, (b) compensatory afforestation shall be raised and maintained over degraded forest land twice in extent to the area of forest land diverted from funds realized from the user agency, (c) the user agency shall submit annual report on status of compliance to conditions stipulated in the approval by the State Government and the concerned Regional Office of the Ministry.

There were five villages with a combined population of 2,956 (937 households) which were submerged with the construction of the dam and their compensation measures were completed. However, two villages, with a total of population of 560 were not affected, but the village people still request for compensation. The IFCD stated that they have not dealt with this problem because this is non-legal one.

On the other hand, on diversion of forest land to non-forest purpose relating to the installation of conduit pipelines, the Directorate of Environment and Ecology, the Government of Manipur submitted an approval letter, “No. 17/4/2000 (EC) /DE-pt, No Objection Certificate” in November 19, 2013 and the Department of Forest and Wildlife, the Government of Manipur issued Forest Clearance in December 19, 2013 to the IFCD. The IFCD plans to carry out the construction in the following schedule.

Construction schedule of transmission pipelines by the IFCD

- October 2014：Procurement of Pipe Materials
  State government approved the Contract award to the supplier.
- September 2014：Re-bidding for construction works of tunnels was conducted.
- March 2015：Completion of construction works of Thoubal Dam

According to the IFCD, they are not involved in acquiring the Environmental Clearance and Forest Clearance for the proposed WTP as this should be within the PHED's scope of work.

2) Forest clearance for proposed WTP

Since the proposed WTP site for the Project occupies a part of Nongmaiching Reserved Forest, Forest Clearance is needed for diversion from forest land to non-forest one. The JICA Study team asked the PHED about this point.

The Forest Clearance is requested after the approval of Environmental Clearance which was issued on October 10, 2014. Then, the PHED applied Forest Clearance by on-line application system to the Regional Office of the Ministry of Environment, Forest, and Climate Change of the Central Government in October 27, 2014. The application form is shown in the Attachment. According to the PHED, Forest Clearance shall be issued at two months after application.

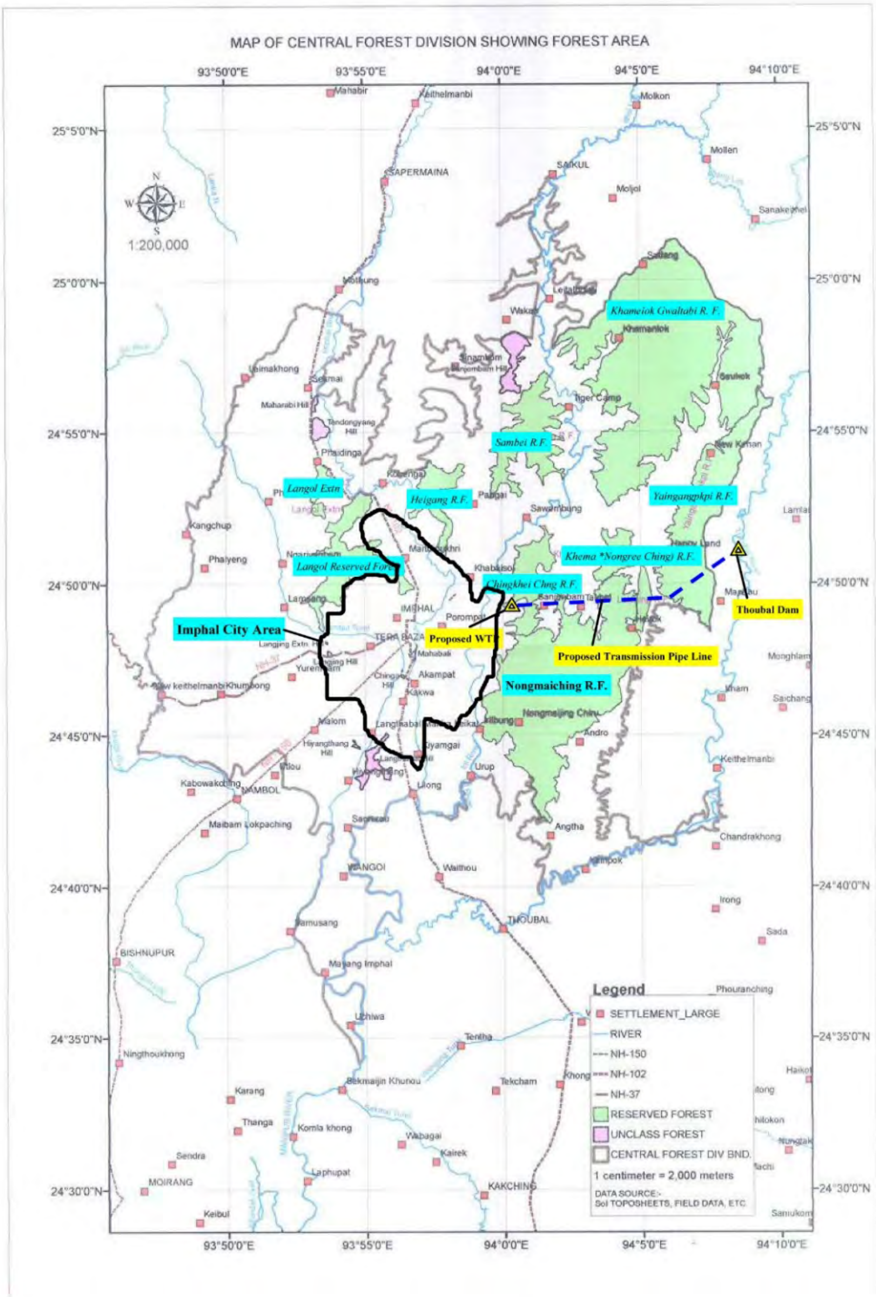
The deforestation area for the proposed WTP is estimated to be 46,500 m^2 as shown below:

Table 7.6 Deforestation Area for the Proposed WTP

No	Facilities	Facilities Area	Slope Area	Sub Total
1	WTP	19,500 m^2	17,000 m^2	36,500 m^2
2	Sun Drying Bed	6,000 m^2	1,000 m^2	7,000 m^2
3	Access Roads	3,000 m^2		3,000 m^2
Total				46,500 m^2

(2) Water Rights

Raw water of 45,000 m^3/day for the Project is planned to be diverted from Thoubal Dam and the construction of the dam is led by the IFCD, which holds the water rights. As water supply has higher priority than irrigation in terms of water rights, there is no issue on water rights for water supply.



Source: The Department of Forest and Wildlife, the Government of Manipur

Figure 7.4 Location of Nongmaiching Reserved Forest (Including Thoubal Dam, Conduit Pipeline Route, and Proposed WTP Site)

7.2.2 Pollution Control

(1) Air Pollution Control

1) National ambient quality standards

According to "National Air Quality Standards (Notification), 2009" by the CPCB, pollutants and concentration in ambient air quality were regulated as follows:

Table 7.7 National Ambient Quality Standards

No	Pollutant	Unit	Time Weighted Average	Concentration in Ambient Air	
				Industrial, Residential , Rural and Other Area	Ecologically Sensitive Areas (notified by Central Government)
1	Sulphur Dioxide (SO_2),	µg/m^3	Annual 24 hours	50 80	20 80
2	Nitrogen Dioxide ($NO_{2)}$	µg/m^3	Annual 24 hours	40 80	30 80
3	Particulate Matter (Size less than 10 µ m) or PM_{10}	µg/m^3	Annual 24 hours	60 100	60 100
4	Particulate Matter (Size less than 2.5 µ m) or $PM_{2.5}$	µg/m^3	Annual 24 hours	40 60	40 60
5	Ozone (O_3)	µg/m^3	8 hours 1 hour	100 180	100 180
6	Lead (Pb)	µg/m^3	Annual 24 hours	0.50 1.0	0.50 1.0
7	Carbon Monoxide	mg/m^3	8 hours 1 hour	0.2 0.4	0.2 0.4
8	Ammonia (NH_4)	µg/m^3	Annual 24 hours	100 400	100 400
9	Benzene (C_6H_6)	µg/m^3	Annual	0.5	0.5
10	Benzopyrene (BaP)	ng/m^3	Annual	0.1	0.1
11	Arsenic (As)	ng/m^3	Annual	0.6	0.6
12	Nickel (Ni)	ng/m^3	Annual	20	20

Source: National ambient air quality standards, CPCB (November 2009)

2) Air quality impact and mitigation measures

As explained in National Air Quality Standards, pollutants are generated by incomplete combustion and/or the use of poor quality fuels in the construction machines and transportation vehicles. Thus, at the construction stage, the Contractor should use well maintained construction machines and vehicles to avoid incomplete combustion of fuels and also use good quality fuel.

(2) Water Pollution Control

1) Water quality requirement for different uses

The CPCB sets the standards for the desired quality of a water body with five categorizations, as shown below:

Table 7.8 Designated Best Uses of Water

Designated Best Use	Class	Criteria
Drinking water source without conventional treatment but after disinfection	A	1. Total coliform organism MPN/100 ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved oxygen 6 mg/l or more 4. Biochemical oxygen demand 5 days 20℃, 2 mg/l or less
Outdoor bathing (Organized)	B	1. Total coliforms organism MPN/100 ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved oxygen 5 mg/l or more 4. Biochemical oxygen demand 5 days 20℃, 3 mg/l or less
Drinking water source after conventional treatment and disinfection	C	1. Total coliforms organism MPN/100 ml shall be 5000 or less 2. pH between 6 and 9 3. Dissolved oxygen 4 mg/l or more 4. Biochemical oxygen demand 5 days 20℃, 3 mg/l or less
Propagation of wildlife and fisheries	D	1. pH between 6.5 and 8.5 2. Dissolved oxygen 4 mg/l or more 3. Free Ammonia (as N) 4. Biochemical oxygen demand 5 days 20℃, 2 mg/l or less
Irrigation, industrial cooling, controlled waste disposal	E	1. pH between 6.0 and 8.5 2. Electrical conductivity at 25℃ micro mhos/cm, maximum 2,250 3. Sodium absorption ratio max.26 4.Boron max. 2 mg/l
	Below-E	Not meeting any of the A, B, C, D and E criteria

Source: CPCB

2) Water pollution impact and mitigation measures

Raw water for the proposed WTP is conveyed from the Thoubal Dam, which is presently under construction. As shown in "3.5 Result of Water Quality Survey", the raw water sampled on July 11, 2014 and July 5, 2014 indicates good water quality within range of drinking water. It is also equivalent for category C "designated best use for water." In addition, the raw water is less than the drinking water standards in heavy metals' concentration.

In the proposed WTP at the operation stage, after backwashing, drain water with sludge is discharged to backwash waste tank and sludge tank. Finally, the drain water is discharged to the sun drying bed and the supernatant water is discharged to river. Since the WTP does not add any hazardous substances in the treatment process and raw water does not also include hazardous substances, water pollution will not be generated by the operation of the WTP.

In addition, the water quality of the Iril River sampled on July 10, 2014(refer to "3.5 Result of Water Quality Survey") is almost within range of the drinking water standards, except for turbidity value (146.1 NTU). The sampling location is near the discharge point of the WTP.

At the construction stage, land formation and cutting of the hill area for construction of the WTP will produce bare land. The project proposes replanting and grass establishment on the bare land slopes, to prevent drain water with high turbidity to be discharged from the construction site. However, the possibility of high turbidity during the rainy season may continue even after the completion of the WTP.

To prevent the discharge of drain water with high turbidity from bare land, the project proposes to set a sedimentation pond in the corner of the sun drying bed area at the construction and operation stages. The pond will store the drain (soil) deposits and supernatant water shall be drained into the river.

(3) Soil Contamination Control

At the construction stage, many construction machines and transportation vehicles will be operated at the constriction sites. Oil and fuel from these machines and vehicles may spill to the ground and water courses causing soil contamination. Thus, the Contractor should treat oil, fuel and grease carefully; avoid setting up of construction machines and vehicles near flowing and drainage channels; conduct safety disposal and storage of grease; clean storage sites of construction machines, and avoid environmental pollution by fuel and oil spills.

(4) Noise and Vibration Control

1) National noise standards

According to "Noise Pollution (Regulation and Control) Rules, 2000", noise limits in dB in categorized areas of industrial, commercial, residential areas, and silence zones are shown in **Table 7.9**. Noise limits in the night time in residential and commercial areas are fairly severe, and 45 dB and 55 dB, respectively. Thus, the construction works of distribution facilities in Imphal City areas must be carried out in the daytime. In this case, the contractor should use small and newer types of construction machines to reduce noise problems.

Table 7.9 Noise Standards

Area Code	Category of Area/Zone	Limits in dB (A) Leq.	
		Daytime	Nighttime
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

（Note） Source: The Noise Pollution (Regulation and Control) Rules, 2000
1. Daytime: from 6:00 a.m. to 10:00 p.m., 2. Nighttime: 10:00 p.m. to 6:00 a.m.
3. Silence Zone: an area comprising not less than 100 meters around hospitals, educational institutions and courts, and zones which are declared as such by the competent authority. dB(A) Leq: the time weighted average of the level of sound in decibels

Noise impacts generated by equipment such as generators, blowers, and pumps were examined by noise calculation equations.

2) Noise impact at the proposed WTP

a) Noise impact at Mega Manipur private school located south of the proposed WTP

Beneath the southern part of the proposed Chingkheiching WTP area is the Mega Manipur School, a private school with an enrolment number of 1,070 (Kindergarten to Class 12). The machines which generate large noise are an emergency standby generator, a blower for backwashing of sand filter, and a booster pump to send clean water for backwashing to an elevated tank. The details are shown in **Table 7.10**.

Table 7.10 Noise Generation Equipment at the WTP and Distance from Equipment to Private School

No	Noise Generation Equipment	Setting Purpose	KW/KVA (Operation Units)	Noise Level	Distance from Equipment to Private School
1	Standby generator	Emergency generator at electric power failure	250 KVA (1 unit)	Noise source: 110 dB, after closing by concrete room, 80 dB	Direct distance: 135 m
2	Air blower	Backwashing for sand filter	55 KW (1 unit)	Noise source: 85 dB, after closing by concrete room and attaching of silencer, 65 dB	Direct distance: 155 m
3	Plant water pump	Sending backwashing clean water to elevated tank	37 KW (1 unit)	Noise source: 95 dB, after closing by concrete room, 59 dB	Direct distance: 160 m

Noise calculation equation to estimate noise level in receptors is as follows:

<u>Noise Calculation Equation</u>

- Noise calculation equation: $L2 = L1 - 20 \log_{10} (d2/d1)$, L2: Noise level in prediction distance (dB), L1: Noise level in standard distance (dB), d2: Prediction distance, d1: Standard distance near point sound level
- Combination sound levels in case of overlapping sounds: $L(dB) = 10 \log_{10} (10^{L1/10} + 10^{L2/10} + \text{----------})$, L(dB): Combination noise level, Li (dB): Noise level by each sound source

In case that the generator, blower, and booster pump operate simultaneously, noise level was calculated and the calculation results of noise of each unit equipment (generator, blower, booster pump) were 37.4 dB, 21.2 dB, and 10.9 dB, respectively. Combined sound level at the time of simultaneous operation of these machines was 37.5 dB. Thus, there will not cause noise issues.

b) Noise impact at private school located in the west side of the hill

In the west side of the hill, a private school with dormitory is under construction. However, the direct-line distance of the proposed WTP to the private school is about 500 m or about three times that of Mega Manipur private school to the WTP. Thus, noise will not cause an issue because of the sound level delay.
The relationship among the locations of the proposed WTP and the above-mentioned schools is shown in **Figure 7.5**.

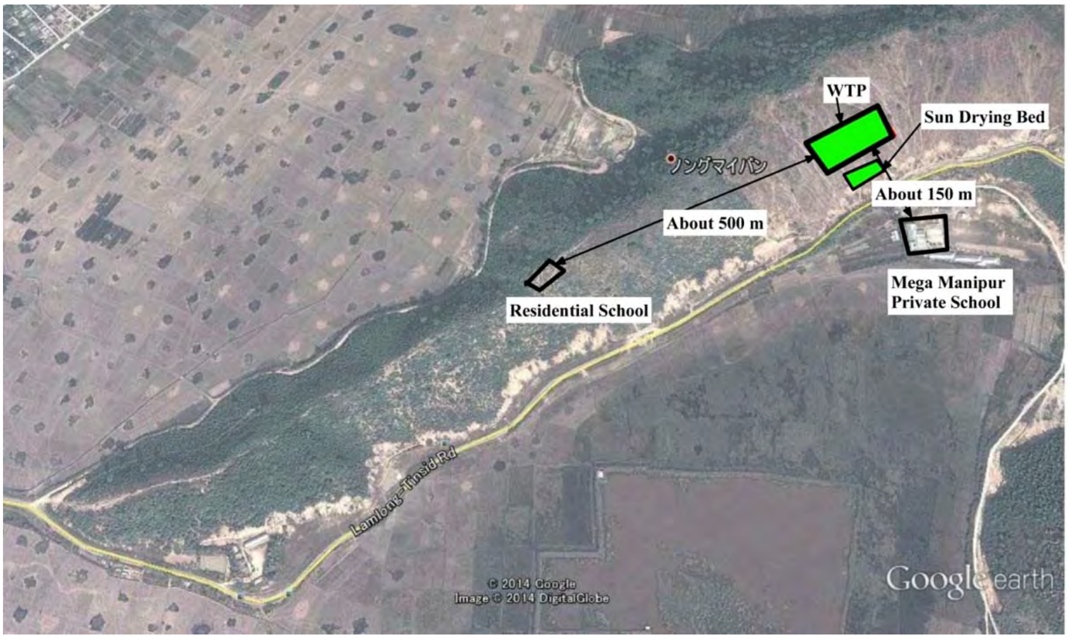


Figure 7.5 Relationship among the Locations of the WTP and Private Schools

c) Noise impact by operation of pumps in distribution facilities

In the distribution facilities, booster pumps will be used to convey clean water from the ground reservoirs to the overhead tanks. The outline of equipment is shown in **Table 7.11**.

Table 7.11 Outline of Noise Generation Equipment in Distribution Facilities

No.	Noise Generation Equipment	Installation Site	KW (Operation Unit)	Noise Level
1.	Booster Pump	Lilandolampak Shift 1 Lilandolampak Shift 2 Old Thumbuthong Shift 2 Laiwangma Shift 1 Sajor Keikai Shift 2	11 KW (One unit/site)	Noise source. 95 dB, after installation of concrete room, noise level at its outside and nearby concrete room is supposed to be 59 dB.
2.		Sajor Leikai Shift 1 Khongman	15KW (One unit/site)	
3.		Prompat Shift 2B	18.5 KW (One unit/site)	
4.		Sangaiprou	30 KW (One unit/site)	
5.		Ghari	90 KW (One unit/site)	

(Note) Installation purpose of booster pumps: When the transmission of clean treated water is stopped from master reservoir to elevated tanks, emergency booster pumps convey clean water from ground reservoirs to overhead tanks. Thus, each ground reservoir with an emergency booster pump is set in the same land area of each overhead tank.

Each booster pump located near a ground reservoir will be used to convey clean water to an elevated tank. Thus, the noise level of operating one booster pump was calculated. In addition, as overhead tanks with ground reservoirs are installed in the urbanized area, the noise level with distance of about 10 m from booster pump to nearby houses was calculated considering neighboring roads and site size.

The noise level of unit source, in case that a booster pump is installed in concrete room, becomes 59 dB just outside of the concrete room. In this case, noise level with the distance of 10 m is 39 dB based using noise calculation equation. The noise level is less than the national noise level standard in the nighttime in the silence zone. Thus, if a booster pump is operated in the condition of closing doors in a concrete room , there will not cause noise issues.

3) Prevention of vibration impact by selection of construction methods

Overhead tanks and ground reservoirs are constructed in the flat land areas which are composed of alluvial plain. Thus, each facility will have support bases of concrete structures with depth of about 15 to 20 m to sustain the facility structures. The support bases are generally constructed by two construction methods: hitting of piles by using piling machines or hole making by augers for setting of iron skeleton frames together with filling of cement grout into the holes. The project adopts the hole making method by augers to avoid the vibration impact. In the other construction works, construction methods that generate large vibration will be not used.

In the operation stage, each machine has vibration protection mounts. Thus, vibration issues will not be generated.

(5) Disposal of Surplus Soil Generated by Cut Earth at Proposed WTP Site and of Sludge at Operation Stage

1) Disposal of surplus soil generated by cut earth at proposed WTP site

The proposed WTP is planned to be constructed on small hill with a height difference of about 60 m. The hill has a lower elevation from the north side to south side and has to be cut in the feature size of about 40 m at the highest portion of the elevation and at the north side of the site. The amount of surplus soil from cutting of the hill is estimated to be 750,000 m^3 and a dumping site will be needed.

The PHED proposed a vacant lot in the premise of Lamphel Pat sewage treatment plant (STP) located in west of the city. The STP in the northeast corner of the premise is presently under construction. The STP has the area of 319,200 m^2 in total and the land space of the STP being under construction occupies 64,600 m^2. The remaining vacant area is 254,600 m^2 and is equivalent to 25.46 ha. The area is grassland surrounded by concrete wall with the height of about 3 m and is a marsh land. If surplus soil from the WTP is disposed there, the height of surplus soils, if the land surface is arranged in flat condition, will be around 2.94 m. The PHED approved to use the STP site as the disposal site of surplus soils generated by land formation of the WTP site on October 28, 2014. The approval letter is shown in the Attachment.

The STP is located in the northwest direction of about 3.2 km away from the city center area and about 8.8 km west of the proposed WTP site. The STP is expected to be completed on March 2015. The construction of the facilities is funded by the State budget and the equipment and machineries are supplied by French fund. The title of the Project is “Sewerage Project Phase-I for Imphal town with French Assistance.” The planned sewage treatment amount is 27, 000m^3/day. **Figure 7.6** and **Figure** 7.7 show the location of the Lamphel Pat STP.

2) Sludge disposal generated by backwashing at proposed WTP

Water treatment is conducted by coagulation, sedimentation, and filtration. After chlorination, treated water is finally distributed in the city area. River water sources have generally high turbidity. The sludge originally generated in the process of water treatment, accumulated in sedimentation tank, and generated by backwashing sand filter has to be removed and disposed to a sludge dumping site. The sludge amount is estimated to be 3.46 ton/day assuming 65% water contents after sun drying, and around 182 m^3/day if sludge has specific gravity similar to fine sand.

The PHED proposed land areas owned by National Institute of Technology (NIT) and Police Complex Station, located near the proposed site (STP site) for the disposal of surplus soils from the WTP. The Police Complex Station land is estimated to be 381,000 m^3 (38.1ha) while the NIT land is about 1,930,000 m^2 (193 ha). The land space is sufficient for disposal of sludge. According to the PHED, permission from both governmental organizations can be taken, and the PHED agreed for this proposal on October 28, 2014, as shown in the Attachment. **Figure 7.8** shows the locations of proposed lands of NIT and Police Complex Station.

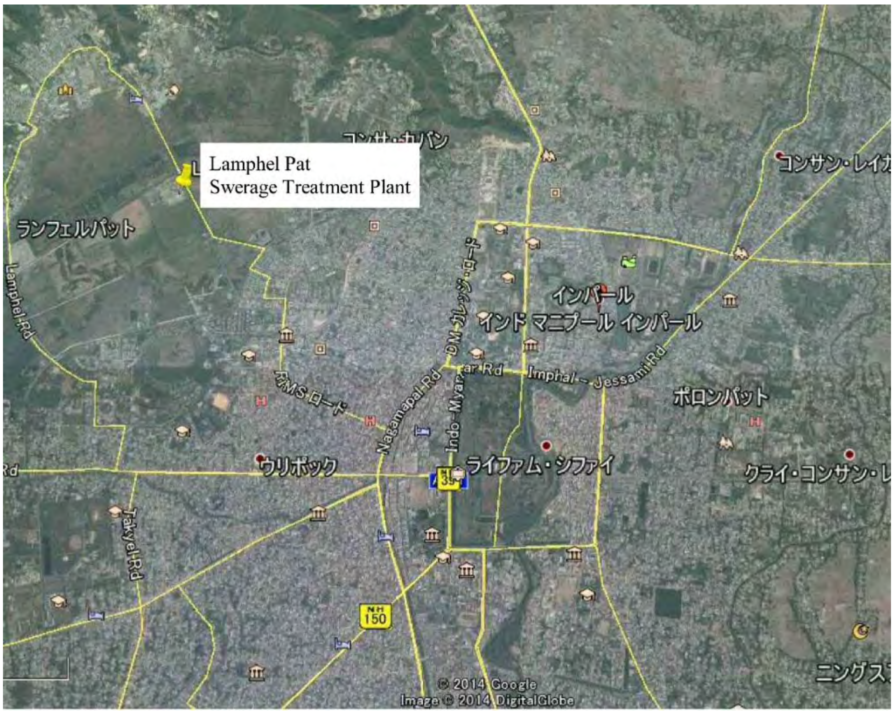


Figure 7.6 Location of Lamphel Pat Sewage Treatment Plant in Imphal City (Under Construction)

Figure 7.7 Site Plan of Lamphel Pat Sewage Treatment Plant (Under construction)

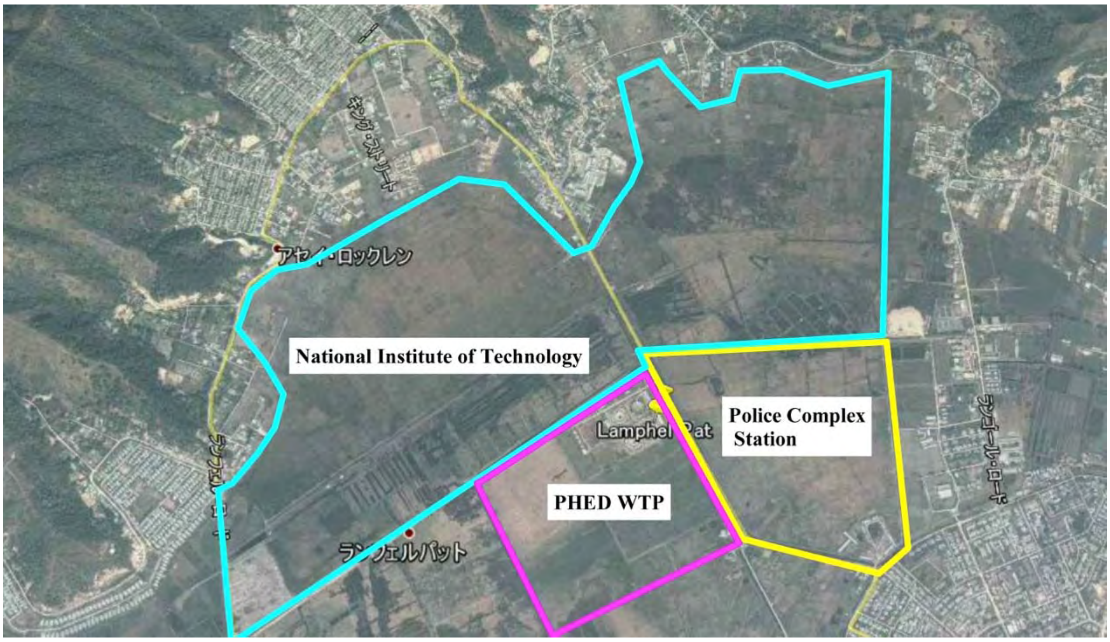


Figure 7.8 Proposed Disposal Site for Sludge (NIT. and Police Complex Station)

(6) Discharge from Proposed WTP

Water supplied to the city area undergoes treatment and chlorination. Sludge accumulated in the filter facility of the WTP is removed by backwashing, and the effluent is discharged into the Iril River. In this case, the water quality of the effluent has to fit the regulation of “The Environmental (Protection) Rules, 1993. Thus, sludge, including in the effluent, also needs to be pretreated for removal. **Table 7.12** shows "general standards for discharge of environmental pollutants: effluents".

Table 7.12 General Standards for Discharge of Environmental Pollutants: Effluents

No	Parameter	Unit	Discharge Standards
1.	Colour and odour		All efforts should be made to remove colour and unpleasant odour as far as practicable.
2.	Suspended solids（Max.）	mg/L	100
3.	Particulate size of suspended solids		Shall pass 850 μ IS Sieve.
4.	pH		5.5 – 9.0
5.	Water temperature		Shall not exceed 5℃ above the receiving water temperature.
6..	Oil and grease (Max.)	mg/L	10
7.	Total residual chlorine (Max.)	mg/L	1.0
8.	NH_4-N (as N) (Max.)	mg/L	50
9.	Total Keldahal Nitrogen (as N) (Max.)	mg/L	100
10.	Free NH_4 (as N) (Max.)	mg/L	5.0
11.	BOD (3 days at 27℃) (Max.)	mg/L	30
12.	COD (Max.)	mg/L	250
13.	As (Max.)	mg/L	0.2
14.	Hg (Max.)	mg/L	0.01
15.	Pb (Max.)	mg/L	0.1
16.	Cd (Max.)	mg/L	2.0
17.	Hexavalent Cr (as Cr^{+6}) (Max.)	mg/L	0.1
18.	Total Cr (as Cr) (Max.)	mg/L	2.0
19.	Cu (Max.)	mg/L	3.0
20.	Zn (Max.)	mg/L	5.0
21.	Se (Max.)	mg/L	0.05
22.	Ni (Max.)	mg/L	3.0
23.	CN (Max.)	mg/L	0.2
24.	F (Max.)	mg/L	2.0
25.	Dissolved Phosphates (as P) (Max.)	mg/L	5.0
26.	Sulphide (as S) (Max.)	mg/L	2.0
27.	Phenol (as C_6H_5OH)	mg/L	1.0
28.	Radioactive materials: (a) Alpha emitter (b) Beta emitter	micro curie/ml micro curie/ml	10^{-7} 10^{-6}
29.	Bio-assay test		The fishes of 90% are living after 96 hours by effluent water of 100%
30.	Mn	mg/L	2
31.	Fe	mg/L	3
32.	V	mg/L	0.2
33.	Nitrate Nitrogen	mg/L	10

Source: Environment (Protection) Rules, 1993, Schedule-VI

(7) Environmental Protection Area

1) Protection area and conservation of ecology

Supervision and management of wildlife sanctuaries and national parks are the responsibility of the Department of Forest and Wildlife, under control of the Department of Environment and Forest, the Government of Manipur. The department conducts protection and conservation of forest and wildlife on the basis of the "Wildlife (Protection) Act, 1972."

In the State of Manipur, there are Keibul Lamjao National Park occupying the southern part of Loktak Lake and Yangopokpi Lokchao Wild Life Sanctuary located near the state boundary in the southeast direction. In addition, one national park and four wild life sanctuaries are under proposal. The locations of declared and proposed national parks and wildlife sanctuaries are shown in **Figure 7.9**, and names and their outlines are in **Table 7.13**.

Since the declared national park is about 25 km from the city area, the area does not directly relate to the Project. But its effluent may indirectly affect the ecology of Loktak Lake because the Iril River, where the WTP effluent is discharged, empties into the Lake.

In areas where pipes will be laid, there are no national parks and wildlife sanctuaries.

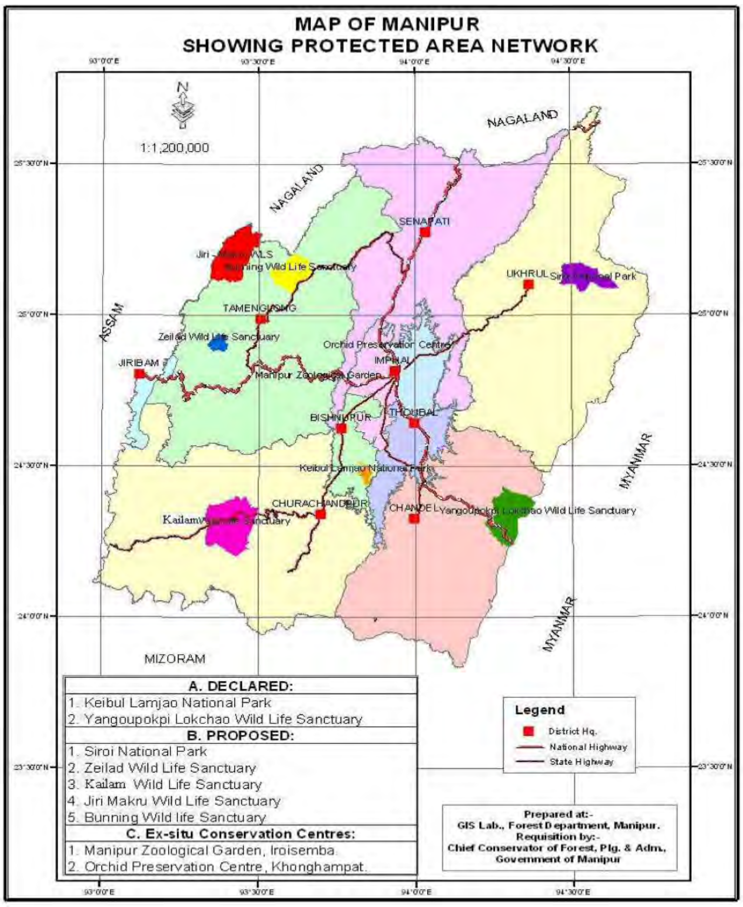


Figure 7.9 Location Map of Declared and Proposed National Parks and Wild Life Sanctuaries

Source: Wild Life Protected Area in Manipur (2006-2007), Forest Department, Manipur

Table 7.13 Outline of Declared and Proposed National Parks and Wildlife Sanctuaries

No	Name of National Park and Wildlife Sanctuary	Outline
Declared		
1	Keibul Lamjao National Park	Area : 40 Km^2 Date of establishment : March 28, 1977 District : Bishnupur Significance : ① Only natural habitat of Brow Antlered Deer (Sangai), (the population of Sangai was confirmed to be 180 in 2003). ② Only Floating National Park in the World ③ Hosts a number of rate and migratory birds
2	Yangoupokpi Lokchao Wild Life Sanctuary	Area : 184.8 km^2 Date of establishment : February 21, 1989 District : Tengnoupal Significance : ① Unique and vibrant ecosystem representing Indo-Myanmar biodiversity due to location of the sanctuary at the confluence of two major geographical zones ② Seasonal migratory of elephants from Myanmar ③ Home of Hoolock gibbon, the only Ape species found in India
Proposed		
1	Siroi National Park	Area : 100 km^2 Date of establishment : November 25, 1982 (Proposed and settlement proceeding not yet completed) District : Ukhrul Significance : ① Home of unique and endemic ground lily, "Lilium macklinae"
2	Zeilad Wild Life Sanctuary	Area : 21 km^2 Date of establishment : April 24, 1997 (Proposed and settlement proceeding not yet completed) District : Tamenglong Significance : ① A group of sevenlakes,"Zeilad, Guiphuapzai, Narouzai, Tuangpuiai, Gouolungzai, Napsiamzai and unnamed one" ② 15 kinds of fish available in the lakes ③ Abode of migratory birds ④ Barak water fall with 7 steps
3	Kailam Wild Life Sanctuary	Area : 187.5 km^2 Date of establishment : June 18, 1997 (Proposed and settlement proceeding not yet completed) District : Churachandpur Significance : ① Habitat of 5 kinds of hornbill, "Great Indian hornbill, Rufous necked hornbill, Wreathed hornbill, Indian Pied and lesser pied hornbill, and brown backed hornbill"
4	Jiri Makru Wild Life Sanctuary	Area : 198 km^2 Date of establishment : September 22, 1997 (Proposed and settlement proceedings not yet completed) District : Tamenglong

		Significance： ① Virgin forests of catchment areas of Jiri and Makru rivers hosting varieties of flora and fauna
5	Buning Wild Life Sanctuary	Area：115.8 km^2 Date of establishment：September 8, 1997 (Proposed and settlement proceeding not yet completed) District：Tamenglong Significance： ① Combination of Alpine grassland and Forest ecosystem ② Beautiful undulating small mounds clothed with varied flowering herbs and shrubs, bamboo orchids mingled with wild lilies ③ water fall with water head of 60 m ④ Catchment areas of four important rivers

Source: Protected Areas Network of Manipur, India, Chief Wildlife Warden, 2012)

2) Loktak Lake

Loktak Lake, located in the south of alluvial plain in the State of Manipur, is known internationally. The lake is characterized by the presence of a naturally formed thick floating biomass. It is also the habitat of the endangered Sangai antlered deer. In 2003, the population of Sangai deer was estimated to be only 180. The surrounding area of the lake is an important habitat of wildlife with great variety and the staying post of migratory birds in the winter season of October to March. Thus, the Government of India designated the south area of the lake as Keibal Lamjao National Park in 1977 and the entire area of the lake was declared as the registered wetland under the Ramsar Convention in 1990. All the main rivers flowing in the western part of the State of Manipur and the Imphal city area empty into the lake and siltation by erosion in catchment areas and eutrophication in the river have had a large impact toward the lake environment. **Table 7.14** shows the outline of Loktak Lake and **Figure 7.10** indicates the locations of Loktak Lake and Keibul Lamjao National Park.

Table 7.14 Outline of Loktak Lake

No	Description	Content
1.	Surface area	26,600ha
2.	Location	Bishnupur District
3.	Elevation（water level）	768.5 m (amsl)

(Note) amsl: above mean sea level
Reference value: elevation in Imphal city area：790 m amsl
Source：North Eastern Region Community Resources Management ”Manipur (2007)”

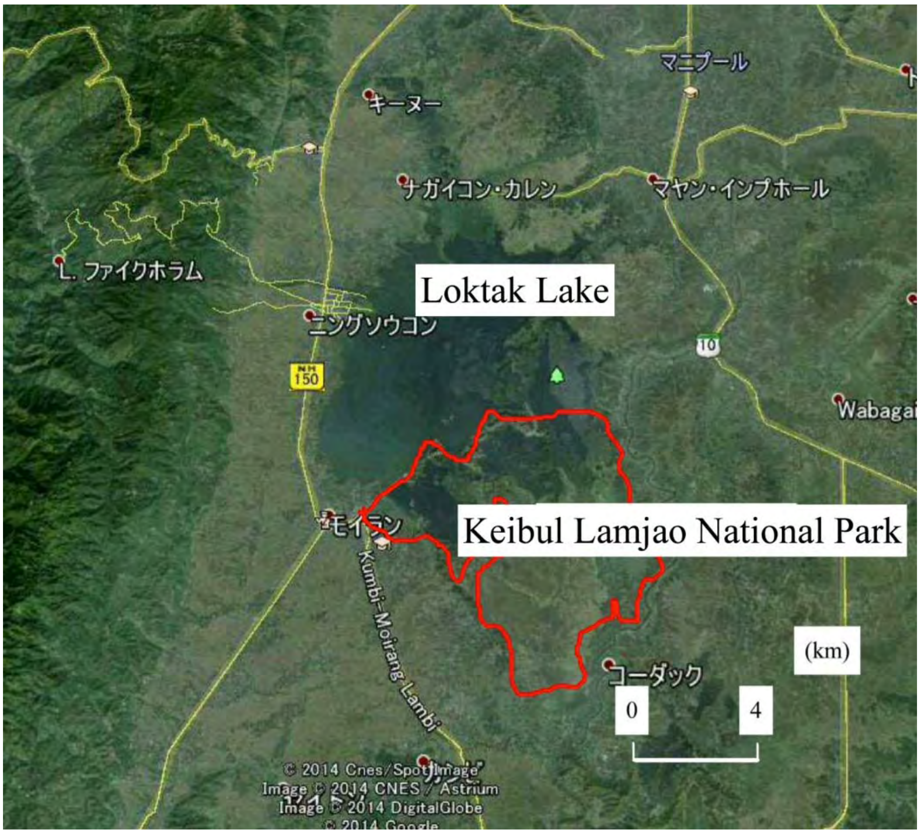


Figure 7.10 Locations of Loktak Lake and Keibul Lamjao National Park

3) Forest vegetation and ecological system

Forest area in the State of Manipur occupies 17.2 km^2 or about 77 % of the total land area of the State of Manipur. It is broadly interpreted that there are four types of forests in the State of Manipur, as shown below:

1. Tropical semi-evergreen forest
2. Dry temperate forest
3. Sub-tropical pine forest
4. Tropical moist deciduous forest

Flora in the State of Manipur is formed by about 2,200 plant species distributed over 213 families and 1,012 genera, together with bamboos of 51 species identified within its geographical boundaries and 500 varieties of orchids. Important mammals, living in the State of Manipur, are tiger, leopard, cloud leopard, Asiatic black bear, Malayan sun bear, Indian elephant, golden cat, Chinese pangolin, slow Loris etc. Especially, in the forest area of the State of Manipur, endangered old deer, “Thamin deer or Cervus eldi” characterized by peculiar horn extending in the front direction and mane are living.

To protect these precious fauna and flora, Biodiversity Conservation Prioritization Project (BCPP) by WWF-India (1997-2000) attempted in identifying priority sites and species on the basis of their biological and socioeconomic values. **Table 7.15** shows the list of important fauna in the State of Manipur and **Table 7.16** indicates that of important fauna in the same state.

