Public Works Department
Government of Goa,
Republic of India

Capacity Development Project for Non Revenue Water Reduction in Goa, Republic of India

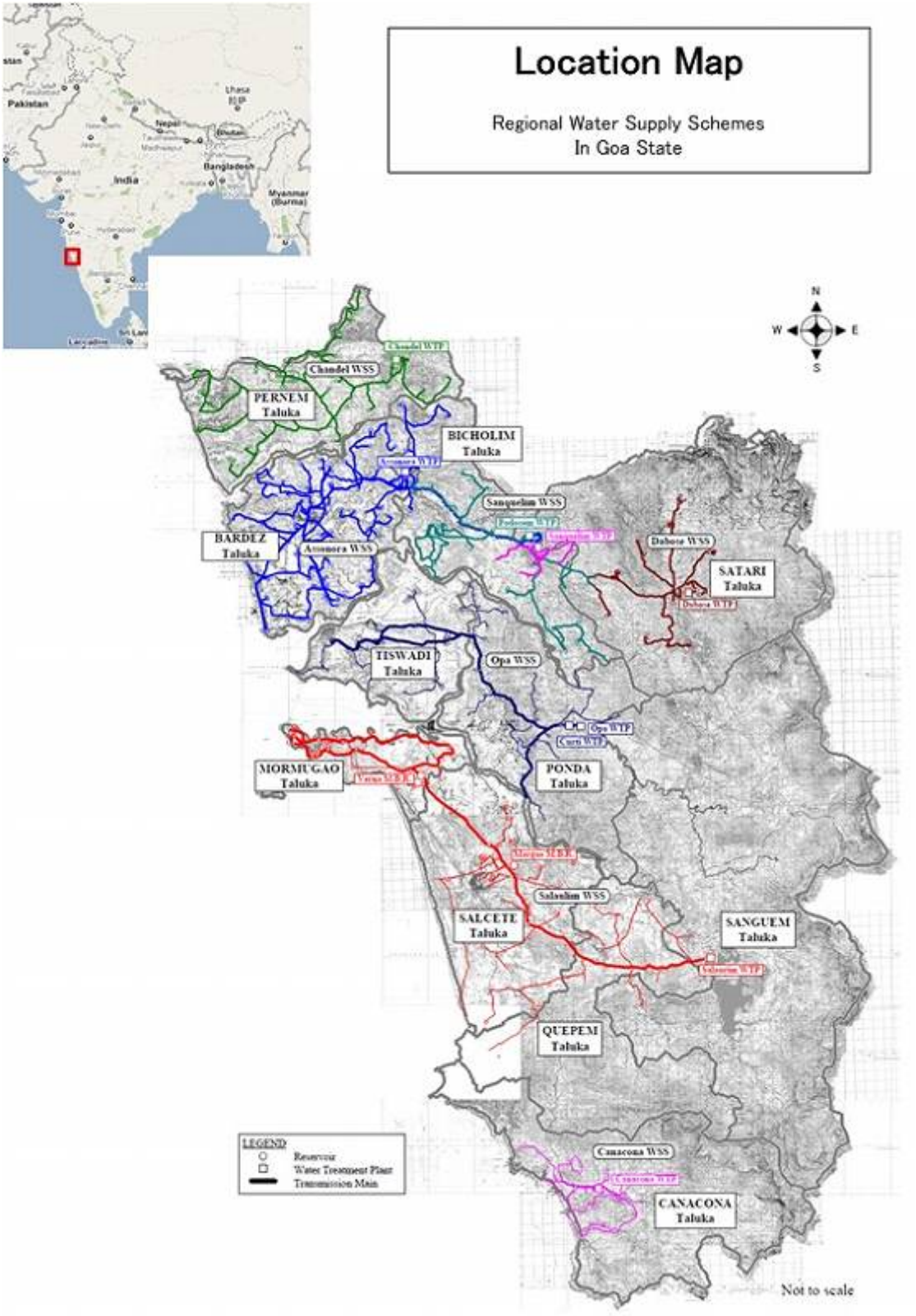
PROJECT COMPLETION REPORT

March 2014

Japan International Cooperation Agency (JICA)

Nihon Suido Consultants Co., Ltd.

ID
JR
13-006


Location Map
Regional Water Supply Schemes
In Goa State
Pakistan
India
Nepal
Bangladesh
Myanmar (Burma)
N
W
E
S
Chandel WSS
PERNEM Taluka
BICHOLIM Taluka
Sanquelim WSS
BARDEZ Taluka
Assonora WSS
Dabora WSS
SATARI Taluka
TISWADI Taluka
Opa WSS
Opa WTP
Curti WTP
MORMUGAO Taluka
PONDA Taluka
Salaulim WSS
SALCETE Taluka
SANGUEM Taluka
QUEPEM Taluka
Canacona WSS
CANACONA Taluka
LEGEND
Reservoir
Water Treatment Plant
Transmission Main
Not to scale

Japan International Cooperation Agency (JICA)
Public Works Department (PWD Goa),
Government of Goa, Republic of India

Capacity Development Project for Non Revenue Water Reduction in Goa

Project Completion Report

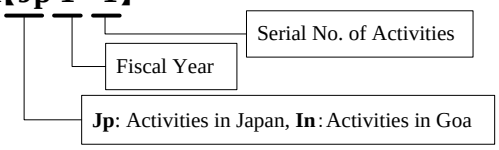
Table of Contents

Attachments

Abbreviations	
AE	Assistant Engineer
CE	Chief Engineer
CNCU	Central NRW Control Unit
CP, C/P	Countarpart
DMA	District Meter Area
FS, F/S	Feasibility Study
GIS	Geographical Information System
GLR	Ground Level Reservoir
GOI	Government of India
GOJ	Government of Japan
HHS	Household Survey
HQs	Headquarters
IWA	International Water Association
JCC	Joint Coordination Committee
JE	Junior Engineer
JET	JICA Expert Team
JICA	Japan International Cooperation Agency
LMA	Leak Management Area
MM	Minutes of Meeting
MNF	Minimum Night Flow
MP, M/P	Master Plan
MPM	Monthly Progress Meeting
NRW	Non-Revenue Water
NSC	Nihon Suido Consultants Co., Ltd.
O&M	Operation and Maintenance
OHT	Overhead Tank
OJT	On-the-Job Training
PCE	Principal Chief Engineer
PD	Project Director
PDM	Project Design Metrics
PI	Performance Indicator
PO	Plan of Operation
PPA	Pilot Project Area
PWD	Public Works Department
RD	Record of Discussion
RNRC	Regional NRW Reduction Cell
SE	Superintendent Engineer
TA	Technical Assistant

Legend

Item【Jp 1 - 1】



1 Outline of the Project

1.1 Background

JICA conducted development study "The Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India" from March, 2005 to November, 2006 based on the request from the Government of India (GOI). In the course of the development study, the feasibility study (F/S) was carried out about the priority projects which were identified in master plan for water supply and sanitation. Target year of the master plan was set as year 2025. In this development study, many problems regarding operation and maintenance of a waterworks were pointed out. In particular, high Non-Revenue Water (NRW) (about 50%) was raised as serious issue. It was also explained in the study that inappropriate measurement system/flow control at water treatment plant or reservoirs, inaccurate pipe network drawings will hinder active NRW reduction activities.

Based on the results of the feasibility study, a Yen Loan Project "Goa Water Supply and Sewerage Project" was requested to Government of Japan (GOJ) by GOI in March, 2007, and Loan Agreement was mutually signed after examination from Japan side in September, 2007. Now the Loan Project is under implementation by GOI.

1.2 Project Formation

In addition to the implementation of the Loan Project, various activities such as under ground leak detection should be implemented to reduce NRW ratio effectively. Under this situation, GOI requested to implement this technical cooperation project "Capacity Development Project for Non Revenue Water Reduction in Goa" in August 2007. Public Works Department (PWD), Goa State, is targeting realization of continuous 24 hour water supply not only by the implementation of the Loan Project but also capacity development in respectt of NRW reduction through technology transfer in the course of this project.

Japan International Cooperation Agency (JICA) dispatched JICA Expert Team (JET) to conduct the capacity development project in March, 2011.

1.3 Objectives of the Project

Project Goal, Project Purpose and activities for respective Outputs are as shown on Table 13.1.

Table 13.1 Project Goal, Project Purpose and activities for respective Outputs

	Descriptions/Actions	
(1)Overall Goal	Non revenue water (NRW) is reduced in the State of Goa	
(2)Project Purpose	Capacity of PWD to reduce NRW is strengthened.	
(3) Outputs	Output 1: Long-term/ Annual NRW Reduction Plan for the entire state is formulated	Act. 1-1 Study and analysis of the present state-wide NRW situation Act. 1-2 Review of Roll-out Plan proposed in the JICA Development Study Act. 1-3 Review of Action Plan proposed in the JICA Development Study Act. 1-4 Formulation of Long-term NRW Reduction Plan Act. 1-5 Formulation of Annual NRW Reduction Plan Act. 1-6 Monitoring of the implementation of Annual NRW Reduction Plan
	Output 2: NRW reduction in pilot areas is planned and implemented	Act. 2-1 Selection of pilot areas Act. 2-2 OJT (on-the-job training) on preliminary works for NRW reduction in pilot areas (1) Zoning of survey areas and preparation of maps & drawings (2) Training on the use of survey tools & equipment (3) Procurement of materials (pipes, valves, etc.), if required (4) Physical isolation of the pilot area (5) Analysis on the present condition (estimation of the monthly billed water, measurement of bulk flows; estimation of the baseline NRW ratio in the zone) (6) Division of the zone into several District Meter Areas .(DMAs) Act. 2-3 OJT on the following on-site works for NRW reduction in each DMA (1) Physical isolation of DMAs and analysis of the present condition (2) Detection & repair of leakage (3) Replacement of distribution & service connection pipes (4) Repair and replacement of meters (5) Legalization of unauthorized connection if any (6) Measurement of NRW reduction in each DMA Act. 2-4 Measurement of NRW reduction in the pilot area
	Output 3: Technologies and skills for NRW reduction are shared within PWD for the entire state	Act. 3-1 Preparation of a manual (1) Standardization of NRW reduction works (2) Formulation of a manual for NRW reduction Act. 3-2 Replication of the above NRW reduction activities to areas outside of the pilot areas by those who received the OJT training Act. 3-3 Organization of seminars

1.4 Project Area

The Technical Cooperation Project “Capacity Development Project for NRW Reduction in Goa” (hereinafter referred to as “the Project”) covers the entire state of Goa as it intends to develop the capacity of PWD for reducing overall NRW in the state. Some activities such as formulation of the long-term NRW Reduction Plan and preparation of the manual were conducted targeting all those who are assigned to continuous NRW reduction efforts in PWD.

On the other hand, the pilot projects were also planned in a couple of selected areas where a set of skills and techniques for reducing NRW is transferred from Japanese experts to Indian counterparts on OJT basis. While selection of three (3) pilot areas (with approximately 2,000 connections each) were finalized at the beginning phase of the Project, the following areas were agreed between both side: one area from Salaulim Water Supply Scheme, another from Opa Water Supply Scheme, and the other from Assonora Water Supply Scheme.

Project Outputs	**Project Area**
Output 1: Long-term/ Annual NRW Reduction Plan for the entire state is formulated	Entire Goa State
Output 2: NRW reduction in pilot areas is planned and implemented	3 pilot project areas selected from Salaulim, Opa, Assonora Water Supply Schemes
Output 3: Technologies and skills for NRW reduction are shared within PWD for the entire state	Entire Goa State

2 Project Activities

2.1 Project Design Matrix (PDM)

Project Design Matrix (PDM) which summarizes overall goal, project purpose, output, objectively verifiable indicators, activities, input is shown in Attachment-1.

2.2 Plan of Operation (PO)

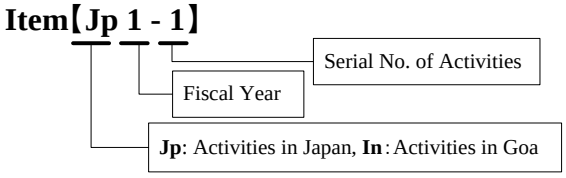
The Plan of Operation ($PO_{\_0}$: Plan of Operation Version 0) is shown in Attachement-3. $PO_{\_0}$ is included in the RD signed by JICA and PWD on September 7, 2010.

The expert team considered actual implementation of the project and prepared new version of PO_1 making some revision on the PO_0 as also shown in the same table. There are no large changes in the entire progress of the activities, but the original plan $PO_{\_0}$ was revised to $PO_{\_1}$ to do the work in 3 pilot project areas in parallel and to take sufficient time for the work of each pilot project area.

2.3 Project Activities

The work flow is shown in Attachement-2. This operation flow corresponds to $PO_{\_1}$ as proposed for partial revision to implement this Technical Cooperation Project in a smooth and effective way.

Legend



2.3.1 Project Activities of First Fiscal Year

Work for the 1st Year: Preparatory Work in Japan

Item【Jp1-1】 Review of Work Plan

The materials and information available in Japan were reviewed and the Work Plan including the basic policies (of technology transfer and project operation), operation methods, implementation system, and schedule for this Project were considered.

Work for the 1st Year: Work in India

Item【In1-1】 Explanation and Discussions of Work Plan

The report titled “Work Plan” was submitted to PWD and the Joint Coordination Committee (JCC) Meeting was held on April 5, 2011. Minutes of the JCC meeting is included in Attachment-7.

All parties attended the JCC meeting agreed that the target and indices of the Project would be

decided after commencement of the project through discussions with PWD.


JCC Meeting, held on April 5, 2011

Item【In1-2】 Organization of Working Group

Selection of members of the Working Group was discussed with the project director and PWD officers concerned. According to the agreement mentioned in RD and MM (Attachment-6), it was agreed that 2 staff from each of the 28 PWD sub-division office, totally 56 staff would be selected and assigned to the project as Working Group. Considering rather big number of staff for the Working Group, JET recommended to divide them into several teams and the PWD agreed.

Teams of the Working Group were established for respective project activities as follows.

- Team 1：Current situation investigation
- Team 2：Planning Long-Term NRW Reduction Plan
- Team 3：Pilot Project Team for Salaurim
- Team 4：Pilot Project Team for Opa
- Team 5：Pilot Project Team for Assonora

Members of Team 1 and Team 2 were selected from members of Team 3 to 5.

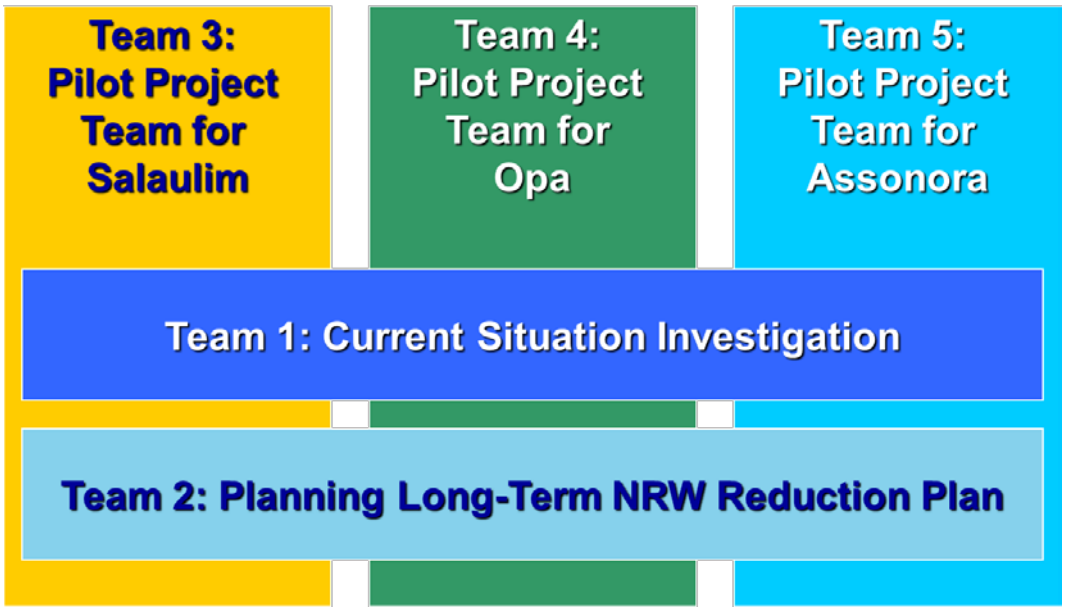


Figure 23.1 Team Formation of Working Group

Regarding public relation (PR) activities, series of meeting were held to discuss PR activities among PWD, PMC (Project Management Consultants for JICA Loan Project), and JET and it was concluded that necessary PR activities for this capacity development project should be implemented by agency of PR activities under the JICA Loan Project. PR activities for people living in Pilot Project area were decided to be commenced from the end of March 2012.

Item【In1-3】 Workshop Held in the 1st Year

The 1st workshop was held to create awareness of this Technical Cooperation Project among the PWD staff, to build up the implementation system smoothly, and to make them understand PWD's ownership. The workshop invited participants from all Sub-Divisions to explain the outline and schedule of the Project in accordance with the Work Plan, and also the outline of the method of making the NRW reduction activities.

In implementing the Project, attention is paid not to cause any communication gaps among PWD, PHE, Circle Offices, Division Offices, and Sub-Division Offices. For this purpose, all the persons concerned met together to receive explanation and carry out discussions on the Work Plan in order to start this Project with a common understanding.

During the 1st Fiscal Year, total 5 Workshops were held as shown below.

1st Workshop

Date Held	April 8, 2011
Venue	Hotel Marriott
Purpose	To share same understanding of the Project (objectives, results, indices, schedule, role of PWD)
Agenda	• Background of the Project • Objectives, results, area of the Project

	• Role of PWD • Project implementation schedule • JICA Experts assigned for the Project • Basic policies for the Project implementation • Activities of the Project • Equipment/materials for the Project procured by JICA • Undertakings from Indian side • Role and members of Joint Coordination Committee (JCC) • Project Evaluation

1st Workshop held on April 8, 2011

2nd Workshop

Date Held	May 5, 2011
Venue	Conference Hall of PWD HQ
Purpose	To share same understanding of the Project (objectives, results, indices, schedule, role of PWD)
Agenda	• Outline of the Project • What "NRW" is • Outline of Long-Term NRW Reduction Plan (Draft) • Major activities of Pilot Project • Selection of Pilot Project Area • Baseline assessment of PWD capacity of NRW reduction

2nd Workshop held on May 5, 2011

3rd Workshop

Date Held	August 11, 2011
Venue	Conference Hall of PWD HQ
Purpose	Outline of Project, Method of Water Audit, Structure of NRW Reduction Plan, Explanation of plan of activities in Pilot Project
Agenda	A. Outline of Project and Water Audit • Outline of Project • Expected results of the Project and schedule of activities • Basics of NRW • Definition of water audit as per IWA（International Water Association） • Real Loss and Apparent Loss • Basics of NRW reduction measures B. NRW Reduction Plan • What "NRW Reduction Plan"is • Plan of activities for Teams 1 and 2 • Expected results of the project activities • Contents of NRW Reduction Roll-Out Plan which was prepared during planning stage in 2004-2006 • Check list of the Roll-Out Plan • Check list of the Action Plan C. Activities of the Pilot Project • Preparatory works • Activities and Schedule • Household survey and house connection investigation • Preparation of pipe network drawings • Preparation of pilot blocks • Survey equipment • Current practice of water audit • Setting target of NRW reduction

4th Workshop

Date Held	September 22, 2011
Venue	Conference Hall of PWD HQs
Purpose	To increase interest of CP for participation of project activities by understanding basics of NRW and contents of project activities. Presentation of progress of project activities by Teams 3 to 5.
Agenda	A. Status of Project • Explanation of Plan of Operation (PO) • Delay of actual project activities comparing to the PO • Importance of project implementation review of PO B. Definition of NRW • Definition by IWA • Component of NRW C. Current situation of NRW in Goa State • Difficulties of data collection and data management regarding NRW in Goa • Average NRW ratio in Goa D. Activities of Pilot Project • Explanation of Pilot Block

	• Household survey • Necessity of network drawings and bulk meters • Schedule of OJT forthcoming E. Presentation of Team 3 to 5 regarding their progress of pilot project F. Discussion


4th Workshop held on September 22, 2011

5th Workshop

Date Held	March 12, 2012
Venue	Conference Hall of PWD HQ
Purpose	Summary of 1st Fiscal Year Activities
Agenda	A. Progress of the Project • Presentation by respective team of the Working Group regarding their activities and progress B. Results of Training in Japan • Presentation by trainee of the Training in Japan C. Schedule of project activities in the 2nd Fiscal Year • Explanation by JET D. Discussion on improvement measures of project activities

Item【In1-4】 Study and Analysis of the Present State-Wide NRW Situation (Activity[1] 1-1)

Team 1 collected data regarding current NRW situation such as water production, water billed amount, and meter conditions etc. with the assistance from JET. Current water meter conditions, and number of leak repairs are summarized as shown on Tables 23.1 to 23.2 and average NRW ratio in Goa is estimated as about 45 % in year 2011. This NRW ratio is estimated value since measuring system is not functioning in good condition.

[1] "Activity" numbers are shown in Table 13. 1 for respective "Output"

Table 23.1 Water Meter Condition in Goa PWD

No.	Water Supply Scheme	Total No. of House Connection	No. of Working Meters	Working Ratio	No. of NOT Working Meters	NOT Working Ratio	No. of Meter Replaced during Apr. 2010 to Mar. 2011
1	SALAULIM	94,885	87,172	91.9%	6,590	6.9%	4,616
2	OPA	57,480	44,786	77.9%	12,694	22.1%	2,696
3	CHANDEL	14,173	13,515	95.4%	658	4.6%	337
4	ASSONORA	46,363	35,534	76.6%	10,829	23.4%	1,427
5	SANQUEMLIM	16,246	13,290	81.8%	2,956	18.2%	116
6	DABOSE	9,600	7,880	82.1%	1,720	17.9%	236
7	CANACONA	6,090	5,938	97.5%	260	4.3%	228
	TOTAL	244,837	208,115	85.0%	35,707	14.6%	9,656

Data Source: PWD Goa, as of March 2011

Table 23.2 Number of Leak Repair in Goa PWD

No.	Water Supply Scheme	No. of Leak Repairs per Year
1	SALAULIM	8,778
2	OPA	4,338
3	CHANDEL	575
4	ASSONORA	3,996
5	SANQUEMLIM	782
6	DABOSE	445
7	CANACONA	391
	TOTAL	19,305

Data Source: PWD Goa, as of March 2011

Item【In1-5】 Confirmation on the Progress of the Roll-Out Plan and Action Plan Proposed in the JICA Development Study (Activities 1-2 and 1-3)

The progress of the Roll-Out Plan and Action Plan for NRW reduction as formulated in the Development Study was confirmed by Team 1. In the Development Study, the Roll-Out Plan and Action Plan related to NRW reduction were formulated based on the results of the pilot project implemented in the Santa Cruz Area. The main measures for NRW reduction as proposed in the Study are:

- Understanding of the basics of NRW reduction including complilation of necessary accurate data to supervise and control physical and commercial losses;
- Active prevention of leakages to reduce the current NRW level;
- Minimizing the future leakage by improving the quality of installation and repair; and
- Minimizing the commercial losses by improving the accuracy of meter inspection and charge collection.