Table 7.15 List of Important Fauna in Manipur State

No	Scientific Name	Common Name	Local Name
1	Cervus eldi eldi	Brow-antlered Deer	Sangai
2	Axis porcinus	Hog Deer	Kharsa
3	Sus scrufa	Wild boar	Lam-ok
4	Cuon alpinust patlas	Indian wild dog	Huithou lamlen
5	Vulpes sp	Fox	Lamhui
6	Felis chaus Gulden Staedt	Jungle cat	Lamhoudong Fehade
7	Felis tommincki	Golden cat	Tokpa
8	Viverra zibetha	Large civet cat	Lam houdong
9	Viverricula indica	Small indian civet cat	Moirang Sathibi
10	Paguma larvata		
11	Mustela erminea	Emine	Sadung
12	Lutra lutra	Otter	Sanamba
h13	Funambulus pennanti	Squirrel	Kheiroi
14	Rattus rattus	Common house rat	Ushi
15	Rattus booduga	Indian field mouse	
16	Spalax microphtalmus	Mole rat	
17	Golunda elioti	Rat	
18	Connomys badius	Bay bamboo rat	Sabi
19	Suncus caeruleus	Musk shrew	Utin
20	Sarex araneus	Common shrew	
21	Pteropus sp	Flying fox	Sekpi
22	Rhinolosus sp	Bat	

Source: Environment and Ecology Office, ENVIS Center, Government of Manipur（2011）

Table 7.16 List of Important Flora in Manipur State

No	Scientific Name	Local Name
1	Sacciolepis myosuroides R. Br	Hup
2	Echinochloa stagnina Retz	Hup
3	Leersia hexandra Sw	Choura
4	Setaria pallidefusca Schumach	Hup
5	Azolla pinnata R.Br	Kang macha
6	Salvinia natans Hoffim	Kang macha
7	Salvinia cuculata Roxb	Kang macha
8	Pistia stratiotes Linn.	Kangiao
9	Eichlomia crassipes Mart	Kabokang
10	Lpomoea aquatica Forsk	Kolamni
11	Jussiaea repens Linn.	Esing kondol
12	Monochoria hastaefolia Prest	Kakia
13	Monocoria hastate (L) Solms	Kabokang laba
14	Polygonum barbarum Linn.	Yellang
15	Polygonum orientale Linn.	Chakhhong
16	Polygonum posumbu Buch Ham ex. D. Don	Chakhhong
17	Polygonum plebejum R. Br	Phakchet
18	Persicaria chinensis (L) H. Gross	Yengkhuman
19	Persicaria perfoliata Linn. H. Gross	Lihar
20	Rumex nepalensis Spreng	Torong khongchak
21	Rumex maritmus Linn.	Torong khongchak
22	Rumex vesicarius Linn.	Torong khongchak
23	Cyperus difformis Linn.	Chumthang manbi
24	Cyperusirotundus Linn.	Chumthang
25	Arundo donax Linn.	Luwangtou
26	Phrgmites karka Retx.	Tourel (tou)
27	Cynodon dactylon Linn Pers	Tingthou
28	Erianthus procerus Roxb	Singnang
29	Erianthus arundinaceus Retz	Singmut
30	Zizania latifolia Turcz	Ising kambong
31	Imperata cylindrical Linn.	Ee
32	Sacharum spontaneum Linn	Mom

Source: The Environment and Ecology Office, ENVIS Center, the Government of Manipur（2011）

At the construction stage of the WTP, protection must be given to valuable animals. If construction workers find the animals, they must be handled with care, giving them the choice to get away to adjacent hilly area or from the site by their own means. In addition, though there is a limited number of shrubs planted in the proposed WTP, countermeasures such as transplanting to the slope of hill site and adjacent places may be necessary.

7.2.3 Social Environment

(1) Ethnic Minorities and Indigenous Peoples

The State of Manipur is topographically divided into two parts: a plain area located by state capital and a surrounding hilly area. Different tribes consisting of Meitei, Pangal (Muslims), Naga, Kuki, Zomi, and Garkhali (Nepali) live in the plain area and speak different languages and have different cultures. The Meitei forms the biggest tribal group, about 60% of the total population. The Meitei tribes also identify themselves into religious groups by such as inherent, Christian and Islam.

The Meitei language, Meiteilon, is the common language in the State of Manipur, in addition to Hindu and English, the public languages in India. Communication is done by these three public languages. Though coming from different tribes, the people of Manipur have equal voting rights and live peacefully together in the city area. The water supply for Imphal City is limited in the plain area, and improvements and expansion of the system will benefit each one equally.

On the other hand, in the hilly area, a number of minority groups live by shifting cultivation and hunting. They have different languages and speak no common tongue. National Constitution Order 19/22, 1950 regulates the people who received unfair treatment in their history as scheduled castes and tribes and the Government of India makes a plan such as allocation of legislative seats in the state and the central governments, their protection, and educational and development assistance. In the State of Manipur, there are 29 tribes and seven scheduled castes. The scheduled tribes live in the hilly areas and the scheduled castes live in the low land areas of valleys among hilly areas.

(2) Historical and Cultural Heritage

The Directorate of Archaeology, under control of the Art and Culture Department, Government of Manipur is responsible for the state’s rich historical and cultural heritage. In the Imphal city area, there are 23 designated historical and cultural heritages. **Table 7.17** shows the list of historical and cultural heritages and **Figure 7.11** indicates the location of historical and cultural heritages in the Imphal city area.

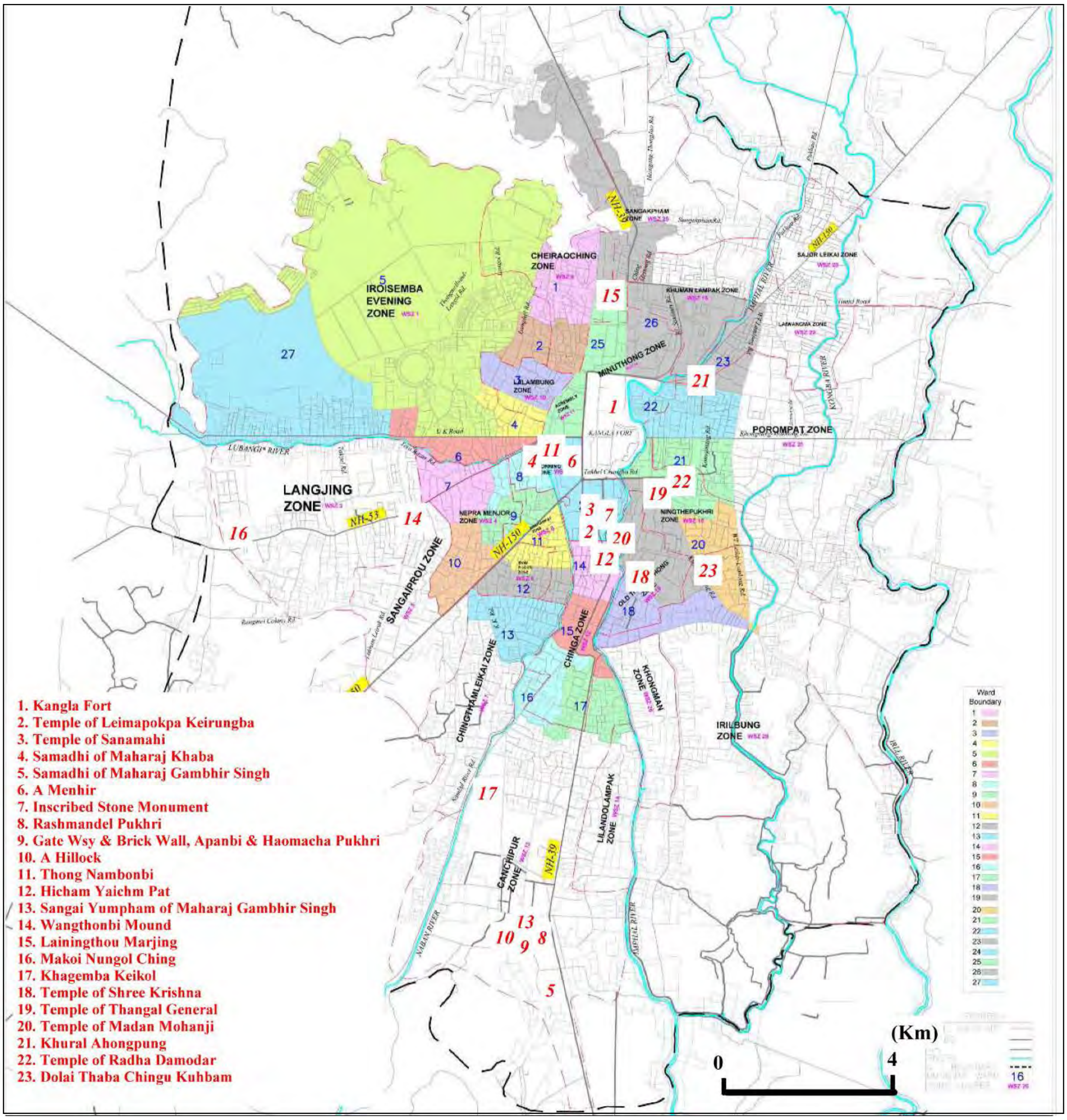
(3) Traffic Control

The Public Works Department controls pipe laying work (transmission and distribution pipelines) as well as the traffic arrangements / requirements at the construction stage. Thus, prior to the commencement of the construction works, the Contractor shall submit proposals including the construction sites and schedule, traffic control manners, drawings, etc. After submission of the proposals, the Public Works Department shall ask the review of the proposals from related agencies and will approve the request / proposal.

Table 7.17 List of Historical and Cultural Heritages in Imphal City area

No	Name of Historical and Cultural Heritage	Location	Reason of Selection
1	Kangla Fort	Imphal	Manipur King's palace of AD33 (Mythical God King) to 1891 (Maharaj Kulachndra). The site includes many important archaeological sites and monuments.
2	Temple of Leimapokpa	M.S.R.T.C Compound	Leimapokpam Dev Singh constructed the temple in 1875. He worshipped the idols of Radha-Binodata.
3	Temple of Sanamahi	1st Bn. M.R. Compound	In the late of 19th century, the Hindu temple was constructed by Maharaj Kulachandra. The temple was dedicated to Lord Sanamahi, an important household deity of Manipur.
4	Samadhi of Maharaja Khaba	Uripok Session Court Compd.	This Hindu construction was put up at the cremation ground of Maharaj Khaba. Maharaj Khaba reigned only one year during the later period of the Seven Year's Devastation (1819-1825).
5	Samadhi of Maharaja Gambhir Singh	Langthabal Village	This was constructed at the cremation ground of Maharaj Gambhir Singh. The Maharaj is one of the most popular kings for defeating the Burmese and ending the Burmese's occupancy (1819-1825).
6	A Menhir	State Museum Approach Road	This Mehhir is believed to have been erected in the 15th century. Scholars are of the opinion that this Menhir was erected as boundary stone demarcating Konthoujam Yumpham (Present Raj Bhavan) from Sanakeithel.
7	Inscribed Stone Monuments	1st Bn. M.R. Compound	Inscribed Stone Monument, better known as the Heisnam Lairemma Inscription. The inscribed stone is related to the worship of the Goddess Heisnam Lairembi (believed to be an incarnation of Goddess Panthoibi).
8	Rashi Mandal Pukhri	Langthabal Village	This site is historically important as the first dancing place for God Kurishna under the patronage of Maharaj Bhagyachandra. The total protected area is 1.58 acres.
9	Gate Way and Brick Wall (in ruins) Apanbi and Haomacha pukhri	Langthabal Village	Gate-Way and Brick Wall (in ruins)： Gate-Way (Sanathong) was the entrance to the palace complex founded by Maharaj Bhagyachandra in 1779. This gateway is the testimony of the past glory days. Apanbi Pukhri: At present, this pond is located within the campus of Manipur University. This pond remained neglected for several years due to the shifting of capital by Maharaj Bhagyachandra. It was later developed by Maharaj Gambhir Singh soon after he established the capital complex at Langthabalin 1827. Haomacha Pukhri: At present, this historical pond is located within the premises of Manipur University. This pond is believed to have been dug up during the reign of Maharaj Bhagyachndra and it may have been used for royal household as well as a source of recreational activities for the member of royal family.

10	A Hillock	Langthabal Village	The hillock is popularly known as Langthabal Konung Ching and is a part of the capital complex of Maharaji Gambhir Singh. Later, he established a summer palace complex along the summit range of the hillocak. The surviving monument on the hillock is a temple consecrated to Radharamon.
11	Thong Nambonbi (Hamped Bridge)	Khwairamband Bazar	This is the oldest surviving brick-built located at the heat of the Imphal City, spanning across he Nambul river.
12	Hicham Yaichampat Pat	Yaiskul Janmasthan	This place is the cremation ground of Yubraj Tikendrajit after he was hanged at Pheidabung Mapan Kangjeibung on August 13, 1891.
13	Sangaiyumpham of Maharaj Gambhir Singh	Langthabal Village	The palace complex, including the royal residency and other dwellings were established by Maharaj Gambhir Singh in 1831 after he shifted his capital from Bishnupur.
14	Wangthonbi Mound	Sagolband Tera	This served as western gate of Manipur.
15	Lainingthou Marjing	Adimjati Chingmeirong	This site is associated with the worship of Laningthou Marjing who was vanished after Anglo-Manipur, 1891. He is worship at the peepal tree situated near Adamjati D.M. College Campus.
16	Makoi Nungol Ching	Langjing Achouba	A sacred hillock of Meiteis is under the protection of State Archaeology, the Government of Manipur. The site is associated with Meitei's belief that after death, the departed soul halts on its sacred journey to the Lord Sidaba Mapu.
17	Khagemba Leikol	Heirangoithong	This is not only a screed site but also an archaeological site where numerous pot shard's were discovered.
18	Temple of Shri Krishna	Brahmapur Guru Aribam Leikai	This temple is believed to have been built by Maharaj Ganbaniwaza in 1722 and built of burnt bricks.
19	Temple of Thangal General	Wangkhei Palace Compound	This brick temple was established by Kangabam Chitananda Singh, popularly known as Thangal General in 1879. Palace compound.
20	Temple of Madan Mohanji	Nahabam Bamon Leikai	This brick temple was established somewhere during the reign of Maharaja Chandrakriti in 1850-1879.
21	Khurai Ahnongpung	Telipatti	It is a small earthen mound and was made to demarcate the eastern boundary of Imphal area by the Meitei King.
22	Temple of Radha Damodar	Wangkhei Purana Rajbari	This temple is made of burnt brick sand with elaborate designs.
23	Dolai Thabahingu Khubam	Wangkhei Yonglal Leirak	During the reign of Maharaj Garibaniwaza, the head Pandit, Lourembam Khongnangthaba used to take meditation. He was one of the pundits who strongly opposed the spread of Hinduism in Manipur.



Source: Directorate of Archaeology, Art and Culture Department

Figure 7.11 Location Map of Historical and Cultural Heritages in Imphal City Area

According to the Directorate of Archaeology, the Art and Culture Department, there are no regulations to control the construction works and no obligation of reporting for the same near monuments and heritages. However, if the construction works for distribution facilities and pipe laying works damage important heritages and monuments, this may cause serious problems. Thus, countermeasures are proposed by "the Environmental Impacts and Mitigation Measures at Construction Stage" in this report.

7.2.4 Work Environment (Occupational safety management law)

The Department of Labour and Employment controls labor employment and occupational safety for construction workers. The regulations followed are the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, the Industrial Act in 1948, and Mining Act in 1952, which regulate occupational safety condition.

According to this Act, all contractors must register their workers, and comply with the following rules:

- Compliance of working hours, employers must provide one day rest per a week for employees with remuneration.
- Payment rules of wages for overtime works
- Elaboration and keeping of employees' record and list, payment documents of wages, cut record of wages, fine record on employees, advance payment record, and annual report to supervising agencies, labour accident and diseases record, generation record of work accidents.
- Bann of employment of disability persons for construction works.
- Installation of supplying facilities of drinking water and toilets and temporary rest facilities at construction sites.
- Setting of day nurseries at construction sites where female workers of 50 or more work.
- Setting of emergent measures' facilities
- Setting of simple eatery facilities at construction sites where construction workers of 250 or more work.

The inspectors of the Department occasionally check on the work environment of construction workers and inspect documents such as wage payment etc and directly consults with construction workers.

Regulation requires employers to pay compensation fee if construction workers in case of injuries or loss of life. The employers have to notify the Department's Inspectors the name of construction project, site conditions, construction work implementer's name and address, working contents, numbers of workers, contact person's name, and implementation period.

If contractor does not conduct the above items, it is deemed to be offense against the law and the penalties imposed are either imprisonment or fine, or both.

The Act does not regulate occupational safety, as described in the "Adverse Impact and Mitigation Measures at Construction and Operation Stages and Environmental Management Plan."

7.3 Stakeholder Meeting

A stakeholder meeting was held at the conference room of Imphal Hotel from 8:30 to 13:40, on the 22nd of October 2014. There were 73 persons who registered and attended the meeting from the Irrigation and Flood Control Department, the Public Works Department, the Department of Forest, the Imphal Municipal Council, the PHED, the representatives of consumer groups, NGOs, and contractors. Furthermore, there was the presence of mass media, such as TV and radio, and from print media, such as the Sangai Express, the Imphal Free Press, the People's Chronicle, the Assam Tribute and the India Times. The meeting schedule is shown in the table below:

Photo 7.1 Stakeholder Meeting held in Imphal Hotel in October 22, 2014

Table 7.18 Meeting schedule for Stakeholder

Time Schedule	Contents	Presenter
8:30 - 9:00	Registration	
9:00 – 9:10	Opening Remarks	Mr. Th. Lokeshwar Singh Superintending Engineer, PHED
9:10 – 9:50	Water Supply Condition of Imphal City (Current Status And Issues) and Outline of JICA Project	Mr. H. Sunil Singh, Chief Engineer, PHED
9:50 – 10:30	Open Discussion	Attendees
10:30– 11:00	Coffee Break	
11:00– 11:20 11:20– 11: 50 11:50 – 12:20	Water Meter and Supplying Pipe Connection Imposition of Water Tariff and its Benefits Environmental Impact and Mitigation Measures	Mr. Kikuo Matsushima JICA Study Team Mr. Kotaro Kikuchi JICA Study Team Mr. Kenji Takayanagi JICA Study Team
12:20 – 12:50	Open Discussion	Attendees
12:50 – 13:10	Closing Remarks	Mr. W.L. Hangsingh, Principal Secretary, PHED
13:10 – 13:40	Lunch Break	

After presentation of Chief Engineer, the PHED on Water Supply Conditions of Imphal City (current status and issues) and Outline of JICA project, an open discussion was held.

Open discussion and the following opinions were presented:
(Note, Q: question, A: answer)

- Q1: Journalist - Time schedule for implementing the project and the generation capacity after project completion, and proper steps to preserve forest area while implementation of the project as the WTP located in a hilltop surrounded by forest.
- A: Chief Engineer, PHED - The project is expected to be completed by 2021. After implementation, the water production capacity of the PHED will be 149.25 MLD, and proper consultation from Forest Department is being taken regarding the same. A checklist is being prepared to ensure that during the whole project cycle, no forest area is harmed.
- A: I.F.S., PHED -Responsibility of everyone to take care and conserve the various water bodies and watersheds and forests surrounding the Imphal City. The people residing in hill areas cut down forest for firewood which fetch them easy money. He urged the people

through stakeholder and media to stop destroying forest, as it is creating imbalance in environment.

- Q2: Imphal Municipal Council - In the presentation, the projected water demand of Imphal City will remain same till 2020. What steps are being taken by the PHED to ensure proper water supply distribution and how can the PHED boost up the water supply system which is supplying a shortage of 21.9 % than the installed capacity?
- A: Chief Engineer, PHED - To maintain the balance of installed capacity and water supply, there is an urgent need in upgrading the water supply system which includes replacing of obsolete equipment and machines for better efficiency, rework of pipeline network, alternate water source etc. which are the main objectives of the project. the PHED is a labour oriented organization. It requires youth manpower for maintenance. At present, 70 % of the working staff are in the age group (50-60) years.
- Q3: Planning, PHED - Proper monitoring and continuous evaluation of the present system for better efficiency. Suggesting the privatization and outsourcing to combat the problem of manpower.
- A: Chief Engineer, PHED - The work culture needs a drastic change for progressive development, and free hand needs to be given for decision making.

After presentation of JICA study team, the open discussion was also held.
Open discussion and the following opinions were presented:

- Q: Planning, PHED - Numerous leakages in the pipeline network system which hampers the proper water supply and many steps are taken by the PHED in controlling such leakages. If the quality and quantity of supply water is improved, people will be willing to pay happily. People pay even more for getting water through tankers.
- A: Superintending Engineer, PHED - Sincere efforts are being made by the PHED to tackle such problems. Moreover, the budget allocation is very less. In the same budget, it is not possible to maintain water supply and O&M together. Many funding organizations are not yet ready for funding development projects in Northeastern region of the country due to problem in law and order and its terrain. He thanked JICA for taking the initiative.

7.4 Land Acquisition and Resettlement

(1) Procedures of Land Acquisition and Resettlement and its Implementation System

The Department of Rural Development is the agency that regulates land acquisition and resettlement. The legal procedures are covered in the “Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, (2013)." Land acquisition inside a state is undertaken by the State government, while that inside union territories is the responsibility of the Central government. Land acquisition is applied only to cases for public purpose and sectors as shown below:

- For strategic purposes relating to naval, military, air force, and armed forces of the Union, including central paramilitary forces or any works vital to national security or defense of India or State police, safety of the people
- For infrastructure projects which includes the following:
    - All activities or items listed in the notification of the Government of India, excluding private hospitals, private educational institutions and private hotels
    - Projects involving agro-processing, cold storage facilities, marketing infrastructures for agriculture, allied activities for dairy, fisheries, and meat processing
    - Projects industrial or mining activities, national investment and manufacturing zones
    - Projects for water harvesting and water conservation structures, sanitation
    - Projects for government administrated/aided educational and research schemes or institutions
    - Projects for sports, health care, tourism, transportation or space programme
    - Any infrastructure facility notified by central government
- Projects for project-affected families
- Projects for housing for income groups, notified by appropriate government
- Projects for planned development or the improvement of village sites or sites in the urban areas or provision of land for residential purposes for the weaker sections in rural and urban areas
- Projects for residential purposes to the poor or landless or to people residing in areas affected by natural calamities, or to persons displaced or affected by reason of the implementation of any scheme undertaken by the government, any local authority or a corporation owned by or controlled by the State.

The Commissioner for Rehabilitation and Resettlement supervises the preparation of rehabilitation and resettlement plans and is in charge of its implementation. The State government appoints officials in the level of secretary. The Collector is the collector for a revenue district under the Act. In addition, the state government appoints an Administrator who is the same level as the officials of the Revenue Department and works out the rehabilitation and resettlement plans and for that purpose, conducts survey and monitoring.

Aside from the Administrator, the state government establishes the Land Acquisition and Rehabilitation Authority in order to provide speedy disposal of dispute relating to land acquisition, compensation, rehabilitation and resettlement. The head of the Authority is a presiding officer who is appointed by the State government. The Authority shall have the same power as civil court on land acquisition and rehabilitation, and only one organization to have original jurisdiction to adjudicate, excluding high court and makes an award within a period of six months after giving notice of the reference.

The procedure for land acquisition is carried out as follows:

a) Acceptance of application form for land acquisition by the state government
b) Social Impact Assessment (SIA) Survey
   - Completion within six months after the start of the survey
   - Survey contents: public purpose/number of affected and displaced families/affected lands/houses/common properties
c) Appraisal of SIA reports by expert group who are appointed by the state government
d) Approval by the state government on appropriateness of the SIA and public purpose for land acquisition
e) Provisional notification for land acquisition (Official gazette, newspaper, relating offices of city, town, and village, and web sites of relating agencies)
f) The Administrator conducts impact and census surveys for dwelling in acquisition lands
   - Working out of draft rehabilitation and resettlement plan based on impact and census survey
   - Publication of rehabilitation and resettlement plan
g) Conduct of public hearing
h) Review of draft rehabilitation and resettlement plan by the collector
i) Approval and publication draft rehabilitation and resettlement plan by the Commissioner
j) Declaration of land acquisition areas by the state government
k) Publication of declaration of land acquisition and rehabilitation and resettlement plan
l) Implementation of rehabilitation and resettlement award by the Collector
   - Rehabilitation and resettlement cost
   - House lands allocated to displacement families and their particulars
   - Particulars of lands allocated to displaced families etc.
     (Note: any person to have complaint to this award can appeal to the Authority.)

In addition, land acquisition cost includes all the followings:

a) Amount of compensation including solarium to the affected families determined by the Authority and court
b) Demurrage to be paid for damages caused to the land and standing crops in the process of acquisition
c) Cost of acquisition of land and building for settlement of displaced
d) Cost of development of infrastructure and amenities
e) Cost of rehabilitation and resettlement
f) Administrative cost for procedures of land acquisition

The procedures on land acquisition are shown in **Figure 7.12**.

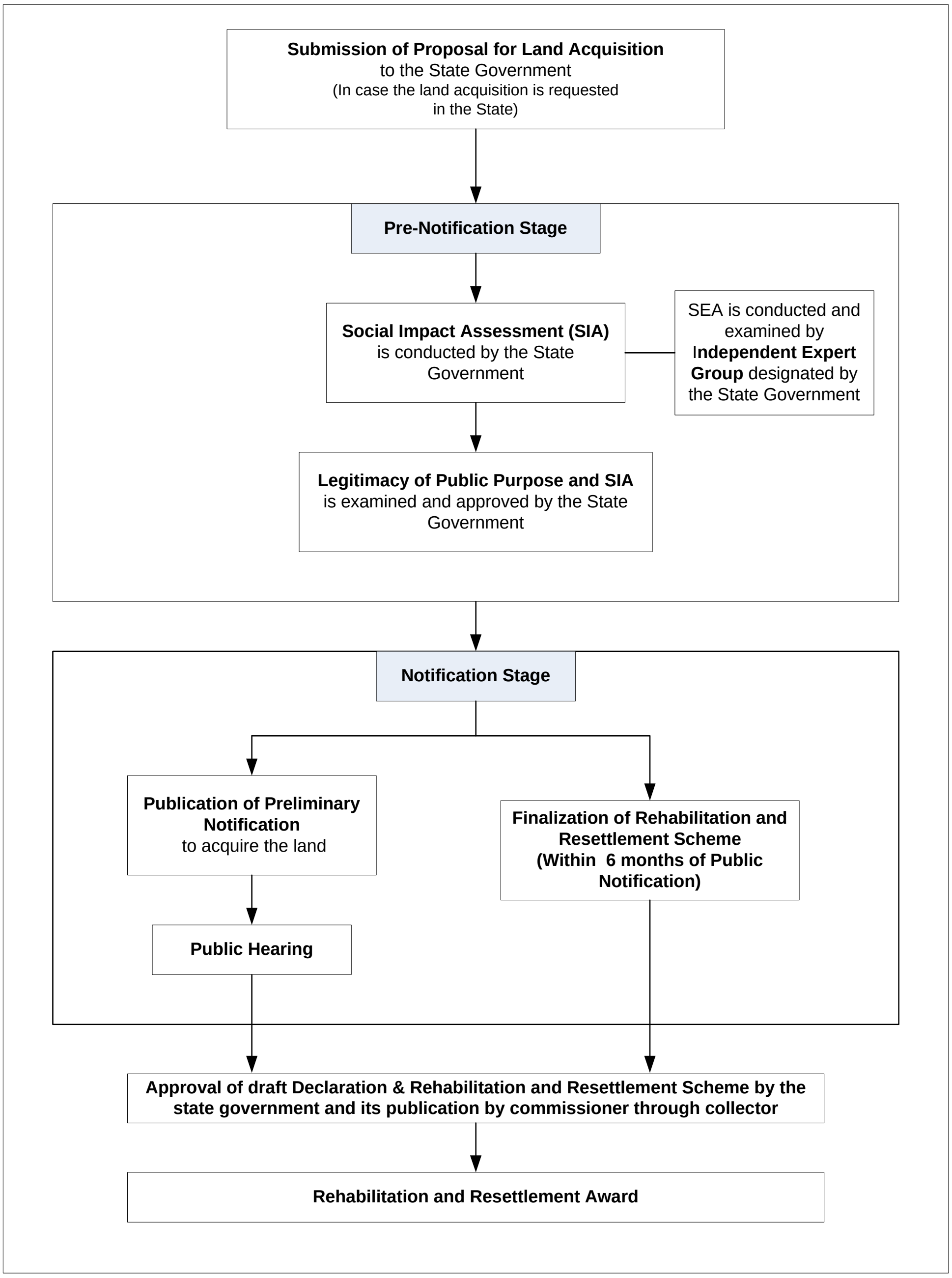


Figure 7.12 Procedure Flow for Land Acquisition

(2) Necessity of Land Acquisition for the Project

Proposed land sites for the Project are located at Chingkheiching hill in the east of Imphal City for the WTP and construction sites for distribution facilities such as overhead tanks and ground reservoirs are distributed in the city area. Construction sites for the WTP and distribution facilities are owned by the government and its transfer procedures need a period for one month. However, the procedures are comparatively simple because it is conducted by only agreement between governmental agencies, compared with compulsory land acquisition of private lands. Thus, Land Acquisition Act for acquisition of lands for the Project is not applied. **Table 7.19** shows the owners of proposed lands for the Project.

Table 7.19 List on Use Purpose for Proposed Lands for the Project and Land Owners

No.	Proposed Site for the Project	Facilities Contents	Land Owner
WTP site			
1.	Chingkheiching hill	WTP, Sun drying bed	State government
Distribution facilities' sites			
1.	Nempra Menjor Zone	OHT	PHED
2.	Sangaiprou Zone	OHT & GLSR	PHED
3.	Iron Pukhri Zone	OHT	PHED
4.	Chingthamleikai Zone	OHT	PHED
5.	Keishampat Zone	OHT	PHED
6.	Laimbung Zone	OHT	PHED
7.	Lilandolampak (Shift 1) Zone	OHT & GLSR	PHED
8.	Lilandolampak (Shift 2) Zone	OHT & GLSR	State government
9.	Minuthong	OHT	PHED
10.	Khuman Lampak	OHT	PHED
11.	Ningthepukhr	OHT	PHED
12.	Thumbuthong (Shift 1) Zone	OHT	State government
13.	Old Thumbuthong (Shift 2) Zone	OHT & GLSR	State government
14.	Prompat (Shift 1B) Zone	OHT	PHED
15.	Prompat (Shift 2B) Zone	OHT & GLSR	PHED
16.	Laiwangma (Shift 1) Zone	OHT & GLSR	PHED
17.	Laiwangma (Shift 2) Zone	OHT & GLSR	State government
18.	Sajor Leikai (Shift 1) Zone	OHT & GLSR	State government
19.	Sajor Leikai (Shift 2) Zone	OHT & GLSR	State government
20.	Ghari Zone	OHT & GLSR	PHED
21.	Khongman Zone	OHT & GLSR	State government
Sub-total		OHT (21 units) GLSR (11 units)	
Hill Top GLSR			
1.	Langing	GLSR (1)	PHED
2.	Langol	GLSR (2)	PHED
Sub-total		GLSR (3)	
Master R			
1.	MR 5	GLSR (1)	PHED
2.	MR 6	GLSR (1)	PHED
Sub-total		GLSR (2)	

(Note) OHT: Overhead tank, GLSR; Ground level service reservoir (for emergency), MR: Master Reservoir

7.5 Environmental Impact Assessment

Table 7.9 shows the survey results of environmental impact assessment.

Table 7.9 Survey Result of Environmental Impact Assessment

Category	No	Impact Items	**EIA at Scoping Time**		**EIA Based on Survey Results**		**Reasons for Evaluation**
			P-Const* U-Const*	Operating*	P-Const* U-Const*	Operating*	
Pollution Control	1	Air pollution	B-	D	B-	D	U-Const：Degradation of air quality is assumed with the operation of construction machines and vehicles. Operating：Degradation of air quality will not be caused because pumps and motors are usually operated by commercialized electric power.
	2	Water pollution	B-	B-	B-	B-	U-Const：High turbidity water discharged to river with rain water from hill slopes of bare lands is one time stored in a sedimentation pond and after sedimentation of turbidity substances, only its supernatant water is drained to river. Thus, though water pollution may be caused, its turbidity shall be significantly diminished. Operating: After completion of the WTP, if the slopes of bare lands are replanted, it is considered that water discharge with high turbidity shall be somewhat continued. However, as the rain water is discharged to river after sedimentation of turbidity matters in a sedimentation pond, water pollution may be caused only in diminished levels of turbidity.
	3	Waste	B-	B-	D	D	U-Const：Surplus soils which generate by land formation at the proposed WTP site is assumed to become about 750,000 m^3. The surplus soils were determined to be disposed to vacant area (25.46 ha) of Lamphel Pat STP owned by the PHED. In addition, surplus soils which generate at the laying works of transmission and distribution pipes is planned to be used as construction materials of roads by the Public Department. Operating: Sludge which generate at the operation time of the WTP is planned to be disposed to huge vacant areas (193 ha and 38.1 ha) of National Institute of Technology and Police Complex Station.
	4	Soil contamination	B-	D	B-	D	U-Const：Soil contamination which be caused by oil spill of construction machines is assumed. Operating：Adverse impact on environment

							is not assumed.
	5	Noise and vibration	B-	B-	B-	D	U-Const：Noise and vibration caused by construction works, operation of construction machines and vehicles are assumed. Operating：The result of noise levels calculated by noise equation at private school which is located in distance of about 150 m south of and beneath the planned WTP indicates that the noise issues are not caused, if a generator, blowers, and booster pumps are operated inside the concrete rooms and blowers with silencers. In addition, in the operation of booster pumps setting with OHTs and GLSRs, if the distance from the pumps to adjacent residences as about 10 m is assumed, the noise levels at nearby residences are below national standards and noise issues will not generate. However, in these cases, it is necessary to be operated in the conditions of closed doors and windows together with setting in concrete rooms.
	6	Land subsidence	D	D	D	D	Construction works which may cause land subsidence are not assumed.
	7	Bad odor	D	D	D	D	Operating：Facilities which cause bad odor are not assumed.
	8	Bottom sediment	D	D	D	D	U-Const：Though mud sedimentation may somewhat increase in the river due to discharge of high turbidity water from the proposed WTP site during construction stage, it will not affect the bottom sediment of river to a large extent because discharged water from construction site of the WTP is drained after one time stored in the sedimentation pond and, in addition, the current turbidity of river water is already very high Operating: Adverse impact to bottom sediment is not assumed.
Natural Conditionma	9	Protected area	B-	B-	B-	D	P-Const and U-Const：Since the proposed WTP forms a part of protected forest, the project proponent has to get forest clearance and pay reforestation fund or plan the transplantation of plants. In Imphal City area where distribution pipelines and elevated tanks and service reservoirs are constructed, there are no protected areas and national parks. Thus, adverse impact during construction stage is not assumed. Directorate of Environment and Ecology of Manipur State notified the PHED to identify the Yaral Pat wetland to be important habitat of migratory birds through Environmental Clearance as recommendation, and locating southwest side of and near the proposed WTP site. As the drainage for wetland is isolated to the Iril River flowing around the WTP site, the

							drainage water for construction site is deemed not to drain to the Iril River. However, the contractor must keep in mind not so as to drain the drainage water from construction site to the wetland. Operating: About 25 km south of Imphal City is Loktak Lake, declared as Ramsar Site, with the southern area designated as national park. All the rivers flowing in Imphal City area empty into the Lake. However, the operation of the completed WTP will not almost affect to ecology of the Lake because backwashing water including chlorine is one time stored in sun drying bed and residual water shall be discharged to river, and rain water from bare land with high turbidity is also once stored in a sedimentation pond and only supernatant water shall be discharged.
	10	Ecosystem	D	B-	D	D	U-Const: The proposed WTP site is located on the low hill covered by low and thin forest. Thus, there are no rare animals, and adverse impact is not assumed. The City area, excluding old palace (Kangla) located in the City center and designated as the protected area of plant and animals, is an urban area or cultivated and paddy fields. Thus, adverse impact against ecosystem is not assumed. Operating: Only residual water is drained to river after backwashing water is one time stored in sun drying bed. In the process, turbidity materials and chlorine are almost removed due to sedimentation to the drying bed's bottom and release to the air. In addition, high turbidity water which is drained with rain water from bare land is one time stored in a sedimentation pond and after removal of high turbidity matters, it is discharged to river. Therefore, the operating of the WTP does not affect adverse impact to the ecosystem of aquatic organism in river.
	11	Hydrology	D	D	D	D	Operating: Water source for the water supply for the project will be abstracted from Thoubal Dam, which is to be used for hydropower generation, irrigation and water supply. The dam is under construction and is located about 18 km away from the center of Imphal City and in the mountainous area. The intake amount for water supply is very small compared with storage capacity of the dam. Thus, adverse impact against hydrology is not assumed.
	12	Topography/geology	B-	D	B-	D	U-Const: The construction works of the project will change the topographic shape of the small hills with no residential houses because it includes large scale cutting of land and land arrangement with height difference of about 60 m. The geology of Manipur is of tertiary formations but the

							land cutting and the land arrangement of the hill will not affect its geology.
Social Environment	13	Resettlement	D	D	D	D	New water supply facilities such as water treatment plant and ground storage tanks etc. are to be constructed on public lands and distribution pipelines are installed along public roads. Thus, there will be no resettlement involved.
	14	Poverty group	D	D	D	D	Though a gap between the rich and the poor exists in Imphal City area, there is no poverty area like slum. Improvement of water supply conditions targets all the people of the City. Water supplied by the PHED will still be cheaper than that from private water vendors, giving positive impacts to the City's people.
	15	Ethnic minorities and indigenous people	D	D	D	D	Ethnic minorities, tribal and indigenous peoples are living in hilly areas around Imphal City. On the other hand, Imphal City area where the project targets is located in the flat alluvium plain. Several tribes such as Meitei/Pangal (Muslims)/Naga/Kuki/ Zomi/ Garkhali (Nepali) live in the city areas. However, all have equal rights, and water will be supplied under equitable conditions.
	16	Local economy of employment and livelihood	B+	B+	B+	B+	U-Const: Employment will increase with the implementation of construction works and positive impact for local economy is assumed. Operation: Number of the PHED's employees as operator of the new WTP is expected to increase as well. Thus, positive impact against local economy is expected.
	17	Land use and utilization of local resources	D	D	D	D	The project objective is to improve water supply system. It will not have much effect on land use and utilization of local resources.
	18	Water Use	D	B+	D	B+	P-Const. & U- Const: Water supply conditions in Imphal City area are in unsatisfactory conditions because of intermittent supply, and inadequate supply of treated water. Operating: Implementing the project will improve and have positive impact on the living conditions of the residents.
	19	Existing social infra and social service	B-	D	B-	D	U-Const：Roads may be dirtied by tires of construction vehicles with soils, and soils that fall from transporting equipment, materials and surplus soils. Operating：Only transportation vehicles for sludge, bleach powder, and coagulation chemicals occasionally pass the roads. It is not assumed to dirt the roads by dirtied ties with soils and to fall objects on roads..
	20	Social organization such as social capital and local	D	D	D	D	Water supply system forms a part of social infrastructure. Augmented water supply system will be operated and managed by the

		authority					PHED.
	21	Bias distribution of damage and benefit	D	D	D	D	The construction site for new WTP is located on small hill with no residential houses. There is no perceived special damage to the environment such as the generation of bad odor. On the other hand, the improvement of water supply conditions will provide benefits to the people. There will be no issues on bias distribution of damage and benefit.
	22	Conflict of interest in the project area	D	D	D	D	The project's water supply area covers the entire Imphal City area and there are no special water supply areas. Thus, the project will not generate conflict of interest.
	23	Cultural heritage	D	D	B-	D	U- Const: In the City area, there are 23 historical and cultural monuments and ruins. Prior to construction and pipe laying works, contractor shall survey their locations and If the monuments and ruins are located near the construction sites, the contractor shall inform the Directorate of Archeology of site conditions and carry out the works with carefully not so as to affect any damages against the monuments and the ruins. Operating: the operation of completed water supply system is not anticipated to affect any damages against the monuments and the ruins.
	24	Landscape	D	D	D	D	Main buildings for the project are the new WTP planned on slope of small hill with thin forest and no residential houses, and are ground reservoirs and elevated tanks located in urban areas. Planned facilities for new WTP are low in height compared with surrounded hill height and its periphery area, there are fairly high hills. On the other hand, as in the flat areas, there are public and private buildings with higher or similar heights with the elevated tanks. There is also, no recreation area which will be affected. Therefore, adverse impact on the landscape is not assumed.
	25	Gender	D	B+	D	B+	Operating: Water supply in the Imphal City is currently in bad condition and is intermittently operated, especially in the dry season which river run-off becomes very small. The inhabitants obtain domestic water by fetching stored water from ponds or buying water from water sellers. The project aims at improving water supply conditions by strengthening water supply capacity. Thus, it will have positive impact on women who fetch water for domestic use .
	26	Children's right	D	B+	D	B+	Operating: in the dry season with often intermittent water supply conditions, children help in fetching water for domestic use from ponds. The project will alleviate the children's tasks giving positive impact

							for children's right.
	27	Infectious diseases of HIV/AIDS	B-	D	B-	D	U-Const: A lot of construction workers from another states in India may come to construction sites in Manipur State. Thus, chances to be infected by HIV/AIDS may be increased. Operating: As health conditions of officials is managed by the PHED, risks to be affected by infectious diseases of HIV/AIDS shall be diminished.
	28	Work environment (Including safety control)	B-	D	B-	D	U-Const：It is necessary to make an arrangement for work environment (including safety control) of the construction workers. Operating：It is necessary to train operators for handling of operation equipment.
Others	29	Accidents	B-	B	B-	B	U-Const：It is necessary to make safety arrangement to avoid construction accidents and handling accidents of construction machines and vehicles, and to prevent falling down accidents of workers from high portion. As pipeline laying works are conducted at road sides of urban areas with heavy traffic and high population density, it is necessary to control traffic to avoid traffic congestion and to pay enough attention to pedestrians. Operating：It is necessary to make a plan and to implement for safety arrangement on handling accidents from operating equipment.
	30	Trans-boundary impact and climate change	D	D	D	D	U-Const： There is no trans-boundary impact. Operating：Implementation of the Project does not directly affect climate change. However, as operation of the new facilities consumes commercial electric power, the generator owned by commercial electric company will release bicarbonate to generate its consumable electrical charge to environment.