Progress of implementation of these roll-out plan and action plan after the Development Study are summarized in Attachment 8.2.

Item【In1-6】 Formulation of Long-Term NRW Reduction Plan (Activity 1-4)

This activities were conducted by Team 2 for formulation of the Long-Term NRW Reduction Plan. The Team 2 commenced its activities for the formulation and record of activities are summarized as follows.

Team Meeting	Date	Activities
1st	October 11, 2011	• Contents to be included in the Plan were listed up through brainstorming by team members • Categorization of listed contents • Discussion on structure, table of contents of the Plan • Review definition and component of water audit • Scheduling of forthcoming works
2nd	October 19, 2011	• Allocation of chapters to each member to draft the Plan based on table of contents • Contents were added to respective chapters through discussions
3rd	October 24, 2011	• Discussion on how to organize the plan, format of description with guidance from JET
4th	October 31, 2011	• Review of contents of Master Plan/Feasibility Study • Discussion on methodology of water audit based on available data • Discussions on draft chapters prepared by each team member
5th	November 11, 2011	• Review of contents of Master Plan/Feasibility Study • Discussions on draft chapters prepared by each team member
6th	November 22, 2011	• Discussions on draft chapters prepared by each team member
7th	November 29, 2011	• Discussions on draft chapters prepared by each team member
8th	December 6, 2011	• Discussions on draft chapters prepared by each team member • Discussion on how-to-incorporate current problems of NRW reduction
9th	December 14, 2011	• Combining respective chapters prepared by team members into one plan.
10th	February 10, 2012	• Reviewing all chapters and final coordination of uncompleted chapters.
11th	February 17, 2012	• Discussions on uncompleted chapters/sections and additional explanations
12th	February 24, 2012	• Review on the first draft Version 1.0 and discussions of necessary correction points
13th	March 5, 2012	• Checking Version 1.5 revised from Version 1.0.

Team 2 meeting for preparation of “Long-Term NRW Reduction Plan (Draft)”

Item【In1-7】 Selection of Pilot Project Areas and Formulation of Pilot Project Plan (Activity 2-1)

Selection of Pilot Project Area

Pilot project areas were selected by Teams 3 to 5 of working group with their initiatives through a series of discussions among PWD, working group, and JET. Selected pilot project areas from respective water supply schemes such as Salaulim, Assonora, and Opa are as described below.

Team No.	Name of Pilot Project Area	Water Supply Scheme	Number of house connection in the pilot project area	Length of pipeline included in the pilot project area
3	Curtorim	Salaurim	2,239	67 km
4	Khadpaband	Opa	1,800	90 km
5	Moira	Assonora	2,180	110 km

For the selection of pilot project area, following aspects were taken into account.

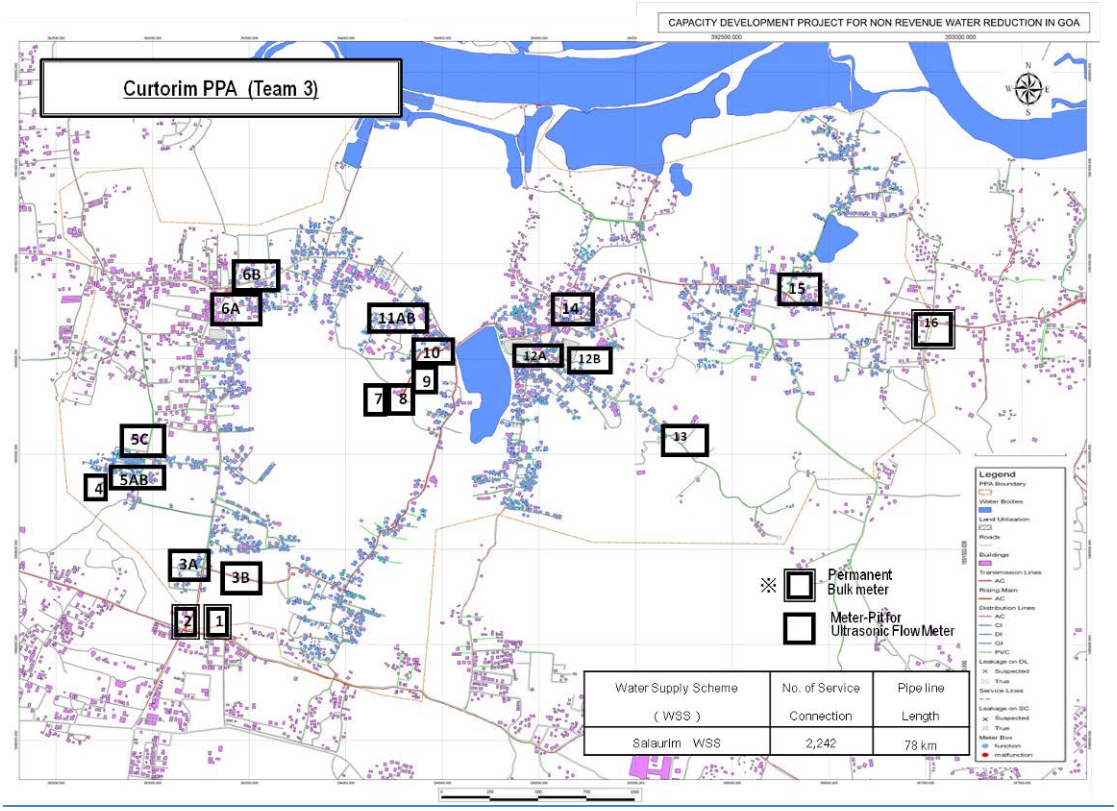
- Total number of house connection in the pilot project area is about 2,000 (recommended figure by IWA is 500 to 3,000)
- Rather easy area to collect information of existing distribution pipes
- Adequate for area isolation (avoid multiple inflow to the area, one or two inflow points are expected)
- Valves for separation of leak management area are existing or easy to install
- Continuous and sufficient water supply condition
- Area which may include a lot of leakages
- No security problems
- No on-going improvement projects

Team No.	Pilot Project Area(PPA)	Water Supply Scheme	No. of Service Connection	Pipeline Length
3	Curtorim PPA	Salaurim	2,242	78 km
4	Khadpaband PPA	Opa	1,538	24 km
5	Moira PPA	Assonora	1,979	60 km

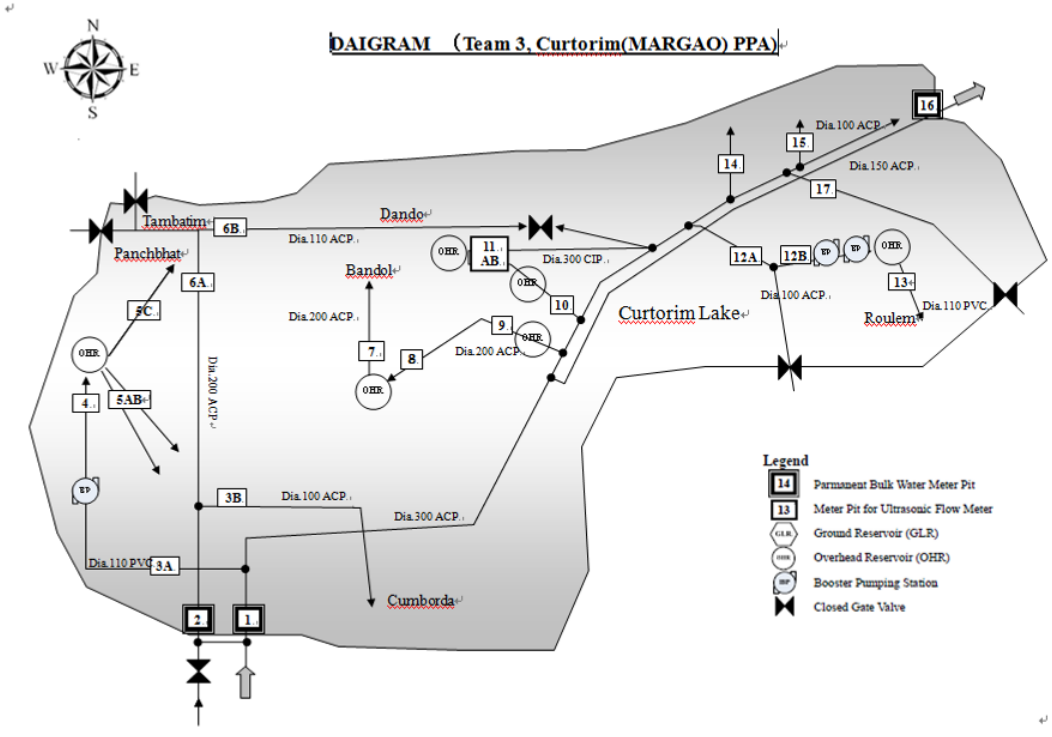
Figure 52.4 Location of Pilot Project Areas

Curtorim Pilot Project Area (Team 3), Salaulim Water Supply Scheme

Plan

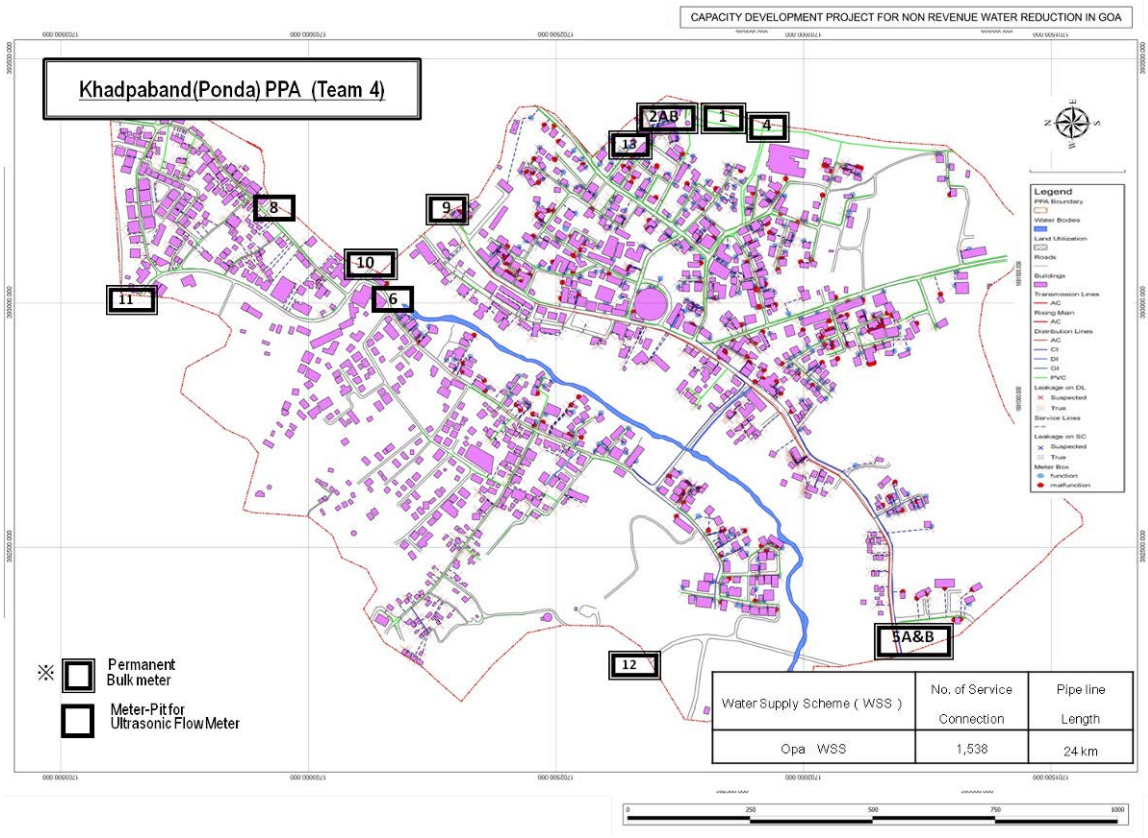


Schematic Pipe System

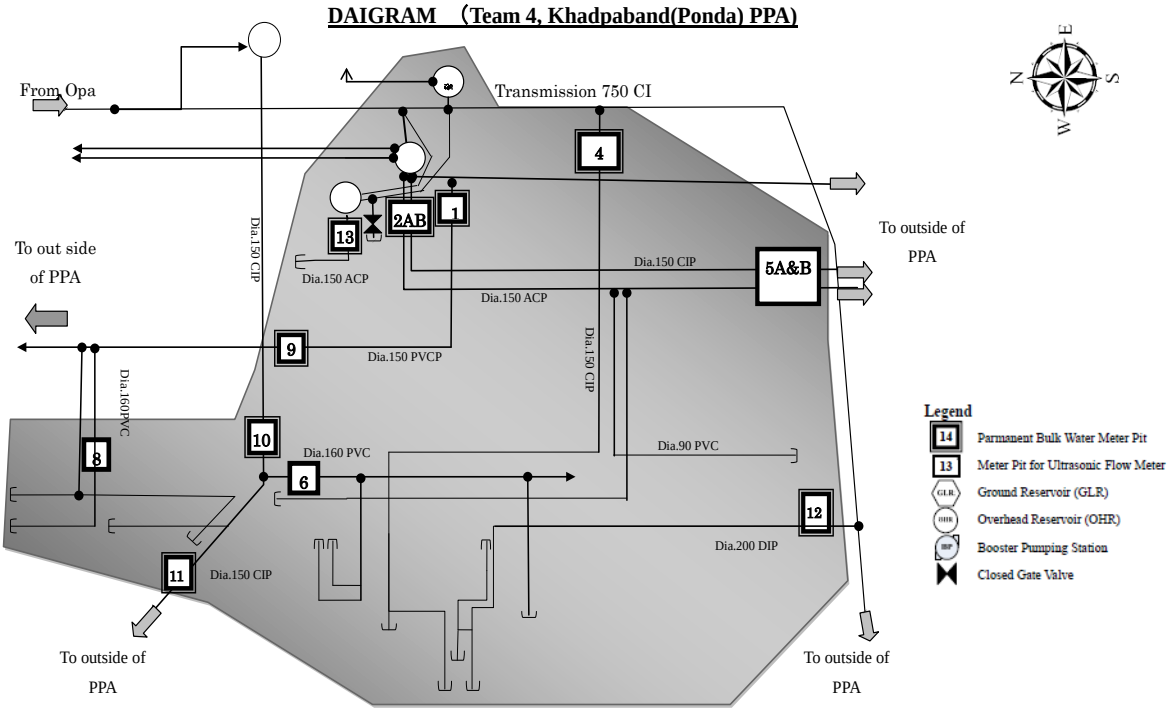


Khadpaband Pilot Project Area (Team 4), Opa Water Supply Scheme

Plan

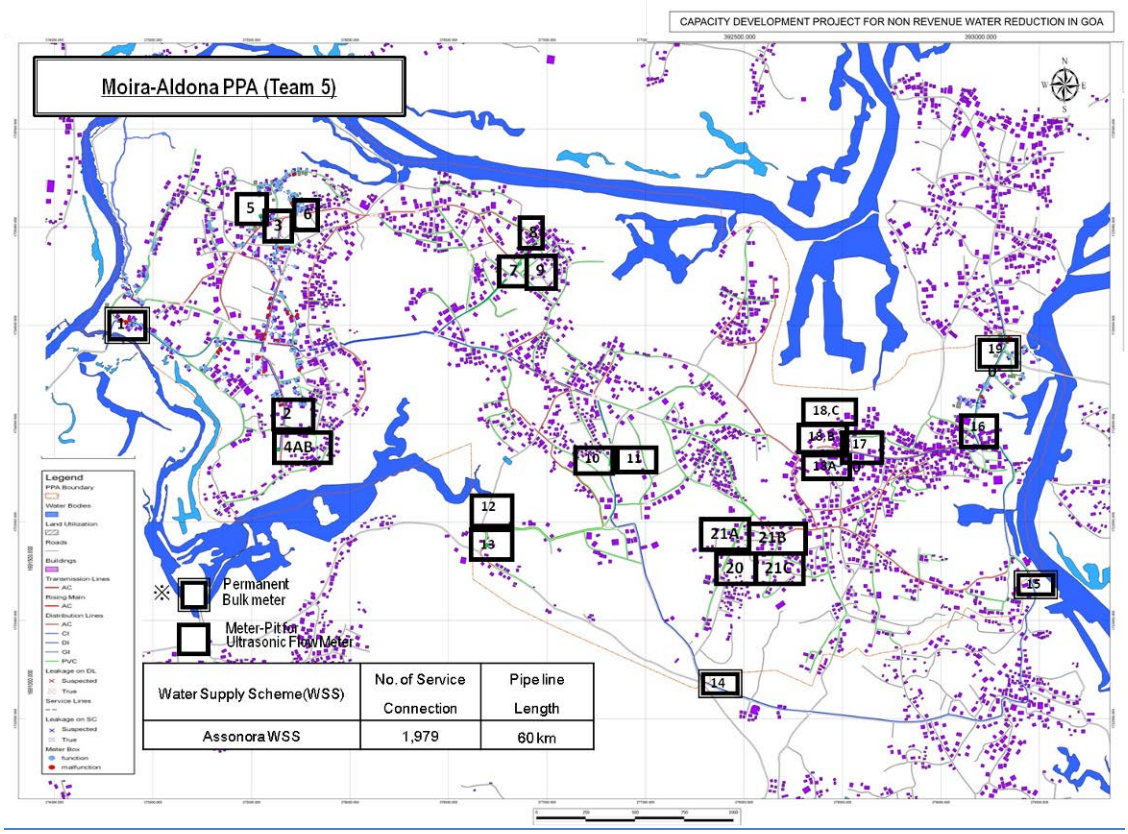


Schematic Pipe System



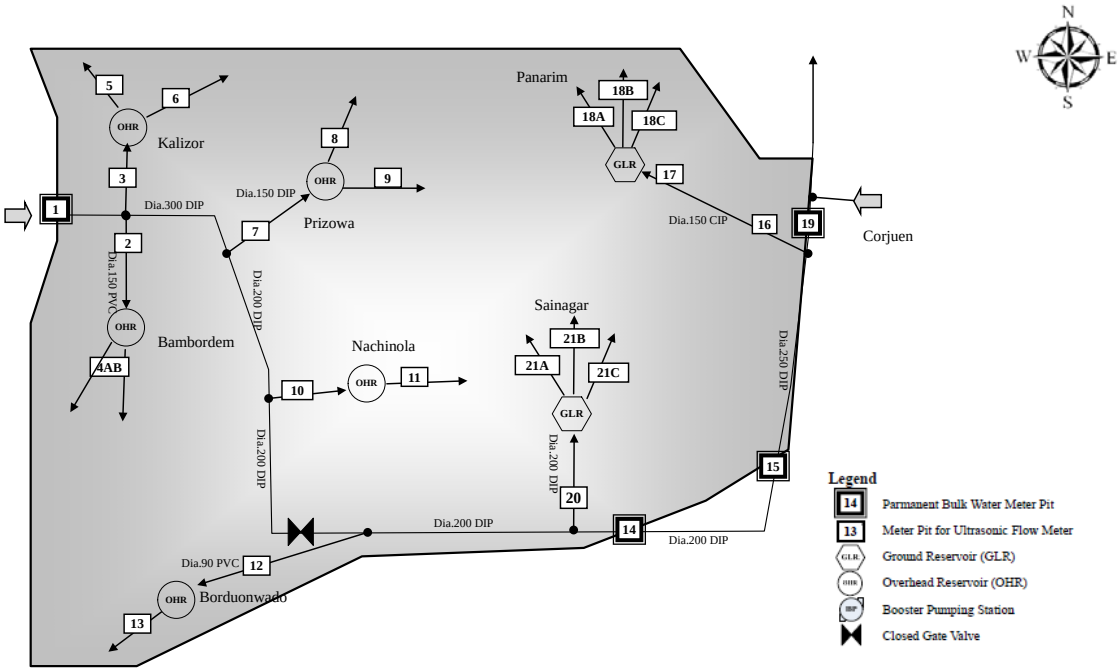
Moira Pilot Project Area (Team 5), Assonora Water Supply Scheme

Plan



Schematic Pipe System

DAIGRAM （Team 5, Moira, Aldona & Nachinola(MAPUSA) PPA）



Schedule of Pilot Project Activities

Because of erection, activities delay of PWD material procurement is caused. In addition, household survey activities in Moira was hindered by election related activities also.

To recover these delays in the second fiscal year, following measures were considered and taken.

- Several activities which were scheduled to be implemented stage wise were implemented simultaneously as much as possible.
- Ultrasonic flow meter (for temporary measurement) were used as substitution of permanent flow measurement to recover delay caused by delay of water meter procurement.
- Working days of project activities increased from the level of 2 to 3 days per week to as much as possible.

Item【In1-8】 OJT (On-the-Job Training) on Preliminary Works for NRW Reduction in Pilot Project Areas (Activity 2-2)

The activities were conducted for Teams 3 to 5. Based on the schedule of activities, OJT was conducted on preliminary works for the pilot project.

Progress of OJT on Preliminary Works for NRW Reduction in Pilot Area

Description		Activities	Targets	Progress
1	Preparation of topographical map and pipe network drawings of the pilot project area	Based on existing pipe network drawings, valve locations, pipe alignment with diameters and their materials to be collected and added to the existing drawings. At the same time, customer list in the pilot project area to be confirmed.	Topographical map and pipe network drawings of the pilot project area are prepared	Since GIS system developed by JICA Loan project covers transmission mains and distribution mains, information of house connections and water meters were added by Team 3 to 5 and JET. These added information will be combined to the GIS system in future.
2	Training on how-to-use leak detection equipment	First Fiscal Year: Training issued were • Kind of equipment • Principle of equipment • Characteristics of equipment • How-to-use equipment Second Fiscal Year Training items will be • Review of how-to-use equipment just before application at the project site.	Trainings regarding equipment are conducted.	Class room lectures (three times for respective team, totally 9 times) regarding equipment handling were conducted. After the class room lecture, training at the project site also conducted and actual survey works were commenced.
3	Procurement of Materials Required for pilot project	Valve condition should be checked before commencement of field work of pilot project.	Required materials are procured.	Required materials (valves and bulk meters) and civil works were listed up by counterpart members and

		Malfunctioning valves, which can not be opened or closed should be replaced by PWD. Those valves should be procured by the PWD.		bidding documents for the procurement were also prepared. However, bidding arrangements were terminated because of election scheduled on March 3, 2012.
4	Isolation of pilot project area	Three pilot project area were selected from respective Salaulim, Opa, and Assonora water supply scheme. Each pilot project area to include about 2,000 house connections.	Pilot project areas are isolated.	Pilot project areas were selected and investigations were conducted. However, physical isolation was terminated because of lack of materials caused by delay of procurement as mentioned above.
5	Estimation of NRW ratio of pilot project area before commencement of the pilot project	Investigation of NRW situation in isolated pilot project area.	Current NRW ratio is estimated and evaluated in the pilot project area.	After procurement of equipment, materials, this activity was conducted.