7.6 Adverse Impact and Mitigation Measures at Construction and Operation Stages

7.6.1 Adverse Impact and Mitigation Measures at Construction Stage

Adverse impact and mitigation measures at construction stage are shown in **Table 7.20**.

Table 7.20 Adverse Impact and Mitigation Measures at Construction Stage

No	Impact Items	Adverse Impact	Mitigation Measures	Responsibility and Supervising Organizations on Implementation of Mitigation	Defrayer of Implementation Cost and Its cost

				measures	
(1) Construction of the WTP at Chingkheiching hill.					
1.	Air pollution	Degradation of temporary air pollution by operating construction machines	• The contractor shall endeavor to use newer and smaller construction machines instead of second hand ones and should maintain the engines in good condition and to keep emission gas clean.	Responsibility organization: Contractor, Supervising organization: Consultant and the PHED	Cost defrayer: Contractor, Implementation cost is included in construction cost.
2.	Water pollution	Discharge of drain water to river including sand and soil from construction site generated by cutting /land formation of hilly area	• During construction work, discharged water including soils with rain water from bare lands shall be drained. • To avoid the inflow of discharged water with high turbidity including soils into river, the Project shall plan to put a sedimentation pond. • After completion of land formation works, the Project shall propose planting trees and grass and/or concrete spraying on bare lands to prevent soil discharge.	Ditto	Cost defrayer: Contractor, Cost for construction of a sedimentation pond and replanting are included in construction cost.
		Bare slope land generated by cutting/land formation of hilly area	• The Project proposes that the contractor conducts replanting immediately on bare slope lands. • In addition, the contractor shall plant grass on the original land slope where access roads are constructed and shall maintain ecological conditions to avoid corruption of slope land topography.	Ditto	Cost defrayer: Contractor, Replanting cost is included in construction cost.
3.	Waste	Disposal of surplus soil generated by cutting /land formation of hilly area	• Surplus soils shall be disposed in vast land area at sewerage treatment plant. • In the disposal site, land arrangement and compaction using bulldozer and road roller are planned.	Ditto	Cost defrayer: Contractor, Disposal cost of surplus soils is included in construction cost.
		Waste treatment of general wastes at construction sites and temporary camps	• The construction and its surrounding areas have to kept clean at all times. • Ordinary wastes will be disposed in disposal bins which are segregated as oil, general wastes, and hazardous wastes, and disposed to suitable landfill and sites.	Ditto	Cost defrayer: Contractor, Implementation cost is included in construction cost.
4.	Soil contamination	Soil contamination and pollution of discharged water by oil and grease and fuel	• Avoid setting up construction machines near flowing and drainage channels. • Store and dispose of grease safely • Clean storage sites of construction machines, and to avoid environmental pollution by fuel and oil spills.	Ditto	Ditto
5.	Noise and vibration	Noise and vibration pollution at construction time	• As there are two private schools with distances of about 500 m and 150 m from the WTP site and which are located in north and south sides of the site respectively. The levels of	Ditto	Ditto

			national noise standards are 50 dB in the daytime and 40 dB in the night time in the silent zone (school etc.) and fairly low. Thus, the contractor shall use small heavy construction machines and the construction works shall be conducted during the day time due to location of the dormitory school in the north side.		
6.	Ecosystem	Decrease of wildlife in construction area	• In case that the workers find wildlife during construction works on the hill area, they must ensure that the wildlife is captured without damage and release it in a similar environment. The contractor must let the workers to know this matter.	Ditto	Ditto
7.	Accidents	Generation risk of accidents of construction workers during construction works such as cutting, land formation, and construction works	• Contractor must decrease generation risk of construction accidents by thoroughly publicizing to the workers at the morning assembles every day on construction process, construction contents, danger areas, and no admission against construction sites without permission. In addition, the contractor must designate off-limits area where only authorized persons can enter by setting taping and signboards. • Contractor must prevent construction work accidents by arranging suitably work environment and organizing well construction equipment and materials.	Ditto	Ditto
		Traffic accidents inside the construction sites by transportation vehicles of surplus soils and construction machines	• To prevent traffic accidents by construction machines inside the construction site, two security guards shall be employed. The security guards will manage /control traffic at congestion points.	Ditto	Ditto
(2) Construction of Overhead Tank and Ground Reservoir, Laying Works of Transmission and Distribution Pipelines					
8.	Waste	Generation of surplus soils and road damage by transmission and distribution pipeline laying works	• Surplus soils generated by transmission and distribution pipeline laying works shall be put on the road side not so as to disturb traffic and after completion of the works, the surplus soils must be immediately disposed in suitable disposal sites. • In addition, in case of asphalt roads, after completing the works, sand and gravel shall be put in regulated depth and compacted on its ground surface	Responsibility organization: Contractor, Supervising organization: Consultant and the PHED	Cost defrayer: Contractor, Implementation cost is included in construction cost.

			and put asphalt on it, and the roads shall be reconstructed to the previous state.		
9.	Noise and vibration	Noise and vibration pollution at construction time	• Construction of overhead tanks and ground reservoirs and pipe laying works are conducted in the urbanized residential, commercial and silent zone areas of Imphal City. According to "the Noise Pollution Rules in 2000", noise limits is 65 dB in commercial area, 55 dB in residential area, and 50 dB in silence zone and they are very severe values. Thus, construction works shall be conducted only in the day time. • Support bases for overhead tanks and ground reservoirs shall avoid piling construction methods and instead, use concrete placement holes with depth of 15 m to 20 m by augers. • Contractor should use mobile generators, attached by silencers to reduce noise level. Vehicles and backhoe machines of small and newer types shall be used to prevent the generation of noise. • In the silent zones, the area including hospitals, education institutes, court, and worship facilities should be checked before starting the construction works, so as not to generate large noise.	Ditto	Ditto
10.	Cultural heritage	Protection of cultural and historical heritages and monuments	• There are no regulations for protection of cultural and historical heritages. However, pipe laying works near these areas shall be carefully done to avoid damage to the heritages. If there is a possibility of damage to the cultural/historical heritage, the contractor shall discuss with the Directorate of Archaeology, Art and Culture Department to select most appropriate construction method.	Ditto	Ditto
11.	Traffic Disturbance and accidents	Traffic Disturbance and Accidents at the time of laying works for transmission and distribution pipes	• At the road side of Imphal City area, during laying works of transmission and distribution pipelines, two security guards in each site shall be assigned to manage / control traffic and to ease congestion in the city areas. • In addition, the contractor prepares sign boards, safety fence, and night illumination and must control entering into the construction sites by pedestrians and traffic vehicles.	Ditto	Ditto
		Traffic accidents	• In the construction sites for overhead	Ditto	Ditto

		and work accidents at the construction time of overhead tanks and ground reservoirs	tanks and ground reservoirs, the contractor must prevent work accidents by putting up safety fences; and allocate two security guards at entrance and exit of general roads to prevent traffic accidents.		
(3) General Management Items for Construction Works					
12.	Air pollution	Fog and dust during construction works	• To avoid fog and dust caused by construction works and to conduct water spraying before or during construction works.	Responsibility organization: Contractor, Supervising organization: Consultant and the PHED	Cost defrayer: Contractor, Implementation cost is included in construction cost.
13.	Soil contamination	Road dirtied from soil adhering to construction vehicle tires; objects falling from transportation vehicles such as construction materials and surplus excavated soil	• There needs to be a system for picking up materials that fall from construction vehicles, especially if said materials are hazardous or may disturb traffic. This can be done by going around the routes twice a day just to ensure that roads are kept free of fallen construction materials and of dirt that adheres to construction vehicles' tires.	Ditto	Ditto
14.	Infection diseases of HIV/AIDS	Enhancement of generation risk of infection diseases of HIV/AIDS	• As inflow of construction workers may increase the risks of infection diseases such as HIV/AIDS. The contractor's supervisor shall instruct, guide and promote worker awareness of infectious diseases during the morning meetings.	Ditto	Ditto
15.	Work environment (Including safety control)	Safety control of construction workers	• All construction staff and personnel who enter into construction sites have to wear safety shoes and hats for construction works. Site manager of the contractor must remind all workers during the morning assembly regarding safety control and management of the construction sites. • In the construction sites where heavy machines for construction are operated, only authorized personnel shall be allowed to enter in.	Ditto	Ditto

7.6.2 Adverse Impact and Mitigation Measures at Operation Stage

Adverse impact and mitigation measures at operation stage are shown in **Table 7.21**.

Table 7.21 Adverse Impact and Mitigation Measures at Operation Stage

No.	Impact Items	Adverse Impact	Mitigation Measures (Environment Management Plan)	Responsibility and Supervising Organizations on Implementation of Mitigation measures	Defrayer of Implementation Cost and Its cost
1.	Water pollution	Discharge of drain water including sand and soils from bare slopes and grass establishment on lands exposed due to cutting and land formation from hilly area to river, together with corruption of hill slope.	Prevention of discharge of soils and sand by planting of trees and grass; clogging of ditches by general wastes and sedimentation of soils inside the WTP; and removal of sediments from the sedimentation pond.	Responsibility and implementation organization: the PHED	Cost defrayer: the PHED, O&M cost.
2.	Waste	Disposal of sludge generated in the WTP	Sludge is disposed at the National Institute of Technology and the Police Complex Station areas. The disposal land shall be arranged by leveling and compaction. .	Ditto	Ditto
3.	Ecosystem	Affection to ecosystem caused by bare lands of slope by land formation and land cutting	Subsequent to planting of trees and replanting of vegetation after completion of land formation, newly continues planting in bare lands with poor vegetation.	Ditto	Ditto
4.	Work environment (Including safety control)	Influence to health conditions of workers caused by leakage of chlorine gas	To prevent a risk of chlorine gas leakage, neutralization equipment in the WTP shall be installed. In addition, to ensure safety of workers at the time of leakage of chlorine gas, gas masks and safety gloves should be prepared. the PHED shall provide adequate training to the workers for work safety countermeasures at the time of leakage of chlorine gas.	Ditto	Ditto
5.	Accidents	Possibility of generation of accidents from handling operating equipment	Setting of equipment and trial operation are conducted under the control of experienced engineers of the contractor especially in the surrounding area where the equipment is located. If necessary, safety fences shall be installed. The contractor shall prepare operation manuals and will inform the workers of the required procedures.	Ditto	Ditto
		Generation of traffic accidents by passing through general roads in transporting sludge and chemicals to and from the WTP	The PHED must instruct the drivers transporting sludge and chemicals to drive carefully in general roads and at the entrance and exit of the WTP.	Ditto	Ditto

(1) Air Pollution Generated by Operation of Equipment

There will be no air pollution from operating the equipment of the WTP, excluding electric power failure.

7.7 Mitigation Measures Cost (Approximate Estimate) against Environmental Impact

As shown in "the Adverse Impact and Mitigation Measures at Construction and Operation Stage," the cost for implementation of mitigation countermeasure is limited to the construction of a sedimentation pond to prevent soil discharge with rain water, planting on bare lands in the WTP, construction of concrete rooms for noise prevention for standby generator and blower and pumps, attachment of silencer to blower, arrangement for disposal site of surplus soils, and employment of security guards at each construction site. Total cost is counted to be about ¥274,000,000 as shown below,

Table 7.22 Cost for Implementation of Mitigation Countermeasure

No	Mitigation Countermeasure	Contents	Implementation Cost
(1) Construction site of the WTP			
1	Construction of sedimentation pond to remove high turbidity component in drain water discharged from the WTP and sun drying bed.	A sedimentation pond of polygonal shape (long axis 5.3 m×7.3 m× Depth 5.0 m) at the corner of sun drying bed under the Chingkheiching hill is established and rainwater from the WTP is drained after collection by a side ditch, together with drain water from sun drying bed.	¥5,200,000
2	Preventing of soil discharge with rain water by planting and grass at bare lands from the construction of the WTP, sun drying bed, and access roads.	Soil discharge from bare lands is prevented by replanting of trees and grass.	¥1,400,000
3	Prevention of noise issues generated by the operation of standby generator, blower, pump at the WTP	A standby generator and pump are installed in concrete rooms and the blower is attached with a silencer in order to reduce noise level.	Concrete rooms ¥19,500,000 Silencer ¥500,000
4.	Measures for work and traffic safety inside the WTP	During the construction period of the WTP, two security guards to control traffic for work safety will be employed. Construction period: 36 months×2 persons	¥803,000
5.	Preventing disruption of accumulated disposal surplus soils at disposal site	In the disposal site of surplus soils, bulldozers for land leveling and road rollers etc. for land compaction are used.	¥200,000,000
(2) Construction sites of OHTs and GLSRs, laying places of transmission and distribution pipelines			
6.	Traffic and work safety control on the roads at places where transmission and distribution pipes will be laid	Laying of transmission pipelines is conducted by 15 construction teams within 60 months. Each team will have two security guards. Laying of distribution pipelines is conducted by seven construction teams within 60 months. Each team will have two security guards.	Employment cost for transmission pipe laying works. ¥20,077,000 Employment cost for distribution pipe laying works. ¥9,369,000
7.	Traffic and work safety control at entrance and exit of OHTs and GLSRs construction sites for construction vehicles	Construction of OHTs and GLSRs a) OHT+GLSR: 11 sites × const. period, 36 months b) only OHT: 10 sites×const. period, 24 months c) MR: 1 site×const. period, 24 months (other one site does not include because it is conducted as a part of rehabilitation works.) d) Hill top GLSR: 3 sites × const. period, 36 months Two security guards are allocated in each construction team.	a) ¥8,833,000 b) 5,353,000 c) ¥535,000 d) ¥2,409,000
	Total		¥273,979,000

7.8 Environmental Management Plan (Implementation Organization, Methodology, Cost, etc.)

(1) Environmental Management System at Construction Stage

The Project will construct the following facilities – a WTP in a part of Chingkheiching hill slope, transmission pipelines from the WTP to Imphal City area with the total length of about 47 km, 21 OHTs, 11 GLSRs for emergency supply to OHTs at the time of stoppage of transmitted clean water, three GLSRs, two MRs, and distribution pipelines with total length of 669 km.

1) Implementation organization of project implementation unit, PHED

As project scale is large, construction works are planned to be contracted out to several contractors. On the other hand, the project implementation unit (PIU) of the PHED is proposed to be established in order to comprehensively supervise the implementation of the Project.

In the PIU, an environmental and social consideration specialist equal to project engineer class is proposed to be allocated as a full-time officer, to review monitoring reports submitted from the consultant and contractors, and inspect site situations. In addition, he shall be supported by an assistant specialist. They will collaborate with the consultant and thoroughly let contractors know the compliance items for environmental management and monitoring parameters.

2) Implementation organization of consultant

The construction sites are divided into the WTP, and distribution facilities, with the sites are distributed across a wide area, with several contractors simultaneously carrying out the construction works. The project will have two persons – a chief and an assistant consultant. The consultant shall inform the contractors of environmental management factors, monitoring parameters, and work safety management items, and its details. The consultant will set meetings with the contractors at least one per week or as necessary, and he discusses with the contractors environmental and work safety management. In addition, he will receive monitoring reports from each contractor and review and submit them to the environmental and social consideration specialist of the PIU, the PHED together with the consultant's opinions and instructed items to the contractors. At least, once a week, he will inspect each construction site and site conditions on environmental and work safety management items and if there are unsuitable facts, he quickly calls site managers of contractors and recommend making required changes.

3) Implementation organization of contractor

Each contractor will submit the documents complete with the name of and the contact manners with the representative of the contractors and full-time site supervisors to the consultant. The representative has the overall responsibility of the construction works and site supervisors have the actual responsibility of supervising site works. The site supervisor must collect construction workers and thoroughly instruct them on environmental and work safety in the meetings before the start of the construction works or if necessary, on a regular basis. In addition, the site supervisors will select one environmental and work safety manager from the engineers who will check environmental and work safety conditions of the sites and make monitoring reports. The site supervisors will inspect the sites and unsafe places and construction practices must be shared / reported to the environmental and work safety manager. In addition, they let the workers know environmental and work safety information through regular meetings as a countermeasure.

In the WTP site, several construction works such as access roads, sun drying bed, and the WTP will be carried out simultaneously in narrow areas, therefore, efficient and adequate supervising system must be implemented. The site supervisors and the environmental and work safety managers will discuss the extent of measures to be undertaken and instruct the two security guards on traffic control and management as well as work safety points to avoid and mitigate causes of accidents.

In the pipe laying works, at the sites where traffic is congested in Imphal City area, the contractor must pay attention not to cause traffic accidents. The site supervisors must close road sides and put safety fences in areas where pipe laying works are undertaken and allocate two security guards during construction period and control vehicles and pedestrians. In the nighttime, night illumination must be set to lessen the probability of accidents.

In the construction works of overhead tanks and ground reservoirs, the works will be carried out in very narrow site areas. Thus, two security guards must be allocated at the entrance and exit from construction sites to ordinary roads to control traffic at the entrance and exits of the sites and inside the site.

Furthermore, in the construction sites, the contractor must put safety fences and safety signage and construction workers must put safety shoes and hats or helmets and other safety gear for work safety.

In complaint management such as noise issues, during construction period, the contractor shall put up a sign board indicating the project name, construction schedule, and name of contact persons at construction sites, and notify residents so if there are complaints from residents, the site supervisors can directly be contacted residents by telephone or other ways. In that countermeasure, the site supervisors should discuss with the contractor's representatives and consultant how to solve the construction-related issues. **Figure 7.13** shows the environmental management system of the construction sites.

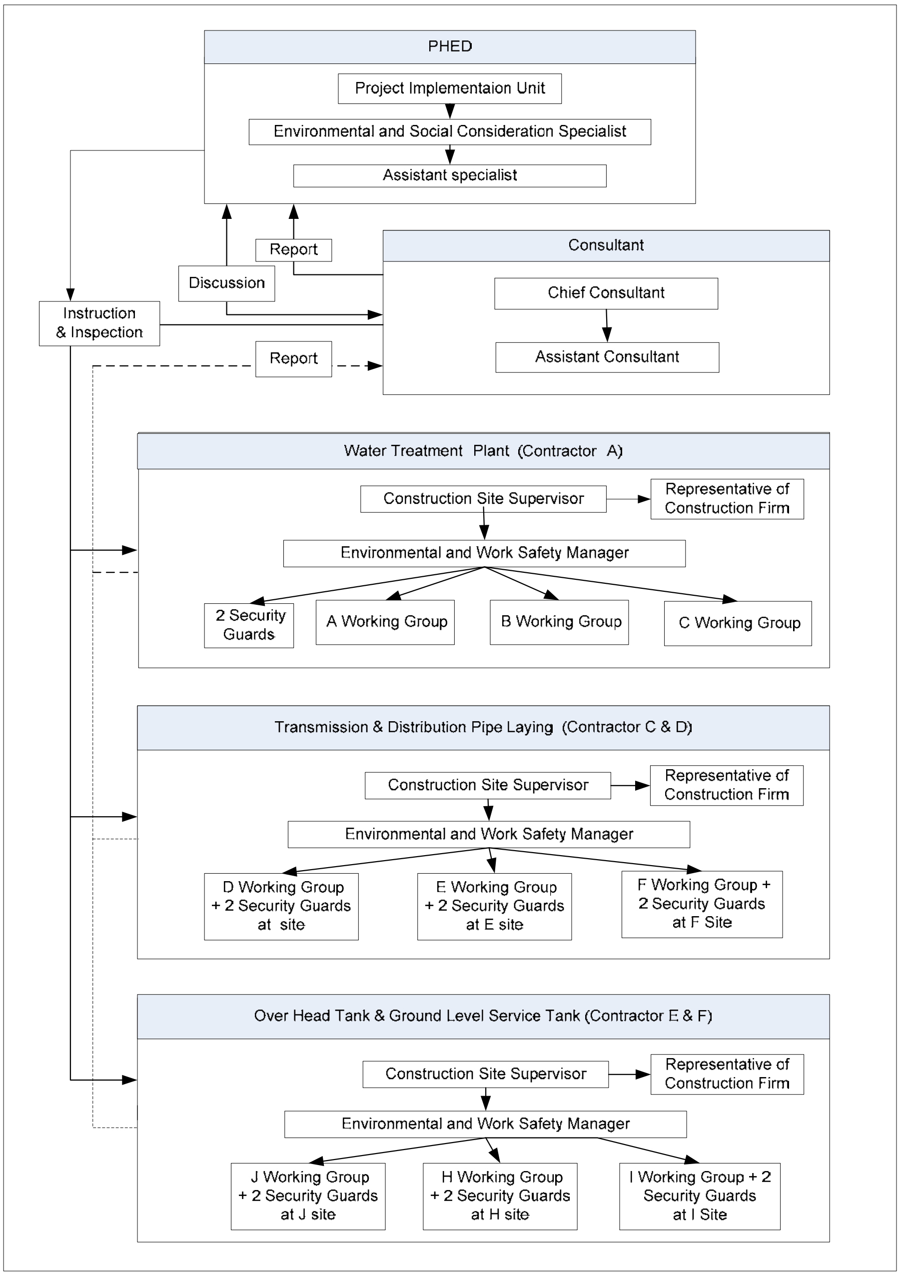


Figure 7.13 Environmental Management System at Construction Stage

(2) Preparation of Concrete Site Environmental Management Plan

Before the start of construction works, the contractor must submit the site environmental management plan (EMP) to the consultant. The consultant shall return it after approval or with request of modification after which the contractor must finalize it. The final site EMP must be submitted to the environmental and social consideration specialist of the PIU, the PHED, and be approved by the officer. The contents of the concrete site EMP are shown in **Table 7.23**.

Table 7.23 Preparation of Concrete Site EMP

No.	Environmental Issue	Mitigation Measure	Implementer	Cost shoulder
(1) Construction Works of the WTP				
1.	Land formation and cutting of hilly area, and generation risk of working accidents at construction works	Preparation of the concrete EMP and work safety management plan on countermeasures against dangerous places to workers for each construction work, together with construction drawings, plans, and schedules. (In order to keep work safety of workers, the contractor thoroughly let workers know on working process, construction contents, dangerous area, no visitors to enter into construction area, and clearly specifies by sign boards and cordon tapes, and always arrange construction materials and equipment and work environmental conditions to prevent work accidents.)	Contractor	Contractor
2.	Soil discharge with rain water at bare lands generated for construction of the WTP, sun drying bed, and access roads.	Rainwater of land formation area is drained to a sedimentation pond through side ditches and finally drain to the river. Preparation of construction schedule plan of temporary and permanent side ditches and sedimentation pond.	Contractor	Contractor
3.	Bare slope land generated by cutting and land formation of hilly area and adverse impact to ecology	Preparation of planting plan together with construction schedule of access roads, the WTP, and sun drying bed. In addition, implementation plans consisting of the transplanting of original trees at the WTP site, and the planting of other trees and grass, and the countermeasures in case that workers find and capture animals in construction sites shall be worked out.	Contractor	Contractor
4.	Noise and vibration pollution at construction time	There are hardly any residential houses in the surrounding area and noise level during construction works is assumed not to be a big problem. But since two private schools are located about 500 m in the west side on the hill and about 150 m in the south and beneath of the WTP, newer and smaller types of construction machines are recommended for use. Preparation of concrete EMP in case that the complaint comes to the contractor.	Contractor	Contractor
5.	Traffic accidents inside the construction sites by vehicles transporting surplus soils and construction machines	Preparation of the concrete EMP on construction site drawings, schedules for each works, heavy construction machines and their number, setting of safety fences, allocation point of security guards, and confirmation items	Contractor	Contractor
6.	Treatment of general wastes at construction sites and temporary camps	Preparation of concrete waste treatment method/plan including waste segregation methods, collection method, collectors, disposal site	Contractor	Contractor
7.	Soil contamination and pollution of discharged water by oil and grease and fuel	Preparation of the concrete EMP for prevention of soil contamination by oil etc. and pollution of drain water from construction works	Contractor	Contractor
(2) Construction Works of OHTs and GLSRs, Laying Works of Transmission and Distribution Pipelines				
8.	Noise and vibration pollution at construction time	As the construction works are carried out in the urbanized area, construction shall be undertaken during day time. In addition, if the contractor uses mobile generators, they must be attached to silencers to reduce noise level. Vehicles and backhoe machines of small and newer types shall be used to prevent generation of noise. Preparation of concrete EMP including working hours and schedule of construction, used construction machines.	Contractor	Contractor

9.	Traffic disturbance and accidents at the time of pipe laying	Preparation of the concrete EMP on the drawings of pipe laying roads, construction road span, work schedule, arrangement plan, setting of safety fences and sign boards for construction works and safety boards	Contractor	Contractor
10.	Traffic accidents and work accidents at the construction time of overhead tanks and ground reservoirs	Preparation of the EMP and work safety plan on drawings of construction sites, work hours per day, arrangement plan of security guards, setting of safety fences, and sign boards for no visitors at the construction sites etc.	Contractor	Contractor
11.	Generation of surplus soils and road damage caused by transmission and distribution pipe-laying works.	Preparation of the EMP on surplus soils generated by transmission and distribution pipe-laying works which should be put on the road side not so as to disturb traffic and after completion of the works, surplus soils must be disposed in suitable disposal sites as soon as possible. In addition, in case of asphalt roads, after completion of works, sand and gravel shall be put in regulated depth and compacted on its ground surface and the roads shall be reconstructed to the previous states.	Contractor	Contractor
12.	Protection of cultural and historical heritages and monuments	In case that there are cultural and historical heritages near the construction sites, prior to the implementation of construction works, the contractor shall make drawings which show their locations and construction sites, and make the EPM. If the construction works damage any cultural and historical heritages, these shall be reconstructed by the contractor at his own cost.	Contractor	Contractor
(3) Common Items on Management of Construction Works				
13.	Temporary pollution degradation of air quality by operating construction machines	Preparation of the EMP to prevent air pollution by using newer machines with good O&M conditions	Contractor	Contractor
14.	Infection diseases of HIV/AID	Preparation of method to thoroughly let workers know how to avoid infection diseases such as HIV/AIDS	Contractor	Contractor
15.	Work safety control of construction workers	Preparation of work safety management plan for construction workers such as construction schedules, work contents, no visitors in areas of heavy construction machines, putting safety hat and shoes, setting of safety fences, arrangement of construction materials, and urgent action plan in case of accidents	Contractor	Contractor
16.	Fog and dust during construction works	Preparation of concrete prevention measures of fog and dust during construction works	Contractor	Contractor
17.	Roads dirtied by tires of construction vehicles, and picking up system of objects that fall from vehicles transporting equipment, materials and and surplus excavation soils	Preparation of concrete countermeasures plan for fallen objects from vehicles during transportation and dirtied roads caused by dirty tires with wetted soils at laying sites for transmission and distribution pipelines and land formation area	Contractor	Contractor

7.9 Monitoring Plan

Adverse impacts at construction and operation stages and monitoring plan for environmental protection are shown in **Table 7.24**. Monitoring results should be recorded and stored by format papers.

Table 7.24 Monitoring Plan for Environmental Countermeasure at Construction and Operation Stages

No	Adverse Impact	Monitoring Parameters	Monitoring Locations	Monitoring Manners	Frequency	Monitoring Implementer and monitoring cost's defrayer
(1) Construction Stage						
1.	Discharge of drain water with high turbidity at the time of cutting and land formation of hill slope	Clogging of side ditches at the WTP site	Side ditches	Physical observation	During construction Once/day	Implementer: Contractor, Cost defrayer: Contractor, Monitoring cost includes in construction cost.
		Removal of soils from the bottom of sedimentation pond	Sedimentation Pond	Physical observation	During construction Once/week	Ditto
		Water quality analysis of discharge water (pH, Turbidity)	Discharge point from sedimentation pond	Chemical analysis (Analysis equipment is included the project plan.)	During construction Once/day	Ditto
2.	Degradation of temporary air quality by operating construction machines	Odour of emission gas from construction machines	All construction sites	Physical observation	During construction Once/day	Ditto
3.	Soil discharge with rain water from slope of bare lands and collapse at WTP site	Replanting and planting conditions	WTP site	Physical observation	During construction Once/week	Ditto
4.	Disposal of surplus soils and general wastes at construction sites and labour camps	Keeping safety and sanitary dumping sites	Disposal sites of surplus soils and general wastes	Physical observation	During construction Once/week	Ditto
5.	Soil contamination water pollution by oil, grease, and fuel	Soil contamination of ground surface and pollution of discharge water by oil, grease, and fuel	All construction sites	Physical observation	During construction Once/week	Ditto
6.	Noise and vibration at construction stage	Noise and vibration	All construction sites	Complaint by people	During construction	Ditto
7.	Safety control of construction workers	Safety management rules and wearing of safety gear	All construction sites	Physical observation	During construction Once/week	Ditto
8.	Generation risk of accidents at entrance and exit gate and at the inside the	Adequate safety traffic control manners	Entrance and exit gate to ordinary road, inside the	Physical observation	During construction Twice/week	Ditto

	construction sites of the WTP, OHTs, and GLSRs by construction vehicles.		construction sites			
9.	Road sites for pipeline laying works	Adequate safety traffic control manners	Road sections of pipeline laying works	Physical observation	During construction Twice/week	Ditto
10.	Fog and dust during construction works	Fog and dust	All construction sites	Complaint by people	During construction	Ditto
11.	Dirtied roads by adhering tires of wetted soils, and fallen objects by vehicles for transportation of equipment and materials and surplus excavation soils	Overloading, appropriateness of loading manners, dirty grade of vehicles' tires	All construction sites	Physical observation	During construction	Ditto
(2) Operation Stage of Facilities After Completion						
1.	Discharge of drain water with high turbidity at the time of cutting and land formation of hill slope	Clogging of side ditches at the WTP site	Side ditches	Physical observation	Once/day	Implementer & defrayer: the PHED, Monitoring cost includes in O&M cost.
		Removal of soils from the bottom of sedimentation pond	Sedimentation Pond	Physical observation	Once/week	Ditto
		Water quality analysis of discharge water (pH, Turbidity)	Discharge point from sedimentation pond	Chemical analysis (Analysis equipment is included the project plan.)	Once/day	Ditto
2.	Generation risk of accidents by handling of operation equipment	Proper coaching by experienced engineers	Facilities of WTP and for Distribution	Physical observation	Especially, during trial operation	Ditto
3.	Sludge disposal generated at the WTP	Keeping safety and sanitary dumping sites	Disposal sites	Physical observation	Once/week	Ditto
4.	Soil discharge with rain water from bare lands and slope collapse at WTP site	Replanting and planting conditions	WTP site	Physical observation	During construction	Ditto
5.	Effect on health conditions of workers caused by chlorine gas leakage	Training by using manuals and experienced engineers	WTP's chlorine gas and neutralization facilities	Physical observation	Once/half year	Ditto
6.	Vehicular accidents in transporting sludge and chemicals when passing through ordinary roads	Adequate safety traffic control manners	Entrance and exit gate to ordinary road, inside the WTP	Physical observation	At the time of running of transportation vehicles	Ditto

(1) Preparation of EMP Report

The contractor will works out and keep environmental and work safety reports including environmental and work safety management systems, with daily or weekly inspection items and submit these reports to the consultant. The consultant will approve these with comments and compile these every month for submission to the PHED. The PHED reports its contents to related agencies, if necessary and if their agencies' inspectors inspect the site, the PHED will explain the situation based on the reports. In addition, the PHED must submit the reports to the JICA India Office every three months during the construction stage and every six month during the operation stage for a period of two years.

(2) Environmental Management Cost

The PIU will employ one chief environmental and social consideration specialist and one assistant specialist during construction period. This is because there are several construction sites where construction will be simultaneously on-going.

During the construction period, the WTP contractor will employ one environmental and work safety manger and also employ two security guards for traffic control and work safety.

In the laying work sites of transmission and distribution pipelines, there will be two main contractors and a total of nine construction teams in the period of 60 months. Two security guards will be allocated for each construction team.

There will be two contractors for the overhead tanks and ground reservoirs to be constructed by 25 construction teams and the construction period is estimated to be from 24 to 36 months. Two security guards will be allocated for each team.

In addition, at operation stages after the completion of facilities, as the facilities almost has no impact to environment, the PHED's managers or operators will be the ones to conduct environmental management including environmental audit as routine works.

Table 7.25 shows environmental management cost (Approximate estimation). Environmental management cost is estimated to be ¥57,415,000.

Table 7.25 Environmental Management Cost (Approximate Estimation)

No.	Cost Item	Contents	Cost
1.	Employment of assistant environmental management supervisor	Employment cost of an assistant specialist of consultant; Construction period 60 months (*)	¥1,561,000
2.	Employment of an environmental and work safety manager and two security guards for traffic control and work safety by Contractor for construction of the WTP	(1) One contractor, employment of one environmental and work safety manager, construction period: 36 months (2) Employment of two security guards for traffic control and work safety, construction period : 36 months	(1) ¥1,338,000 (2) ¥803,000
3.	Employment of an environmental and work safety manager for each contractor and two security guards for each working team for laying of transmission and distribution pipelines.	(1)Two contractors, employment of one environmental and work safety manager, construction period: 60 months (2) Employment of two security guards for traffic control and work safety to each transmission pipeline laying team, total of 15 teams, construction period for laying of transmission pipelines: 60 months (2) Employment of two security guards for traffic control and work safety to each distribution pipeline laying team, total of 7 teams, construction period : 60 months	(1) ¥4,461,000 (2) ¥20,077,000 (3) ¥9,369,000
4.	Employment of an environmental and work safety manager by each contractor and two security guards for each working team for construction of overhead tanks and ground reservoirs.	(1)Two contractors, employment of one environmental and work safety manager, construction period: 36 months (2) Employment of two security guards for traffic control and work safety to each construction team, construction period: 24 to 36 months a) OHT & GLSR: 11 construction teams construction period: 36 months b) OHT only: 10 construction teams construction period: 24 months c) MR: 1 construction team, construction period: 24 months (Other MR is not included because it is constructed as a part of rehabilitation of the existing WTP.) d) Hill Top GLSRs: 3 construction teams construction period: 36 months	(1) ¥2,676,000 (2)¥17,130,000 a) ¥8,833,000 b) ¥5,353,000 c) ¥535,000 d)¥2,409,000
		Total	¥57,415,000

（Note）Environmental and work safety supervisor of the PIU, PHED is not included due to application by the budget of the PHED.
(*) As chief consultant is originally counted as project supervisor, this cost does not included.
Above cost indicates net environmental management one except VAT etc.
(Exchange rate) 1 Rs = ¥2.08 (JICA exchange rate = average value during July to May, 2014)

7.10 Others (Global issues, etc.)

The Project purpose is to construct the WTP, transmission and distribution pipelines, and distribution facilities of OHTs and GLSRs. The implementation of the project does not directly affect to climate change. Consumable electric charge is estimated to be 51.9 KWh by setting of blower and pumps at the WTP and booster pumps at GLSRs with OHTs and is assumed to indirectly release bicarbonate gas corresponding to its electric charge to the atmosphere.

Its bicarbonate gas is estimated to become about 33.9 CO_2 ton/month, and about 406 CO_2 ton/year.

(Note: released bicarbonate gas amount is estimated by using "Appendix table CO_2 emission coefficient of grid electric power of each country (India 0.906 t CO_2 e/MWh) of IPCC Guidelines for National Greenhouse Gas Inventories in 2006."

Table 7.26 Power Consumption of Planned Water Supply Facilities

No	Equipment	Motor (KW)	Quantity	Total KW	Operating hour/day	KWh
(1) Equipment at WTP						
1	Air blower	55 KW/Unit	1 (operating)	55	1 hrs/day	2.3 KWh
2	Blower	37 KW/Unit	1 (operating)	37	6 hrs/day	9.3 KWh
3.	Plant water pump	5.5 KW/Unit	1 (operating)	5.5	24 hrs/day	5.5 KWh
4.	Wash waste pump	22 KW/Unit	1 (operating)	22	12 hrs/day	11 KWh
5.	Sludge mixer	1.5 KW/Unit	1 (operating)	1.5	24 hrs/day	1.5 KWh
6.	De-sludge pump	11 KW/Unit	1 (operating)	11	12 hrs/day	5.5 KWh
(2) Equipment at OHTs and GLSRs						
7.	Booster Pump	11 KW/Unit	5 (5 sites)	55	0.07 hrs/day	3.9 KWh
8.	Booster Pump	15 KW/Unit	3 (3 site)	45	0.07 hrs/day	3.2 KWh
9.	Booster Pump	18.5 KW/Unit	1 (1site)	18.5	0.07 hrs/day	1.3 KWh
10.	Booster Pump	30 KW/Unit	1 (1site)	30	0.07 hrs/day	2.1 KWh
11.	Booster Pump	90 KW/Unit	1 (1site)	90	0.07 hrs/day	6.3 KWh
Total						51.9 KW

(Notice) Daily power consumption was calculated by daily based average one on basis of operating hours.

7.11 Monitoring Form

The latest results of the below monitoring items shall be submitted in the lenders (JICA India Office) as part of Progress Report throughout the construction phase every three months.

Construction phase

1.Monitoring Plan

No	Monitoring Factor	Monitoring Place	Monitoring Results	Countermeasure
1.	Clogging of side ditches at the WTP site	Side ditches		
2.	Removal of soils from the bottom of sedimentation pond	Sedimentation pond		
3.	Water quality analysis of discharged water (pH, Turbidity)	Discharge point from sedimentation pond		
4.	Odour of emission gas from construction machines	All construction sites		
5.	Replanting and planting conditions and hill slope collapse	The WTP site		
6.	Keeping safety and sanitary dumping sites	Disposal sites of surplus soils and general wastes		
7.	Ground and discharge water contamination by oil, grease, and fuel	All construction sites		
8.	Noise and vibration	All construction sites		
9.	Safety control of construction workers	All construction sites		
10.	Adequate safety control manners at construction sites of WTP, OHT, GLSR and Pipeline laying sites	Entrance and exit gates to ordinary roads, and inside the construction sites		
		Road section of pipeline laying works		
11.	Fog and dust	All construction sites		
12.	Overloading, appropriateness of loading manners to transportation vehicles, dirty grade of vehicles tires.	All construction sites		

The latest results of the below monitoring items shall be submitted in the lenders (JICA India Office) as part of Progress Report throughout the construction phases every six month up to two years.