Preparation of topographical map and pipe network drawings of the pilot project area

Based on existing pipe network drawings, valve locations, pipe alignment with diameters and their materials were collected and added to the existing drawings. At the same time, customer list in the pilot project area was confirmed.

Investigation of water meter condition

Household survey

Training on how-to-use leak detection equipment

Class room lectures (three times for respective team, totally 9 times) regarding equipment handling were conducted.

Class Room Lectures	Contents of Lecture	Date of Lecture (Target Team)
First Session	Basics of NRW Reduction ・Necessity of NRW reduction activities ・Mechanism of leak generation ・Drill of basic NRW calculation	9/29（Team 5） 9/30（Team 4） 10/5（Team 3）
Second Session	Basic of Equipment which will be used (Structure, principles, how-to-use) ・Listening bar (Stethoscopic bar) ・Metal Locator ・Metal Pipe Locator ・Leak Sound Detector	10/4（Team 5） 10/11（Team 4） 10/12（Team 3）
Third Session	Preparatory work for Leak Survey ・ Application of those equipment mentioned above	10/6（Team 5） 10/14（Team 4） 10/15（Team 3）

After the lecture, on-site training of leak detection on house connections was commenced. At the on-site training, not only training of how-to-use equipment but also how to record the results of field work was also given so as to fit actual work of PWD.

Class room Lecture

OJT on how-to-use Leak Sound Detector


OJT of how-to-use listening rods (stethoscopic bar)

The First Year Work in Japan

Item【Jp1-2】 Training in Japan

Training in Japan of the 1st Fiscal Year was conducted from January 15 to January 28, 2012. Total number of trainees was 15 members, who were selected from project working group.

Purposes of the training were following.
1. To understand practices of Japan for reduction of NRW
2. To utilize technologies/knowledge obtained through the training effectively
3. To improve counter measures for NRW reduction in Goa

The training in Japan was completed successfully and trainees stated that the training was very effective for them. Results of the training will be incorporated to their Long-Term NRW Reduction plan, and reflected to pilot project activities and PWD routine works.

2.3.2 Project Activities of Second Fiscal Year

Output 1:
Long-term/ Annual NRW Reduction Plan for the entire state is formulated
Preparation of the Long-term NRW Reduction Plan was almost complete at the end of the 2nd Fiscal Year.

Basic idea of organization improvement is as follows.
- New organizational unit should be established designated only for NRW reduction activities.
- Central NRW Control Unit will be established in PWD Headquarters
- Regional NRW Reduction Cells will be established in respective Sub-Division office

Output 2:
NRW reduction in pilot project areas is planned and implemented
During the last 1st fiscal year, project activities were delayed because of election of Goa State Government. The delay caused in the 1st fiscal year still affected project progress in the 2nd fiscal

year and all planned project activities were not completed by the end of the 2nd fiscal year.

Leak detection in pilot project area was completed and flow measurement before leak repair was also completed. NRW ratio before the leak repair as baseline was analyzed during this fiscal year.

Output 3:
Technologies and skills for NRW reduction are shared within PWD for the entire state

This Output 3 was achieved by implementation of NRW reduction activities in selected areas, outside of the pilot project area (it was agreed to call the area as "DMA area"). PWD counterpart people use and apply experiences, technologies, and knowledge gained through the pilot project activities for the activities in DMA area. And these experiences, technologies, knowledge will be transferred to new PWD staff who did not involve in pilot project activities. Execution of these DMA activities was implemented in 3rd year.

As a conclusion of the 2nd JCC meeting which was held at the beginning of the 2nd fiscal year, number of DMA areas were decided as 9 areas. Although major DMA activities are scheduled to be conducted in the 3rd year, procurement procedures (procurement of materials and contractors) was initiated under support of JET during this fiscal year.

During the 2nd fiscal year, preparation of NRW Reduction Manual was started and finalized at the beginning of the 3rd fiscal year. The Manual was distributed to PWD staff.

（1） Major Milestones of Project in 2nd Fiscal Year

1） JCC Meeting

2nd JCC meeting was held on June 26, 2012 at the beginning of the 2nd fiscal year. During the meeting, scope and schedule of project activities in the 2nd fiscal year were explained by JET. Implementation of Training in Japan and Mid-Term Review were also confirmed by the JCC members. Number of areas for NRW reduction activities outside of pilot project areas were discussed and concluded that 9 areas should be selected for 3rd year activity.

3rd JCC meeting was held on February 14, 2013 at the end of Mid-Term Review. During the meeting, results of the Mid-Term review were explained by Joint (PWD and JICA) Review Team. The results of the review was very positive from the aspects of five evaluation indices although some delays were observed.

2） Mid-Term Review

From February 2 to 16, 2013, Mid-Term Review was conducted as mentioned above. During the 1st week of the Review, Japanese evaluation consultant appointed by JICA conducted interviews with JET, PWD higher authorities, counterparts, questionnaire survey, field investigation, and information collection. From the 2nd week, JICA officers from Tokyo and India Office joined the Review. Since this is the "joint" review, four officers from PWD including Project Director and Chief Engineer also joined the Review. Results of the Review were as mentioned above.

3） Workshop

Workshops were held three times during the 2nd fiscal year as shown below.

June 26, 2012	6th Workshop At the beginning of the 2nd fiscal year. Scope and schedule of 2nd fiscal year activities were explained and discussed.
February 5, 2013	7th Workshop Status of project progress was explained to Mid-Term Review consultant.
March 12, 2013	8th Workshop Summarizing 2nd fiscal year activities and explanation of scope and schedule of 3rd fiscal year activities.

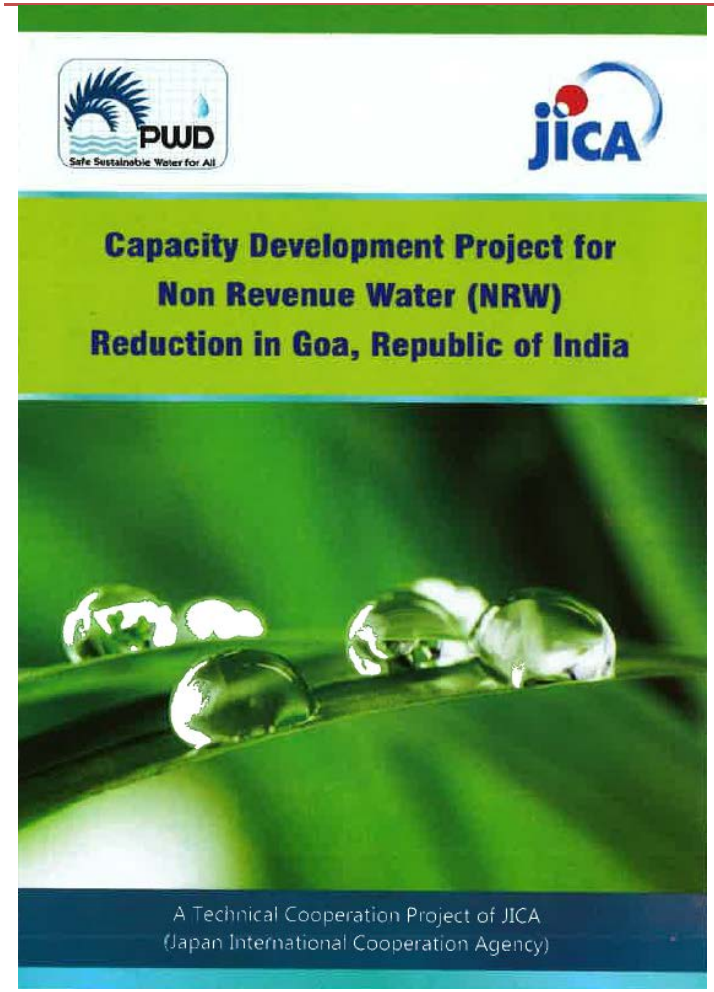
Details of respective workshop are described in the following section,【In2-6】 Workshops for the 2nd Year (Activity 3-3).

4） Training in Japan

Training in Japan was conducted for two weeks from November 24 to December 8, 2012 in Japan. Totally 16 counterparts visited Japan. Detailed program of the Training in Japan is described in the following section, Item【Jp2-1】 Training in Japan.

5） Public Relations for Pilot Project Activities

Various activities such as house hold survey, leak sound detection during night, etc. were conducted in respective pilot project area. For developing understanding of these activities of NRW reduction and importance of NRW reduction to customers living in the pilot project area, pamphlet shown below were prepared and distributed to all households (about 6,000 houses) in the pilot project area.


PWD
Safe Sustainable Water for All
JICA
Capacity Development Project for
Non Revenue Water (NRW)
Reduction in Goa, Republic of India
A Technical Cooperation Project of JICA
(Japan International Cooperation Agency)


Activities in the Pilot Project Areas :
Household Survey
Household surveys will be carried out to collect particulars about water supply conditions of consumers.
Inspection of Water Meter Condition
Inspection of water connection including water meter will be conducted to ascertain their condition.
Preparation of Pipe Network Drawings
Leak Sound Survey on Water Connections
This will be conducted using a listening bar to detect leak sound.
Leak Sound Detection along Distribution Pipelines
This will be carried out during night hours with the use of various equipment when water consumption is deemed to be minimal, and also external noises/disturbances are minimum.
WE REQUEST YOUR KIND COOPERATION
IN THE COURSE OF OUR PROJECT ACTIVITIES
If you have any query please contact PWD Goa
Tel. no. (0832) 6519872 - 74
Issued in Public Interest by:
Public Works Department
Government of Goa

Project Background

Non Revenue Water (NRW) is a loss of water supply system caused by leakage or through water meter errors. According to the past study of JICA, high NRW (about 40%) was noticed in the study area and the same was cause of serious concern.

"Goa Water Supply and Sewerage Project", a Japanese Yen Loan Project, is under implementation by Government of Goa (GOG), to improve the overall water supply condition in Goa. GOG is also implementing a "Capacity Development Project for NRW Reduction in Goa" since March 2011, under JICA technical cooperation.

Public Works Department (PWD) Goa is targeting 24x7 water supply, not only by increasing water supply volume, but also by capacity development of PWD, with respect to NRW reduction, through technology transfer.

The technical cooperation project will continue until March 2014. On completion of the capacity development project for NRW reduction, PWD Goa will continue with the NRW reduction activities, throughout Goa, on routine basis.

Project Area

The Project will basically cover the entire state of Goa. On the other hand, pilot projects are also planned in selected areas where a set of skills and techniques for reducing NRW are transferred by Japanese experts to Indian counterparts on an on-the-job training basis. 3 pilot project areas have been selected, each include approximately 2,000 house connections.