Operation phase

2. Monitoring Plan

No	Monitoring Factor	Monitoring Place	Monitoring Results	Countermeasure
1	Clogging of side ditches at the WTP site	Side ditches		
2.	Removal of soils from the bottom of sedimentation pond	Sedimentation pond		
3.	Water quality analysis of discharged water (pH, Turbidity)	Discharge point from sedimentation pond		
4.	Generation risk of accidents by handling of operation equipment	Facilities for the WTP and distribution		
5.	Keeping safety and sanitary conditions at sludge dumping sites	Disposal sites		
6.	Replanting and planting conditions and hill slope collapse	The WTP site		
7.	Training by using manuals and experienced engineers for leakage chlorine gas	The WTP's chlorine gas and neutralization facilities		
8.	Adequate safety traffic control manners for transportation vehicles of sludge and chemicals	Entrance and exit gate to ordinary roads, and inside the WTP		

7.12 Environment Check List

Table 7.27Environment Check List

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country' government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA report, does the conditions satisfied? (d) Aside from the above EIA report, are the project required to acquire necessary approvals and licenses on the environment from relating authorities?	(a) N/A (b) N/A (c) N/A (d) Y	(a) The Project received Environmental Clearance (EC) from Directorate of Environment and Ecology dated on October 10, 2014. According the EC based on the EIA Notification (S.O. 1533) in 2006, the Project does not need the EIA procedures. (b) It is not applicable due to the above reason. (c) It is not applicable due to the above reason. (d)The WTP for the project is proposed to be constructed on small hill in a part of Nongmaiching Reserved Forest, thus Forest Clearance will be requested from the Ministry of Environment, Forest, and Climate Change of Central Government. This procedure will be required after the receipt of the EC on October 10, 2014. The PHED conducted through an online application for Forest Clearance to the Ministry on October 27, 2014. The entire procedure / period will take about two month.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the local stakeholders? (b) Have the comment from residents reflected to project contents?	(a)Y (b) Y	(a) Stakeholder meeting was held at conference room of the Imphal Hotel on October 22, 2014. The project was thoroughly explained such as construction of the WTP on a part of Chingkheiching hill, 21 Over Head Tanks (OHTs), 11 Ground Level Service Reservoirs (GLSRs), two Master Reservoirs (MRs), three Hill Top GLSRs, Transmission Pipeline of 47 km, and Distribution Pipelines of 669 km. In the construction of the WTP, surplus soil of 750,0001 m^3will be generated. Disposal of the surplus soils and discharged water with high turbidity may generate environmental issues. In the construction of pipe laying and OHTs and GLSRs, works will be carried out in the urbanized town area which may cause traffic congestion, accidents and noise problems. In the stakeholder meeting, environmental impact and mitigation measures were explained to the stakeholders. As the result, the project obtained a measure of understanding from the local stakeholders. (b)Main inquiries from stakeholders were on the general contents of water supply conditions of Imphal City, the outline of the project contents, water tariff, and willingness to payment. There were no inquiries relating directly to project implementation. Thus, the comments from residents were somewhat related to project contents.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a)There are no alternatives considering that the scale of each distribution facility is small and their locations are determined by the demand of water zones, topography, and ease of acquisition of proposed lands. Thus, alternative plans of the WTP which has large impact / land area were examined. (A Plan): Zero option where the WTP will not be constructed; (B Plan): Where the construction of the WTP will be in the lowland area of Imphal City area; (C Plan): Where the construction of the WTP will be a part of the Chingkheiching hill. These three plans were examined based on environment and social consideration, including supply conditions, ease of land acquisition, O & M cost, and construction cost. As a result, C Plan was judged to have the highest appropriateness for project implementation, as compared with the other options.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a)Y (b) N/A	(a) Air pollution caused by leakage of chlorine gas is a remote possibility in the future. But countermeasures must be planned. In, "adverse impact after completion of the WTP and mitigation measures" the installation of neutralization facility and training of personnel on procedures if chlorine gas leakage happens are proposed. Thus, mitigation measures are prepared. (b) Chlorine gas does not generally leak. The leakage of chlorine gas is very rare case. Thus, it is not applicable.
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) N/A	(a) The WTP system will not discharge effluent with high SS to the river because backwashing water is discharged to the sun drying bed and the residual water is discharged to the river after sedimentation in a pond to remove high turbidity including sludge. The raw water from Thoubal river does not contain high BOD and COD, actually less than the Indian effluent standards.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(3) Waste	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) Sludge amount generated in the backwashing process of filters of the WTP is 3,460 kg/day. The sludge will be disposed in the vast vacant area of National Institute of Technology (193 ha) and Police Complex Station (38.1 ha) or will be used as road construction materials for the Department of Public Works. The sludge is disposed to their sites in compliance with Indian regulations.
	(4) Noise & Vibration	(a) Do noise and vibrations generated from the facilities, such as pumps comply with the country's standards?	(a) Y	(a) Noise level generated by generators, blowers, pumps at the WTP and distribution facilities of OHTs and GLSRs are within the national noise standards. The Project will not have any noise issues. The WTP is constructed on a part of Chingkheiching hill and there are no residential houses around the proposed WTP area. There is a school 150 m on the lower land south of the proposed WTP, but generator equipment will be located in concrete rooms and silencer is attached in blower to reduce noise level. The booster pumps at the OHT and the 11 GLSR sites are also set in concrete rooms to reduce noise level. Assuming that the distance of these pumps to neighboring houses is about 10 m, the facilities however face the general direction of the roads. All operating conditions were examined and noise calculations were made. The conclusion is that no noise problems will be generated.
	(5) Land Subsidence	(a) In case of extraction of a large volume of groundwater, is there possibility that the extraction of groundwater will cause land subsidence?	(a) N	(a) Land subsidence will not happen because water supply source for the proposed WTP is the river water from Thoubal Dam and large volume of groundwater is not going to be extracted.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance for rebuilding the livelihood of involuntary resettlement' residents given in advance? (c) Are resettlement plans including recovery of livelihood base after resettlement, compensation by requisition price of lands and houses established with the survey for resettlement? (d) Does the payment of compensation fee conducted prior to resettlement? (e) Are the compensation principals shown in written document? (f) Of involuntary resettlement residents, does the resettlement plans properly consider vulnerable groups, especially, females, children, elderly people, poverty groups, ethnic minorities, and indigenous people etc.? (g) Does the agreement by resettlement people prior to resettlement conducted? (h) Is the implementation system to properly carry out residents' resettlement arranged together with implementation budget and budget measures? (i) Is the monitoring plan for resettlement impact established? (j) Does the complaint handing countermeasures established?	(a) N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a) The project sites consists of a hilly area for the WTP and flat lands for OHTs and GLSRs and MRs and Hill top GLSRs. These lands are owned by the State Government and the PHED and they have no residential houses. Thus, implementation of the project will not cause any involuntary resettlement. (b) It is not applicable due to the above reasons. (c) It is not applicable due to the above reasons. (d) It is not applicable due to the above reasons. (e) It is not applicable due to the above reasons. (f) It is not applicable due to the above reasons. (g) It is not applicable due to the above reasons. (h) It is not applicable due to the above reasons. (i) It is not applicable due to the above reasons. (j) It is not applicable due to the above reasons.
	(2) Living & Livelihood	(a) Does project implementation affect adverse impact to living condition of inhabitants by change of land use and of utilization of water bodies? (b) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impact, if necessary.	(a) N (b) N/A	(a) Project implementation has no possibility of affecting adversely the living condition of inhabitants by changing land use and of utilization of water bodies. Adversely, it will provide positive impact by improvement of quality for water supply / quality of life. (b) It is not applicable due to the above reason
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) Y	(a) The project includes the laying of distribution pipeline with total length of 669 km along the roads and the construction of OHTs and GLSRs in Imphal City area. These construction works may be carried out in the neighboring areas of cultural and historical heritages. In addition, there are no Indian regulations to protect these cultural and historical heritages from construction works. Thus, environmental management plan (EMP) describes precaution statements during construction period. If the contractor keeps these statements, the construction activities will not cause any damage.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The project will not affect local landscape as the WTP is constructed in middle portion (on slope) of the hill, and furthermore, OHTs and GLSRs are comparatively small structural objects compared with buildings of urbanized areas. Also, these proposed sites are not located at special landscape areas.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous people? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a)N/A (b)N/A	(a) There is no adverse impact of the Project to the different tribes living in the water service area of Imphal City. These tribes consist of Meitei, Pangal (Muslims), Naga, Kuki, Zomi, and Garkhali (Nepali) of which the Meitei has the biggest population of around 60%. The tribes co-exist peacefully within the city. (b) It is not applicable due to the above reason.
	(6) Work Environment	(a)Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in hardware side for individuals relating to the project such as the installation of safety equipment to protect labor accidents and the management of toxic substances involved? (c) Are soft side countermeasures such as tangible safety education for labors and the formulation of safety sanitary plans (including traffic control and public health) to interested persons to the project planned and conducted? (d) Are proper countermeasures taken not so as to threaten the safety of inhabitants' peoples and interested persons of the project by guardsmen for the project?	(a)Y (b)Y (c)Y (d)Y	(a) The project proponent is the PHED, which is a part of the State government, thus it abides by both Central and State government laws and rules and regulations., The Department has detailed knowledge on laws and ordinance associated with the working conditions which the project proponent should observe. Thus, the proponent will not be violating any law and ordinance associated with the working condition of the country. (b) The installation of safety equipment and wearing of safety gear to protect from work-related accidents will be planned and conducted during the construction and operation stages by contractor and implementation organization as described in EMP. (c) The formulation of safety sanitary plans (including traffic control and public health) to interested persons to the project and tangible safety education for laborers will be planned and conducted by the contractor and project proponent. (d) The project shall ensure sufficient education and communication so as not to compromise the safety of the workers and other interested persons. Guards shall be employed for this purpose.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate mitigation countermeasures considered to reduce adverse impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) Do construction activities adversely affect the natural environment (ecosystem)? In that case, are adequate mitigation countermeasures prepared? (c) Do construction activities adversely affect to social environment? In that case, are adequate mitigation countermeasures prepared? (d) Do construction activities cause traffic congestion? Are mitigation countermeasures prepared?	(a) Y (b) N (c) N (d) Y	(a) Mitigation countermeasures against adverse impacts (eg., noise and vibrations, traffic control, and waste disposal etc.) during construction are sufficiently considered as described in "Adverse Impacts and Mitigation Measures at Construction stage" and Environmental Management Plan of this report. The contractor and implementation organization should comply with these descriptions. (b) Since construction works are conducted at a part of Chingkheiching hill and in urbanized area of Imphal City, which have no important natural environments (ecosystem), there are no adverse impacts to these two areas. (c) Construction activities will not affect the social environment. (d) Traffic congestion by construction activities for the WTP will not be generated because the construction site is located in the countryside. However, the laying of transmission and distribution pipelines and the construction of OHTs and GLSRs may cause traffic congestion because their works are to be carried out in the urbanized area of Imphal City. To avoid traffic congestion and accidents, two security guards shall be assigned in every site. In addition, especially, in the sites for pipe laying, signboard and night illumination and safety fence etc. for traffic safety shall be prepared.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) How are the items, methods, and frequencies of the monitoring program planned? (c) Can the proponent establish an adequate monitoring system (organization, personnel, equipment, and budget and their continuity)? (d) Do reporting manners and its frequencies from proponent to concerned agency regulate?	(a) Y (b) Y (c) Y (d) N	(a) Monitoring plan is implemented by the contractor and the implementation organization as contained in "Monitoring Plan" of the report based on Indian regulations for both the construction and operation stages. (b) Monitoring parameters and methods were selected by assuming adverse impacts from the implementation of the project and their frequencies were determined by the experiences such as past local villages' water supply project and supervision for construction works of water supply systems. (c) The project requests to establish the Project Implementation Unit (PIU) in the PHED. In the PIU, the environmental management system shall be also established and its budget shall be prepared by the State Government. On the other hand, the project is implemented by several contractors and the project requires that each contractor employs one environmental and safety management staff to control the environmental and safety conditions in each construction site, together with one assistant environmental specialist for the consultant. They shall carry on environmental monitoring works. The employment of one environmental and safety management staff by contractor and assistant environmental specialist shall be included in the project budget. (d) The Environmental Clearance (EC) issued by the Directorate of Environment and Ecology states the EIA procedures are not required for the project and the project proposal is not under the preview of the EC. Then, it is presumed that the Directorate of Environment will not conduct environmental monitoring. However, the EC also recommends having the detailed EMP. Thus, the implementation agency, the PHED, shall keep the monitoring report in their office, if necessary, in any time, they shall report the result of environmental management conditions on construction works to related agency.

Category	Environmental Items	Main Check Items	Yes: Y No: N	Confirmation of Environmental Consideration (Reasons, Mitigation Measures)
6Note	Refer to Other Environmental Checklist	(a) Where necessary, pertinent items described in the Dam and River Project checklist should also be checked.	(a) N/A	(a) It is not applicable for the project.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) The project does not include factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, and global warming. Though the implementation of the project consumes commercial electric charge 51.9 KWh and CO_2 amount 406 /tons/year equal to its consumable electric power estimated to be released in the atmosphere, it does not directly relate to global issues.

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

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

Chapter 8 Implementation Plan and Project Cost

8.1 Status of Procurement and Construction

8.1.1 General Condition of Bidding

All biddings for public works in India follow the tender laws and Tender Transparency Act stipulated by the Government of India. Every state of India has a general guideline for bidding, known as the Procurement Guidelines, for public works for its municipal bodies. In Manipur, bidding is conducted by adhering to the guideline called "The Procurement Solution of National Informatics Center (NIC) of the Government of India" issued by the Finance Department of the state.

The bidding procedure in Manipur for locally funded projects is generally single stage two envelope system, comprising of Technical and Financial Bid. The evaluation is made using the Least Cost Method for the technically qualified bidder. For externally funded projects, the two stage bidding is often carried out. The 1st stage is the Pre-qualification, followed by the 2nd stage, where the bidders who have been shortlisted are invited to submit their Technical and Financial bids for the works. However, in most if not all cases, the basis of the contractor's selection is the Least Cost Method. The International Federation of Consulting Engineers (FIDIC) conditions of contract are followed for externally funded projects.

Presently, PHED has gone for e-governance as per the guidelines set by the Tender Transparency Act and has adopted the e-procurement option for online bidding for tenders since 2011. Online bidding for tender has been undertaken for the Phase I work of the "Integrated Water Supply Project Imphal" by PHED.

8.1.2 Material and Equipment Procurement

Almost all the civil and building work materials except for sand can be procured in Manipur, as shown in **Table 8.1**. As for pipe materials, PVC pipes and HDPE pipes are not in use in Manipur. DI pipes are basically used for mains with diameters larger than 100mm, and GI pipes are used for diameter smaller than 100mm. Both types of pipes are transported mainly from Kolkata and Guwahati to Imphal.

Mechanical and electrical equipment can be procured in India, however imported equipment are occasionally used for certain projects.

Table 8.1 Material and Equipment Procurement

Work Type	Material/Equipment	Imphal/ Manipur	Other Area in India	Foreign Country
(1) Civil Work	Worker	O		
	Sand		O	
	Cement	O		
	Form	O		
	Reinforcement Bar	O		
	Pile	O		
(2) Pipe Work	PVC Pipe	Not used in Manipur at present		
	HDPE Pipe	Not used in Manipur at present		
	DI Pipe		O	
	GI Pipe		O	
(3) Mechanical・Electrical Work	Pump		O	O
	Gate		O	O
	Valve		O	O
	Control Panel		O	O
	Transformer		O	O
	Generator		O	O
(4) Construction Machinery	Excavator	O		
	Crane	O		
	Dump Truck	O		
(5) Building Work	Brick	O		
	Interior Material	O	O	

Remarks Other area in India: Kolkata, Guwahati, Delhi, Mumbai, Chennai.
Major part of procurement is from Kolkata.

8.1.3 Overview of Local Contractors in Manipur

Construction companies registered with the PWD (Public Works Department) in Manipur are classified into Special Class, First Class, Second Class, Third Class, and Fourth Class. These classifications are determined by the levels of fund, number of employees, and number of owned construction machinery. Currently, 200 companies are registered as Special Class and 270 companies are registered as First Class. Tender price is set to Rs 30 million for the contractors with First Class, but it is unlimited for the First class.

Around 750km of clear water transmission mains and distribution mains shall be installed in Imphal city during the five-year construction period. Therefore, the capability of the local construction companies to carry out the pipe installation is of great importance to complete the project within the timeframe and the required quality. There are more than 10 companies in Manipur, which have experience in pipe installation. The overview of the major contractors is shown in the **Table 8.2**.

Table 8.2 Overview of Major Construction Companies for Pipe Installation in Manipur

1. Contractor Name		N. OKENDRO SINGH	W. MANIHAZ SINGH	H. MANORANJAN SHARMA	L. SARANGAJIT SINGH
2. Location		Tera Sapam Leirak, Imphal	Sagolband Sayang, Imphal	Khwai Brahmapur, Nagamapal, Imphal	Thangmeiband Polem Leikai, Imphal
3. Permanent Staff		24	55	25	80
4. Experiences in Pipe Installation Works		14 Years	32 Years	28 Years	More than 15 Years
5. Machinery for pipe works		JCB/Excavator: 3 Dump Truck: 5, Truck:1	JCB/Excavator: 2 Dump Truck: 1, Truck:2	JCB/Excavator: 2 Dump Truck: 3, Truck:1	JCB/Excavator: 2 Dump Truck: 3, Truck:3
6. Work Progress					
Condition	Area	Rural area	Congested urban area	Rural area	Rural area
	Pavement	Non-paved road	Paved road	Partially paved road	Non-paved road
	Obstacle	No obstacle	Many underground obstacles	No obstacle	No obstacle
	Pipe line	Water transmission D500mm Depth 1.5m	Pressure Sewer Dia 500mm Depth 4m	Distribution main Dia 500mm Depth 1.5m	Distribution main Dia 150mm Depth 1.5m
Progress		100 m /day / party	10 m /day / party	63 m /day / party	165 m – 195 m /day / party
Condition	Area		Congested urban area		Congested urban area
	Pavement		Paved road		Paved road
	Obstacle		No underground obstacles		Many underground obstacles
	Pipe diameter		Gravity Sewer Dia 200mm, Depth 2m		Distribution main Dia 150mm Depth 1.5m
Progress			50 - 60 m /day / party		110 m – 138 m /day / party (Work shall be done during night time)
7. Influence on Construction Schedule due to Road Blockade		If road blockade occurs, the construction schedule will be delayed by 20 days. It is assumed the blockade occurs once a year.	Usually the contractor has a stock of construction material. So, the influence on construction schedule is limited.	Usually the contractor has a stock of construction material. So, the influence on the construction schedule is limited.	In case road blockade occurs, the transportation will be done through an alternative route. So, the influence on construction schedule is limited.
8. Past Similar Work		- Construction of Raw Water Transmission Pipe Line Canchipur Water Supply Scheme (2004) - Awang Khunou Water Supply Scheme (2009) (2010) - Construction of Office Building of Imphal West PHED (2012)	- Sewerage Project (Pressure sewer DI Pipe Dia 500) (2011) - Sewerage Project (Gravity sewer DI Pipe Dia 200) (2012)	- Operation and Maintenance of Imphal W/S under Maintenance Division I (Laying of 150 mm dia DI pipe) (2012) - Upgrading/Improvement of distribution Mains system at Hill and Valley District (Laying of distribution pipe line) (2014)	- Upgrading of Mayang Imphal Water Supply Scheme (Construction of RCC overhead tank 250m^3) - Upgrading of Mayang Imphal Water Supply Scheme (Construction of RCC overhead tank 450m^3)

The lengths and average diameter of clear water transmission mains and distribution mains to be installed in the Imphal city are summarized in **Table 8.3**.

Table 8.3 Pipe Length and Average Diameter of Clear Transmission Mains and Distribution Mains

Paved Road/ Non-Paved Road	Paved Road	Non-Paved Road
Total Length (Clear Water Transmission Mains and Distribution Mains)	600km	143km
Diameter	100 - 1000mm	100 - 1000mm
Average Diameter	171mm⇒ estimate **200mm**	122mm⇒ estimate **150mm**

Average pipe diameter and total length of the pipes to be installed in paved roads are estimated to be Dia 200mm and 600km, whereas that in non-paved roads is estimated to be Dia 150mm and 143km.

Pipe installation length per day is dependent on the pavement and traffic conditions, and on underground congestion of utilities' cables and pipes. Based on the interview results with local construction companies as shown in **Table 8.2**, pipe installation length of diameter 150 to 200mm per day is estimated at 60m/day.team for paved road and 100m/day.team for non-paved road as shown in **Table 8.4**.

Table 8.4 Estimate Progress of Pipe Installation Work

Pavement	Paved Road			Non-Paved Road	
Diameter	150mm	200mm (Depth 1.5m)	500mm	150mm	500mm
Obstacle (Under grand utility etc)	Heavy	No Obstacle	No Obstacle	No Obstacle	No Obstacle
Pipe Installation per day (m/day.party)	110-138	50-60	63	165-190	100
Estimated Pipe Installation per day for Dia 150mm to 200mm (m/day.party)	**60** *1)			**100** *2)	

*1) Pipe installation length per day in Japan is almost same as Dia 150mm and Dia 200mm. Then pipe installation record of Dia 200mm is used.

*2) Past record of pipe installation length 165m/day.party is quite a long distance compared with paved road. To be on the safet side, 100m/day.party for Dia 500mm is used.

It is estimated that a total 12 teams (10 teams for pipe-laying in paved roads and two teams for pipe-laying in non-paved roads) should be deployed in Manipur, in order to complete the pipe installation work within five years construction period.

<u>Pipe Installation on paved Road (Dia 150 to 200mm)</u>

60 m/day.team × 22 days/month *3) × 10 month/year *4) × 5 years × 10 teams = <u>660 km</u> > *600km*

<u>Pipe Installation on non-paved Road (Dia 150to 200mm)</u>

100 m/day.team × 22 days/month × 10 month/year × 5 years × 2 teams = <u>220 km</u> > *143km*

*3) 30 days – 6 days (2 Saturdays and 4 Sundays) – 2 days (unexpected non-working days) = 22 days

*4) Considering rainy season from June to September about 4 months, capable month for construction work is assumed by following calculation;

8 months + 4 months×50% = 10 months, (50% is rate of estimated capable construction work)

8.1.4 Overview of Local Consultants in Manipur

There is no consulting firm in Manipur. PHED and other organizations hire consultants from Guwahati and/or other states when design works or preparation of DPR is done.

Construction supervision is conducted by the contractor's engineers for small-scale construction works. On the other hand, PHED and other organizations engage consultants from Guwahati and/or other states for the supervision of large-scale construction works.

8.1.5 Transportation of Material/ Equipment to Manipur

Construction materials and equipment are basically transported from Guwahati, Silchar, Tipaimukh etc to Manipur through National Highway NH-39, NH-53, NH-150 since there is no railway in and around Manipur. Even though conditions of these roads may not be adequate (e.g. narrow and partially damaged), transportation of materials and equipment has been executed satisfactorily. However, Manipur has been experiencing frequent road blockades caused by approximately two dozens militant groups. The road blockades adversely affect its economy and cause inconvenience to the people. Manipur has been considered to be one of the most volatile states in India.

Topographically, Manipur is divided into hill area and valley area. The densely populated valley areas, constituting just one-fourth of the geographical area, is surrounded on all sides by the sparsely populated hill areas which constitute two-third of the remainder. The tribal groups, who mainly inhabit the hills, are generally critical of the state government, which is largely dominated by the Meitei communities that live in the valley areas.

Total number of annual blockades from 2004 to 2013 is shown in **Figure 8.1** and major blockades are shown in **Table 8.5**. Two organizations – the All Naga Students' Association of Manipur (ANSAM) and the Meitei Erol Eyek Lionasillon Apunba Lup (MEELAL) have been responsible for calling the maximum number of blockades during the last three years. While the former has significant influence in the Naga-dominated hill areas, the latter draws its strength from the valley areas.

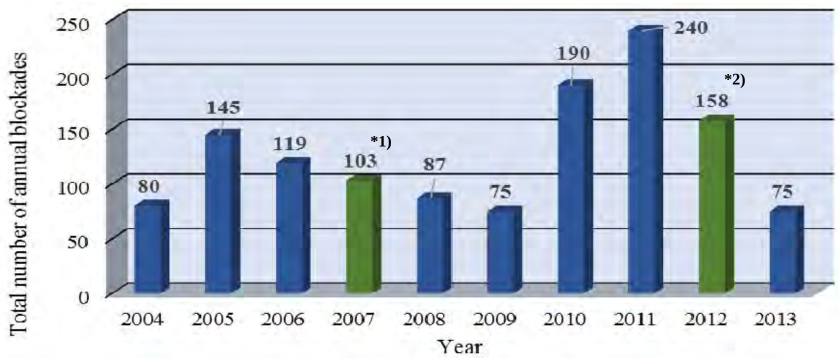


Figure 8.1 Total Number of Annual Blockades from 2004 to 2013

Remarks *1) The average number between 2006 and 2008
*2) The average number between 2011 and 2013

Manipur is connected by road to the rest of India and to Myanmar by three national highways (NH-39, NH-53 and NH-150). The Mao-Imphal section of NH-39 is the state's major link route to the outside world. A large number of passengers, buses and other vehicles ply on this highway. Along with it, the Imphal-Moreh section of NH-39 is also widely used by the business community to shop at the key town of Moreh on the Indo-Myanmar border. With no railway links, a blockade of these highways has been the most common and effective method for agitators to bring pressure to bear on the state government.

Along with the innumerable blockades, another factor which compounds the problem is the so-called "taxes" levied by insurgent groups. Several militant groups, particularly the National Socialist Council of Nagaland-Isaac-Muivah (NSCN-IM), impose different rates of “illegal tax” on commercial vehicles plying these routes, depending on the value of the consignments being carried. For example, on the Mao-Imphal section of NH-39, the NSCN-IM reportedly charges an oil tanker 3,000 Rs per trip, 2,000 Rs for trucks carrying cooking gas cylinders, and 1,000 Rs for those carrying cement. Apart from this, the outfit also regularly collects illegal permit fee from trucks to ply on this highway. Other militant groups are active in their respective areas of operation as well.

As a result of the surveys to PHED and IPS (Indian Police Service), there are no official measures and prospects to solve blockades and “illegal taxation”. On the other hand, there are some general measures mentioned in newspaper (Imphal Free Press) as enumerated below:

- The state government should ensure free movement of transport along the national highways.
- The state government should ensure no shortage of essential items in the valley.
- Deployment of a strong security force all along the route is necessary.
- Security escorted convoys should ply along the highway.
- Legal actions against the blockaders, by arresting them followed by filing FIRs (First Information Report) [*1)] under relevant section of IPC (Indian Penal Code) [*2)] are necessary.

**1): First information report or in short FIRs is a written record prepared by police against the person or people who breaks the law.*

**2): Indian penal code or IPC is the list of criminal law or codes of criminal. E.g. It has the punishment records who offence the law, criminal conspiracy etc.*

Table 8.5 Past Record of Major Blockade the Road surrounding Manipur

	Name of Blockade the Road	Location	Year	Blockage Period (days)	Conducted by	Purpose of Blockade the Road
1	NH-39 and NH-53	Sadar Hills	Aug 1, 2011	20 days	Sadar Hills Districthood Demand Committee (SHDDC)	Demanding Separate district.
2	NH-39 and NH-53	Naga dominated areas, affected whole of Manipur	Aug 21, 2011	121 days	United Naga Council	Counter blockades Against the above purpose of demanding separate district.
3	NH-39	Naga dominated areas, blocks the NH which connects Manipur to the rest of the country	June 18, 2010	Unknown	All Naga Students' Association of Manipur (ANSAM)	1) "null and void" the autonomous council elections held recently in the Naga areas of Manipur, 2) an alternative administrative arrangement for Nagas of Manipur and 3) the expedition of 'Indo-Naga peace process' (13-year-old talks between the Centre and the Isak-Muivah faction of the militant National Socialist Council of Nagaland).
4	NH-53	Imphal Jiribam highway	May 7, 2014	7th May to 13th May, 2014	Joint Forum for Transport Welfare Association (JFTWA), Tamenglong	In protest Government's alleged failure to repair the Tamenglong-Khongsang road
5	NH-39 & NH-53	Hilly area	Jul 10, 2013	48 hours	Kuki State Demand Committee (KSDC)	Kukiland (separate land for Kuki).
6	Imphal Moreh Road	Chandel District	July 5, 2013	Unknown	Kuki Students' Organization and Naga Students' Union (Chandel District)	7,000 students were not allowed for the Manipur board exam.

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8.1.6 Price Escalation

Cost and price of civil materials, pipe materials and construction work have been steadily increasing in India. It is necessary to pay attention to the price escalation because it will account for large influence for estimation of the project cost for project period from 2016 to 2022. Price escalation for major materials and construction work in DSR (Delhi Schedule Rates) and MSR (Manipur Schedule Rates) is shown in **Table 8.6**, and statistical data of IMF (India) is shown in **Table 8.7**.

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Table 8.7 Price Escalation Sourced by IMF (India)

Year		2007	2008	2009	2010	2011	2012	2013	2014	Avegage
Inflation (Average Consumer Prices)	Index	132,730	144,937	160,321	175,547	192,176	211,796	231,888	250,026	
	Percentage		9.20%	10.61%	9.50%	9.47%	10.21%	9.49%	7.82%	9.47%

Average price escalation for last several years based on these information indicate a very high rate of 8.96% to 9.47% per year. PHED uses a 6.0% price escalation when they prepare BOQ for bidding, noticed and instructed by the Secretariat Works Department of Government of Manipur (see **Appendix A8.1**).

Considering these price escalation data, project cost should be estimated.

8.2 Implementation Plan

This section presents project implementation plan and schedule for Imphal Water Supply Improvement Project.

8.2.1 Project Packaging

Imphal Water Supply Improvement Project has been divided to three project / funding packages (namely, Phase-I, II and III projects) based on the priority of the project works and their implementation.

Phase I project was sanctioned by MoUD, GOI for the funding under JNNURM in January 2014. The construction contract has been recently awarded to a contractor and it is envisaged that design work for the construction should commence in due course. With regards to the Phase-II project, PHED submitted a DPR to MoUD for their sanction in October 2014. The document is currently under review. See **Table 8.8** for the details of the project components of both Phase-I and II projects.

The Phase-III will be undertaken by JICA Project. Details of the components of JICA Project (PHED Phase-III Project) and the proposed project implementation arrangements are discussed in the following sections of this chapter.

Table 8.8 Components of Phase I and Phase II Projects (PHED Project)

Package	Project Components	Quantity / Number/ Length	Estimated cost, Rs. in lakh
Phase-I	Construction of intake	6	8975.19
	Construction of Water Treatment Plant	9	
	Construction of Clear Water Reservoir	5	
	Construction of Service /Master Reservoir	3	
	Clear Water Pumping Station	3	
	Construction of Overhead Tank	1	
	Construction of Emergency Reservoir	1	
Phase-II	Construction of Intake.	3	37957.94
	Laying of Raw Water Main	28,797 m	
	Construction of Clear Water Reservoir	4	
	Construction of Clear Water Pumping Station	3	
	Construction of Service /Master Reservoir	3	
	Construction of Overhead Tank	1	
	Laying of Clear Water Main	51,609 m	
	Laying of Distribution Network	298,578 m (5 zones)	
	Installation of Bulk Water Meter	60	
	Installation of Bulk Consumer Meter	68	
	Installation of Consumer Meter	35,490	

Note: Information provided by PHED.

8.2.2 Project Component (JICA Project)

The components of JICA Project, which are the almost same contents as PHED Phase-III Project, are shown in **Table 8.9**.

Table 8.9 JICA Project Component (almost same contents as PHED Phase-III)

No.	Facility Name	Capacity	Quantity	Remarks
1	Earth Cutting Work for Chingkheiching WTP		Earth Cutting Volume: 750,000m^3	
2	Chingkheiching WTP	45 ML (45,000m^3/day)	One	Included MR-6, Operator Quarter, Laboratory Building, Drain, Compound Wall, Approach Road, Site Clearance and Demolition Work
3	SCADA System	-	44 nos. of Remote Stations	At Porompat WTP
4	Clear Water Transmission Main	-	Dia 150-1000mm, L=50km	
5	Master Reservoir (MR-5)	2.0 ML	One	Included Laboratory Building, Drain, Compound Wall
6	Service Reservoir (GLSR)	0.17ML to 0.75ML	Three	Included Bulk Meter and Consumer Meter, Power Feeder, Drain, Compound Wall
7	Rehabilitation of Service Reservoir (GLSR)	0.36 ML to 1.81 ML	Five	Included Bulk Meter and Consumer Meter, Power Feeder, Drain, Compound Wall, Approach Road
8	OHT		21	Included Bulk Meter and Consumer Meter, Power Feeder, Drain, Compound Wall, Approach Road
9	Emergency Reservoir	-	11	Included Pumping Station (Civil & Mechanical Work), Power Feeder, Drain, Compound Wall, Approach Road
10	Distribution Mains (West Area)	-	Dia 100-800mm, L=360km	
11	Distribution Mains (East Area)	-	Dia 100-600mm, L=333km	
12	Distribution Mains (WSZ-15 Minuthong)	-	Dia 100-400mm, L=18km	
13	Distribution Mains (WSZ-16 Khuman Lampak)	-	Dia 100-400mm, L=23km	
14	Service Pipe and Water Meter (West Area)	-	37,075 units	
15	Service Pipe and Water Meter (East Area)	-	29,071 units	
16	Service Pipe and Water Meter (WSZ-15 Minuthong)	-	2,958 units	
17	Service Pipe and Water Meter (WSZ-16 Khuman Lampak)	-	2,287 units	
18	O&M Equipment	-	One Ls	Maintenance Machinery for Pipe, 4-Wheel Vehicle, Pickup Truck, Computer, Printer etc.
19	GIS and MIS Equipment/ Software	-	One Ls	Software for GIS /MIS Systems, Equipment for GIS /MIS Systems, Investigation and other Work for GIS /MIS Systems

PHED requests to construct 15 numbers of the new Operator Quarters and 5 numbers of the new Laboratory Buildings at different sites. However, it is supposed to be needed only two Operator Quarters at Chingkheiching WTP which will be center area WTP in Imphal City. There is no need to construct Operator Quarters at the other sites, because the operators will not need to stay at Master Reservoirs and Ground Level Emergency Reservoirs for 24 hours, due to sustainable water supply in the future by this project.

Regarding Laboratory Buildings, it is supposed to be need three buildings at Chingkheiching WTP, Porompat WTP and Kangchup WTP, which will be main WTP to monitor of water quality. It is supposed to be more discussion with PHED.

8.2.3 Packaging for the Project Components

Contract packaging for the Project is one of the most important factors for the smooth implementation of all the project components. 9 packages are considered in the project.

Construction works of Chingkheiching WTP will need several kind of expertise such as civil, structural, mechanical, electrical and instrumental works. Coordinated management among these works will be inevitable. Time for such coordinated management will influence the time of completion. Mechanical and electrical works will be carried out after the most of the structures have been completed. Careful arrangement in corporate with civil and architectural works will be required for installation of mechanical and electrical equipment.

From the aspect of construction supervision and management, a project management consultant (PMC) will be required for review of contractors' submissions, organize progress meetings, schedule factory inspection, certification of accomplishment, maintain quality control, and preparation of documents for payment.

Under the JICA ODA loan procedures, the contract package shall be concurred by JICA for each stage of prequalification evaluation, tender evaluation, and contract. In principle, under the JICA ODA loan procedure, tendering shall be done as Local Competitive Bidding (LCB) and International Competitive Bidding (ICB).

Proposed contract packages, six packages for the JICA ODA loan, are shown in **Table 8.10**. Packaging is proposed considering the following:

1) Some part of construction site at Chingkheiching WTP should be prepared before the start of construction work, since earth cutting work and transport of surplus soil are required for about a three year period.
2) Earth cutting work and construction work for the WTP shall be separate packages. Earth cutting work is considered to be conducted by LCB, such as Manipur local contractors, since this work does not require high technical level and contractors in Manipur have plenty of experience for such works.
3) Construction work for the WTP will start in the area where earth cutting work is conducted, and will be completed in three years.
4) The SCADA system is considered as one package, since this requires highly-developed technology.
5) Clear water transmission mains and reservoirs and OHTs are composed of one package, since these works can be conducted independently of the WTP work and the distribution mains work.
6) Installation of distribution mains and service pipe/ water meter is considered as four packages for west area, east area, WSZ-15 Minuthong and WSZ-16 Khuman Lampak in Imphal city, since the pipe length is considerable, or about 693km, including a big number of service pipe/ water meter of about 70,000 units.

7) Package -7 and -8 are considered for LCB since pipe length and No. of water meter are small amount.
8) Procument of Software for GIS /MIS Systems, Equipment for GIS /MIS Systems, Investigation and other Work for GIS /MIS Systems is considered as independent Package.

8.2.4 Project Implementation Schedule

The expected overall implementation schedule is shown in **Figure 8.2**. In preparation of the overall schedule, following schedule is considered for pre-construction and construction stage.

Pledge of JICA Loan	June 2015
Signing of Loan Agreement	July 2015
Selection of PMC (Project Management Consultant) for Detailed Design and Construction Supervision	9 months
Detailed Design, Preparation of Specifications	12 months
Contractor Prequalification (P/Q), evaluation and JICA concurrence	3 months
Preparation of tender documents for individual project components, JICA concurrence on tender documents	3 months
Project Tender period	2 months
Evaluation of contractor proposals	3 months
JICA concurrence on tender evaluation (Contractor proposals)	1 month
Contract negotiation	2 months
JICA concurrence on contract award	1 month
Total period of Construction Work	60 months
Completion of the Project	December 2022
Defect Notification	12 months

Implementation Schedule

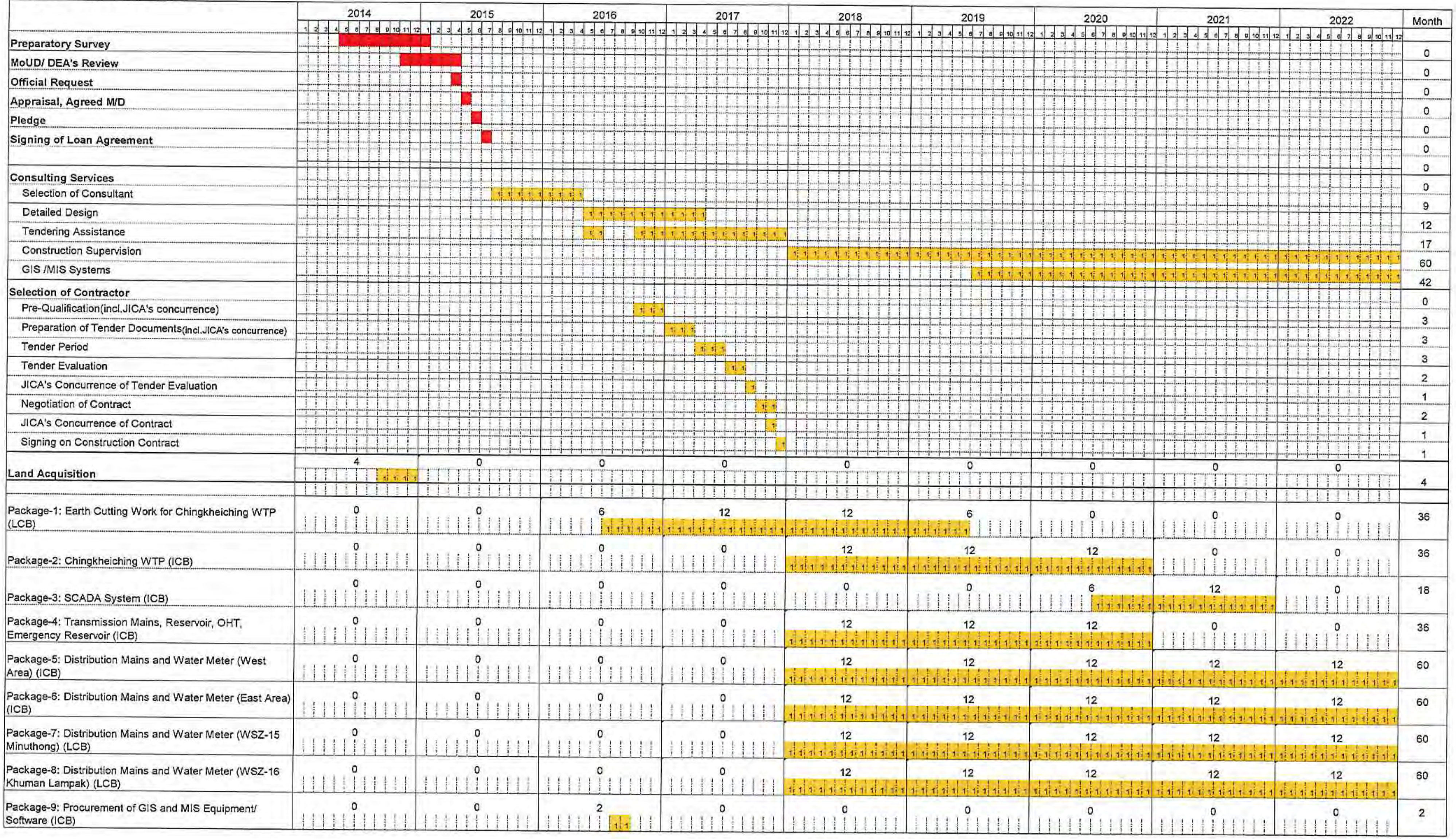


Figure 8.2 Implementation Schedule

8.2.5 Implementation Method

(1) Process of Project Implementation

Implementation of the Project will consist of the six major processes:

1) Preparation of finances
2) Selection of consultants for detailed design, construction supervision, PMC and soft component
3) Preparation of tender documents and detailed design
4) Tender of build-operate contractors/consortiums
5) Construction and commissioning
6) Defect notification period

Selection of the consultants will need to be conducted by PHED in accordance with the JICA Guideline. RFP (Request for Proposal) should be prepared by PHED. PMC for detailed design, construction supervision and soft component should be set to be one lot because suitable coordination will be very important not only for each package but also for construction work and the soft component. Selection process of the consultant will have to be initiated soon after the commitment for the finance is made by the Japanese side. The preparation of tender documents and detailed design will be carried out by the PMC to be selected and employed by PHED. Conditions applied in the tender documents will have to meet the requirements in the JICA Guideline. JICA normally requires that the procurement of goods and services will be obtained through ICB and LCB. Construction will therefore be carried out by the contractor/s awarded with the contract through the ICB and LCB method.

The construction works of the contractor/s will need to be regularly inspected and supervised, normally by the PMC engaged by PHED.

(2) Method of Detailed Design for Major Facilities

Major differences in “Construction as Designed” and “Design-Build Concept” are described as follows:

1) Construction as Designed

Contractors are issued for the detailed drawings to construct the facilities designed by the Employer and/or consultants. Construction will follow the detailed dimensions and specifications which are stipulated in the tender documents. Liability of the contractor will be limited to quality of the construction work as long as the facilities are built as designed. Preparation of design drawings will take a longer time compared with the Design-Build Concept.

2) Design-Build Concept

Tender documents and drawings stipulate the minimum requirements for construction. Contractors will have flexibility in construction details. However, they are subject to approval by the client and its consultant. As the structural design is normally carried out by the Contractor, time for the preparation of the tender document will be shortened. The Contractor should be liable for his design. Duration of the detailed design will solely depend on the grade of design. Preparation of the tender drawings in full details will take longer time while introduction of the "Design-Build (turn-key) Concept" will shorten the time for the design stage.

However, with the advantages of the Design-Build (turn-key) Concept, there are several issues need to be considered in the Design-Build Concept. These issues are important for mitigation of the unnecessary time wastage during the construction period to be spent for review and revision of the design submitted by the Contractor.

(3) Subjects to be considered in the Detailed Design Stage

The preliminary design for the proposed components presented in this report is prepared with design concepts as described in **Chapter 5**. Details of the preliminary design were prepared to the extent possible for budgetary purposes.

In the detailed design of each component, flexibility should be allowed to reduce, to the extent possible, civil construction, electrical and mechanical costs, and O&M costs and encourage the usage of suitable materials and input consistent with local conditions as long as the water supply systems conform to the basic requirements of design, treatment capacity and supply standards.

There are several issues to be considered in the design stage from both technical and economic points of view as described below:

1) Participation of Local Consultants

Participation of local consultants is necessary for technology transfer from the foreign consultants. Local consultants will also be able to contribute to make economical design since they are familiar with local practices for construction works and locally available materials and equipment in India.

2) Approval of Detailed Design

During the design stage, engineering consultants appointed for the Project should be required to submit sufficient details for their design prior to the preparation of the final design and specifications.

3) Process Design

Process design will have to be determined considering not only technical aspects of operation but also cost-effective aspects. In the preliminary design by the JICA Survey Team, water treatment plant, clear water transmission main, reservoirs, OHTs, distribution mains and service pipe with flow meter are planned in generally accepted shapes. The detailed arrangement and each treatment unit, etc. will have to be determined considering the total costs for pipelines, structures and equipment.

4) Specifications

Specifications are to be developed by the PMC to make contractors develop adequate confidence in preparing costs for construction, ease of O&M and availability of services etc. in the design stage to select the best fit the conditions of the Project. Any equipment and machinery as well as material required for construction that is available and best fit condition.

(4) Procurement Method

The construction materials for civil works such as concrete, RC pile, sand, gravel, brick, reinforcement bar and DI pipe can be procured in India by the Contractor as per specifications in tender document. Construction machinery such as excavator, pile driver, dump truck and bulldozer are owned by local contractor or can be leased in India. Major mechanical equipment such as pumps, chemical dosing equipment and valves can be imported from suitable countries. Electrical equipment such as cables, control panels, transformer and generator can be transported from India.

(5) Implementing Organization (PIU)

PHED will be the primary agency responsible for executing and supervising the Project. Proposed Project Implementation Unit (PIU) in PHED is shown in **Figure 8.3**.

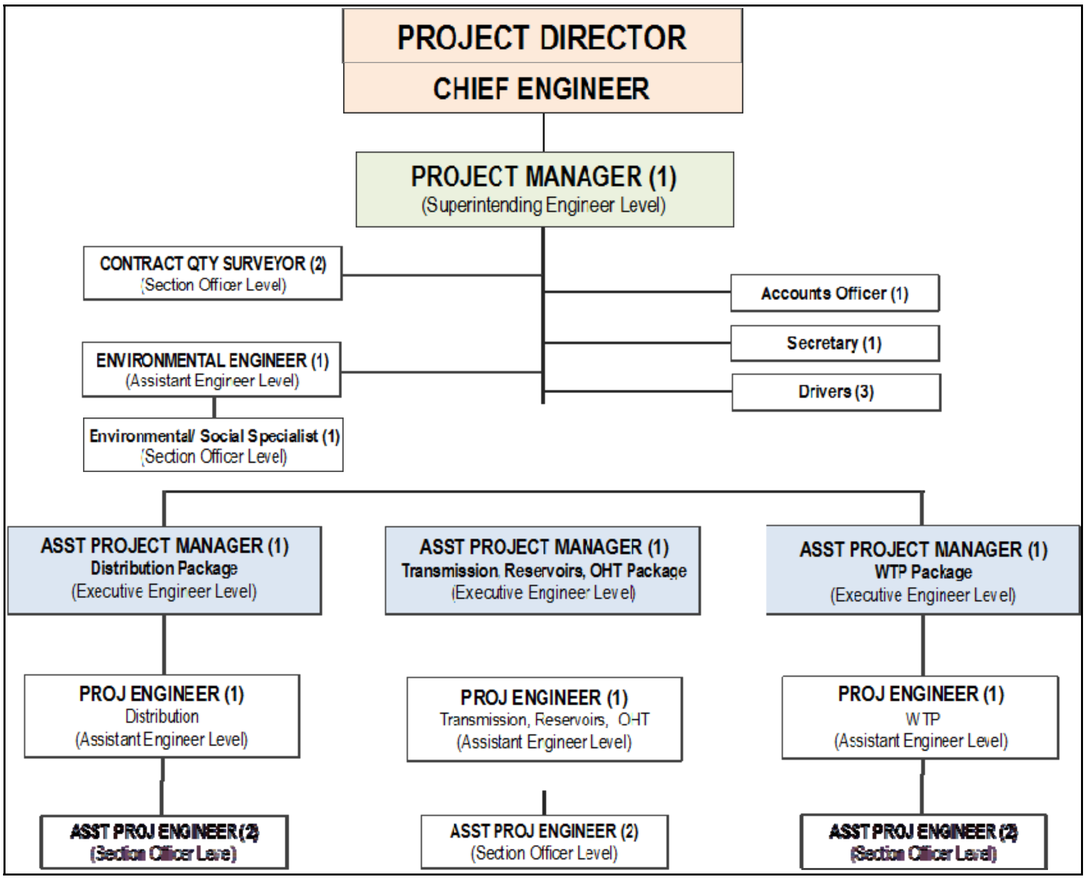


Figure 8.3 Proposed Project Implementation Unit in the PHED Organization

8.2.6 Consulting Services

(1) Terms of Reference

1) Consulting Service for Detail Design and Construction Supervision

PHED shall procure consulting services for detailed design of the Imphal water supply project and the PMC shall consist of both international and local consultants.

Work consists of detailed design of water treatment plant, clear water transmission main, reservoir, OHT distribution mains and service pipe with customer meter. It will include preparation of detail technical specification and tender document for (i) Earth Cutting Work, (ii) Water Treatment Plant and SCADA System, (iii) Clear Water Transmission Mains, Master Reservoir (MR-5), Service Reservoir (GLSR), OHT, Emergency Reservoir, Rehabilitation of Service Reservoir (GLSR), (iv) Distribution Mains (West Area), Service Pipe and Water Meter (West Area), and (v) Distribution Mains (East Area), Service Pipe and Water Meter (East Area), leading to project implementation.

PHED shall procure services of the PMC for the management of Imphal water supply project and the PMC shall consist of both international and local consultants.

Details of Terms of Reference for Consulting Service for Detail Design and Project Management are shown in **Appendix A8.2.**

Chapter 9 Financial and Economic Analysis

9.1 Outline

The water supply project creates various sorts of impacts, including the increase in the volume of water supply to meet future demand, reduction in water expenditure other than the PHED's piped water, improvement of living environment from safe drinking water supply, and reduction in waterborne disease with the improvement of hygiene conditions. Project evaluation in this chapter mainly focuses on increased benefits from the safe water supply which can be expressed in monetary terms.

The result of financial analysis is expressed in an indicator, FIRR. The benefit of financial analysis is revenue from water supply. The primary revenue of PHED is water tariff payment from users, in addition to other operational revenue such as connection fee, penalty fee, and tender document fee. To estimate future revenue from the management of the Imphal Water Supply System, the metered tariff system is proposed and was estimated. The proposed tariff rates have been further assessed in the cash flow analysis to see the balance of revenue and expenditure of PHED's water supply operation.

The results of economic analysis are expressed in such economic indicators as EIRR, N.P.V, and B/C Ratio. Economic analysis is conducted in view of impacts on the national economy, and all costs and benefits generated by the project are converted to the economic prices by applying a standard conversion factor. At the end of the analysis, sensitivity analyses were made on the financial and economic analysis to examine the impacts on the water supply management due to uncertainties and risks.

9.2 Social and Economic Conditions in the Project Area

9.2.1 Social and Economic Conditions

(1) Population and Literacy Rate

The population of Imphal East and West in 2011 is 456 thousand and 518 thousand respectively. In Imphal East, less than half (40%) of population live in the urban area, whereas more than half (62%) of population live in urban in Imphal West. The literacy rate in Imphal East and Imphal West is more than 70%, almost the same as the national average (73%), but the female's rates are lower than that of the male's as shown in the table below.

Table 9.1 Population and Literacy Rate (2011)

Item	Male	Female	Total
Imphal East Total	226,094	230,019	456,113
Literate Population	173,314	151,350	324,664
Literacy Rate	77%	66%	71%
Imphal West Total	255,054	262,938	517,992
Literate Population	205,985	186,641	392,626
Literacy Rate	81%	71%	76%
Manipur Total	1,290,171	1,280,219	2,570,390
Literate Population	960,015	808,166	1,768,181
Literacy Rate	74%	63%	69%

Source: Statistical Year Book Manipur 2013

(2) Religions

The major religion in Imphal East and West is Hindu, which accounts for 61% in Imphal East and 74% in Imphal West. Next large religious group in both areas is Muslim, followed by Christians, Sikhs and Buddhists. Looking at the entire Manipur, the second largest religious group after Hindu is Christians followed by Muslims.

Table 9.2 Population of Manipur by Major Religions (2011)

Item	Hindus	Sikhs	Muslims	Christians	Buddhists	Others	Total
Imphal East	240,347	183	62,932	23,414	78	67,922	394,876
	(61%)	(0%)	(16%)	(6%)	(0%)	(17%)	(100%)
Imphal West	330,994	671	19,124	18,080	312	75,201	444,382
	(74%)	(0%)	(4%)	(4%)	(0%)	(17%)	(100%)
Manipur Total	996,894	1,653	190,939	737,578	1,926	237,798	2,166,788
	(46%)	(0%)	(9%)	(34%)	(0%)	(11%)	(100%)

Source: Statistical Year Book Manipur 2013

Note: Others includes other religions and thise whio do not stated any religions.

(3) Monthly Household Income and Expenditure

Monthly household income and expenditure are not available in the Statistical Year Book of Manipur, but this was part of the questions fielded in the Social Condition Survey conducted by the JICA Survey Team in 2014. The average monthly income of the respondent is INR 49,703, whereas the average monthly expenditure is INR 22,530. Out of 321 respondents, 5% is below poverty line, and the largest income group falls under the INR 10-50 thousand per month, which accounts for 61% of total respondents.

The largest expenditure item is food (35%), followed by education (32%), transport (10%), health (6%) and clothing (5%). As for expenditure for water, 74% of the respondents spend money for water and the average expenditure is INR 480 per month, making up 2% of total monthly expenditure.

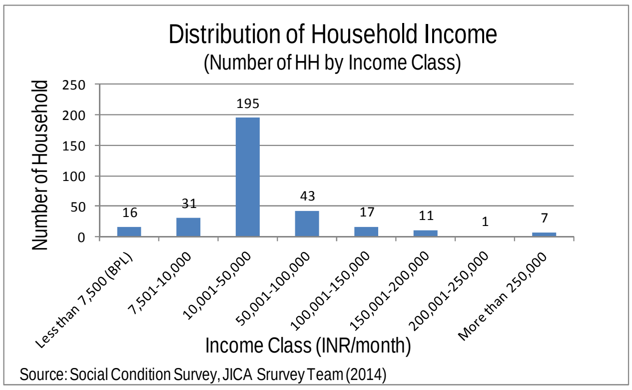


Figure 9.1 Distribution of Household Income

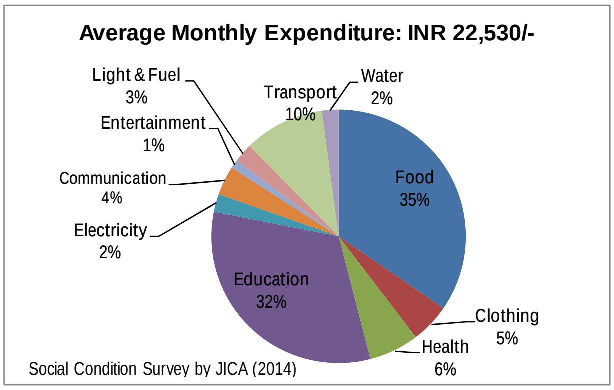


Figure 9.2 Average Monthly Expenditure

9.2.2 Water Consumption

(1) Source of Drinking Water

Data for the main source of drinking water is available from the Statistical Year Book of Manipur 2013, but the category of water sources is limited, including only tap, well, and hand pump/tube well. According to the statistics, the major source of drinking water in Manipur is tap water (38.6%), followed by well (7.5%) and hand pump/ tube well (6.8%).

More detailed questions were asked in the Social Condition Survey, as shown in the table below. According to the survey, majority of households use PHED piped water for drinking purpose, estimated at 60% of total water sources. Next largest source of drinking water is tanker supply (28%), followed by public hydrant (6%), bottled water (4%), and pond/river (1%). For washing water, 56% of the respondents use PHED piped water, and others are tanker supply (20%), pond/river (17%), and public hydrant (6%).

Table 9.3 Main Water Source (Number of Household by Source)

	PHED Pipe	Tanker	Private	Pond/ River	Tubewell	Public Hydrant	Bottled Water	Total
Drinking and Cooking	193 (60%)	91 (28%)	1 (0%)	4 (1%)	1 (0%)	20 (6%)	12 (4%)	322 (100%)
Washing	179 (56%)	63 (20%)	0 (0%)	55 (17%)	4 (1%)	18 (6%)	0 (0%)	319 (100%)

Source: Social Condition Survey, JICA Survey Team, 2014

(2) Volume of Water Consumption by Source

On the other hand, average volume of water consumption by water source was indicated in the Social Condition Survey, and is summarized in table below. The PHED's pipe water is the largest, and the volume is 10,500 letters per household per month. Next is water supply by water tanker, followed by tube well, pond/river, public hydrant, and private water supply.

Table 9.4 Average Volume Water Consumption by Source

	PHED Pipe	Tanker	Private	Pond/ River	Tubewell	Public Hydrant	Bottled Water	Rain Water	Others
Water Consumption (litter/hh/month)	10,494	6,985	5,500	6,518	6,800	5,763	779	5,000	8,600

Source: Social Condition Survey, JICA Survey Team, 2014

(3) Quality of Water Supply Services

Water supplied by PHED is not adequate in terms of duration and quality. Among the beneficiaries of the PHED water supply service, around 80% of households obtain piped water on alternate days or twice a week or less, as shown in table below. In addition, looking at the duration of piped water supply in a day, 86% of households use piped water less than three hours in the supply day.

Table 9.5 Days of Water Supply in a Week

Days of Water Supply in a Week	Number of Household	Percentage
Once a Week	11	5%
Twice a Week	79	35%
Alternate Days	94	42%
Daily	28	12%
Other	14	6%
Total	226	100%

Source: Social Condition Survey, JICA Survey Team, 2014

Table 9.6 Hours of Water Supply in a Day

Duration of Water Supply in a Day	Number of Household	Percentage
24 hours	1	0%
12-23 hours	3	1%
4-12 hours	15	7%
2-3 hours	89	39%
less than1 hour	109	47%
Others	13	6%
Total	230	100%

Source: Social Condition Survey, JICA Survey Team, 2014

According to the survey, 23% of respondents complained that frequency of water supply is inadequate, and 20% complained that pressure of piped water is too weak to use enough volume of water in their home. Because of the weak pressure, some households had to install a hand pump at the end of pipe to increase water pressure. Other major complaints were: too much leakage (16%), too many disruptions (16%), and low quality of water (15%). As for quality of piped water, 47% of households pointed out that PHED's piped water has sometimes bad taste, and 63% indicated that the water sometimes smells bad. In addition, 71% complained that color of piped water is sometimes bad due to contamination problem. As a result, people are reluctant to pay water tariff, and water tariff collection rate of PHED is presently a low 19.8%.

9.3 Water Tariff Revision and Timing for Implementation

With the implementation of the project, each connection in the service area will have a water meter, and water tariff mechanism must correspond to the volumetric method. At present, PHED adopts a flat rate at INR150/month for domestic connection. PHED started a pilot study to install water meters to the selected individual connections, and will start metered tariff collection in the near future. The metered tariff rates are INR150/month as the basic tariff and INR10/m^3 as volumetric tariff from over 30m^3 water consumption. Here, a revised tariff rate is proposed and the steps to estimate the proposed tariff rates are provided.

9.3.1 Clarification of Basic Condition

To estimate the metered tariff, the following basic conditions are clarified.

- The projected number of connections is estimated based on population projection in the DPR, which is divided by average population per household (5 person/HH). According to the DPR, population coverage rate by water supply is 100% for 2022.
- The number of bulk consumer connections is taken from PHED's data and an increase rate of 5% is applied for future projection. Bulk consumers include residential, institutional, commercial, and industrial connections. The residential connections include official residence area, tribal colony and housing complex, whereas institutional connections include the government offices and institutions, schools and colleges, and hospitals. Shown in the table below is the number of connections for commercial and industrial users, which are relatively small. These figures should be revised before project completion. At that time, a more accurate number of connections will be obtained through the establishment of a subscribers' database.

Table 9.7 Projected Number of Connection

Itam	%	2011	2016	2021	2026	2031	2036	2041	2046
Projected Population /a		586,214	652,340	718,465	794,487	870,508	961,327	1,052,146	1,158,086
Potential Number of Domestic Connection /b		117,243	130,468	143,693	158,897	174,102	192,265	210,429	231,617
Population Coverage by Water Supply (%)		100%	100%	100%	100%	100%	100%	100%	100%
Number of Domestic Connection		117,243	130,468	143,693	158,897	174,102	192,265	210,429	231,617
Bulk Demand /c			212	223	235	247	259	272	285
Residencial	5%		11	12	13	14	15	16	17
Institutional	5%		162	170	179	188	197	207	217
Commercial	5%		37	39	41	43	45	47	49
Industrial	5%		2	2	2	2	2	2	2
Total Demand			130,680	143,916	159,132	174,349	192,524	210,701	231,902

Note: a/ Source of figure is the Draft Project Report (DPR).
b/ Potential number of connection is estimated based on average population per household (5 person/HH).
c/ Number of connection of bulk consumer in 2016 is applied PHED's data in 2014. Increase rate of 5% is applied in projection.

- Projected demand of domestic connection and bulk consumers is obtained from the DPR, and the bulk demand is divided by share of bulk users based on the PHED's data. Also, the DPR's estimation of projected production capacity (149.25 mld.) is applied to the tariff estimation.

Table 9.8 Projected Demand by Users

Itam	% /a	2011	2016	2021	2026	2031	2036	2041	2046
Total Domestic Water Demand (mld) /b		71.45	79.56	87.67	97.01	106.34	117.52	128.70	141.76
Bulk Demand (mld) /b		20.27	21.33	21.87	22.42	22.98	23.56	24.14	24.75
Residencial	6%	1.28	1.34	1.38	1.41	1.45	1.48	1.52	1.56
Institutional	83%	16.88	17.76	18.21	18.67	19.14	19.62	20.10	20.61
Commercial	10%	2.10	2.21	2.27	2.32	2.38	2.44	2.50	2.57
Industrial	0%	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Total Water Demand (mld)		91.72	100.89	109.54	119.43	129.32	141.08	152.84	166.51
Unaccounted for Water (mld) /b		16.19	17.80	19.33	21.08	22.82	24.90	26.97	29.38
Projected Water Requirement (mld)		107.91	118.69	128.87	140.51	152.14	165.98	179.81	195.89

Note: a/ Share of bulk consumer is obtained from PHED's data in 2014.
b/ Bulk demand is obtained from the Draft Project Report (DPR), and divided by share of bulk users based on the PHED's data.

- Based on the projected demand of domestic connection and bulk consumers, projected consumption share of each user category is estimated as shown in the table below.

Table 9.9 Projected Consumption Share of Each User Category

Itam	%	2011	2016	2021	2026	2031	2036	2041	2046
Total Domestic Water Demand (mld)		77.9%	78.9%	80.0%	81.2%	82.2%	83.3%	84.2%	85.1%
Bulk Demand (mld)		22.1%	21.1%	20.0%	18.8%	17.8%	16.7%	15.8%	14.9%
Residencial		1.4%	1.3%	1.3%	1.2%	1.1%	1.0%	1.0%	0.9%
Institutional		18.4%	17.6%	16.6%	15.6%	14.8%	13.9%	13.2%	12.4%
Commercial		2.3%	2.2%	2.1%	1.9%	1.8%	1.7%	1.6%	1.5%
Industrial		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total Water Demand (mld)		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Projected consumption share of each user is estimated based on the table (2) Projected Demand by Users (mld).

9.3.2 Allocation of Total Cost

Total costs include all expenses incurred from Phase I to III of the Imphal Water Supply Project. The total costs are composed of operating expenses and capital costs. The former includes O&M costs and depreciation costs, whereas the latter includes interest charge and asset maintenance cost. In the water tariff estimation, the costs for newly constructed facilities and procured equipment are converted into depreciation cost, which is usually estimated by the straight-line method. In this tariff estimation, the depreciation for replacement cost, including plant and machinery, pipelines, and building/ facilities, is estimated based on durable years stipulated in the "Manual on Water Supply and Treatment", Central Public Health and Environmental Engineering Organization (CPHEEO) in 1999.

To establish metered tariff, the total cost is necessarily allocated into the fixed cost and the variable cost. The fixed cost is constant cost regardless of water consumption volume, and includes employment cost, repair and maintenance cost, depreciation cost, and asset management cost. On the other hand, the variable cost is changeable cost when volume of consumption increases, and includes power cost and chemical cost. Based on the fixed cost, basic tariff is estimated, while volumetric tariff is estimated based on the variable cost. The result of total cost allocation is shown in the table below.

Table 9.10 Total Annual Cost of Imphal Integrated Water Supply Project in 2022 (Unit: INR1000)

Cost Item	Phase 1 & 2 (JNNURM)			Phase 3 (JICA)			Imphal Integrated Water Supply Project		
	Sub-total	Fixed Cost	Variable Cost	Sub-total	Fixed Cost	Variable Cost	Total Cost	Fixed Cost	Variable Cost
I. Operating Expenses									
1. Operation and Maintenance Cost									
a. Personnel Expense /a	97,472	97,472		38,770	38,770		136,242	136,242	0
b. Repair & Maintenance Cost	43,911	43,911		26,527	26,527		70,438	70,438	0
c. Communication /b	431	431		294	294		725	725	0
d. Chemical Cost	68,048		68,048	9,775		9,775	77,823	0	77,823
e. Power Cost	75,371		75,371	4,488		4,488	79,859	0	79,859
f. Other O&M Cost /c				109,293	109,293		109,293	109,293	0
2. Depreciation Cost /d	149,274	149,274		293,423	293,423		442,697	442,697	0
Sub-total		291,088	143,419	482,570	468,307	14,263	917,077	759,395	157,682
II. Capital Cost									
1. Interest Charge /e				15,663	15,663		15,663	15,663	0
2. Asset Maintenance					0		0	0	0
Sub-total	0	0	0	15,663	15,663	0	15,663	15,663	0
Total	0	291,088	143,419	498,233	483,970	14,263	932,740	**775,058**	**157,682**

Note: a/ Personnel expense does not include salaries for head office staffs such as EE, AE, SO.
b/ Communication Cost is composed of communication costs and car rental costs.
c/ Other O&M Cost includes consulting fee, administration cost and taxes.
d/ Depreciation cost includes Plant and Machinary, Pipelines, and Building/ Facilities.
e/ Interest rate of 0.3%, Yen Loan's basic conditionality to India, is applied.

9.3.3 Initial Estimation of Water Tariff Rate (Non-adjusted)

Metered tariff is composed of the basic tariff and the variable tariff. The former is estimated based on the fixed cost whereas the latter is estimated from the variable cost items. The following are basic formula for estimating both tariff rates.

- Basic Tariff (INR/month) = Fixed Cost (INR/month) ÷ Number of Connection
- Volumetric Tariff (INR/m^3) = Variable Cost (INR/year) ÷ Water Production (m^3/year)

Prior to the tariff estimation, the fixed cost and volumetric tariff are allocated to each user category based on their water consumption share. Results of the estimation are as follows.

Table 9.11 Initial Estimation of Basic Tariff (Revision for 2022)

Item	Consumption Share (%)	Fixed Cost (INR1000/year)	Number of Connection	Cost per Month (INR/connection)
Domestic Consumption	80.0%	620,316	143,693	360
Residencial	1.3%	9,764	12	67,810
Institutional	16.6%	128,846	170	63,160
Commercial	2.1%	16,062	39	34,320
Industrial	0.0%	142	2	5,900
Total	100.0%	775,058	143,916	450

Table 9.12 Initial Estimation of Volumetric Tariff (Revision for 2022)

Item	Consumption Share (%)	Variable Cost (INR1000/year)	Water Production		Unit Cost (INR/m3)
			(mld)	(m3/year)	
Domestic Consumption	80.0%	126,200	119.45	43,599,898	3.00
Residencial	1.3%	1,986	1.88	686,299	3.00
Institutional	16.6%	26,213	24.81	9,056,167	3.00
Commercial	2.1%	3,268	3.09	1,128,913	3.00
Industrial	0.0%	29	0.03	9,946	3.00
Total	100.0%	157,682	149.25	54,476,250	3.00

Note: Unit Cost = Variable Cost ÷ Production Volume

9.3.4 Adjustment by Willingness to Pay and Affordability to Pay

The above initial estimation of tariff rates is adjusted based on demand side indicators including the willingness to pay (WTP) and the affordability to pay (ATP). In principle, the water tariff rates have to be established to recover all costs generated by daily water supply operation. However, if the rates are beyond the consumers' capacity to pay, successful and sustainable water supply management will not happen since the customers cannot pay their water bill. Therefore, demand side indicators regarding consumers' payment ability are critical and vital for sustainable operation.

The willingness to pay and the affordability to pay were obtained through the Social Condition Survey conducted by the JICA Survey Team in 2014. According to the survey, from among 321 valid respondents, 45% of households expressed their WTP at INR150/month, whereas another 45% replied their WTP is INR300/month. The average WTP is estimated at INR 265/month.

The following figures show the beneficiaries' WTP by income class and by water consumption grade. Monthly income of below poverty line (BPL) is estimated at INR 7,500/month, and average WTP of this class is INR159/month. From the figure, it can be observed that as income class increases, expressed WTP also increases up to INR471/month. Also, when looking at WTP by water consumption grade, the same tendency is noticed – that as consumption increases, WTP increases from INR 237/month till INR 600/month.

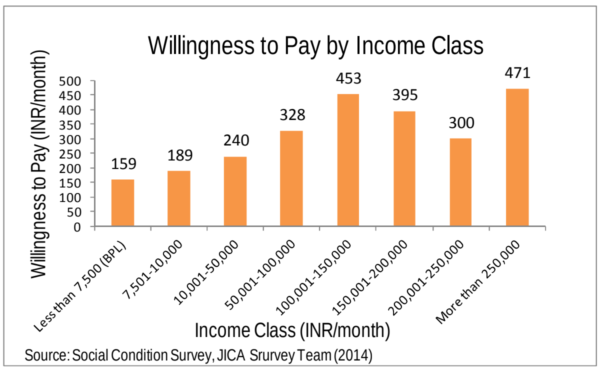


Figure 9.3 WTP by Income Class

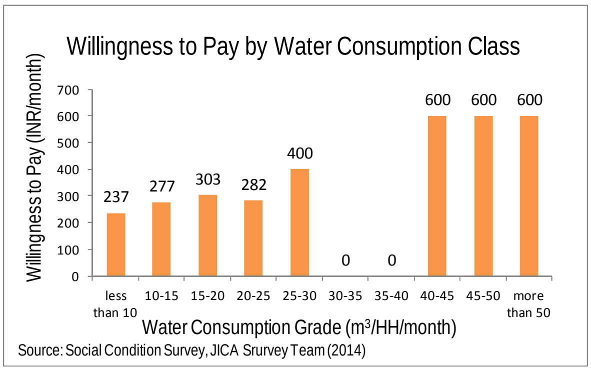


Figure 9.4 WTP by Water Consumption Class

In general, some say that WTP taken from interview or questionnaire survey is biased due to the nature of the methodology. Therefore, affordability to pay was also taken into consideration for cross checking purposes. The following figures illustrate the beneficiaries' affordability to pay by income class and water consumption grade. Affordability to pay is usually estimated at 3 to 5% of disposable income, and the lowest figure of 3% is applied in this analysis based on the UNDP's guideline/ recommendation. As shown in the table below, affordability to pay of the BPL is estimated at INR225/month, and that of the lowest water consumption class (less than 10m^3 per month) is INR 1,117/month. These figures are more than the usual WTP.

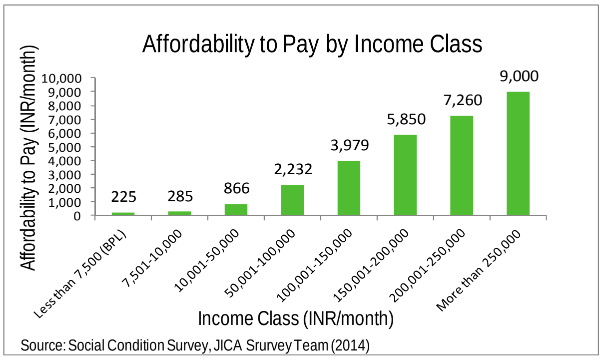


Figure 9.5 ATP by Income Class

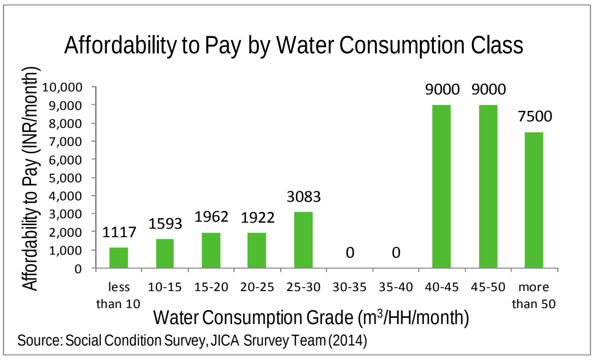


Figure 9.6 ATP by Water Consumption Class

9.3.5 Proposed (Adjusted) Water Tariff Rates

Based on the procedures stated above, the average monthly expenditures of individual connections were estimated and compared with the current tariff level, the WTP and the ATP, as shown in table below. The proposed tariff rates (after adjustment by the WTP and the cost recovery requirement) will be introduced from 2022, and the tariff levels are not so far from the current payment level, and are well within the WTP.

Table 9.13 Proposed Water Tariff Schedule of Domestic Connection (Revision for 2022)

Monthly Consumption (m^3)	Basic Charge (INR/ Connection/ Month) (1)	Volumetric Charge (INR/m3) (2)	Average Tax Payment (INR/Connection /Month) (1) + (2)	Reference /a (current payment with infration)		
				Current Payment Level (INR/ Connection /Month)	Willingness to Pay (INR/ Connection /Month)	Affordability to Pay (INR/ Connection /Month)
Less than 10	180	0	180	208	329	1,552
10 to 20	180	20	280	208	395	2,347
20 to 30	180	22	490	208	449	3,230
More than 30	180	24	720	208	834	11,514

Note: a/ Inflation rate of 4.2% per annium is considered.

Above tariff schedule shows that monthly water tariff rates (INR/month) of domestic consumption is flat up to 10 m^3/month of water consumption, but when consumption volume exceed 11 m^3/month, the tariff rates increase as water consumption increase. As for unit tariff rates (INR/m^3), it fall until water consumption category of less than 10 m^3/month, but increase when water consumption exceed 11 m^3/month as shown in figures below.

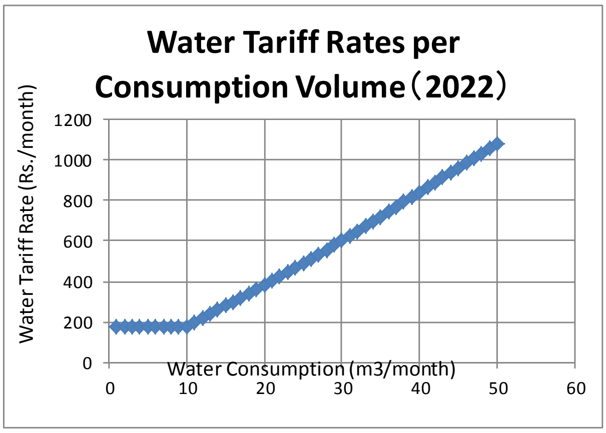


Figure 9.7 Water Tariff Rates (2022)

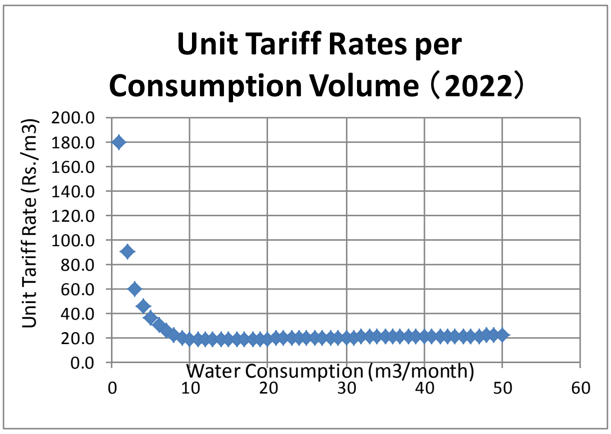


Figure 9.8 Water Tariff per Unit Consumption

Also, the following table shows the proposed water tariff rates of bulk consumers. Compared with **Table 9.11,** Initial Estimation of Basic Tariff (Revision for 2022), the basic tariff rate is remarkably low, since this is adjusted based on current water tariff payment level. Instead, the volumetric tariff rates increase as the category of consumption volume increases.

Table 9.14 Proposed Water Tariff Schedule of Bulk Consumption (Revision for 2022)

Monthly Consumption (m^3)	Basic Charge (INR/Connection/Month)				Volumetric Charge (INR/m3)
	Residential	Institutional	Commercial	Industril	
Less than 100m3	2,030	2,530	2,750	2,770	28
101-200m3	2,030	2,530	2,750	2,770	28
201-300m3	2,030	2,530	2,750	2,770	42
301-500m3	2,030	2,530	2,750	2,770	42
501-800m3	2,030	2,530	2,750	2,770	56
801-1000m3	2,030	2,530	2,750	2,770	56
1001-1500m3	2,030	2,530	2,750	2,770	70
More than 1501m3	2,030	2,530	2,750	2,770	70

9.3.6 Timing of the Water Tariff Revision

Even though cost recovery is a basic principle of tariff revision, it is recommended to start metered tariff at a lower level upon its introduction in 2022 and that the tariff level should not be much higher than the current tariff level. The main focus will be to let consumers develop the healthy habit of paying water tariff regularly for the water that they use or consume, and enjoy 24/7 clean water for the next five years. Thereafter, the consumers, upon recognizing that clean water is indispensable in their lives, will be more open to a higher tariff level and the next round of increases can be made to meet the cost recovery requirement.

For the cost recovery requirement, as earlier discussed at the beginning of this chapter, the short-term objective is to cover all operation and maintenance costs, and full cost recovery shall be required during the long-term business operation. As the following figures indicate, water tariff will be revised every 5 years (2022, 2027, and 2032). If the proposed tariff rates are approved by the government, the O&M costs could be covered at the second year of the first water tariff revision in 2023, whereas the full cost recovery would materialize at the second year of the third water tariff revision in 2033.

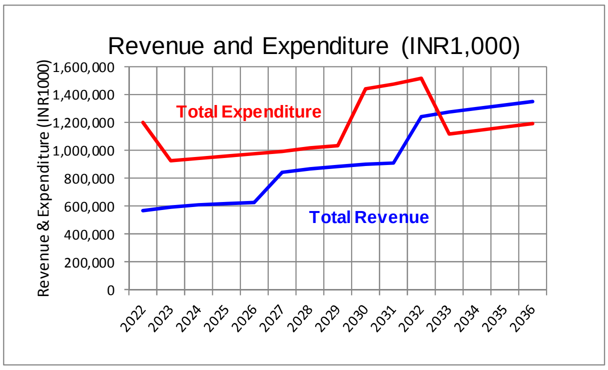


Figure 9.7 Revenue and Expenditure Balance

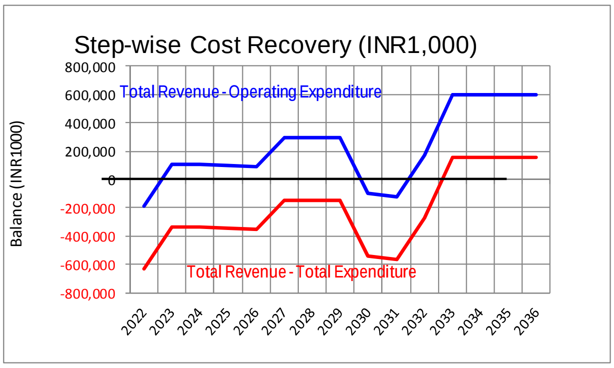


Figure 9.8 Step-wise Cost Recovery

9.4 Consideration for Poverty

In principle, the water tariff level must be established to cover the cost of water supply operation, and the cost of service should be equitably distributed to all users. However, it is also necessary to consider that some minimum level of consumption would be charged at a relatively lower tariff rate to support the low income group, whereas those who use bulk quantities of water would be made to pay higher charge. In other words, lower levels of consumption should have a lower unit tariff rate.

The poverty consideration was taken into account in the volumetric charging method. According to the Social Condition Survey in 2014, the BPL households use less water volume, and their average monthly water consumption is estimated at 5.9 m^3 per household. Even though the basic tariff is the same for all income classes (INR180/month), the volumetric tariff rate of the lowest consumption group (less than 10m^3 per month) is set at ZERO.

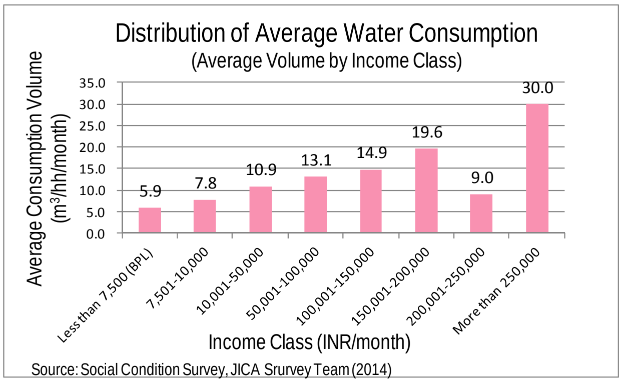


Figure 9.9 Average water Consumption

If the proposed tariff is approved by the government of Manipur, the average monthly payment of the BPL households is INR180. The amount is within willingness to pay of BPL class (INR159/month) and the affordability to pay (INR225/month). Furthermore, according to the Social Condition Survey 2014, the BPL class already pays INR778/month on average to satisfy their water demand from various sources including PHED piped water and tanker supply. When considering this situation, the proposed tariff level is reasonable because it meets both requirements of fairness and poverty consideration.