1) One area from Salaulim Water Supply Scheme - Curtorim
2) One area from Opa Water Supply Scheme - Khadpaband
3) One area from Assonora Water Supply Scheme - Moira



Project Goal and Outputs

Overall Goal

Reduction of Non revenue Water (NRW) in the state of Goa

Project Purpose

To Strengthen Capacity of PWD to reduce NRW

Outputs

1) Long-term/ Annual NRW reduction plan for the entire state is formulated.
2) NRW reduction in pilot project areas is planned and implemented.
3) Technologies and skills for NRW reduction are shared within PWD for the entire state.

Leak Survey Equipment

Overflowing Water Tank

Why NRW should be reduced?

Non Revenue Water (NRW) Reduction leads to the reduction of revenue loss, reduction in requirement of additional water resource development and also reduce the requirement of new water works. Thereby, saving in requirement of additional water infrastructure development funds. Overall, it will improve the financial situation of water supply sector and will result in better operation and maintenance and better water supply services to consumers.

JICA Expert Team (JET)

JICA Expert Team (JET) will support PWD for project implementation by providing adequate training and recommendations. PWD Staff will work with Japanese Experts in the field and learn to use different leak detection equipment and techniques to reduce NRW.


This pamphlet was prepared and printed with cooperation of JICA Loan Project, Goa Water Supply and Sewerage Development Project as agreed with Goa PWD.

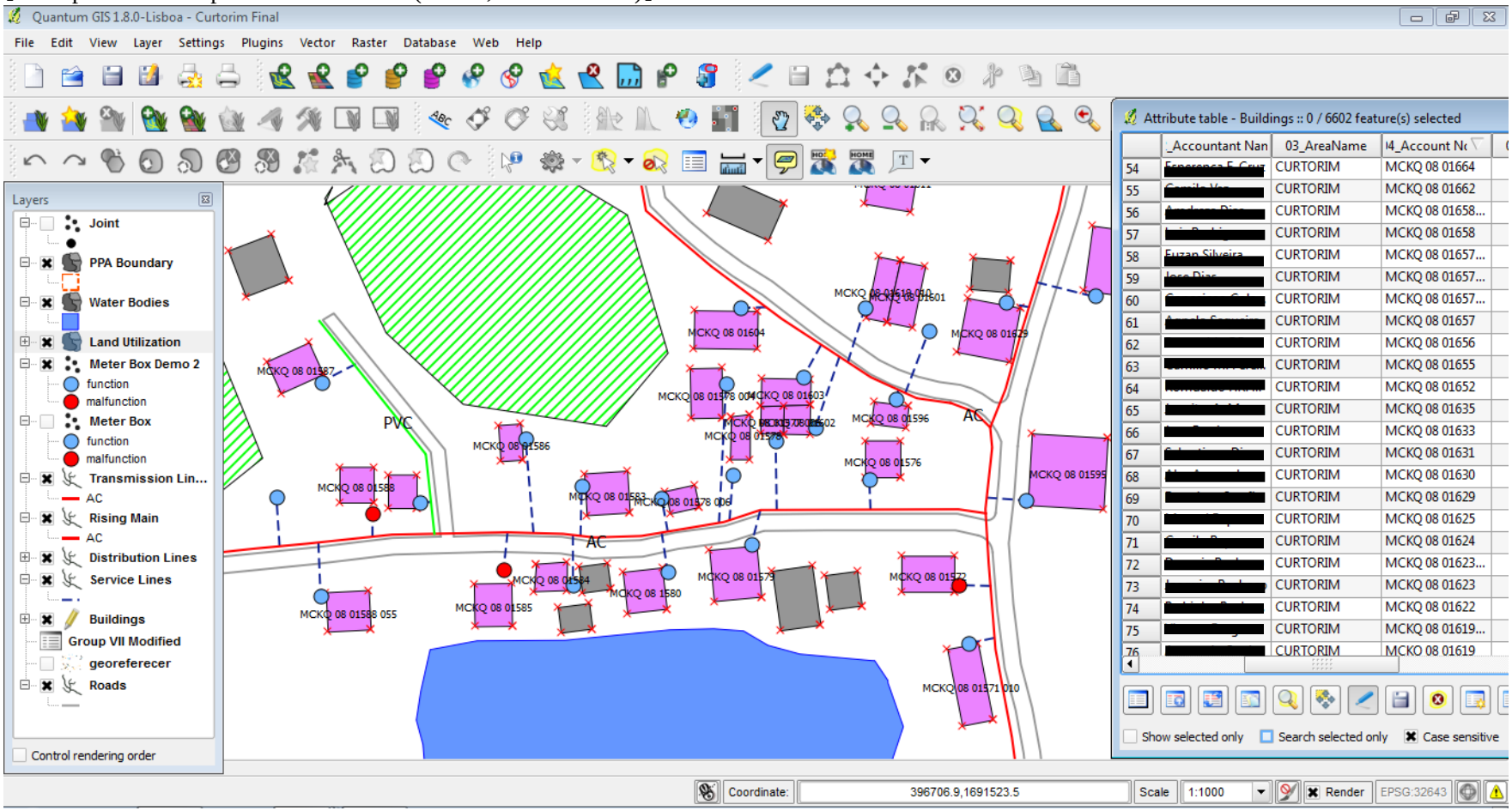
(2) Work for the 2nd Year: Work in India

Item【In2-1】OJT on Preliminary Works for NRW Reduction in Pilot Areas (Continued) (Activity 2-2)

Preparation of Maps and Pipe Drawings in PPAs

After getting training of GIS (Geographic Information System) the Team Leader and other members in charge of GIS in each team prepared GIS pipe network drawings using base maps given by the Yen Loan Project. Free software of Quantum GIS was used for the preparation.

【Example of GIS Map and attributed data (Team3, Curtorim PPA)】



Training for Usage of Survey Equipment

Class room lecture and field training were implemented on the usage of survey equipment, which is procured in March 2013.

i) From 2nd July to 4th July (3 days): Training on usage of ultrasonic flow meter
ii) From 9th July to 11th July (3 days): Training on usage of survey equipment (leak detector, water pressure gauge, metal locator, and metal pipeline locator)

Following the training, JET gave OJT on usage of equipment for flow measurement, leak detection and pipe locating at site. In addition, trainings were given to PWD staffs other than counter parts outside the PPAs since PWD staffs, especially from the area of Team 3 and Team 5, requested for the survey several times.

This kind of requests are considered as the evidence of PWD's active attitudes for NRW reduction, which are effects of the Project.

Procurement of required material (Including pipes, valves and meters)

In the first year of the Project, bidding procedure could not be progressed after December 2012 due to election of GOA State Assembly in March 2012. JICA agreed to procure bulk flow meters (electromagnetic flow meter) and valves. Procurement of the other required material and services were contracted out by PWD. The bidding process took long time and the issues were discussed several times between PWD and JET to expedite the progress.

Isolation of PPA

Permanent type bulk flow meters were installed on pipes at the boundary of PPA for isolation. Since most of the pipe systems in the selected PPA are tree branch shape but not network, water supply would be stopped at the downstream if gate valves were installed and closed at the boundary. Therefore bulk flow meters were installed, instead of gate valves, at such points for isolation of PPA.

Estimation of initial NRW ratio in PPA before NRW reduction activities

1) The results of HHS (Household Survey)

Conditions of consumer meters are checked during HHS.

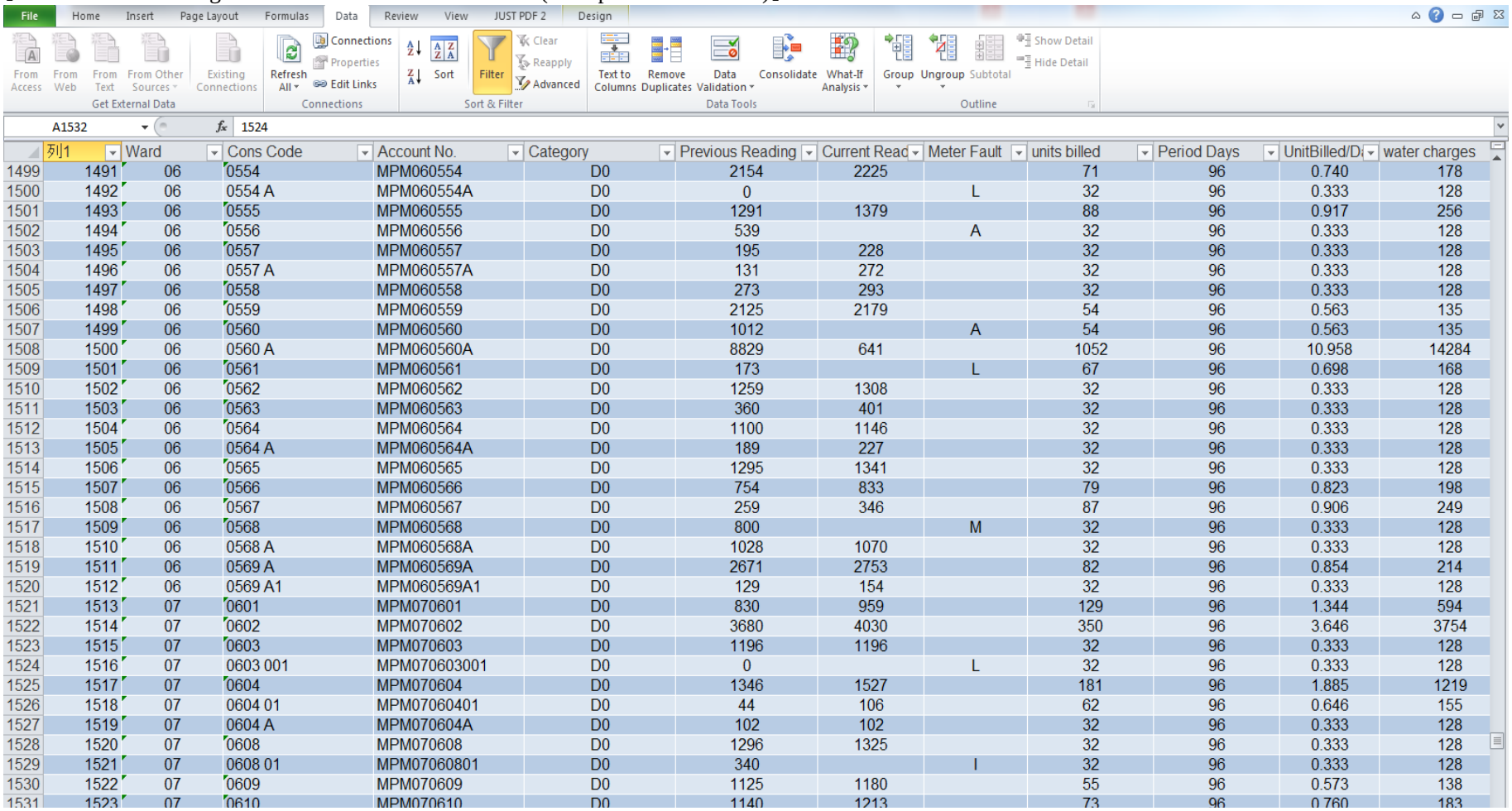
2) The Results of Leak Detection

Team leader of each Team separated the members into groups and allocated respective area to each group. Night leak survey was conducted form October 2012 to February 2013 with the instruction and support of JET.