9.5 Financial Analysis

9.5.1 Condition of Financial Analysis

The financial evaluation is conducted by estimating the financial internal rate of return (FIRR). Basic conditions for the financial evaluation are as follows.

1) Base year of the project evaluation is set for 2014. All future expenses and incomes generated from the project implementation are converted to the present value, by applying discount rate of 9%. The rate is derived from the policy rate of Reserve Bank of India (India's Central Bank).
2) Actual market prices are applied in the financial analysis, and transfer items including interests, taxes, and subsidies are included in the financial costs. Price escalation is taken into account in the cost items since tariff level is determined with due consideration of future price escalation. In addition, physical contingency is also included in the analysis.
3) Project cost includes Phase I and II components under the JNNURM, and Phase III component as studied by JICA, since project benefits generated by the Great Imphal Water Supply Project cannot be dissociated from each implementation phase.
4) The construction will start from 2015-16 and be completed in 2021-22. Therefore, the benefit will be generated from 2022, and duration of analysis is 30 years after completion of the construction.
5) Two cases are examined in the FIRR estimation based on the tariff level. In the 1^{st} case, willingness to pay and current water tariff payment level are not taken into consideration, and tariff level increases are based on the price escalation (Non-adjusted Water Tariff Rates). The 2^{nd} case is adjusted by willingness to pay and current water tariff payment level, and cost recovery requirement is also considered (Adjusted Water Tariff Rates).

9.5.2 Financial Benefits

The benefit of financial analysis is revenue from water supply management. The primary revenue of PHED is water tariff payment from users, in addition to other operational revenue including connection fee, penalty fee, and tender document fee. Management efforts of PHED also generate financial benefits, which include the reduction in non-revenue water and O&M cost. The following are the details of the financial benefits.

1) Metered tariff will be introduced to all metered connections from 2022, and will be revised every five years based on the changes in O&M cost and number of connections. The tax rate is composed of fixed charge and volumetric charge, and differs from user category and consumption volume.

The following tables show monthly tax revenue of the 2nd case (Adjusted Water Tariff Rates).

Table 9.15 Monthly Tax Revenue by User Category (Domestic Connection)

(Unit: INR1000/ Month)

Itam	Unit Rate (INR/m3)					Shor-term					Mid-term					Long-term				
	2022	2027	2032	2037	Share (%)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Number of Domestic Connection						146,734	149,775	152,815	155,856	158,897	161,938	164,979	168,020	171,061	174,102	177,735	181,367	185,000	188,632	192,265
Tariff Revenue (Fixed)						26,412	26,959	27,507	28,054	28,601	34,007	34,646	35,284	35,923	36,561	46,211	47,155	48,100	49,044	49,989
less than $10m^3$	180	210	260	370	56.1%	14,811	15,117	15,424	15,731	16,038	19,069	19,427	19,786	20,144	20,502	25,913	26,442	26,972	27,502	28,031
10-20m3	180	210	260	370	34.6%	9,133	9,322	9,512	9,701	9,890	11,759	11,980	12,201	12,422	12,643	15,980	16,306	16,633	16,959	17,286
20-30m3	180	210	260	370	8.1%	2,139	2,184	2,228	2,272	2,317	2,754	2,806	2,858	2,910	2,961	3,743	3,819	3,896	3,972	4,049
more than 30m3	180	210	260	370	1.2%	329	336	343	350	356	424	432	440	448	456	576	588	599	611	623
Tariff Revenue (Fixed)						9,489	9,687	9,883	10,079	10,277	20,512	20,897	21,283	21,668	22,053	33,531	34,217	34,902	35,587	36,273
less than $10m^3$	0	0	0	0	56.1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20m3	20	40	60	80	34.6%	6,445	6,579	6,712	6,846	6,980	14,226	14,493	14,761	15,028	15,295	23,421	23,900	24,378	24,857	25,336
20-30m3	22	42	62	82	8.1%	1,508	1,540	1,571	1,602	1,634	3,178	3,238	3,298	3,357	3,417	5,149	5,255	5,360	5,465	5,570
more than 30m3	24	44	64	84	1.2%	1,536	1,568	1,600	1,631	1,663	3,108	3,166	3,224	3,283	3,341	4,961	5,062	5,164	5,265	5,367
Domestic Connection Sub-total						35,901	36,646	37,390	38,133	38,878	54,519	55,543	56,567	57,591	58,614	79,742	81,372	83,002	84,631	86,262
Other Revenue /a						1,795	1,832	1,869	1,907	1,944	2,726	2,777	2,828	2,880	2,931	3,987	4,069	4,150	4,232	4,313
Domesctic Connection Total						37,696	38,479	39,259	40,040	40,822	57,245	58,320	59,396	60,470	61,545	83,729	85,441	87,152	88,863	90,575

Note: a/ Other revenue is 5% of tariff revenue based on the past record, and includes tender form fee, penalty, etc.

Table 9.16 Monthly Tax Revenue by User Category (Residential Connection)

(Unit: INR1000/ Month)

Itam	Unit Rate (INR/m3)					Shor-term					Mid-term					Long-term				
	2022	2027	2032	2037	Share (%)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Number of Domestic Connection						12	12	13	13	13	13	13	14	14	14	14	14	15	15	15
Tariff Revenue (Fixed)						24	24	27	27	27	39	39	42	42	42	58	58	62	62	62
Less than 100m3	2,040	3,000	4,130	5,010	9.1%	2	2	2	2	2	4	4	4	4	4	5	5	6	6	6
101-200m3	2,040	3,000	4,130	5,010	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300m3	2,040	3,000	4,130	5,010	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
301-500m3	2,040	3,000	4,130	5,010	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
501-800m3	2,040	3,000	4,130	5,010	27.3%	7	7	7	7	7	11	11	11	11	11	16	16	17	17	17
801-1000m3	2,040	3,000	4,130	5,010	18.2%	4	4	5	5	5	7	7	8	8	8	11	11	11	11	11
1001-1500m3	2,040	3,000	4,130	5,010	18.2%	4	4	5	5	5	7	7	8	8	8	11	11	11	11	11
More than 1501m3	2,040	3,000	4,130	5,010	27.3%	7	7	7	7	7	11	11	11	11	11	16	16	17	17	17
Tariff Revenue (Fixed)						255	255	275	275	275	505	505	543	543	543	790	790	846	846	846
Less than 100m3	24	44	64	84	9.1%	14	14	16	16	16	29	29	31	31	31	45	45	48	48	48
101-200m3	24	44	64	84	0.0%	13	13	14	14	14	26	26	28	28	28	41	41	44	44	44
201-300m3	36	66	96	126	0.0%	20	20	21	21	21	39	39	42	42	42	61	61	65	65	65
301-500m3	36	66	96	126	0.0%	39	39	43	43	43	78	78	84	84	84	122	122	131	131	131
501-800m3	48	88	128	168	27.3%	79	79	85	85	85	156	156	168	168	168	244	244	262	262	262
801-1000m3	48	88	128	168	18.2%	37	37	40	40	40	73	73	78	78	78	114	114	122	122	122
1001-1500m3	60	110	160	210	18.2%	33	33	35	35	35	65	65	70	70	70	102	102	109	109	109
More than 1501m3	60	110	160	210	27.3%	20	20	21	21	21	39	39	42	42	42	61	61	65	65	65
Residential Connection Total						279	279	302	302	302	544	544	585	585	585	848	848	908	908	908

Table 9.17 Monthly Tax Revenue by User Category (Institutional Connection)

(Unit: INR1000/ Month)

Itam	Unit Rate (INR/m3)					Shor-term					Mid-term					Long-term				
	2022	2027	2032	2037	Share (%)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Number of Domestic Connection						172	174	175	177	179	181	183	184	186	188	190	192	193	195	197
Tariff Revenue (Fixed)						437	442	445	450	455	543	549	552	558	564	882	891	896	905	914
Less than 100m3	2,540	3,000	4,640	5,060	11.9%	52	53	53	54	54	65	65	66	67	67	105	106	107	108	109
101-200m3	2,540	3,000	4,640	5,060	7.3%	32	32	32	33	33	40	40	40	41	41	64	65	65	66	67
201-300m3	2,540	3,000	4,640	5,060	6.6%	29	29	29	30	30	36	36	37	37	37	58	59	59	60	61
301-500m3	2,540	3,000	4,640	5,060	9.3%	41	41	41	42	42	50	51	51	52	52	82	83	83	84	85
501-800m3	2,540	3,000	4,640	5,060	10.6%	46	47	47	48	48	58	58	58	59	60	93	94	95	96	97
801-1000m3	2,540	3,000	4,640	5,060	0.7%	3	3	3	3	3	4	4	4	4	4	6	6	6	6	6
1001-1500m3	2,540	3,000	4,640	5,060	11.3%	49	50	50	51	51	61	62	62	63	63	99	100	101	102	103
More than 1501m3	2,540	3,000	4,640	5,060	42.4%	185	187	188	191	193	230	233	234	237	239	374	378	380	383	387
Tariff Revenue (Fixed)						233	233	254	254	254	464	464	499	499	499	724	724	777	777	777
Less than 100m3	24	44	64	84	11.9%	14	14	16	16	16	29	29	31	31	31	45	45	48	48	48
101-200m3	24	44	64	84	7.3%	13	13	14	14	14	25	25	27	27	27	39	39	42	42	42
201-300m3	36	66	96	126	6.6%	17	17	19	19	19	35	35	37	37	37	54	54	58	58	58
301-500m3	36	66	96	126	9.3%	32	32	35	35	35	64	64	69	69	69	100	100	107	107	107
501-800m3	48	88	128	168	10.6%	56	56	61	61	61	111	111	120	120	120	174	174	187	187	187
801-1000m3	48	88	128	168	0.7%	31	31	34	34	34	62	62	67	67	67	97	97	104	104	104
1001-1500m3	60	110	160	210	11.3%	39	39	42	42	42	77	77	83	83	83	120	120	129	129	129
More than 1501m3	60	110	160	210	42.4%	31	31	33	33	33	61	61	65	65	65	95	95	102	102	102
Institutional Connection Total						670	675	699	704	709	1,007	1,013	1,051	1,057	1,063	1,606	1,615	1,673	1,682	1,691

Table 9.18 Monthly Tax Revenue by User Category (Commercial Connection)

(Unit: INR1000/ Month)

Itam	Unit Rate (INR/m3)					Shor-term					Mid-term					Long-term				
	2022	2027	2032	2037	Share (%)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Number of Domestic Connection						39	40	40	41	41	41	42	42	43	43	43	44	44	45	45
Tariff Revenue (Fixed)						108	110	110	113	113	134	137	137	140	140	203	208	208	213	213
Less than 100m3	2,760	3,260	4,730	5,510	16.7%	18	18	18	19	19	22	23	23	23	23	34	35	35	35	35
101-200m3	2,760	3,260	4,730	5,510	13.9%	15	15	15	16	16	19	19	19	19	19	28	29	29	30	30
201-300m3	2,760	3,260	4,730	5,510	2.8%	3	3	3	3	3	4	4	4	4	4	6	6	6	6	6
301-500m3	2,760	3,260	4,730	5,510	5.6%	6	6	6	6	6	7	8	8	8	8	11	12	12	12	12
501-800m3	2,760	3,260	4,730	5,510	11.1%	12	12	12	13	13	15	15	15	16	16	23	23	23	24	24
801-1000m3	2,760	3,260	4,730	5,510	2.8%	3	3	3	3	3	4	4	4	4	4	6	6	6	6	6
1001-1500m3	2,760	3,260	4,730	5,510	8.3%	9	9	9	9	9	11	11	11	12	12	17	17	17	18	18
More than 1501m3	2,760	3,260	4,730	5,510	38.9%	42	43	43	44	44	52	53	53	55	55	79	81	81	83	83
Tariff Revenue (Fixed)						9	9	10	10	10	426	426	459	459	459	666	666	712	712	712
Less than 100m3	1	44	64	84	16.7%	1	1	1	1	1	29	29	31	31	31	45	45	48	48	48
101-200m3	1	44	64	84	13.9%	1	1	1	1	1	24	24	26	26	26	37	37	40	40	40
201-300m3	1.5	66	96	126	2.8%	1	1	1	1	1	30	30	32	32	32	47	47	50	50	50
301-500m3	1.5	66	96	126	5.6%	1	1	1	1	1	57	57	62	62	62	90	90	96	96	96
501-800m3	2	88	128	168	11.1%	2	2	2	2	2	105	105	113	113	113	164	164	176	176	176
801-1000m3	2	88	128	168	2.8%	1	1	1	1	1	57	57	62	62	62	90	90	96	96	96
1001-1500m3	2.5	110	160	210	8.3%	1	1	2	2	2	68	68	73	73	73	106	106	113	113	113
More than 1501m3	2.5	110	160	210	38.9%	1	1	1	1	1	56	56	60	60	60	87	87	93	93	93
Commertial Connection Total						117	119	120	123	123	560	563	596	599	599	869	874	920	925	925

Table 9.19 Monthly Tax Revenue by User Category (Industrial Connection)

(Unit: INR1000/ Month)

Itam	Unit Rate (INR/m3)					Shor-term					Mid-term					Long-term				
	2022	2027	2032	2037	Share (%)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Number of Domestic Connection						2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tariff Revenue (Fixed)						6	6	6	6	6	7	7	7	7	7	10	10	10	10	10
Less than 100m3	2,780	3,460	4,840	5,640	50.0%	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
101-200m3	2,780	3,460	4,840	5,640	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300m3	2,780	3,460	4,840	5,640	50.0%	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5
301-500m3	2,780	3,460	4,840	5,640	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
501-800m3	2,780	3,460	4,840	5,640	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
801-1000m3	2,780	3,460	4,840	5,640	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001-1500m3	2,780	3,460	4,840	5,640	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 1501m3	2,780	3,460	4,840	5,640	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tariff Revenue (Fixed)						32	32	36	36	36	55	55	59	59	69	101	101	108	108	108
Less than 100m3	24	44	64	84	50.0%	14	14	16	16	16	29	29	31	31	31	45	45	48	48	48
101-200m3	24	44	64	84	0.0%	7	7	8	8	8	14	14	15	15	15	22	22	24	24	24
201-300m3	36	66	96	126	50.0%	11	11	12	12	12	12	12	13	13	23	34	34	36	36	36
301-500m3	36	66	96	126	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
501-800m3	48	88	128	168	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
801-1000m3	48	88	128	168	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001-1500m3	60	110	160	210	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 1501m3	60	110	160	210	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Induatrial Connection Total						38	38	42	42	42	62	62	66	66	76	111	111	118	118	118

2) Water supply management also generates other revenues including connection fee, penalty fee, and tender document fee. The revenue and expenditure statement of PHED indicates that the other revenue had been around 3% to 8% (weighted average 5.1%) of tax revenue in the past five years as shown in table below. Therefore, 5% of tax revenue is regarded as the "other revenues" in the financial analysis.

Table 9.20 Past Revenue Record of Imphal Water Supply (2009/10 to 2013/14)

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	Average
Tax Revenue	7,031	7,499	9,070	15,155	16,647	55,402
Others	245	292	266	1,156	877	2,836
% in Tax Revenue	3.5%	3.9%	2.9%	7.6%	5.3%	**5.1%**

Source: PHED

3) After the project, Imphal water supply will be managed based on the formulated business plan and clear revenue and expenditure statement, which will enhance the accountability of water supply operation because the results of the action of operating staff will be evident. As a result, collection efficiency of water tariff would be improved and more efficient control of expenditures would be practiced. These administrative efforts are also taken into consideration in the analysis.

9.5.3 Result of Financial Analysis

(1) Result of FIRR Estimation

Based on the above-mentioned conditions, financial analysis was conducted and the result in terms of FIRR was estimated at 0.7% in the 1st case (Non-adjusted Water Tariff Rates). Since tariff level of the 1st case is not adjusted by the WTP, and the level increases are only based on the price escalation, the O&M is satisfied from the beginning of the short-term operation whereas the replacement cost can be covered within the mid-term operation. On the other hand, FIRR of the 2nd case (Adjusted Water Tariff Rates) becomes 0.4%, and the cost recovery requirement of both the O&M and the replacement costs are satisfied during the short-term operation and the long-term operation respectively.

Even though the FIRR of 0.4% is not so high, it can be said that the project implementation is financially feasible. The reason why the FIRR is moderate is due to high project costs and relatively low revenue from water tariff collection. The project costs include Phase I, II and III and level of tariff rates are enough high to recover annual O&M cost from the beginning of project completion. However, the tariff level is not enough high to recover construction cost of all the three phases due to low payment capacity of beneficiaries. As the cash flow analysis indicates, PHED will raise tariff level every five years, and the full cost recovery is the long-term target, or more than 10 years after the renewal operation started. Since the project is evaluated in the present value basis applying the discount rate, future benefits are basically undervalued.

(2) Sensitivity Analysis

Sensitivity analyses were made to examine impact on the water supply management due to uncertainties and risks. The cases that the sensitivity being tested are: (i) project cost increases by 10%, (ii) operation and management cost increases by 10%, (iii) tariff revenue decreases by 10%, (iv) tariff revenue decreases by 20%, and (v) no management efforts is conducted. As following table indicates, FIRR is more sensitive when tariff revenue decreases. If tariff revenue decreases by 10% or more, FIRR becomes negative. From the result of analysis, it can be said that water tariff collection is a key for success and sustainable operation of water supply management by PHED.

Table 9.21 Results of Sensitivity Analysis

	Base Case	Project Cost Increases by 10%	O&M Cost Increases by 10%	Revenue Decreases by 10%	Revenue Decreases by 20%	No Management Efforts
FIRR (%)	0.4%	0.0%	-0.3%	-0.6%	-2.0%	0.0%

9.6 Economic Analysis

9.6.1 Condition of Economic Analysis

The economic evaluation was conducted by estimating economic indicators such as economic internal rate of return (EIRR), net present value (NPV) and cost-benefit ratio (B/C). Basic conditions for the economic evaluation are the same as the financial analysis, but some different points are as follows.

1) Actual market prices are applied in the financial analysis, whereas economic prices are adopted in the economic analysis. To convert the market (financial) prices to the economic prices, a standard conversion factor (SCF) of 0.96 is applied. The SCF is estimated after due consideration of market distortion factors, including customers and other import duties.

2) Transfer items including interests, taxes, and subsidies are eliminated from the financial prices to obtain the economic prices, since these items are just transferred among entities in view of national economy level. Price escalation is not taken into consideration in the economic prices, but physical contingency is included in the analysis.

3) Project costs are divided into two parts, including local currency portion and foreign currency portion. The former includes those materials and equipment procured from the domestic market, whereas the latter is those from foreign markets. On one hand, to estimate economic prices, the SCF is applied to the domestic materials since domestic markets are usually distorted by taxes and subsidies. On the other hand, the SCF is not applied to the international price of imported goods since international market is considered as more ideal market than the internal market.

9.6.2 Economic Benefits

(1) Economic Benefits of Water Supply Project

Water supply projects generate various types of economic benefits, and following are typical economic benefits, which include both tangible and intangible benefits. Among benefits stated in the table below are: (i) cost saving from current water acquisition, and (ii) increase in water supply volume. These are estimated in monetary terms to enable the estimation of the economic feasibility of the project.

Table 9.22 Economic Benefits of the Water Supply Project

Benefit	Details
Cost Saving from Current Water Acquisition	Reduction in water expenditure from other sources (water tanker, private suppliers, bottled water, etc.), O&M expenditure of tube well (cost for pump installation, fuel or electricity), Time saving from water acquisition, etc.
Increase in Water Supply Volume	Willingness to Pay of water users of improved water supply services
Mitigation of Damages related to Water Supply	Mitigation of Damages from intermittent water supply (interruption of work due to intermittent water supply), Reduction in water expenditure from drought damages, etc.

Improvement of Hygiene Condition	Reduction in Water Borne Disease (medical consultation fee, expenses for medicine, avoidance of absence due to illness, etc.)
Environmental Benefit	Economization of water resources (by reducing leakage from transmission, distribution main, storage tank, and individual connection)
Improvement of Living Environment	Improvement of living environment of water users, generation of recreation effect including water park, bird watching, etc.

(2) Cost Saving from Current Water Acquisition

According to the Social Condition Survey (2014), consumers in the service area get water for their daily consumption from various sources including water tanker, private piped water, own or neighbor's well, and bottled water, in addition to PHED piped water. The survey examined the consumers' average monthly payment for acquiring water, and the results are summarized in the table below. Among total respondents, 25% of households obtain PHED piped water, whereas 26% of households buy water from water tanker at cost of 967 INR/month. According to the survey, the average expenditure for water acquisition is estimated at 590 INR/month.

Table 9.23 Monthly Water Expenditure by Different Source

Source of Water	Number of Household	% in Total Sample	Total Payment (INR/month)	Average Expenditure
1. PHED Piped Water	114	24.9%	17,825	156
2. Water Tanker	118	25.8%	114,140	967
3. Private Piped Water	1	0.2%	600	600
4. O&M Expences for ouwn Source	3	0.7%	9,800	3,267
5. From Neighbour	0	0.0%	0	-
6. Commercial Well/ Tap Stand	8	1.7%	720	90
7. Bottled Water	21	4.6%	13,350	636
8. Others	0	0.0%	0	-
Total	265	58%	156,435	590

Source: Social Condition Survey, JICA Survey Team (2014)

In addition, around 60% of respondents have a water pump in their home and average expenditure for installation is 7,100 INR/household. Also, around 56% of respondents have water tank and procurement cost of 1,000 liter plastic tank is 6,000 INR/unit. Depreciation costs are also added in the water expenditure of "without-project case". On the other hand, future water costs after the project implementation are regarded as the water expenditure of "with-project case". The gap between the with-project case and the without-project case is estimated for the net project benefit of the reduction in water expenses.

- Additional Cost in Drought Year

Water scarcity is almost an annual phenomenon in Imphal and the scarcity period of water is three months, or from March to June. During this period, consumers suffer from shortage of domestic water since price of potable water increases day by day. In 2014, price of potable water increases from 200 INR/1000 liters to 750 INR/ 1000 liters during March to May, according to several new sources[1]. Even after the payment, consumers have to wait two to three days due to overshooting demand against supply.

By implementing the Phase III component of the Imphal Integrated Water Supply Project, Chingkheiching WTP will be constructed at the site of Thoubal Dam. The Chingkheiching WTP will supply 45 mld of additional clean water to the city, and annual water scarcity will be mitigated. In the economic analysis, it is assumed that serious water shortage will occur every 3 to 4 years (35% probability), which is estimated based on the past record of annual rainfall. In addition, during March to June, serious water shortage happens only 50 days, taking the safe side in the estimation. As a result, 4,250 INR/HH/Year is estimated to benefit from mitigating drought impact on consumers.

Table 9.24 Reduction in Water Expenditure in Drought Season

Price of Potable Water in Drough Season (INR/m^3) /a	Water Requirment (m^3/HH/day)	Scarcity Period (days)	Probability /b (%)	Expenditure in Drought Year (INR/HH/Year)
400	0.675	50	35%	4,725

Note: a/ Prices of potable water in drought season ranges between INR200/m^3 to INR750/m^3 in 2014.
b/ Drought year (less than average annual rainfall) occures 19 times during 1956-2010 and probability is estimated 19 years÷54 years.

(3) Increase in Water Supply Volume

In the financial evaluation, the main benefit is revenue from water supply operation. However, water tariff is sort of a tax and is regarded as a transfer item from beneficiaries to the service provider. Therefore, in the economic evaluation, tariff revenue cannot be the economic benefit. Instead, incremental water supply volume is assessed by applying WTP of the beneficiaries.

The following table shows the incremental water supply volume by the project. Current design capacity is 104.25 mld, but actual output is estimated at 80.28 mld, only 77% of the design capacity. On the other hand, planned water supply volume will be 149.25 mld, and the gap between planned output and present output, 68.97 mld, is the incremental water volume which is used in the economic evaluation.

Table 9.25 Incremental Water Consumption

Item	Present (2011)		Future (2021)	Incremental Water Volume	
	Design Capacity (mld) /a	Present Output (mld) /b	Production Capacity (mld) /a	(mld)	(m^3/year)
Production Volume	104.25	80.28	149.25	68.97	25,174,050

Note: a/ Data is obtained from the Draft Project Report (DPR)
b/ Data is obtained from PHED

[1] http://timesofindia.indiatimes.com/city/guwahati/Water-crisis-throws-life-out-of-gear-in-Imphal/articleshow/34283910.cms

In the economic analysis, the WTP is estimated based on demand function and is finalized through socio-economic survey. However, necessary data for assuming demand function of domestic water in Imphal is difficult to obtain. Therefore, the WTP in this analysis is estimated through a simple estimation method, and is an intermediate value of current (before the project implementation) water cost for consumers and future (after the project implementation) water cost of them.

As a result, the WTP of water consumption category of less than 10m^3 per month is estimated at 367 INR/month, while the WTP in those in more than 30m^3 category is 1,793 INR/month. Average willingness to pay in the economic analysis is estimated at 818 INR/month, as shown in the table below.

Table 9.26 Willingness to Pay by Water Consumption Category

Water Consumption (m^3/month)	Current Expenditure to Obtain Domestic Water		Water Traiff after Project (b)	Estimated WTP (a+b)/2
	Annual	Monthly (a)		
less than 10m^3	7,000	583	150	367
10-20m^3	8,100	675	265	470
20-30m^3	9,300	775	505	640
more than 30m^3	33,800	2,817	770	1,793
Total				818

Based on the above assumptions, incremental water supply volume is converted into monetary terms, and total willingness to pay for the improved water services is estimated at 985,075 INR/year in financial value, and 945,671 INR/year in economic value, as shown in the table below. In the benefit estimation, the willingness to pay of domestic consumers who consume more than 50m^3 per month is applied to the bulk consumers since their WTP could not obtained through the Social Condition Survey.

Table 9.27 Total Willingness to Pay

Itam	Incremental Water Volume (m^3/year)	WTP (INR/month)	Monthly Water Consumption (m^3/HH) /b	Unit WTP (INR/m^3)	Total WTP (INR 1000/Year)	
					Financial Price	Economic Price
Domestic Water Demand	20,147,973					
less than 10m^3	(6,593,727)	367	20	18	119,393	114,617
10-20m^3	(8,894,718)	470	20	23	206,445	198,187
20-30m^3	(3,485,515)	640	20	32	110,159	105,753
more than 30m^3	(1,174,012)	1,793	20	89	103,970	99,811
Bulk Demand /a	5,026,077			89	445,108	427,303
Total	25,174,050				985,075	945,671

Note: a/ Unit WTP of the more than 50m^3 category is applied to bulk consumption.
b/ Monthly water consumption of household is estimated by applying 135lpcd with HH size of 5 person/HH

(4) Other Benefits

The water supply project also generates intangible benefits including enhancement of amenity and well-being, and capacity enhancement of water management body. When people obtain enough water, they start using more water for cleaning purposes, not only in their housing area but also in the surrounding area including roads and other common spaces. At home, people could allocate more water to washing perishable goods, dishware, toilet, and bathing. In the public, urban disasters including spreading fire could be mitigated by means of fire hydrant. This may result in increase in land value, and allow urban planners to draw positive picture and improve degree of freedom for their planning.

For domestic consumers, continuous supply of water saves time for procuring water from other sources and boiling for drinking purpose, and increases time to use more productive purposes. Unnecessary boiling water also results in promotion of energy saving at the household level. In addition, mitigation of waterborne disease reduces absence from study and work.

For service providers, the project will enhance their operating capacity. After the project, Imphal water supply will be managed based on the business plan and clear revenue and expenditure statement, which enhances accountability of water supply operation because the results of the action of operating staff are known. As a result, collection efficiency of water tariff would be improved and more efficient control of expenditures would be practiced.

9.6.3 Result of Economic Analysis

(1) Result of the Analysis

Based on the above conditions, economic analysis was conducted, and results of analysis in terms of EIRR, NPV, and B/C Ratio are shown in the table below.

Table 9.28 Result of Economic Analysis

	EIRR	NPV (INR1000)	B/C Ratio
Indicators	11.5%	1,665,535	1.17

The results indicate that all economic indicators are positive. The policy rate of Reserve Bank of India (India's Central Bank) is 9% in 2014, and this can be seen as the opportunity cost of capital in India, therefore, project implementation is economically feasible. In addition, the B/C ratio is more than one and the NPV is positive. The magnitude of NPV indicates that the project will generate a huge impact on the local economy.

(2) Sensitivity Analysis

Sensitivity analyses were made to examine impact on the water supply management due to uncertainties and risks. The cases that the sensitivity being tested were: i) project cost increases by 10%, ii) operation and management cost increases by 10%, iii) benefit decreases by 10%, and iv) benefit decreases by 20%. As following table indicates, EIRR is less sensitive when project cost increases by 10%, but more sensitive when project benefits decrease by 10%. If the project benefits decrease by 20%, EIRR becomes 9.3%, almost equal to the policy rate of Reserve Bank of India.

Table 9.29 Result of Sensitivity Analysis

	Base Case	Project Cost Increases by 10%	O&M Cost Increases by 10%	Project Cost and O&M Cost Increases by 10%	Benefit Decreases by 10%	Benefit Decreases by 20%
EIRR (%)	11.5%	10.6%	11.4%	10.5%	10.4%	9.3%

9.7 Mid- and Long-term Revenue/ Expenses and its Sustainability of Implementation Agency

To see the balance of revenue and expenditure and assure the sustainability of the PHED's water supply management, cash flow statements for short-term, mid-term, and long-term operation were developed. The cash flow statements show the movement of PHED's revenue and expenditure during a certain period. Cash inflow comes from PHED's daily operation and includes the tax revenue and other revenue including connection fee and penalty fee, whereas cash outflow includes operating expenditure and replacement cost. Cash flow analysis will help PHED to set relevant water tariff level to cover operational costs from water supply services, and help PHED foresee potential problems in the future.

9.7.1 Assumptions of Cash Flow Analysis

To develop an effective cash flow statement of PHED's water supply management, the following assumptions were applied.

- Tariff will be revised every five years, to achieve step-wise operational objectives: i) Short-term Objective (1st Step) is to recover the operating cost, ii) Mid-term Objective (2nd Step) is to recover the operating cost and the depreciation for replacement of existing facilities, and iii) Long-term Objective (3rd Step) is to recover the operating cost, the depreciation for replacement of existing facilities, and a part of new capital investment.
- Depreciation for replacement cost, including plant and machinery, pipelines, and building/ facilities, is estimated based on durable years stipulated in "Manual on Water Supply and Treatment", Central Public Health and Environmental Engineering Organization (1999). The straight line method, which is simpler and hence more popular in water tariff estimation, is applied with consideration of 5% of residual value.
- The inflation rate per annum will be applied to the general increase in the operating costs during the short-tem, mid-term and long-term operation period, and is estimated at 4.2% per annum.
- Revenue improvement efforts including reduction in non-revenue water and revenue pilferage are taken into account in the cash flow analysis, and are estimated at 2% of annual revenue respectively.
- Operating expenditure reduction efforts including O&M efficiency improvement (2% of repair and maintenance cost), energy saving effect (3% of power cost), and administration cost saving

and staff replacement effect (2% of personnel expense) are taken into account in the cash flow analysis.

- The costs that beneficiaries have to shoulder, including installation fee of water meter and service pipe connection fee, are not included in the water tariff, but are separately collected from water users. Duration of installation of the water meter and the service pipe connection are three years, but collection period of these costs are 10 years since depreciation of them are also 10 years.

9.7.2 Result of Analysis

The major findings of the cash flow analysis are as follows, and the results are shown in **Table 9.30** Short-term, Mid-term and Long-term Cash Flow Analysis. In the cash flow analysis, the water tariff rates adjusted by the WTP and the cost recovery requirement are applied.

- The operating cash balance (total revenue – operating costs) is “plus” from the second year of the short-term business plan (2022-2026), if the proposed tariff levels will be approved. However, the balance temporarily falls into the red from 2030 to 2032 due to the first renewal of the water meter and service pipe connection.
- The total cash balance (total revenue – operating costs – replacement costs) is “minus” during the short-term (2022-2026) and the mid-term business plan (2027-2031), but changes to “plus” from the second year of the long-term business plan (2032-2036). The reason why the total cash balance falls deeply from 2030 to 2032 is same as the operating cash balance, due to the first renewal of the water meter and service pipe connection.
- Revenue increases at the time of water tariff revision. However, the increase rate of expenditure is higher than that of revenue, and periodic tariff revision is necessary to keep the positive figure of operating cash balance (total revenue – operating costs).
- The subsidy from the state government of Manipur to recover the operating cost is not required from the second year of the short-term business plan. However, if PHED wants to recover all costs including replacement cost, subsidy will be necessary until the second year of the long-term business plan.

Table 9.30 Short-term, Mid-term and Long-term Cash Flow Analysis

Financial Year	Short-term					Mid-term					Long-term				
	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year	12th Year	13th Year	14th Year	15th Year
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
1. Revenue Forecast	566,813	595,370	606,168	616,473	626,751	845,556	867,541	882,978	897,173	911,397	1,244,682	1,277,553	1,301,940	1,324,521	1,346,982
(1) Revenue Forecast	566,813	576,746	587,165	597,071	606,971	825,398	839,020	853,937	867,560	881,264	1,214,025	1,235,715	1,259,274	1,280,951	1,302,584
Tax Revenue	465,596	475,082	485,055	494,515	503,967	713,010	726,019	740,321	753,329	766,419	1,045,951	1,066,663	1,089,244	1,109,943	1,130,599
Other Revenue (5.0% of Water Sales)	21,541	21,988	22,434	22,880	23,327	32,711	33,326	33,940	34,554	35,169	47,845	48,823	49,801	50,779	51,757
Meter and Survice Pipe Connection Fee	79,676	79,676	79,676	79,676	79,676	79,676	79,676	79,676	79,676	79,676	120,229	120,229	120,229	120,229	120,229
(2) Revenue Improvement Efforts	0	18,624	19,003	19,402	19,781	20,159	28,520	29,041	29,613	30,133	30,657	41,838	42,667	43,570	44,398
Revenue Increase by Reduction in Non Revenue Water	0	9,312	9,502	9,701	9,890	10,079	14,260	14,520	14,806	15,067	15,328	20,919	21,333	21,785	22,199
Revenue Increase by Reduction in Revenue Pilferage	0	9,312	9,502	9,701	9,890	10,079	14,260	14,520	14,806	15,067	15,328	20,919	21,333	21,785	22,199
(3) Revenue Improvement Index															
Reduction in Non-Revenue Water (% to Previous Year's Sale)	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Reduction in Revenue Pilferage (% to Previous Year's Sale)	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2. Expenditure Forecast	1,196,909	929,125	944,828	961,191	978,241	996,007	1,014,519	1,033,811	1,438,301	1,475,390	1,514,037	1,119,418	1,143,115	1,167,806	1,193,534
(1) Expenditure	1,196,909	935,654	951,632	968,280	985,628	1,003,704	1,022,540	1,042,168	1,447,010	1,484,464	1,523,492	1,129,271	1,153,381	1,178,503	1,204,681
1) Operating Expenditure	754,212	492,957	508,935	525,583	542,931	561,007	579,843	599,471	1,004,313	1,041,767	1,080,795	686,574	710,684	735,806	761,984
a. Personnel Expense	136,242	141,964	147,926	154,139	160,613	167,359	174,388	181,712	189,344	197,296	205,583	214,217	223,214	232,589	242,358
b. Repair & Maintenance Cost	70,438	73,396	76,479	79,691	83,038	86,525	90,159	93,946	97,892	102,003	106,287	110,751	115,403	120,250	125,300
c. Communication	725	756	788	821	855	891	929	968	1,008	1,051	1,095	1,141	1,189	1,238	1,291
d. Chemical Cost	77,823	81,091	84,497	88,046	91,744	95,597	99,612	103,796	108,155	112,698	117,431	122,363	127,503	132,858	138,438
e. Power Cost	79,859	83,213	86,708	90,349	94,144	98,098	102,218	106,512	110,985	115,646	120,504	125,565	130,838	136,334	142,060
f. Other O&M Cost	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537	112,537
g. Meter & Survice Pipe Installation	276,588	-	-	-	-	-	-	-	384,391.7	400,536.0	417,358.5	-	-	-	-
2) Replacement Cost	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697
Depreciation for Replacement Cost	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697	442,697
(2) Operating Expenditure Reduction Efforts	0	6,529	6,804	7,089	7,387	7,697	8,021	8,357	8,709	9,074	9,455	9,853	10,266	10,697	11,147
O&M Efficiency Improvement Effest (O&M Audit)	0	1,409	1,468	1,530	1,594	1,661	1,731	1,803	1,879	1,958	2,040	2,126	2,215	2,308	2,405
Eneragy Saving Effect (Electricity Audit)	0	2,396	2,496	2,601	2,710	2,824	2,943	3,067	3,195	3,330	3,469	3,615	3,767	3,925	4,090
Administration Cost Saving and Staff Redeployment Effect	0	2,725	2,839	2,959	3,083	3,212	3,347	3,488	3,634	3,787	3,946	4,112	4,284	4,464	4,652
(3) Expenditure Improvement Index															
O&M Efficiency Improvement (% to Previous Year)	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Eneragy Saving Effect (% to Previous Year)	-	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Administration Cost Improvement (% to Previous Year)	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
3. Balance															
(1) Balance (Total Revenue - Operating Expenditure)	-187,399	108,942	104,037	97,980	91,207	292,247	295,718	291,865	-98,431	-121,296	173,341	600,832	601,522	599,412	596,145
(2) Balance (Total Revenue - Total Expenditure)	-630,096	-333,755	-338,660	-344,717	-351,490	-150,450	-146,979	-150,832	-541,128	-563,993	-269,356	158,135	158,825	156,715	153,448
Subsidy Requirement Amount to Cover Gap	630,096	333,755	338,660	344,717	351,490	150,450	146,979	150,832	541,128	563,993	269,356	-	-	-	-

Table 9.31 Estimation of Financial Internal Rate of Return (FIRR)

(Unit: INR1000)

#	Year	Project Cost				Project Benefit					Benefit-Cost	Discount Rate /a (9%)	Discounted Cost	Discounted Benefit
		Phase 1&2	Phase 3	O&M Cost	Cost Total	Tax Revenue	Other Revenue	Meter & Survice Pipe Connection Fee	Management Improvement	Benefit Total				
0	2014											1.0000		
1	2015	818,482	22,877		841,359					0	-841,359	0.9100	765,636	0
2	2016	1,429,506	291,090		1,720,596					0	-1,720,596	0.8281	1,424,825	0
3	2017	1,633,181	368,606		2,001,786					0	-2,001,786	0.7536	1,508,488	0
4	2018	816,590	3,057,645		3,874,236					0	-3,874,236	0.6857	2,656,756	0
5	2019	408,295	3,361,767		3,770,062					0	-3,770,062	0.6240	2,352,640	0
6	2020		3,138,134	254,740	3,392,874					0	-3,392,874	0.5679	1,926,709	0
7	2021		1,185,818	265,439	1,451,258					0	-1,451,258	0.5168	749,953	0
8	2022		1,173,985	641,675	1,815,660	429,141	21,457	79,676	23,695	553,970	-1,261,690	0.4703	853,818	260,506
9	2023		178,534	380,420	558,954	437,842	21,892	79,676	24,317	563,728	4,774	0.4279	239,193	241,236
10	2024			396,398	396,398	447,103	22,355	79,676	24,973	574,108	177,710	0.3894	154,364	223,567
11	2025			413,046	413,046	455,804	22,790	79,676	25,619	583,890	170,844	0.3544	146,371	206,912
12	2026			430,394	430,394	464,460	23,223	79,676	26,276	593,635	163,241	0.3225	138,792	191,433
13	2027			448,470	448,470	713,005	35,650	79,676	36,541	864,873	416,403	0.2935	131,605	253,799
14	2028			467,306	467,306	726,014	36,301	79,676	37,398	879,389	412,083	0.2670	124,790	234,834
15	2029			486,934	486,934	740,316	37,016	79,676	38,321	895,329	408,395	0.2430	118,329	217,572
16	2030			891,776	891,776	753,324	37,666	79,676	39,207	909,873	18,098	0.2211	197,205	201,207
17	2031			929,230	929,230	766,389	38,319	79,676	40,111	924,496	-4,734	0.2012	186,994	186,041
18	2032			968,258	968,258	1,045,891	52,295	120,229	51,688	1,270,103	301,844	0.1831	177,311	232,586
19	2033			574,037	574,037	1,066,603	53,330	120,229	52,930	1,293,092	719,055	0.1666	95,659	215,484
20	2034			598,147	598,147	1,089,183	54,459	120,229	54,265	1,318,135	719,988	0.1516	90,706	199,889
21	2035			623,269	623,269	1,109,882	55,494	120,229	55,542	1,341,146	717,877	0.1380	86,009	185,074
22	2036			649,447	649,447	1,130,537	56,527	120,229	56,836	1,364,128	714,681	0.1256	81,556	171,303
23	2037			676,723	676,723	1,585,757	79,288	120,229	75,533	1,860,807	1,184,084	0.1143	77,333	212,644
24	2038			705,146	705,146	1,614,812	80,741	120,229	77,204	1,892,985	1,187,839	0.1040	73,328	196,852
25	2039			734,762	734,762	1,643,889	82,194	120,229	78,896	1,925,209	1,190,447	0.0946	69,531	182,185
26	2040			1,345,651	1,345,651	1,672,895	83,645	120,229	80,608	1,957,376	611,725	0.0861	115,880	168,558
27	2041			1,402,168	1,402,168	1,701,985	85,099	120,229	82,347	1,989,660	587,491	0.0784	109,880	155,918
28	2042			1,461,060	1,461,060	1,735,773	86,789	181,420	84,298	2,088,279	627,219	0.0713	104,190	148,918
29	2043			866,198	866,198	1,769,610	88,480	181,420	86,276	2,125,785	1,259,587	0.0649	56,211	137,949
30	2044			902,579	902,579	1,803,325	90,166	181,420	88,275	2,163,186	1,260,607	0.0591	53,300	127,743
31	2045			940,488	940,488	1,837,174	91,859	181,420	90,307	2,200,759	1,260,271	0.0537	50,540	118,265
32	2046			979,987	979,987	1,870,925	93,546	181,420	92,363	2,238,255	1,258,268	0.0489	47,923	109,455
33	2047			1,021,146	1,021,146	1,904,726	95,236	181,420	94,452	2,275,834	1,254,688	0.0445	45,442	101,276
34	2048			1,062,305	1,062,305	1,938,527	96,926	181,420	96,540	2,313,413	1,251,108	0.0405	43,019	93,683
35	2049			1,103,464	1,103,464	1,972,328	98,616	181,420	98,628	2,350,992	1,247,528	0.0369	40,664	86,636
36	2050			2,019,862	2,019,862	2,006,129	100,306	181,420	100,716	2,388,571	368,708	0.0335	67,735	80,099
37	2051			2,097,781	2,097,781	2,039,929	101,996	181,420	102,804	2,426,150	328,368	0.0305	64,016	74,037
38	2052			2,177,244	2,177,244	2,073,730	103,687	273,754	104,892	2,556,063	378,819	0.0278	60,462	70,981
	Total	5,106,054	12,778,455	28,915,552	46,800,061	40,547,006	2,027,350	4,086,998	2,021,861	48,683,216	1,883,155		15,287,162	5,286,643