3) Estimation of Initial NRW Ratio before NRW Reduction Activities in PPAs

The volume of water inflow to PPA was measured using portable type ultrasonic flow meter for continuous 24 hours since permanent type electromagnetic flow meters were not installed. Billed amount in PPA at the timing of flow measurement was not available and the available data of nearest timing were used for estimation of NRW. An example of summary data sheet of billing records is shown below.

【Data sheet for Bulling record summarized for each PPA (example of Moira PPA)】



	列1	Ward	Cons Code	Account No.	Category	Previous Reading	Current Read	Meter Fault	units billed	Period Days	UnitBilled/D	water charges
1499	1491	06	0554	MPM060554	D0	2154	2225		71	96	0.740	178
1500	1492	06	0554 A	MPM060554A	D0	0		L	32	96	0.333	128
1501	1493	06	0555	MPM060555	D0	1291	1379		88	96	0.917	256
1502	1494	06	0556	MPM060556	D0	539		A	32	96	0.333	128
1503	1495	06	0557	MPM060557	D0	195	228		32	96	0.333	128
1504	1496	06	0557 A	MPM060557A	D0	131	272		32	96	0.333	128
1505	1497	06	0558	MPM060558	D0	273	293		32	96	0.333	128
1506	1498	06	0559	MPM060559	D0	2125	2179		54	96	0.563	135
1507	1499	06	0560	MPM060560	D0	1012		A	54	96	0.563	135
1508	1500	06	0560 A	MPM060560A	D0	8829	641		1052	96	10.958	14284
1509	1501	06	0561	MPM060561	D0	173		L	67	96	0.698	168
1510	1502	06	0562	MPM060562	D0	1259	1308		32	96	0.333	128
1511	1503	06	0563	MPM060563	D0	360	401		32	96	0.333	128
1512	1504	06	0564	MPM060564	D0	1100	1146		32	96	0.333	128
1513	1505	06	0564 A	MPM060564A	D0	189	227		32	96	0.333	128
1514	1506	06	0565	MPM060565	D0	1295	1341		32	96	0.333	128
1515	1507	06	0566	MPM060566	D0	754	833		79	96	0.823	198
1516	1508	06	0567	MPM060567	D0	259	346		87	96	0.906	249
1517	1509	06	0568	MPM060568	D0	800		M	32	96	0.333	128
1518	1510	06	0568 A	MPM060568A	D0	1028	1070		32	96	0.333	128
1519	1511	06	0569 A	MPM060569A	D0	2671	2753		82	96	0.854	214
1520	1512	06	0569 A1	MPM060569A1	D0	129	154		32	96	0.333	128
1521	1513	07	0601	MPM070601	D0	830	959		129	96	1.344	594
1522	1514	07	0602	MPM070602	D0	3680	4030		350	96	3.646	3754
1523	1515	07	0603	MPM070603	D0	1196	1196		32	96	0.333	128
1524	1516	07	0603 001	MPM070603001	D0	0		L	32	96	0.333	128
1525	1517	07	0604	MPM070604	D0	1346	1527		181	96	1.885	1219
1526	1518	07	0604 01	MPM07060401	D0	44	106		62	96	0.646	155
1527	1519	07	0604 A	MPM070604A	D0	102	102		32	96	0.333	128
1528	1520	07	0608	MPM070608	D0	1296	1325		32	96	0.333	128
1529	1521	07	0608 01	MPM07060801	D0	340		I	32	96	0.333	128
1530	1522	07	0609	MPM070609	D0	1125	1180		55	96	0.573	138
1531	1523	07	0610	MPM070610	D0	1140	1213		73	96	0.760	183

※Billing data issued by Revenue Section (Cell) of respective sub-division were summarized for each PPA in time series. This sheet, the results of HHS and GIS map were linked with each other subsequently in order to use the same for estimation of NRW ratio and its monitoring.

Initial NRW before NRW reduction activities is estimated as baseline data based on the survey results in PPA. The estimated figures are shown below.

PPA		a	b	c	d = c x (a / b)	e	f = 1 - (d / e)
		Actual Number of House Connection	Registered Number of Connection shown on Billing List	Total Billed Consumption	Adjusted Billed Consumption	Actual Water Inflow to PPA	NRW Ratio
		nos.	nos.	m3/day	m3/day	m3/day	
Cultorim		2,242	1,959	1,466	1,678	3,054	45%
Khadpaband		1,551	1,269	1,502	1,836	4,452	59%
Moira	Moira	1,045	994	898	944	1,964	52%
	Aldona	934	575	406	659	1,448	54%
	Sub-Total	1,979	1,569	1,304	1,604	3,412	53%

Note:

a Total number of connections confirmed through household survey in PPA

b Number of connection, which were obtained through household survey in PPA and customer number shown on billing list was matched.

c Total billed consumption for connections shown in "b"

d There are several missing connections on billing list (a-b), billed consumption was adjusted to cover such missing connecti

e Actual water inflow to respective PPA measured by Teams

Item【In2-2】 OJT on the On-Site Works for NRW Reduction in each DMA (Activity 2-3)

The OJT for six (6) NRW reduction measures as shown in the Table below are conducted for the PWD C/P under the pilot project plan.

Details and Targets of OJT for NRW Reduction Measures

	Item of Measure	Description	Target
1	Physical isolation of DMAs and analysis of the present condition	Investigation of the NRW ratios before the measures are taken in LMAs	Each pilot area is isolated into leak management zones. The NRW ratios are monitored before the measures are taken.
2	Detection & repair of leakage	The working group is furnished with the OJT for NRW reduction technology through their activities in LMAs.	Leak detection and repair conducted. The distribution pipes and service connection pipes repaired or replaced.
3	Replacement of distribution & service connection pipes	The items of exercise are: a. Operating procedures of survey equipment; b. Pipe repair and service connection technologies; c. Recording, statistical processing and analysis of survey data.	The water meters repaired or replaced. Unauthorized connections to be brought into legal connections.
4	Repair and replacement of meters	Countermeasures for reduction of apparent losses (including free supply from public stand post, unaccounted water reduction, water theft and meter errors) to be	
5	Legalization of unauthorized connection if		

	any	discussed. The technical and skill level of the working group is /will be built up to allow the lateral spread of those technologies.	
6	Measurement of NRW reduction in each DMA	The NRW ratios in the LMAs in which the measures have been taken will be estimated to verify the effects of NRW reduction activities. The effects of the measures will be confirmed.	The NRW ratios after the measures will be estimated. The effects of NRW reduction will be confirmed.

Physical Isolation of each LMA and estimation of NRW ratio before NRW Reduction Activities

In some LMA flow measurement was done only after construction of meter pits for temporal flow meters. The water inflow volume to most of LMAs was measured. After flow measurement, billing data were sorted out for each LMA and NRW was estimated.

Leak Detection and Repair

Leak detection was conducted before completion of flow measurement. As for a problem of current leak repair, leakages on GI (Galvanized Iron) pipes are generally repaired inserting something into leak holes and fastening together with rubber tubes. JET pointed out the problem in the methods at the sites and plumbers understood. However the plumbers could not change the situation since repair materials are not at hand and it is difficult to stop water due to shortage of gate valves. It is essential to install proper number of gate valves for stopping water during leak repair.

Repair and Replacement of Distribution and Service Pipes

Pipes required to be replaced were not found in PPA. PWD wants to replace all the AC pipes. The pipe replacement shall be executed in a properly planned manner.

Repair and Replacement of Consumer Meters

The table below shows number of consumer meters to be installed or replaced in each PPA.

Team	Number of water connections with malfunctioning meters or without water meters
3	65
4	661
5	260
Total	986

Note: data as of end of February 2013

Disconnection and Legalization of Unauthorized Connection

Table below shows detected unauthorized connection in each PPA and actions already taken. When

unauthorized connection was found, actions should be taken immediately, such as disconnection and registration as new connection. However it may be difficult to take immediate actions with several reasons.

Detected Unauthorized Connection

Team	Detected Unauthorized Connection	Disconnected	Remain as Unauthorized Connection
3	8	0	8
4	16	0	16
5	15	6	9

Note） Data as of the end of February 2013

Measurement of NRW in LMA after NRW Reduction Activities and Evaluation of the Activities
The activities were carried out after completion of leak repair and other NRW reduction activities.

Item【In2-3】 Measurement of NRW Reduction in the Pilot area (Activity 2-4)

Leak repair works in PPA was yet completed at the end of the 2nd Fiscal Year due to delay of procurement of bulk flow meters and selection of contractors by PWD. In order to know the effects of the NRW reduction activities at an early stage, it was planned to repair relatively large leakages (assumed as more than 1 m^3/hour) with high priority and measure the effects of NRW reduction.

Item【In2-4】 Preparation of a Manual (Activity 3-1)

Based on the results of the pilot projects, NRW reduction manual for PWD was prepared. Since NRW reduction activities in the PPAs were executed to suite the site conditions and capability of the staff, the manual was to be prepared based on the experience of the activities. The manual was finalized after the PPA activities were completed, the beginning of 3rd Fiscal Year. The manual was utilized in the DMA activities and then reviewed /improved by PWD based on the finding in the activities.

This manual covers comprehensively the series of activities from the preparatory work to the estimation of the effects, including the operation methods of the relevant equipment. The manual was prepared considering that PWD would conduct NRW reduction activities independently using the manual as reference material in the future. Especially following issue is considered to be important for PWD to continue the NRW reduction activities as described in details.

Leak survey (leak volume)
Type, principle and features of each of survey equipment (including leak detector, metal pipe locator, metal detector, ultrasonic flow meter and hydraulic gauge);
Operating procedure of survey equipment;
Methods of recording, data processing and analysis of survey data

This manual also describes, together with the work flow chart, the points which require special attention for the work of measuring the inflow rate, minimum night flow and hydraulic pressure in

distribution, the late-night leak detection work by means of a listening bar or leak detector, the work of repairing detected leak points, and the work of re-measuring the minimum night flow.

The manual is composed of Part A and Part B. Comprehensive activities for NRW reduction are discussed in Part A, while characteristics, principle, usage methods and points to be taken care of relevant equipment for NRW Reduction area explained in Part B. The contents of Part A are as show below.

PART A

Item【In2-5】 Review of Long-Term NRW Reduction Plan and Formulation of Annual NRW Reduction Plan (Activities 1-4 and 1-5)

Long-Term NRW Reduction Plan was formulated for the entire GOA state in the first year of the Project. The Plan discussed NRW reduction activities for PWD to execute in mid /long-term

targeting five years or more after commencement of the Project. Targets of Objectively Verifiable Indicators for Activity 2 and Activity 3 are also mentioned in the Plan.

Based on the results of the pilot projects, the Long-Term NRW Reduction Plan as formulated in the first year of the Project was reviewed and details of the Plan was examined. Then, the annual plan for NRW reduction for the successive year was prepared. In addition to this work, the target value for the second indicator in this Project "the number of NRW reduction activities carried out in areas outside of the pilot areas" was set. .

JET reviewed Long-Term NRW Reduction Plan Ver. 1.5 prepared in the first year of the Project and revised as Ver.1.6 by indicating its comments on structural review of the report, articles to be added and required modifications. The Team members scrutinized the comments, discussed the improvement and amended the Plan as ver.1.7 with assistance of JET. Team 2 members continued the discussion and prepared ver.1.8 by reflecting the comments in the meetings.