Note a/ Policy rate of Reserve Bank of India (India's Central Bank)

IRR	0.4%

Table 9.32 Estimation of Economic Internal Rate of Return (EIRR)

(Unit: INR1000)

#	Year	Project Cost				Project Benefit			Benefit-Cost	Discount Rate /a (9%)	Discounted Cost	Discounted Benefit
		Phase 1&2	Phase 3	O&M Cost	Cost Total	Incremental Water Consumption	Reduction in Expenditure	Benefit Total				
0	2014									1.0000		
1	2015	785,743	10,157	0	795,900	0	0	0	-795,900	0.9100	724,269	0
2	2016	1,372,326	241,860	0	1,614,186	0	0	0	-1,614,186	0.8281	1,336,708	0
3	2017	1,567,853	293,813	0	1,861,666	0	0	0	-1,861,666	0.7536	1,402,898	0
4	2018	783,927	2,357,826	0	3,141,753	0	0	0	-3,141,753	0.6857	2,154,456	0
5	2019	391,963	2,472,977	0	2,864,940	0	0	0	-2,864,940	0.6240	1,787,814	0
6	2020		2,195,164	191,055	2,386,219	0	0	0	-2,386,219	0.5679	1,355,060	0
7	2021		735,844	191,055	926,899			0	-926,899	0.5168	478,985	0
8	2022		691,939	292,909	984,848	945,671	1,311,293	2,256,964	1,272,116	0.4703	463,127	1,061,343
9	2023		13,425	101,854	115,279	945,671	1,338,531	2,284,202	2,168,923	0.4279	49,331	977,478
10	2024			101,854	101,854	945,671	1,365,646	2,311,317	2,209,463	0.3894	39,664	900,064
11	2025			101,854	101,854	945,671	1,392,895	2,338,566	2,236,712	0.3544	36,094	828,715
12	2026			101,854	101,854	945,671	1,294,730	2,240,401	2,138,547	0.3225	32,845	722,474
13	2027			101,854	101,854	945,671	1,319,639	2,265,310	2,163,456	0.2935	29,889	664,761
14	2028			101,854	101,854	945,671	1,344,519	2,290,190	2,188,336	0.2670	27,199	611,577
15	2029			101,854	101,854	945,671	1,369,058	2,314,729	2,212,875	0.2430	24,751	562,498
16	2030			358,353	358,353	945,671	1,393,938	2,339,609	1,981,256	0.2211	79,245	517,375
17	2031			358,353	358,353	945,671	1,222,969	2,168,640	1,810,287	0.2012	72,113	436,406
18	2032			358,353	358,353	945,671	1,248,717	2,194,388	1,836,035	0.1831	65,623	401,845
19	2033			101,854	101,854	945,671	1,274,429	2,220,100	2,118,246	0.1666	16,973	369,964
20	2034			101,854	101,854	945,671	1,299,612	2,245,283	2,143,429	0.1516	15,446	340,486
21	2035			101,854	101,854	945,671	1,325,335	2,271,006	2,169,152	0.1380	14,056	313,392
22	2036			101,854	101,854	945,671	1,271,530	2,217,201	2,115,347	0.1256	12,791	278,430
23	2037			101,854	101,854	945,671	1,295,980	2,241,651	2,139,797	0.1143	11,639	256,165
24	2038			101,854	101,854	945,671	1,320,063	2,265,734	2,163,880	0.1040	10,592	235,615
25	2039			101,854	101,854	945,671	1,344,275	2,289,946	2,188,092	0.0946	9,639	216,701
26	2040			101,854	101,854	945,671	1,368,440	2,314,111	2,212,257	0.0861	8,771	199,278
27	2041			101,854	101,854	945,671	1,392,558	2,338,229	2,236,375	0.0784	7,982	183,233
28	2042			101,854	101,854	945,671	1,420,826	2,366,497	2,264,643	0.0713	7,263	168,758
29	2043			101,854	101,854	945,671	1,448,944	2,394,615	2,292,761	0.0649	6,610	155,395
30	2044			411,520	411,520	945,671	1,477,200	2,422,871	2,011,351	0.0591	24,301	143,078
31	2045			411,520	411,520	945,671	1,477,200	2,422,871	2,011,351	0.0537	22,114	130,201
32	2046			411,520	411,520	945,671	1,477,200	2,422,871	2,011,351	0.0489	20,124	118,483
33	2047			101,854	101,854	945,671	1,477,200	2,422,871	2,321,017	0.0445	4,533	107,819
34	2048			101,854	101,854	945,671	1,477,200	2,422,871	2,321,017	0.0405	4,125	98,116
35	2049			101,854	101,854	945,671	1,477,200	2,422,871	2,321,017	0.0369	3,753	89,285
36	2050			101,854	101,854	945,671	1,477,200	2,422,871	2,321,017	0.0335	3,416	81,249
37	2051			101,854	101,854	945,671	1,477,200	2,422,871	2,321,017	0.0305	3,108	73,937
38	2052			101,854	101,854	945,671	1,477,200	2,422,871	2,321,017	0.0278	2,828	67,283
	Total	4,901,812	9,013,005	5,429,134	19,343,951	29,315,801	42,658,727	71,974,528	52,630,577		9,645,867	11,311,403

Note a/ Policy rate of Reserve Bank of India (India's Central Bank)

IRR	11.5%
B/C	1.17
NPV	1,665,535

【Reference】

The water tariff discussed in the financial and economic analysis in this chapter does not includes meter installation fee and service connection fee, and these fees are intended to collect separately from the beneficiaries. In this section, as an additional case study, the water tariff which includes meter installation fee and service connection fee is discussed in terms of FIRR and EIRR. The former water tariff which excludes meter and service pipe connection fees is defined as case (a), whereas the latter water tariff which includes both fees is defined as case (b), as a matter of convenience.

(1) Water Tariff Rate

Water tariff rates of case (a) and (b) are compared in the table below. In the case (b), water meter and service pipe fees are regarded as a part of facility, and the depreciation cost of them are taken into consideration in this analysis. The life period of water meter and service pipe is 10 years and will be renewed every 10 years.

As the comparison result indicated, basic charge is the same in both case, but volumetric charge of the case (b) is higher than the case (a). The price gap of the both tariff is around INT 8～9/m^3 in each water consumption category exclusing less than 10 m^3/month consumption category.

Table 9.34 Water Tariff Rate for Domestic Consumption (2022)

1) Domestic Consumption

Monthly Consumption (m^3)	(a) Water Tariff which does not includes Meter/ Service Pipe Fees			(b) Water Tariff which includes Meter/ Service Pipe Fees			Reference /a (current payment with infration)		
	Basic Charge (INR/ Connection/ Month) (1)	Volumetric Charge (INR/m3) (2)	Average Tax Payment (INR/Connection /Month) (1) + (2)	Basic Charge (INR/ Connection/ Month) (1)	Volumetric Charge (INR/m3) (2)	Average Tax Payment (INR/Connection /Month) (1) + (2)	Current Payment Level (INR/ Connection /Month)	Willingness to Pay (INR/ Connection /Month)	Affordability to Pay (INR/ Connection /Month)
Less than 10	180	0	150	1	180	1,552	208	329	1,552
10 to 20	180	20	265	2	280	2,347	208	395	2,347
20 to 30	180	22	505	3	490	3,230	208	449	3,230
More than 30	180	24	770	3	720	11,514	208	834	11,514

Note: a/ Inflation rate of 4.2% per annum is considered.

(2) Cost Recovery

Following figure shows the cost recovery result of the case (b). The cost recovery of operation and maintenance cost is materialized just after the project completion, and that of depreciation cost can be realized from the first year of the long-term business plan (2023 - 2036).

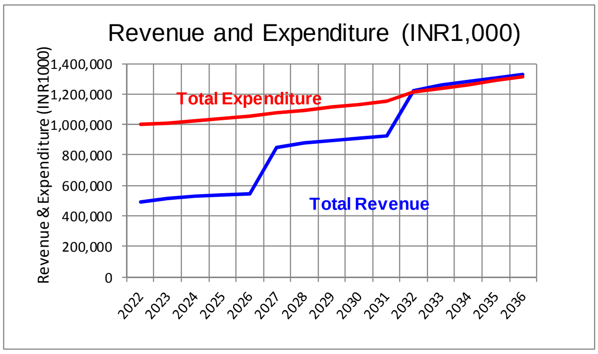


Figure 9.10 Revenue and Expenditure Balance

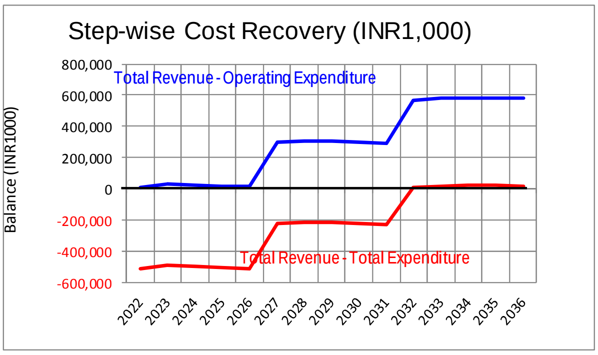


Figure 9.11 Step-wise Cost Recovery

(3) Result of Financial Analysis

Based on the water tariff (b), which includes water meter and service pipe connection fees, financial analysis in terms of FIRR is conducted, and the result is 1.4%. The FIRR of the case (a) is 0.4%, indicating the case (b) is financially more feasible.

(4) Result of Economic Analysis

Results of economic analysis applying the case (b) water tariff are 11.7% in EIRR, 1.20 in B/C, and INR 1,908 million. All economic indicaters show positive figures and the result is indicated the case (b) is economicaly enough feasible. As following table shows, the result shows better features than the case (a).

Table 9.35 Result of Economic Analysis

Case Study	EIRR	B/C	NPV (INR1000)
(a) Water Tariff which does not includes Meter/ Service Pipe Fees	11.5%	1.17	1,665,535
(b) Water Tariff which includes Meter/ Service Pipe Fees	11.7%	1.19	1,827,518

Chapter 10 Operational and Effect Indicators

The year of project completion is set at 2022 and the operational and effect indicators have been set at 2024, or two years after project completion.

The operational and effect indicators are summarized in **Table 10.2** with descriptions below.

10.1 Operational Indicators

The operational indicators show how efficiently the waterworks system is to be operated to achieve the targets envisioned with the implementation of the Project.

10.1.1 Population Served

In Imphal water supply, data on the daily water intake, production and transmission amount are not available because there is no flow measurement made on the water supply side. Likewise, water demand side data is also unavailable since water consumption data is on a flat rate basis. In other words, there is no reliable data in terms of the water flow.

One of the few reliable data is the number of domestic connections, at 9,597 connections at present in the JICA project area (See **Table 10.3**), which is the basis for water tariff collection. The water supply coverage or the percentage of population served (47,985 = 9,597 × 5.0 persons/HH) to the total population (432,368) within the service area is estimated at 11.1% using the average household members of 5.0 persons which was calculated approximately with the population and the number of households in Census 2011. One of the objectives of Phase-III project is to install water meters to the 71,391 households in the service area. The meter installation also includes the existing customers, since almost of them have no meter (Although water meters have been currently installed to 584 connections, they shall be replaced under Phase-III project). The present number of metered service connections is small, but even meter reading of these service connections is neglected.)

Assuming that the number of connections will increase as the rate of population, the number of metered service connection will be 75,974 in the year 2024 and then the served population is estimated at 379,770 units in 2024. While the 2024 population is estimated at 498,763 persons using the same population projection method as used in the DPR, The water supply service coverage will then be 76.1% in the year of 2024 two years later after the project completion.

To establish a self-supporting organization for the Imphal water supply system, the shifting from a flat rate to a metered rate system is a basic and all-important operational and management principle. It is important, therefore, to plan this physical transition, and this must include a program to inform, educate and get the understanding and cooperation of the customers not only to connect to the water supply system, but also to pay their water tariff under the metered rate system.

10.1.2 Amount of Water Supply

Although there is no reliable data in terms of a water supply amount, the value estimated by the PHED is 81,380 m^3/day for the 19 existing water treatment plants (See **Table 10.1**). This figure is used as the present daily water supply amount. When the Project will be completed in 2022, the total daily water production amount will be 122,500 m^3/day in 2024. Because the relationship between WTP and water supply zone (WSZ) is not necessarily one to one, and water produced at plural WTPs is supplied to plural WSZs, the production capacity and water production for one specified WSZ shall be allocated based on the water demand percentage. Thus, the production capacity and water production for five WSZs under JNNURM project area is first calculated and then, those for twenty-one (21) WSZs under JICA project area is obtained by deducting the above JNNURM values from the total ones under the entire service area. Of Imphal water supply.

The following assumptions are used for calculating the values for the year of 2024.

1) There is no change in the no. of connections other than domestic connections.
2) The increase of connections shall follow the population growth rate.
3) The meter will be installed at 35,490 units by 2018 in JNNURM (Phase-II) and increase in proportion to the population growth rate (2024/2018＝1.083) thereafter to 2024.
4) The meter will be installed at 71,391 units by 2022 in JICA (Phase-III) and increase in proportion to the population growth rate (2024/2022＝1.026) thereafter to 2024.
5) Sangakpham WSZ (WSZ 25) in JNNURM area will be transferred to JICA area after the project completion in 2022.
6) Water will be supplied so as to fully meet the water demand in 2024.

The total production capacity will be augmented from 104,250 m^3/day in 2014 to 149,250 m^3/day in 2022 through the project completion with re-construction of 10 existing WTPs and new construction of Chingkheiching WTP. The production capacity and water production under JICA project area will be expanded from 69,400 m^3/day and 56,950 m^3/day in 2014 to 110,030 m^3/day and 83,340 m^3/day in 2024, respectively.

Table 10.2 Summary of Operational and Effect Indicators

Category	Name of Indicators		JNNURM Area (Phase-II)		JICA Area (Phase-III)		Entire Service Area	
			Present (2014)	Target (2024)	Present (2014)	Target (2024)	Present (2014)	Target (2024)
Operational Indicators	(A) Population within Service Area	(Pers.)	180,122	204,424	432,368	498,763	612,490	703,187
	(B) No. of Domestic Connections	(Units)	11,001	35,630	9,597	75,954	20,598	111,584
	(C) Served Population = (B) × 5.0	(Pers.)	55,005	178,150	47,985	379,770	102,990	557,920
	(D) Water Production	(m^3/day)	24,430	39,220	56,950	83,340	81,380	122,560
	(E) Production Capacity	(m^3/day)	34,850	39,220	69,400	110,030	104,250	149,250
	(F) Water Consumption	(m^3/day)	11,360	27,984	13,459	58,250	24,819	86,234
	(G) Utilization Rate of Facility (%) = (D) / (E) × 100	(%)	70.1	100.0	82.1	75.7	78.1	82.1
	(H) Ineffective Water Rate (%) = [(D) – (F)] / (D) ×100	(%)	53.5	28.6	76.4	30.1	69.5	29.6
	(I) Leakage Rate (%)	(%)	N/A.	Less than 15%	N/A.	Less than 15%	N/A.	Less than 15%
Effect Indicators	(J) Population Coverage by Water Supply (%) = (C) / (A) × 100	(%)	30.5	87.1	11.1	76.1	16.8	79.3
Breakdown of Water Consumption	(F) Water Consumption	(m^3/day)	11,360	27,984	13,459	58,250	24,819	86,234
	Domestic	(m^3/day)	7,426	24,050	6,478	51,269	13,904	75,319
	Bulk Water Supply	(m^3/day)	1,843	1,843	3,072	3,072	4,915	4,915
	Tanker Water Supply	(m^3/day)	614	614	1,753	1,753	2,367	2,367
	Hostel/Hotel	(m^3/day)	0	0	627	627	627	627
	School/College/Office/Industry	(m^3/day)	1,116	1,116	1,148	1,148	2,264	2,264
	Public hydrant	(m^3/day)	361	361	351	351	712	712
	PHED Office	(m^3/day)	0	0	30	30	30	30

N/A: Not Available

Basis for Calculation (Multiplier: population growth rate between years)	(A) Population within Service Area	(人)	2011: 172,366 2014: 172,366×1.045	2021: 196,562 2024: 196,562×1.040	2011: 413,749 2014: 413,749×1.045	2021: 479,580 2024: 479,500×1.040		
	(B) No. of Domestic Connection	(Units)	Table 10.2	2018: 35,490 2024: (35,400-2,500)×1.083 Assumption ③&⑤	Table 110.2	2022: 71,391 2024: 71,391×1.026+2,500×1.083 Assumption ④&⑤		
	(C) Served Population = (B) × 5.0	(Pers.)						
	(D) Water Production	(m^3/day)	Table 110.3	Table 110.3	Table 110.3	Table 110.3		
	(E) Production Capacity	(m^3/day)	Table 110.3	Table 110.3	Table 110.3	Table 110.3		

Table 10.3 Present No. of Connections by Project Area

	Entire Service Area		JNNURM Area (5 Water Supply Zones)							JICA Area	
	No.of Conns.	Consump. (MLD)	No. of Conns. Koirengei	Cheiraoching	Sangalpham	Porompat	Chinga	Total	Consump.* (MLD)	No.of Conns.	Consump. (MLD)
Domestic	20,598	13,904	2,595	3,003	8	2,789	2,606	11,001	7,426	9,597	6,478
Public Hydrant	211	712	13	7	-	87	-	107	361	104	351
Tanker Supply	131	2,367	-	-	-	34	-	34	614	97	1,753
Hostel	19	513	-	-	-	-	-	0	0	19	513
Hotel	3	114	-	-	-	-	-	0	0	3	114
School/College	60	540	8	3	-	29	4	44	396	16	144
Office	114	1,710	10	-	-	38	-	48	720	66	990
Industries	5	14	-	-	-	-	-	0	0	5	14
Bulk Supply	16	4,915	-	-	-	6		6	1,843	10	3,072
Sub-total	21,157	24,789	2,626	3,013	8	2,983	2,610	11,240	11,360	9,917	13,429
PHED Office		30									30
Total		24,819							11,360		13,459

* The estimarted consumption in the entire service area is allocated in proportion to the rate of the number of connections.

* Consumption is allocated in propotion to the rate of "No. of Connections".

Source: JICA Survey Team

Table 10.4 Breakdown of Production Capacity and Water Production under JNNURM Project Area

S. No.	WTP	Year Constructed	Present Production (MLD) Designed Capacity	Present Output	Proposed Production (MLD) Proposed Capacity	Additional	Total	Water Supply Zone (WSZ)	2011 Data for 2014 Water Demand (MLD)	Percentage (%)	2021 Data for 2024 Water Demand (MLD)	Percentage (%)
1	Kangchup	1965	14.53	11.62	14.53		14.53					
2	Kangchup (Extension)	2000	9.08	6.81	9.08		9.08					
3	Minuthong	1977	1.14	0.57	1.14		1.14					
4	Khuman Lampak	1999	0.45	0.45	4.54		4.54					
5	Canchipur	1979	2.27	0.00	9.08		9.08					
6	Canchipur-1	1992	4.54	3.10								
7	Canchipur-2	2009	6.81	6.81	6.81		6.81					
	Sub-total		13.62	9.91	15.89		15.89					
8	Koirengei	1979	2.27	0.91	15.89	1.00	15.89	Koirengei	22.454	0.87	15.892	0.98
9	Potsangbam - I	1997	6.81	2.72				Sangakpham	3.193	0.12	(Sifted to JICA Area)	
10	Potsangbam - II	2008	6.81	6.81				En-route	0.256	0.01	0.349	0.02
	Sub-total		15.89	10.44	15.89	1.00	16.89	Sub-total	25.903	1.00	16.241	1.00
11	Ningthempukhri	1983	4.54	2.27	4.54		4.54					
12	Old Thumbuthong	2008	2.00	2.00	2.00		2.00					
13	Porompat	1979	2.27	1.10	9.53	3.00	9.53	Porompat	9.329	0.84	10.161	1.00
17	Porompat-1	1989	6.81	4.77				Laiwangma	0.963	0.09	0.000	0.00
18	Porompat-2	1992	6.81	4.77				Sajor Leikai	0.758	0.07	0.000	0.00
	Sub-total		15.89	10.64	9.53	3.00	12.53	Sub-total	11.050	1.00	10.161	1.00
14	Singda	1983	18.16	18.16	18.16		18.16	Iroisemba East	10.918	0.38	11.047	0.48
								Iroisemba West	9.022	0.31	6.752	0.29
								Cheiraoching	5.815	0.20	5.093	0.22
								Lalambung	1.296	0.04		0.00
								Assembly	1.968	0.07		0.00
								Sub-total	29.019	1.00	22.892	1.00
15	Chinga	1978	1.14	0.70	1.14	4.00	1.14	Chinga	3.055	1.00	3.850	1.00
16	Moirangkhom	2008	1.00	1.00	1.00		1.00					
	Sub-total		2.14	1.70	2.14	4.00	6.14					
19	Irilbung	2007	6.81	6.81	6.81		6.81					
	Chingkheiching	(2019)			45.00	(8.00)	37.00					
	Total		**104.25**	**81.38**	**149.25**	**0.00**	**149.25**					

Source : PHED (Arranged by JICA Survey Team)

Calculation Method:

- When plural WSZs receive water supply from plural WTPs, the production capacity and water production will be allocated in proportion to the water demand percentage of respective WSZs.
  Production Capacity: 15.89 MLD × 0.87 = 13.82 MLD
  Water Production: 10.44 MLD× 0.87 = 9.08 MLD
- The water capacity and water production is first calculated for WSZs in JNNURM (Phase-II) area and then Those in JICA (Phase-III) area is calculated by deducting the above JNNURM values from the total.

WSZ	Designed Capacity	Present Output	Designed Capacity	Present Output
Koirengei	13.82	9.08	16.55	16.55
Sangakpham	1.91	1.25	0.00	0.00
Porompat	13.35	8.77	12.53	12.53
Cheiraoching	3.63	3.63	4.00	4.00
Chinga	2.14	1.70	6.14	6.14
INNURM (Phase-II)	34.85	24.43	39.22	39.22
JICA (Phase-III)	69.40	56.95	110.03	83.34
Total	104.25	81.38	149.25	122.56

Source: PHED

10.1.3 Rate of Facility Utilization

The present rate of facility utilization is 82.1% from a production capacity of 69,400 m^3/day and a water production of 56,950 m^3/day estimated by PHED in 2014 (See **Table 10.5**), which will be 75.7% under a production capacity of 11,030 m^3/day and a water production of 83,340 m^3/day in 2014 through the completion of Chingkheiching WTP.

10.1.4 Ineffective Water Rate

The present effective water is estimated at 13,459 m^3/day for a water production of 56,950 m^3/day with an ineffective water rate of 76.4% in the JICA project area as shown in **Table 10.6**. Through the service pipe and meter installation, the effective water will be increased to 58,250 m^3/day for a water production of 83,340 m^3/day with an ineffective water rate of 30.1%.

10.1.5 Leakage Rate

In relation to the actual status of leak loss, there is no substantial data available except for the following two facts:

- The social condition survey was conducted for 338 households in 34 areas. During that period, the surveyor reported that the open-end pipes without a stop cock or tap were found in many houses.
- In the last year, 394 pipe failures occurred in the jurisdiction of Maintenance-I and Maintenance-II Divisions, out of which 89% were pipe leaks and the remaining 11% were the pipe burst. The pipe failure were found in small-size pipes with an diameter of not more than 150 mm (approximately 60%), in cast iron pipes and galvanized iron pipes (55.3%), and pipes with more than 20 years after installation (approximately 55%). About 35% pipe failure was presumably caused by aged pipes. Taking that into account, leakage rate seems to be quite high. It should be noted that out of the total pipe length of 319.4 km, small-size pipes with an diameter of not more than 150 mm is 185.6 km in length (58.1%), cast iron pipes and galvanized iron pipes is 177.2 km in length（55.5%）and pipes with more than 20 years after installation is 144.3 km in length (45.2%).

Although there is no quantitative data relating to leakage amount or leakage rate, the present leakage rate is considered to be rather high, judging from the situation mentioned above.

With the implementation of the project, it can be said that the leakage rate will be remarkably improved. It is difficult to explain the grounds numerically, but it is considered possible to attain the national benchmark of less than 15% based on the following information:

- All existing pipes with a total length of 319.4 km will be replaced and in addition, 635.7 km of pipes will be newly installed.

- Since the service pipe installation work is accompanied with meter installation, existing customers will also become the target for the service pipe installation work. Therefore, all the customers will have new service pipes installed using better quality materials, done under better workmanship that will result to a substantial improvement in the service connection conditions.

10.2 Effect Indicators

The effect indicators will show that the quality of life, such as health and productivity, of the project beneficiaries (people of Imphal City water supply service area) will improve greatly. In addition, the water environment will be conserved and sustained.

10.2.1 Percentage of Population Served

The percentage of population served to total population within service area is 11.1% for the year 2014 and 76.1% for the year 2024, two years after the project completion as calculated in **Table 10.7**.

Chapter 11 Project Risk

11.1 Project Risk

11.1.1 Risk Concerning Raw Water Intake from Thoubal Dam for A New WTP

The raw water for the new Chingkheiching WTP will be taken from the Thoubal Dam, which is under the control of the IFCD. The intake facility has been already completed at the Thoubal Dam and the raw water transmission pipes will be installed from the valve chamber constructed downstream of the dam (as the starting point) to the new WTP (as the terminal point). The procurement and construction works concerned with the above works will be done under four following contract packages:

1) Procurement of piping material for raw water transmission (DIP1,000mm x18.55km)
2) Installation work for raw water transmission (DIP1,000mm x18.55km)
3) Tunnel work (Package-1) for raw water transmission (2.28km long)
4) Tunnel work (Package-2) for raw water transmission (0.84 km long)

As of the end of October, the contractor has been already decided for “1) procurement”; and the contract for “2) installation work” will be started under direct construction management of IFCD, when the piping materials will arrive at the sites. The the contracts for 3) and 4) tunnel works are now under the process of tendering and the tender opening is scheduled on November 10, 2014. The construction period is set for 24 months for the tunnel works.

The dam closure work will be resumed after the end of monsoon season and completion is targeted by the end of March 2015, while all the raw water transmission works is expectedly to be completed by the end of 2016. Therefore, if the above works will proceed as scheduled, it will be completed before the start of Phase-III (JICA) Project. Even though there is some delay at the above works, it will take three years for the completion of the new WTP; and there will be less risk regarding the construction of the raw water transmission to the new WTP.

According to the DPR for the “Augmentation of Water Supply for Imphal City by 45 MLD (10 MGD) with Raw Water from Thoubal Dam” prepared in 2008, the water intake facility was planned to have three inlets at different elevations on the intake tower so as to make selective intake possible to correspond to the water quality conditions. But the actual intake mouths are already constructed in the dam, and were independently placed at three different locations and elevations. Since a sluice valve will be installed for each raw water transmission pipe at the downstream of the dam embankment, the selective intake of raw water will still be possible. If, in case of emergency, the raw water transmission pipe will be clogged, it will be very troublesome, since a worker will have to enter into the pipe to manually remove the obstacles, and the lowering of the dam water level will have to be done, resulting to the suspension of water intake operations.

In addition, since the pipe bottom elevation of the intake mouths is set at the same elevation as the ground with no screen (see **Photo 11.1** and **Figure 11.1**), there is a high possibility that the intake mouth will suck earth and sand, floating splinters of wood, etc, causing damage to the valves and clogging the pipes. Therefore, a structure to protect from earth and sand, the attachment of stainless screens to the openings (see **Figure 11.2** Intake Mouth in Thoubal Dam (Modified Plan)) should be constructed. An improvement plan shall be submitted to the IFCD officially from the PHED on this matter.

Upper Intake Mouth of Raw Water in the Thoubal Dam

Low Intake Mouth of Raw Water in the Thoubal Dam

Photo 11.1 Intake Mouth of Raw Water in the Thoubal Dam

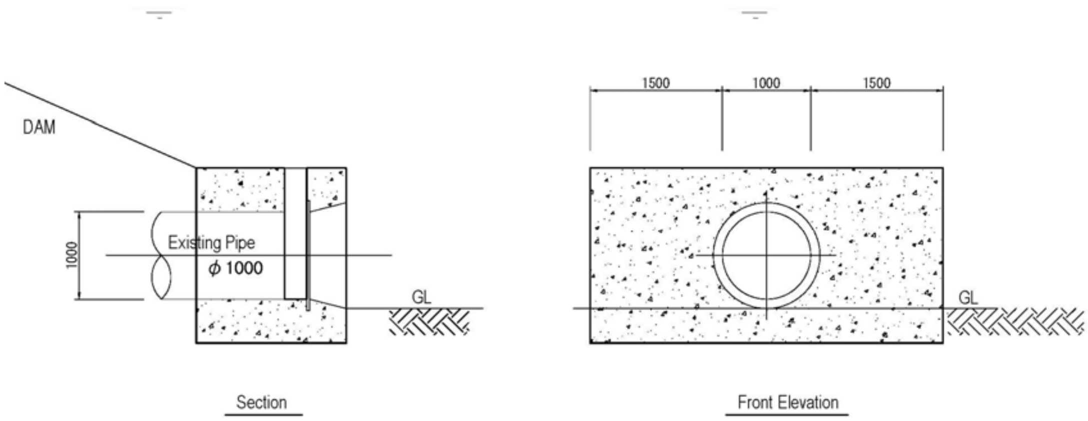


Figure 11.1 Intake Mouth in Thoubal Dam (Present)

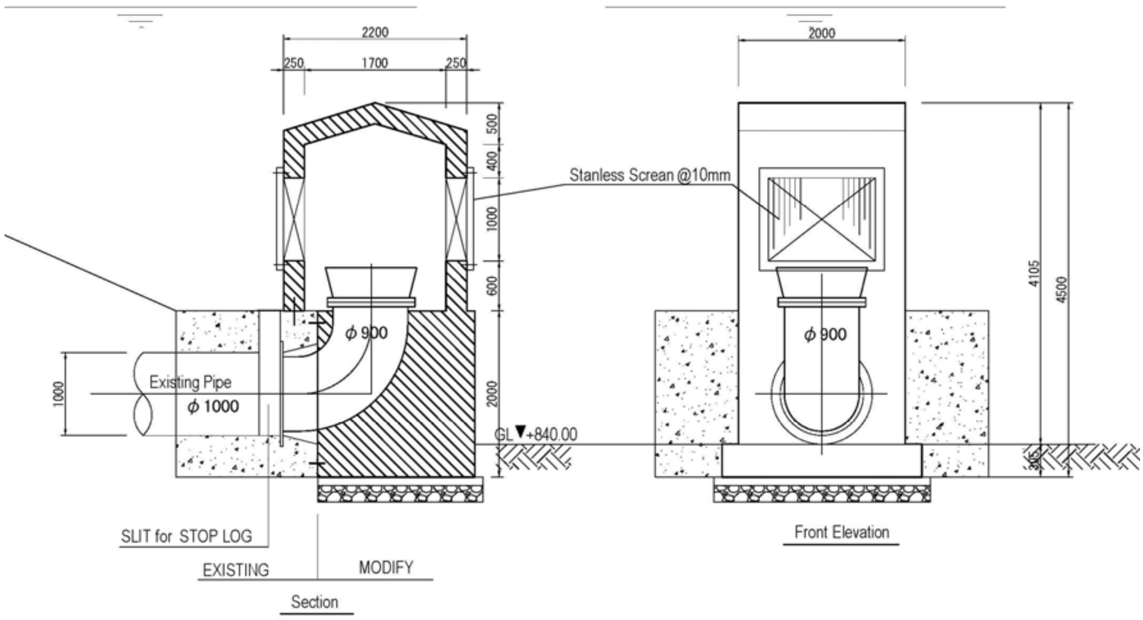


Figure 11.2 Intake Mouth in Thoubal Dam (Modified Plan)

Even though the modified plan for intake mouths will be done by the IFCD, it is unavoidable that the screen will be clogged sometime during the intake operation. In such a case, it is necessary to remove the clogged materials by lowering the dam water level and calling for a diver to perform the declogging work. Whenever the water level will drop, such removal work will be done preventively, to reduce the danger of using a diver. The installed screen can also be used longer.

11.1.2 Risk Concerning Phase-I and Phase-II Projects

The Phase-I Project for the refurbishment and renewal of major existing water supply facilities using the JNNURM fund is now in the final decision-making process. As for the Phase-II Project, similarly using the JNNURM fund, there is no clear schedule at this moment. Phase-II aims to connect the existing major facilities refurbished/renewed under the Phase-I Project and to develop the distribution networks. Since the Phase-I and Phase-II Projects are interdependent / interoperable in terms of sequential construction of facilities, there is a risk that if the Phase-II Project will not be implemented, or there is some delay in Phase-II Project, then Phase-I project cannot enter into operation.

The Phase-III Project using the JICA loan will construct the facilities from the production to the distribution, except for the raw water transmission pipes from the intake to the new WTP undertaken by the IFCD. It can enter into operation without being affected by the progress of the Phase-I and Phase-II Projects with full supply coverage of the 11 water supply zones (WSZs). However, the situation of four WSZs partially covered by Thoubal System is as follows:

- Clear water is transmitted to an overhead tank and ground level service reservoir in Porompat WSZ (**Figure 11.3**), but the downstream distribution network is included in the Phase-II Project.
- In Chinga WSZ (**Figure 11.4**), the ground level service reservoir that clear water is transmitted to is included in the Phase-II Project.
- In Minuthong WSZ (**Figure 11.5**), an overhead tank and distribution network are included in the Phase–III Project.

Therefore, the partial water supply from Thoubal System may be affected by the progress of the Phase-II Work in Porompat and Chinga WSZs, while clear water can be distributed from Thoubal System independently to Minuthong WSZ. The new Chingkheiching WTP will be able to commence the water supply partially from 2021, although all works will be completed by the end of 2022.

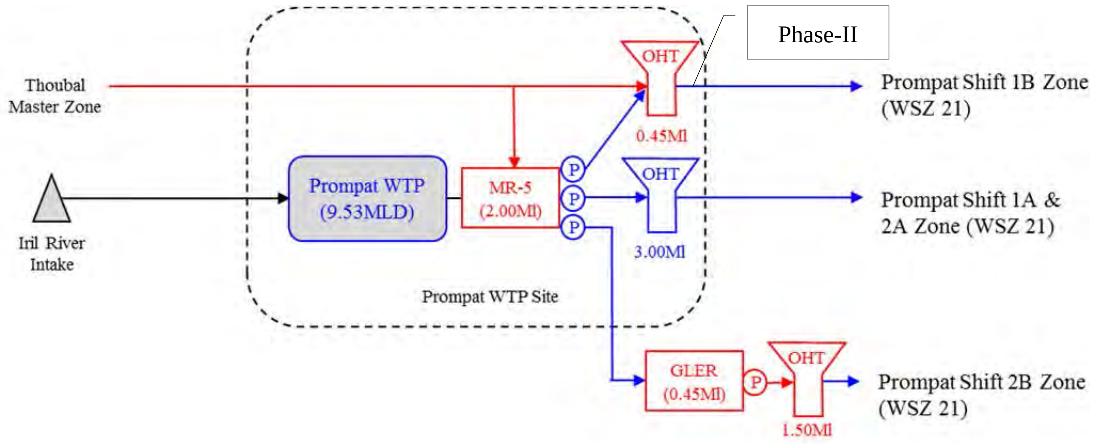


Figure 11.3 Porompat Master Reservoir Zone (MRZ-5)

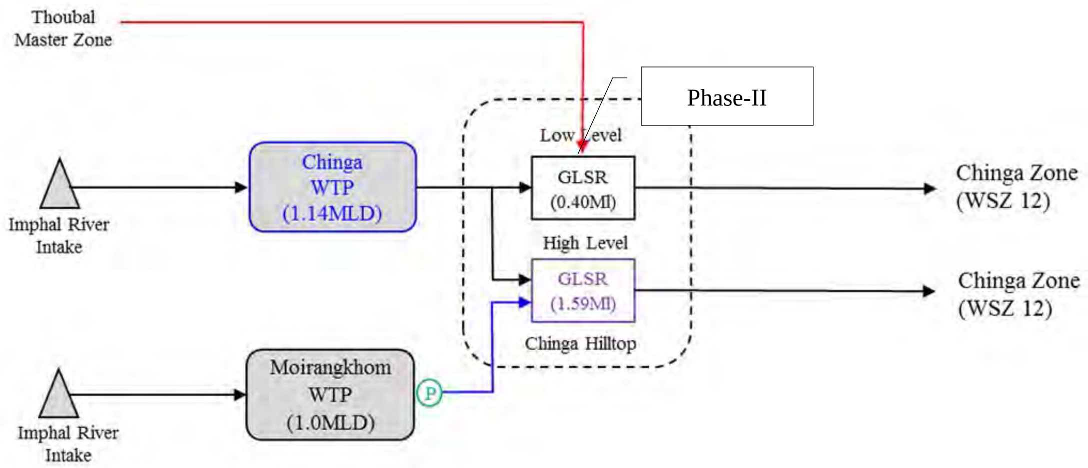


Figure 11.4 Chinga and Moirangkhom WTP Zone (CZ-4)

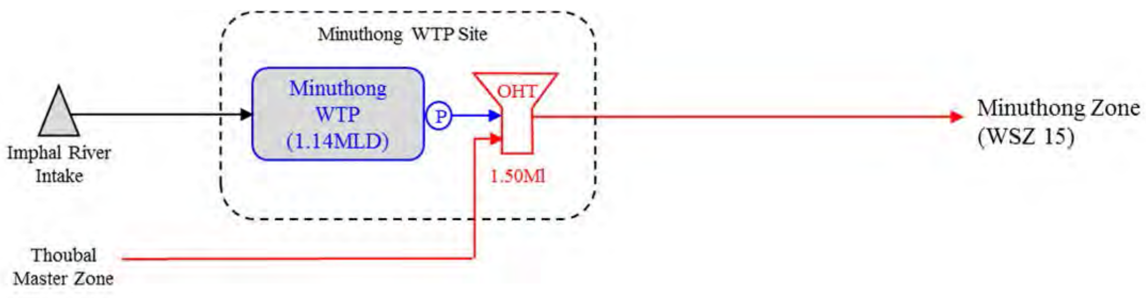


Figure 11.5 Minuthong WTP Zone (CZ-2)

The construction period is scheduled for 2015 to 2016 for the Phase-I Project and for 2018 to 2022 for the Phase-III Project. The construction for Phase-II Project, on the other hand, has not yet been fixed, but is expected to start with some delay from the Phase-I and completed within two years. Therefore, there will be still enough time to complete the new WTP construction works. But it is necessary to closely monitor the progress of both the Phase-I and Phase-II Projects.

11.2 Climate Change

11.2.1 Basic Idea

(1) Necessity of Adaptation

The Imphal Water Supply System has currently supplied clean water to a population of 102,990 through 19 water treatment plants. However, since the refurbishment and renewal of existing water supply facilities have not been done satisfactorily, the WTPs have been steadily deteriorating and many equipment have either malfunctioned or exist to function altogether. The result is inadequate water supply and unreliable water supply service. This is one of major causes that the number of connections has made little progress.

While, in the management of water supply services, the flat rate system without any linkage of water consumption has been adopted, tariff income has covered only 14% of operation and maintenance expenses, and the spent the collection rate is a low 30.2% due to the poor quality of water supply services. Therefore, a great deal of subsidy has been injected yearly by the State government of Manipur and the present management of Imphal water supply services is very far from being organizationally and financially self-supporting.

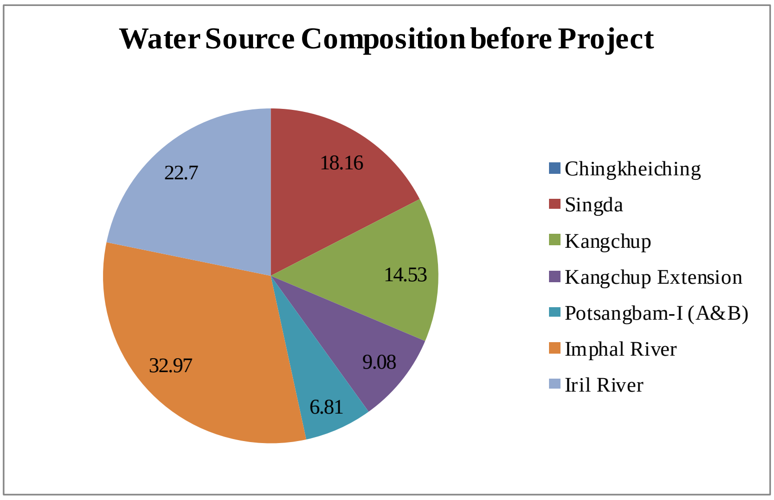
The Imphal Water Supply Improvement Project aims to provide the following facilities, using the local fund of JNNURM and the loan from the Japanese Government.

- To restore the initial production capacity of existing water supply facilities through full refurbishment and renewal.
- To construct the new water treatment plant with a production capacity of 45,000 m^3/day (10 MGD) taking raw water from Thoubal Dam under construction to cope with the increase of population and resultant water demand expected in the future.
- To develop a completely new water distribution network in the entire planned service area of water supply.
- To install the service pipe from the distribution main and provide water meter to 100% of customers/ service connections.

By the project implementation,

- By taking raw water from Thoubal Dam, the percentage of dam water which is relatively a more stable water source than river water will increase to 42.4% (see **Figure 11.6**).
- The drinking water supply with stable and safe water quality will be attained through the improvement of treatment processes.
- Since almost distribution pipes will be newly installed as well as the service pipe installations, the leakage rate will considerably be improved.

- The 24x7 water supply service will be achieved.
- By the service pipe installations for respective customers, it is feasible to shift from a flat rate system to a metered rate system, thus improving the financial condition through the stepwise increase of water tariff, aiming for a self-supporting Imphal water supply management.



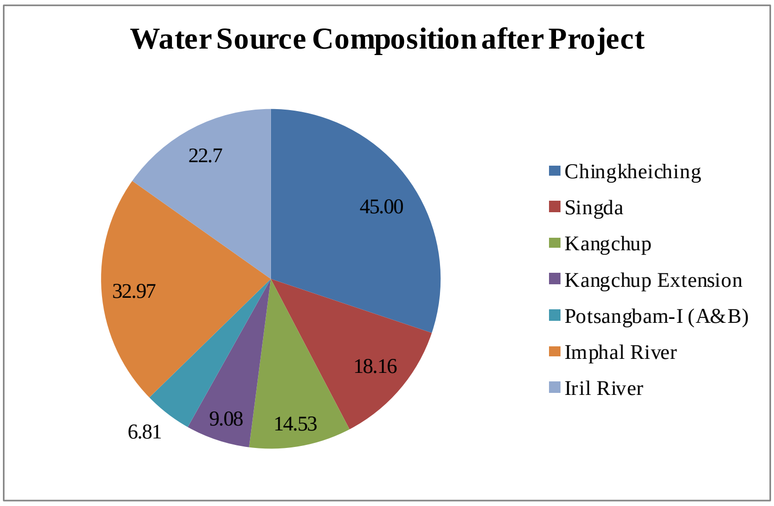


Figure 11.6 Change of Water Source Composition before and after the Project

However, to make such structural and financial improvement fruitful, it is necessary to improve several organizational and institutional problems/ issues in PHED together with enlisting the understanding and cooperation of its customers.

(2) Contents for Adoption

The contents for organizational and institutional improvements to be addressed by PHED are as follows:

- Self-supporting organizational management
- Formulation of long-term and annual business plans
- Provision of an asset management ledger

- Improvement of information management system
- Streamlining of water tariff revision and improvement of tariff collection system
- Mandatory water meter installation
- Preparation of financial statement
- Improvement of customer services
- Improvement of human resources and personnel management system
- Formation of NRW reduction system

In addition, to get the understanding and cooperation of customers, it is necessary to extend the awareness campaign in accordance with the programme, as required. The subjects include, but are not limited to, the following:

- Promote / market the benefits of connecting to water supply system
- Promote regularization of illegal connections
- Promote understanding of benefits of meter installation and the rationale behind the metered rate system
- Campaign for payment of water tariff under the metered rate system
- Educate the customers on water saving/ conservation measures

(3) Effect of Climate Change Adaptation

The adaptability for climate change will be improved in the following aspects:

The financial conditions of a water supply service provider will be considerably improved toward the self-supporting organization through the following:

- Shift from a flat rate system to a metered rate system
- Stepwise increase of water tariff
- Improvement of tariff collection rate
- Increase in the number of service connections
- Decrease in the number of illegal connections
- Reduction in NRW
- Decrease of wasteful water use

11.2.2 Vulnerability

(1) Step 1

1) Trend of Climate from the past to the present and Assessment of Risk

a) Assessment based on “Manipur State Action Plan for Climate Change -2013”

The Environmental Directorate of Manipur has prepared "Manipur State Action Plan for Climate Change -2013" and described on the "rainfall variability trends in Manipur" as follows:

To examine the current variability in precipitation over Manipur in the last 57 years (1954-2011) the daily precipitation datasets were analyzed. Annual rainfall quantum varies from 956.5 to 2269.9 mm over Manipur as displayed in ***Figure 11.7****. National Data Centre, IMD, Pune has also reported in a compiled "National Monthly mean Maximum and Minimum Temperature and Total Rainfall Dataset" that the average monthly total rainfall has varied from 12.2 mm (January) to 407.3 mm (July) as in* ***Figure 11.8***

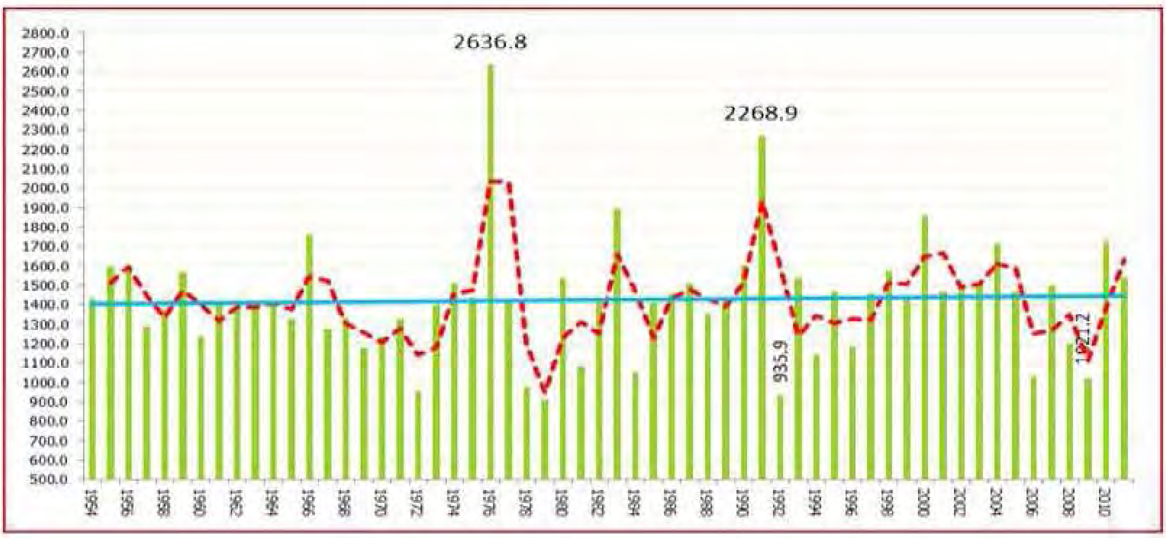


Figure 11.7 Annual Precipitation at Imphal, Manipur

Source: National Data Centre, Indian Meteorology Department (IMD), Pune

Figure 11.8 Average Monthly Rainfall Pattern over Manipur (1901-2000)

The decadal assessment of monthly rainfall reveals that the period of raining days in Manipur has extended from monsoon months i.e. June-October to pre-monsoon months like April and May. Few districts of central and southern Manipur experienced a marginal decrease in precipitation over Imphal (east and west), Bishnupur, Thoubal, Tamenglong, Jiribam, Chandelin the last 100 years whereas the northern districts of Manipur i.e. Senapati and Ukhrul have observed a considerable increase in precipitation as depicted in **Figure 11.9**.

Figure 11.9 District-wise Precipitation Trend (mm/day/100 years) of Southwest Monsoon Season (June to Sept) for the Last 100 years (1901-2000)

The water source of Chingkheiching Water Treatment Plant with a production capacity of 45,000 m^3/day is surface water stored in the Thoubal Dam located approximately 20 km east of Imphal City. Thoubal Dam is under construction in the Thoubal River, different from the Imphal River and the Iril River which were the currently the main water sources for the Imphal Water Supply System. When the analytical results are applied to the river composed of water sources for Imphal at present, the upper reaches of the Thoubal River is situated in Ukhrul District where a considerable increase of rainfall is projected. The uppermost reach of the Imphal River is also fortunately situated in Senapati District. The Iril River also has a basin in Senapati District but its percentage is not that high. The basin of Singda Dam is located in the district where a slight decrease of rainfall is unfortunately projected.

Figure 11.10 River Map in Manipur

Among others, to have a new water source in the Thoubal Dam has the following five advantages:

i) Water sources can be diversified due to the different river systems from the present.

ii) Water can be transmitted from Thoubal Dam to the overhead tanks/ ground level service reservoirs through Chingkheiching WTP by gravity. It means the water is supplied to the tap in the house without any pumps.

iii) Water amount is controllable due to the stored water in the dam.

iv) The priority of the multi-purpose dam is given to drinking water use in case of a drought.

v) The water resource will be stable even in the future.

2) Assessment based on “Climatological Features of Drought Incidences in India”

Source: “Climatological Features of Drought Incidences in India”, Climatology No.21/2005, India Meteorological Department, Government of India

The India Meteorological Department (IMD) defines drought in any area when the rainfall deficiency in that area is ≥26% of its long term normal. It is further classified into moderate and severe drought depending upon whether the deficiency is between 26 to 50% and more than 50% respectively. In "*Climatological Features of Drought Incidences in India*", using the 130 year data from 1875 to 2004, the area-wise time occurrence and drought occurrence probability was calculated for moderate and severe drought.

In this study, Manipur State is handled together with the states of Nagaland, Mizoran and Tripura as the same meteorological sub-division in which 12 moderate drought, no severe drought and 12 drought in total have occurred with a drought occurrence probability of 9%. In addition, two year consecutive drought occurred four times in 1887-1988, 1899-1900, 1924-1925 and 1999-2000, three year consecutive drought occurred once in 1987-1989 and no three year consecutive drought. There are 35 states and territories in India classified into three categories based on the drought occurrence probability.

Table 11.1 Classification of Drought Occurrence

Category	Drought occurrence probability
Chronically drought affected area	>20%
Frequently drought prone area	10%～20%
Least drought affected area	<10%

Therefore, the Manipur State is categorized into the least drought-affected area together with six other states in the northeastern region.

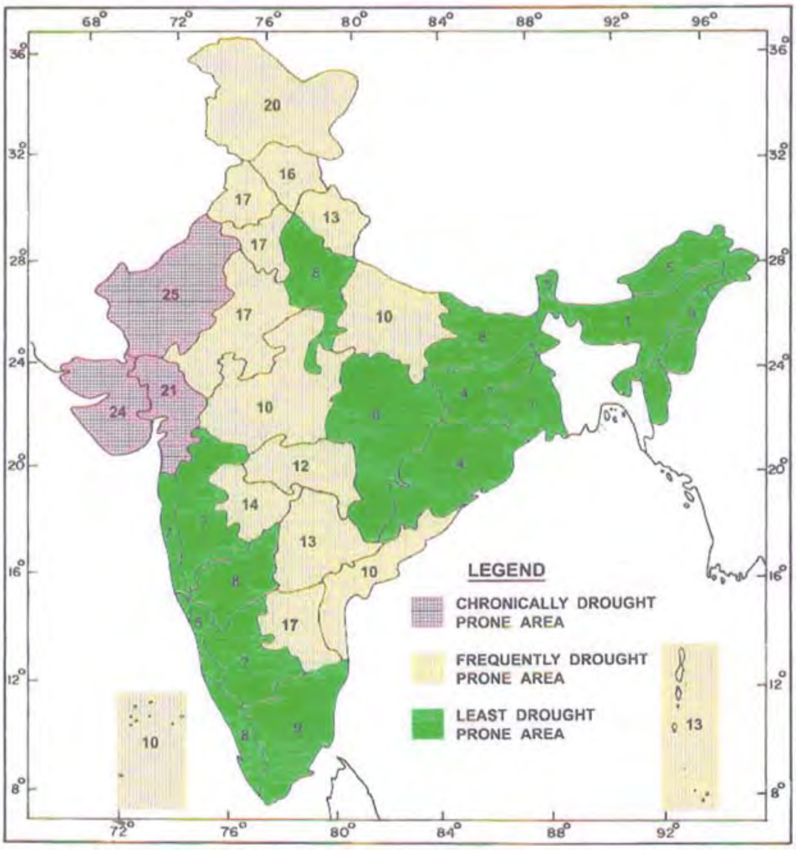


Figure 11.11 Drought Affected Area in India

However, upon entering into the twenty-first century, drought occurred in 2006, 2009, and 2013 as shown in **Table 11.1**, three times for nine years of 2005 to 2013 showing the different trend up to now. Adding these latest droughts to the above, the drought occurrence probability is raised to 12%, then being re-categorized into the frequently drought prone area, due to occurrence of drought 15 times for 139 years of 1875 to 2013.

Table 11.2 Rainfall in Imphal (2011-2013)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Deficiency	Drought?
2001	2.2	98.0	66.0	89.5	138.5	430.9	138.8	99.3	100.2	152.0	155.4	0.0	1,470.8	7.0	No
2002	35.3	1.5	14.4	92.7	256.8	163.5	140.1	490.7	98.8	172.0	10.4	30.1	1,506.3	4.8	No
2003	1.5	13.3	32.0	118.9	159.7	284.6	370.4	193.6	130.6	121.5	4.1	74.8	1,505.0	4.9	No
2004	0.0	0.0	0.0	146.2	190.6	194.8	335.6	265.4	295.6	264.4	16.2	3.8	1,712.6	-8.2	No
2005	0.0	90.2	182.8	71.0	136.2	171.2	226.6	191.0	181.4	185.2	20.8	10.8	1,467.2	7.3	No
2006	0.0	49.4	5.2	41.7	227.2	175.9	158.4	90.4	129.8	114.0	25.6	16.0	1,033.6	34.7	Yes
2007	31.2	152.4	17.6	136.8	233.4	201.0	218.6	112.2	191.0	150.0	52.6	0.0	1,496.8	5.4	No
2008	34.2	21.0	69.6	17.8	94.6	260.2	210.2	244.5	150.8	87.6	1.7	8.7	1,200.9	24.1	No
2009	0.0	20.8	50.9	78.8	156.4	69.3	181.1	151.0	131.3	166.0	15.6	0.0	1,021.2	35.5	Yes
2010	6.9	0.3	128.1	229.5	193.7	238.4	296.1	103.6	262.3	195.0	12.6	59.2	1,725.7	-9.1	No
2011	17.5	2.8	47.6	38.9	274.7	383.2	298.8	278.4	146.6	49.3	1.3	0.0	1,539.1	2.7	No
2012	26.4	6.0	73.2	151.3	102.3	213.5	210.0	112.5	182.0	163.2	87.8	0.0	1,328.2	16.1	No
2013	0.0	1.7	31.8	83.6	71.5	81.5	198.0	239.7	132.1	18.1	0.2	0.4	858.6	45.7	Yes
Ave.	12.2	37.5	84.5	120.1	154.2	262.1	407.3	198.7	131.5	112.1	48.1	14.0	1,582.3		

Note: The average is based on the average monthly rainfall pattern in Manipur (1901 - 2000) in Figure 2.5 of "Manipur State Action Plan on Climate Change - 2013" by the Directorate of Environment, the Government of Manipur.
In "*Climatological Features of Drought Incidences in India*", the average of four states including Manipur is used for the judgment of drought, but the average in ***Table 11.2*** is that in the Manipur State but used for the judgment of drought due to its climate similarity since the above four states are handled as on meteorological sub-division

The cause of this obvious frequent occurrence of droughts since 2004 is not clear and for whether this phenomenon is explainable by the present long-term climate change theory or whether it means the addition of a new factor which cannot be explained by the long-term climate change theory, we have to wait for the future clarification.

Risk and Change Concerned with Climate Change

a) Understanding of Meteorological Conditions after Climate Change

The Environmental Directorate of Manipur has prepared "Manipur State Action Plan for Climate Change -2013" and described on the "**Climate Change Impact on Water Resources**" as follows:

According to India's first climate change science assessment report from INCC (Source: 4x4 Climate Change Assessment report 2010, INCCA), Manipur is vulnerable to the water-induced disasters because of its location in the eastern Himalayan periphery, fragile geo-environmental setting and economic under-development. Most of the surface water resources in the state are currently witnessing threats from heavy siltation rate, uncontrolled quarrying activities in the catchment areas, increasing pH at wetlands, etc. which are leading to water quality deterioration.

The trend in precipitation in the northeastern region including Manipur and the projected patterns of precipitation and evaporation predict considerable spatial variability in water yield in the 2030s. The state is in one of the rain fed regions of the country and receives appreciable amount of unevenly distributed precipitation throughout the year with peak rainfall during monsoon period. However, because of the hilly topography, water does not get to recharge over a long period of time.

The valley areas witnessed frequent floods recently even after short spell of storm due to various reasons like: manmade ecological changes in the catchment areas, the high intensity rainfall during the rainy season in the hilly areas i.e., the upper catchments of the rivers and heavy runoff and low infiltration in degraded watersheds in the upper reaches of the rivers resulting in flash floods. As a result, the available agricultural lands and habitats are damaged by such floods. Flash floods are frequent also within the urban settlement areas during rainy season. The damages due to flood comprise of breach of bunds, overflowing, landslides, erosion and depression of river banks at the vulnerable areas. Heavy siltation occurs during the monsoon season in the rivers and streams. Several perennial streams and natural springs have is appeared gradually due to siltation.

Drinking water supplied through Public Health Engineering Department is not adequate to meet the increasing demands of the people. Acute shortage of safe drinking water has been a prominent problem being faced by the people during the past few decades. Such situation may worsen in the context of already induced climate change scenario.

Pollution of water sources poses risks for health and ecosystem. All these issues mark the need of a mitigation policy that incorporates 'polluter- pays' type principle and implement strict strategies with the same.

Source: "Manipur State Action Plan for Climate Change -2013", Page 46

Table 11.3 Adaptation Option for Water Resource sector

Issues	*Climate Change Impact*	*Adaptation Options*
Inadequate Water quantity	∞ *Average mean annual rainfall is projected by INCCA to vary from a minimum of 940±149 mm to a maximum of 1330±174.5mm, with increase from 0.3% to 3% by 2030s with respect to the 1970s.* ∞ *As intensity of rainy days increases in a more warming scenario, number of rainy days is likely to decrease by 1–10 days in Manipur. The intensity of rainfall in the region is likely to increase by 1-6 mm/day.* ∞ *Entire state of Manipur is projected to receive increased precipitation.* ∞ *Northern parts of the State are projected to experi-ence an increase of ≥19% rainfall to the last 30 years.*	∞ *Augmentation of water resources in rainy seasons by developing ponds and reservoirs,* ∞ *Watershed management, water harvesting [including rainwater]* ∞ *Protection and augmentation of floating vegetative mass (phumdi) for conservation of lacustrine ecosystem and dependent species and humans,* ∞ *Updation of infrastructure [storage and distribution system] & expanding hydrometry network:* ∞ *Dredging of rivers*
Inadequate Water quality	∞ *Water-logging, uneven hydrology and vector born diseases and pest incidence*	∞ *Plantation on river banks to create a buffer zone wherever feasible and Maintenance of riparian buffer strip / corridor to improve stream health wherever feasible.* ∞ *Survey and mapping of groundwater resources including arsenic affected areas* ∞ *Monitoring of water quality especially in arsenic prone areas* ∞ *Recharge of groundwater through rainwater harvesting to address arsenic contamination and control of pollutants of groundwater resources*
Flood	∞ *The available agricultural lands and habitats are damaged by such floods. Flash floods are quite frequent within the urban settlement areas during rainy season due to poor drainage conditions.*	***Structural adaptation measures****:* ∞ *Strengthen & build embankments, channel mprovement, canals and retention ponds to control flood, protect river bank, erosion control, drainage clearance, silt management.* ∞ *Geo-textile fabric tube technology for enduring protection against floods and erosion.* ***Non-structural adaptation:*** *Efficient management of flood plains and contingency planning for disaster preparedness and response* ***Regulatory Measures:*** ∞ *Strict regulation of urban land use in the valley, find a way out of the inundation at the barrage and treatment of upper catchment areas.* ∞ *Follow up National Flood Policy to support rehabilitation, resettlement and compensation.*
Groundwater management	∞ *Changes in precipitation and evapotranspiration may influence ground water recharge;* ∞ *Increased rainfall intensity leading to higher run-off and less recharge;* ∞ *Increased flood events affecting groundwater quality in alluvial aquifers.*	*Sustainable use of ground water resources:* ∞ *Safeguard the groundwater reserves* ∞ *Focus on harnessing surface water resources in view of projected increase in precipitation*

Source: “Manipur State Action Plan for Climate Change -2013”, Page 50-51

Key Strategies to tackle the impact of climate change:

- *Enhancement of water resources, catchment treatment and improvement of basin health though augmentation of other water infrastructure both for conservation and use*
- *Structural reform for both urban and rural water sector management*
- *Institutionalizing Monitoring and Evaluation system for both water quality and impact of Climate Change*
- *Identifying new water harvesting scheme (ponds) and rain water harvesting and small check dams at community lands*
- *Restoration, conservation and management plan for all the lakes and wetlands including Catchment Area Treatment plan:*
- *Developing ground water models for different agro-climatic zones*
- *Quality monitoring of ground water in arsenic affected areas and adaptation measures*
- *Preparation of contingency plan for the both at state/district level*

Source: “Manipur State Action Plan for Climate Change -2013”, Page 52-54

b) Understanding of other socio-economic change factors

The National Water Policy, prepared in April, 2002, claims that in the planning and operation of systems, water allocation priorities are as follows:

- Drinking water
- Irrigation
- Hydro-power
- Ecology
- Agro-industries and non-agricultural industries
- Navigation and other uses

However, the priorities could be modified or added, if warranted, by the area/ region-specific considerations.

3) Assessment on the Sensitivity against Climate Change

a) Damage situation in the past

As mentioned in the report, there is not reliable data to back water production and consumption except that derived from water supply coverage, which is 17.2% of the total households

Meter reading records from the trial meter project in Irilbung WSZ gave the per capita consumption was in the range of 90 Lpcd to173 Lpcd with an average of 120.5 Lpcd. Although this value was still below the Indian benchmark of 135 Lpcd, the high possibility of wasteful water use is evident considering that a flat rate system encourages wasteful use of water.

According to the data of the Department of Pediatrics, JN Institute of Medical Science, Imphal, the number of children admitted for water-borne diseases had been recorded for three years (2011-2013), which shows a slight increase in the trend of water-borne diseases such as diarrhea, dysentery, enteric fever (typhoid/paratyphoid), and infectious hepatitis. However, the total number of water-borne diseases in Imphal is not available.

b) Provision of preventive facilities

The intake mouth is placed at three points on the dam embankment with different elevations. The raw water transmission pipe from each intake mouth has its own valve and the selective water intake is possible corresponding to the water quality condition in the dam.

c) Sensitivity against Climate Change

The existing water supply facilities have been used for a long time since their construction and have deteriorated due to aging. This project aims to refurbish, renew and restore the functions of the existing water supply facilities using the local fund of JNNURM and to construct the new water treatment plant with a production capacity of 45,000m3/day (10 MGD) taking raw water from Thoubal Dam using the JICA loan to supply the increased demand for water in future. Therefore, the adaptability for climate change will be significantly improved.

The percentage of dam water will be increased from 12.2% before the project to 42.4% after the project and when adding the groundwater to this, the percentage will be 47.0% or almost half of water sources.

(2) Step2

1) Assessment of Adaptability against Climate Change

a) Assessment of Adaptability against Climate Change

- Operational Condition of Water Supply Facilities

  Water supply services are managed by the Public Health Engineering Department (PHED), the State of Manipur but the water tariff income covers only 14% of expenses for operation and maintenance of water supply facilities. The water supply coverage is 17.2%. A flat rate system is currently adopted with a collection rate of 30.2%. Therefore, the budget for refurbishment and renewal of water supply facilities has not been sufficient, and the aging of facilities has been progressing so that most of mechanical and electrical equipment are out of order.

- Change of Non-Revenue Water (NRW)

The production amount at the water treatment plant is calculated by measuring the water level in the rectangular channel. However, the water level data gives the momentary flow but not the daily integral flow. Therefore, one day's production is divided into five zones and the average of water levels measured at each zone is used for the calculation of a daily flow. However, since the conversion of water level data to flow data is not done every day, there is no daily, monthly and annual flow data record. In addition, during the monsoon season except for a drought year, the production amount is recorded as the same as the production capacity with no measurement of water level. In the water consumption side, due to the adoption of a flat rate system, there is no reliable data. Although the meter is installed at only 0.5% of the total households, meter reading is not done regularly. As a result, there is no reliable water amount data on both water production and consumption sides.

➢ Status of Leakage

More than 45% of distribution pipes have been installed more than 20 years ago. About 400 cases of water leaks and pipe bursts have been recorded per annum. Therefore, the water leakage rate is considered to be high but its actual status is unknown. Assuming a per capita consumption of 120.5 Lpcd, the NRW rate was calculated at 78%. While there are many illegal connections as admitted by the PHED, the actual status is also unknown.

Information from the social condition survey conducted for 322 households at 32 areas revealed another cause of water loss, which comes from open-end pipes with no cock or tap found at many households.

➢ Water quality condition in water supply

・Possibility of additional water source

Thoubal Dam is planned as the multi-purpose dam for water supply, irrigation and hydraulic power generation. The DPR projected that the water demand will exceed the water supply capacity around 2031. In such a case, the allocation tradeoff among the purposes is considered so as to give the priority to water supply.

・Public awareness for water-saving

Public awareness on the need for water-saving or water conservation is not high. Many households have open-end pipes with no cock or tap, thus water just flows away. The flat rate system also contributes to the wasteful use of water, or to the "don't care" attitude of the customers.

・Below Poverty Line (BPL) and slum

The percentage of BPL in Manipur is 32.59% for urban, 38.80% for rural, or a total of 36.09% for the year 2011-2012. This is higher compared to the whole India, which is 13.70%、25.70% and 21.92% respectively, and especially the fact that the urban area of Manipur is ranked as the highest in 36 states and territories of the whole India. However, it should be noted that the BPLs of Manipur earn Rs.1,170 for urban and Rs.1,118 for rural, both of which are higher than those of the whole India, namely Rs,1,000 and Rs.816 respectively. That for the urban area of Manipur is ranked fifth from the highest.

There is no slum in Imphal and the poverty people are dispersed in the entire city. The people so fewer who are called "homeless".

Source: "Press Note on Poverty Estimates, 2011-12", Government of India, Planning Commission, July 2013

- For budgetary allocation for water supply concerned with measures against climate change by the state government, see **Table 11.4** and **Table 11.5.**

- Activities by NGO for water supply concerned with measures against climate change by the state government

  There is almost no activity by NGOs for urban water supply, but there are NGO activities in the field of rainwater harvesting for rural water supply.

b) Confirmation on the factors to deteriorate the impact by climate change

・Water pollution of existing water sources by other water users

In Imphal, the water intake from the river is prohibited except for the water supply purpose. The water supply sources for the existing water treatment plants dispersed in the city are the river systems. There is a sewage treatment plant project assisted by the French Government that is expected to enter into operation in March 2015, but the present sewer system covers only the core area of the Imphal City and not the whole basin of the rivers currently used as the water sources. Therefore, the water treatment plants, especially those located downstream of the river in the city, will have a higher risk of being polluted by the domestic wastewater in the future.

Thoubal Dam to be used as the water source for the new WTP is located about 22 km away eastwards in the undeveloped mountainous area. Hence, there is a low possibility of water pollution in the future from this dam.

Table 11.4 Key Priorities for State Mission for Water Resources (Abstraction of PHED-concerned only)

Sr. No	Sector Thematic Area	Strategies	Status	Type	Nature	Priority	Actors ./ Agencies	Proposed Budget Estimate 12th FYP (2012-17) (Rs. In Cr)	Available under Budget Estimate (2012-13) (Rs. In Cr)	Proposed Budget Estimate during (2013-14) (Rs. In Cr)
1	Enhancement of water sources catchment and improvement of river / stream basin health on priority basis	Catchment area treatment and conservation of water sources through river basin care and development (Nambul, Imphal, Thoubal, Kongba and Iril River)	Ongoing	MT	PA	H	Forest	23.00		5.00
							PHED			
							Environ.	2.00	0.40	0.60
		Maintenance of riparian buffer strip / corridor and water resources to improve stream health	Proposed	AD	PA	H	PHED	5.00		1.00
		Artificial water recharge in and around the spring heads for maintaining perennial flow through afforestation and renovation	Proposed	AD	PA	H	PHED	9.00		0.90
		Assessment of the likely recurrence, magnitude and location of floods, droughts, landslides in the climate change scenario, detailed assessment of water demand in current and climate change scenario	Proposed	AD、MT	RD	H	PHED IFCD Environ.	2.00		0.50
3	Policy, regulatory delivery options, technologies, R&D and HRD, Survey and monitoring for adapting the impacts of higher or shortage annual rainfall	Preparation of State Water Policy	Proposed	AD、MT	RD	H	PHED	0.50		0.50
		Assessment of the likely recurrence, magnitude and location of floods, droughts, landslides in the climate change scenario, detailed assessment of water demand in current and climate change scenario	Proposed	AD、MT	RD	H	PHED IFCD Environ.	2.00		0.50
4	Watershed management, water harvesting (including rainwater)	Rain water harvesting at community lands, roof top harvesting, etc. for collection of water sources (integrate to the building by laws)	Proposed	AD、MT	PA	H	PHED	23.00		9.00

Sr. No	Sector Thematic Area	Strategies	Status	Type	Nature	Priority	Actors ./ Agencies	Proposed Budget Estimate 12th FYP (2012-17) (Rs. In Cr)	Available under Budget Estimate (2012-13) (Rs. In Cr)	Proposed Budget Estimate during (2013-14) (Rs. In Cr)
5	Conservation of water resources (wetland, lakes, rivers, major water bodies) and encouragement of indigenous and community pond / lake	Encourage and develop community water harvesting as mini water reservoir at hill ridges, minor / integrated irrigation tanks/ community ponds, water harvesting in terms of digging / extension of ponds	Proposed	AD、MT	PA	H	PHED MDS Environ.	100.00		9.00

Note:

Type: MT－Mitigation, AD－Adaptation

Nature: PA－Policy Action, RD－Research & Development, DP－Demonstration Project, IP－Investment Project, CB－Capacity Building

Priority: H－High, M－Medium, L－Low

Scale: S－State, D－District, B－Block

Time Frame: LT－Long Term, MT－Middle Term, ST－Short Term

Source: "Manipur State Action Plan for Climate Change -2013", Page 56-58

Table 11.5 Medium & Low Priority Actions for Water Resources Sector (Abstraction of PHED-concerned only)

Sr. No	Sector Thematic Area	Strategies	Status	Type	Nature	Priority	Scale	Time Frame	Action / Agencies	
1	Reduction/minimization of distribution loss of water supply and efficient demand side management	Updation of infrastructure [storage and distribution] and expanding hydrometry network Enhance water use efficiency in urban households Re-utilization of domestic waste water for urban households and agriculture	Ongoing	AD	PA	M	s	LT	PHED	
		Updation of infrastructure [storage and distribution] and expanding hydrometry network	Ongoing	AD	PA	M	s	LT	PHED	
		Enhance water use efficiency in urban households	Proposed	MT	PA	M	s	LT	PHED	
2	Drilling of 750 tube wells (375 for State and 375 for Central) @ Rs. 2.00 lakhs/well	Medium implementation constraint and medium importance	Ongoing	AD	PA	L	s	LT	PHED	

Note:

Type: MT—Mitigation, AD—Adaptation

Nature: PA—Policy Action, RD—Research & Development, DP—Demonstration Project, IP—Investment Project, CB—Capacity Building

Priority: H—High, M—Medium, L—Low

Scale: S—State, D—District, B—Block

Time Frame: LT—Long Term, MT—Middle Term, ST—Short Term

Source: "Manipur State Action Plan for Climate Change -2013", Page 59

(3) Step 3

1) Assessment of Vulnerability (See Table 11.6)

Overlapping the factors 1) to 4), the vulnerability against the climate change in the target area and inter-region gap are studied with the following method:

Table 11.6 Assessment of Vulnerability

Assessment Item	Low	←Vulnerability→	High
Sensitivity against climate change in the future	Small		High
Operational conditions of the water supply service provider	Good		Poor
Available water amount by the alternative water source and water quality condition	Good		Poor
Awareness for water-saving	High		Low
Socio-economic conditions in the target residential area	Good		Poor
Budget for climate change affect in the water supply sector	Much		Less
Coping activities by NGOs against climate change affect in the water supply sector	Active		Non-active

2) Project assessment of adaptive measures

Table 11.7 Assessment during Project Study

Assessment item	Outcome	Assessment method	Operation and effect indicators concerned
Sensitivity against climate change in the future	Stable and safe water supply and improved sanitary environment	Quantitative	Water distribution amount Water supply coverage Water intake amount
	Since the storage water in Thoubal Dam is the water source of which a water amount is controllable and stable and safe water supply is possible.		
Operational conditions of the water supply service provider	Decrease of NRW rate and leakage rate and constant water quality of drinking water	Quantitative	NRW rate Leakage rate Water quality
	The water supply service provider is aiming to shift from a flat rate system to a metered rate system and, since almost all transmission and distribution pipes will be new as well as new service pipe installations, the leakage rate will be considerably improved together with NRW reduction.		
Available water amount by the alternative water source and water quality condition	Decrease of water shortage risk in the future by the arrangement of alternative water source	Qualitative	—
	The National Water Policy claims to give the first priority to drinking water supply, and it is also committed at Thoubal Dam that, when the water demand will exceed the water supply capacity, the allocation to irrigation will be decreased in order to increase drinking water supply.		
Awareness for water-saving	Improvement of awareness for water-saving by customers	Qualitative	—
	Due to the adoption of a flat rate system, the water-saving awareness is not so strong. However, by shifting to a metered rate system, it is expected that the water-saving awareness will be raised but a water-saving awareness campaign should be also implemented simultaneously.		
Socio-economic conditions in the target residential area	Improvement of living environment in case of an inclusion of the poor	Qualitative	—

	residential area such as a slum, etc.		
	It is recognized that there is no clear slum in Imphal but it is committed that the water supply service will be improved in the entire service area.		
Budget for climate change affect in the water supply sector	Constant or increase of budget	Quantitative	－
	In the Manipur State Action Plan for Climate Change shows the project name and budget concerned with water resource in which the budget is allocated focusing on rainwater harvesting. However, the rainwater harvesting is the issue for rural water supply but not for urban water supply. Except for this, the preparation of the state water policy is the big issue but has not yet been addressed to.		

■ Provision and refurbishment of water supply facilities

・Water intake point

No reason to change

・Diversification of water sources

This water supply augmentation project will take raw water from a newly constructed dam from a different basin that other water treatment plants are currently sourcing water from. The water sources are therefore diversified and adaptable to the climate change.

When the water demand will increase, dam water allocated to the irrigation purpose will be shifted to water supply purpose.

・Facility plan in consideration of climate change impact in the future

At this moment, there is no basis to decide the flow in consideration of climate change impact in the future. The per capita water consumption is set at 135 Lpcd or the Indian benchmark which is used for the facility planning.

■ NRW reduction

・Strengthening of management, operation and maintenance system for NRW reduction

At present, there is no data on NRW, but taking into account the high rate of old pipes, the leakage rate is considered to be high. With the implementation of the Project, all distribution pipes and service pipe installations will be new. It is expected that NRW will be considerably improved.

The PHED admits that there are numerous illegal connections at present, although its actual number/ situation is unknown. These should be regularized or penalized, as the case may be; but the bottomline is to have all service connections pay for the water they consume through the water tariff. The biggest point in the regularization will be the mitigation of penalties, to balance of burden by the legal connections. The procedure for regularization should be strictly implemented and the awareness campaign of the regularization of illegal connections shall be extended emphasizing the one-time chance to receive the “benefit” of amnesty.

・Public awareness campaign for water-saving / conservation

The awareness to save or conserve water is not strong, since the water tariff is always same regardless of how much water is consumed. However, with the installation of a water meter in each service connection brought about by the shift to the metered rate system, there is a need to inform and educate the customers that whatever they use or waste will be subject to water tariff. There has to be a change in mindset from wasteful to judicious use of water as a precious resource.

■ Strengthening of water quality management

・Disinfection practice in the water treatment process

All existing treatment plants will be rehabilitated/ renewed, including disinfection equipment making it possible to carry out the disinfection at all WTPs.

・Measures for offensive odor by water quality change

At Singda Dam, which is one of water sources for Imphal water supply, the occurrence of blue-green algae was observed on the water surface in June 2014, but offensive odor has not been reported.

Table 11.8 Major Alternative Items during Monitoring Review

Project contents	Alternative indicators	Assessment method	Operation and effect indicators concerned
Hard measures	Improvement of target year at the time of facility augmentation or new facility construction	Quantitative	–
Soft measures	Change of water-saving awareness by customers	Qualitative	–
Others	Increase/decrease of customers	Quantitative	–

3) Consideration in the study of adaptive measures

1) Monitoring and review

The frequent occurrence of droughts in the latest decade since 2004 was beyond the scope of past and recent experiences and has instilled some fear to the water supply service providers. In collaboration with the Meteorological Department, it is advisable to monitor the rainfall pattern carefully and start the water level control earlier, including the implementation of water conservation awareness measures.

2) Flexibility for climate change

・Response to the reduction in water availability at water sources

In the National Water Policy, the first priority is given to the drinking water supply purpose. It is committed to reduce the use of water for irrigation purposes and increase the drinking water allocation, when the water demand will exceed the water supply capacity in Thoubal Dam.

・Response to an increase of water demand

The water demand is expected to exceed the water supply capacity around 2031.

・Response to the deterioration of water quality at a water source

Low possibility since the dam basin is located in mountainous undeveloped area.

(4) Maladaptation

■ Maladaptation by the Project (Low possibility)

The clear water from the new Chingkheiching WTP (production capacity of 45,000 m^3/day) will fully cover the water demand at 11 WSZs, and partially at three ESZs of Porompat, Chinga and Minuthong. The water demand is expected to exceed water supply capacity around 2031 and by that time there will be an allowance in water supply and the Chingkheiching system will be able to support the WSZs with a river/ water source during a drought, connecting transmission pipes with others.

■ Common maladaptation other than adaptive measures (Low possibility)

・Decrease of water availability by climate change impact (Low possibility)

The climate change projection on the rainfall shows an increase of rainfall in the upper reach of the rivers and dam which have been used or will be used as water sources for water supply.

・Deterioration of water quality at a water source (Low possibility)

The basin of Thoubal Dam to be used as a water source for water supply is located in the mountainous undeveloped area with an elevation of more than 900 m. The possibility of future water pollution is considered low.