Realization of organizational set-up is one of the most essential issues in the Plan. Therefore PWD and JET had series of discussions to prepare realistic organizational plan. JET also assisted internal discussion of PWD and following ideas are almost concluded.

Central NRW Control Unit is planned to be set up in PWD head office to execute management activities such as preparation of NRW reduction plan, monitoring of the activities, collection and processing of the data, securing budget and executing required trainings. Regional NRW Reduction Unit is planned to be organized in each sub-division to execute NRW reduction activities at the field. It is considered to make clear the responsibility of Regional NRW Reduction Unit in each sub-division considering improvement of ownership. It is one of the important tasks for Central Control Unit to make open to the public the results of NRW reduction in each sub-division and to improve motivation of the Regional NRW Reduction Unit.

Preparation of Annual NRW Reduction Plan

Annual NRW Reduction Plan was prepared by Team 2 along with preparation of the Long-Term NRW Reduction Plan. There will be three documents which will be prepared as part of the project and they are related each with other as described below.

- Long-Term NRW Reduction Plan

The plan is for entire Goa State and covers long time span. The plan is basis of NRW reduction activities of PWD Goa and includes policy of PWD for NRW reduction, target of reduction, and various aspects of action plans together with their implementation schedule and preliminary cost estimate.

- Annual NRW Reduction Plan

Although the annual plan is prepared for one-year activity of 3rd fiscal year of this project, the annual plan will be referred as implementation plan of the Long-Term NRW Reduction Plan, especially for DMA activities, year by year continuously after this capacity development project.

- NRW Reduction Manual

The Manual is prepared based on actual experience of pilot project. All DMA activities are explained following the order of work flow from setting DMA to final evaluation. When PWD

staff implement NRW reduction activities in the field as scheduled by the annual plan, the manual will be important and useful reference for the PWD staff.

Relationship among these documents is as shown figure below.

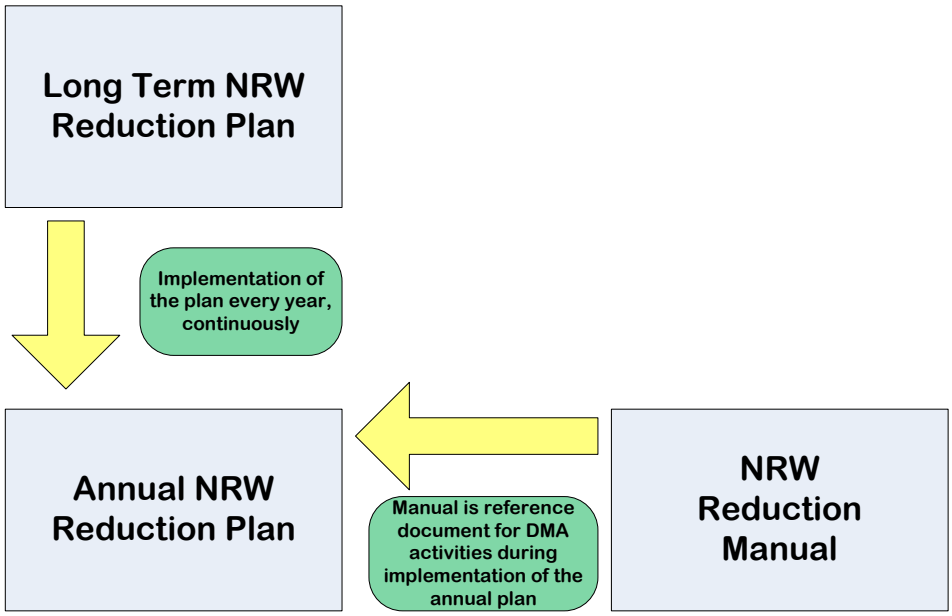


Table of contents of the annual plan is as below.

Item【In2-6】 Workshops for the 2nd Year (Activity 3-3)

During the 2nd fiscal year, three times, 6th , 7th , and 8th , workshops were held and details of each workshop are as follows.

6th Workshop

Date: June 26, 2012
Venue: Conference Hall of PWD Headquarters
Major Topic: Scope and schedule of 2nd fiscal year project activities

At the beginning of the 2nd fiscal year, scope and schedule of the 2nd fiscal year project activities were explained and discussed to have same understanding among PWD officers and counterparts concerned. Presentations by counterparts regarding progress of project activities were also made. Agenda of the workshop was as shown below.

Agenda

Opening Address by Project Director
Presentation by JICA Expert Team by Mr. Mamiya
- ☐ Project Outline
- ☐ Activities in the 1st Fiscal Year
- ☐ Schedule and Scope of 2nd Fiscal Year Project

Formulation of NRW Reduction Manual by Ms. Nakamura
Forthcoming Activities of Pilot Project Area and for the 3rd Fiscal Year
by Mr. Sakaoka
PWD's Countermeasures to tackle problems encountered
by three Team Leaders (Team 3, 4, and 5)
Closing Notes by Chief Engineer

7th Workshop

Date: February 5, 2013
Venue: Conference Hall of PWD Headquarters
Major Topic: Presentation of progress of project activities for Mid-Term Review

This workshop was held as a part of Mid-Term Review to explain status of project activities. PWD counterparts made presentation regarding progress of their activities to member of Mid-Term Review. Presentations were as follows.

- Current situation of NRW in Goa State by Team 1
- Preparation of the Long-Term NRW Reduction Plan by Team 2
- Progress of pilot project in Curtorim by Team 3
- Progress of pilot project in Khadpaband by Team 4
- Progress of pilot project in Moira by Team 5
- Progress of DMA activities for 3rd fiscal year

8th Workshop

Date: March 12, 2013
Venue: Hotel Marriott, Goa
Major Topic: Summarizing 2nd fiscal year activities and explanation of scope and schedule of 3rd fiscal year activities

Agenda of the 8th Workshop was as follows.

Agenda

Registration
Opening Address by Principal Secretary of PWD
Opening Address by Chief Engineer I
Presentations
i) Contents of "Long-Term NRW Reduction Plan" by Team 2
ii) Contents of "Annual Plan of NRW Reduction" by Team 2
iii)Contents of NRW Reduction Manual
iv) Preliminary Results (NRW Ratio before Project) of Pilot Projects By Teams 3, 4, and 5
v) Progress of DMA Activities by representative from DMA Leaders
vi) Review of Project Activities in 2nd Fiscal Year and Plan of 3rd Fiscal Year Project Activities by JICA Expert Team (JET)
Way forward for NRW Reduction in Goa and Conclusion of Workshop by Project Director

Item【In2-7】 NRW Reduction Activities to Areas outside of the Pilot areas (Activity 3-2)

The PWD staff who will participate in the pilot projects will develop the NWR reduction activities to areas outside of the pilot areas independently, taking the key part in each Sub-Division and making use of the NRW reduction manuals as prepared as described above. These activities will be monitored and followed up so that PWD will be able to cope with those activities in an independent and self-supporting way.

During the 2nd JCC meeting which was held on June 26, 2012, number of areas outside of the pilot project area (agreed to call those area outside of the pilot project area as "DMA area") was decided as 9 areas.

General outlines of each DMA area (location, size) are described in the following sections. Total number of the DMA areas became 10 because PWD active counterparts prefered to increase one more location for their NRW reduction activities.

Location of DMA Areas

【List of DMA Areas】

List of Selected DMA for 3rd Year Project Activities

DMA No.	DMA Name	Water Supply Scheme	PWD Jurisdiction		No. of House Connections (Estimated)	Length of Distribution Pipe (km) (Estimated)	DMA Team Leader
			Division No.	Sub Division No.			
1	Colva	Salaulim	IX	II	1,110	30.0	Mr. Viraj Patil
2	Curchorem	Salaulim	XX	I	800	7.0	Mr. Devidas Gaude
3	Sanguem	Salaulim	XX	II	900	7.5	Mr. P S Yarnal
4	Canacona	Canacona	XX	IV	800	7.5	Mr. Sarvesh Phadte
5	Miramar	Opa	III	I	600	4.0	Mr. Rajendra Borkar
6	Maracaim	Opa	III	IV	650		Mr. Yashwant Mapari
7	Porvorim	Assonora	XVII	V	1,000		Mrs. Prachi Kudalkar
8	Pernem	Chandel	XVII	II	977	13.6	Mr. Sandeep Morajkar
9	Mayem	Sanquelim	XVII	I	850	7.0	Mr. Prashant Gavas
10	Valpoi	Dabose	XVII	VI	800		Mr. Prashant Gaude

Note: Blanks are being identified by DMA Team Leader.

Criteria set by PWD counterparts to select DMA areas were as follows.

- Areas should be spread in entire Goa State
- Areas in the jurisdiction of the PWD staff who participated the pilot project activities
- Areas contain about 1,000 house connections (recommended figure by IWA is 500 to 3,000 connection per area) (IWA: International Water Association)
- Areas where pipe network information is available
- Areas which are easy to isolate from neighboring area (avoid multiple water entry, one or two water inlets is preferable)
- Areas which have gate valves to separate into leak management areas or areas easy to install such valves
- Areas which are receiving continuous water supply with adequate water pressure
- Areas where effective leakage reduction is anticipated (area where many leak repairs were implemented before)
- Areas where security condition is good for night survey activities

Although activities of DMA areas are scheduled to be conducted in the 3rd fiscal year, several activities were started during the 2nd fiscal year.

Item【In2-8】 Monitoring the implementation of the Annual Plan (Activity 1-6)

The NRW reduction activities by PWD in the areas outside of the pilot project areas as described above will be monitored and assisted by experts so that those activities will be implemented in accordance with the Annual Plan formulated.

To effectively manage the outputs of those activities, an appropriate monitoring process will be

required. This process will include setting an indicator to attain the reasonable outputs, reporting on the systematic and timely activities and outputs thereof, and quick response to any deviation from the planned activities. It is also necessary to establish the monitoring and evaluating methods to check whether the activities are making proper progress in accordance with the Annual NRW Reduction Plan.

In the drafted Annual NRW Reduction Plan, methodologies of the monitoring are discussed in one chapter. The monitoring methods will be applied not only for the 3rd fiscal year but also for PWD's continuous NRW reduction activities after completion of this project.

For the monitoring,

- PWD authorities who have responsibility of monitoring of the NRW reduction activities should be clearly defined. In the annual plan, responsible organizational unit is defined as Central NRW Control Unit (CNCU). For the 3rd year, MPM will monitor the progress since the CNCU was not yet established.
- Periodical meetings amongst the CNCU, Regional NRW Reduction Units (RNRU), and PWD officers/staff concerned to share the information regarding progress and problems encountered.
- CNCU will monitor and summarize progress of NRW reduction activities. If a delay is observed in certain DMA areas, CNCU will recommend measures to cover the same.
- At the end of every fiscal year, CNCU will prepare Annual Report of NRW Reduction and results of NRW reduction, sub-division office wise will be shown in the Annual Report to increase motivation of NRW reduction.

The Second Year Work in Japan

Item【Jp2-1】 Training in Japan

Training in Japan of the 2nd Fiscal Year was conducted from November 24 to December 8, 2012. Total number of trainee was 16 members, who were selected from project working group.

Purposes of the training were following.

1. To understand practices of Japan for reduction of NRW
2. To utilize technologies/knowledge obtained through the training effectively
3. To improve counter measures for NRW reduction in Goa

The training in Japan was completed successfully and trainees stated that the training was very effective for them. The learnings of the training will be incorporated in their Long-Term NRW Reduction plan, and reflected in pilot project activities and PWD routine works.

2.3.3 Project Activities in Third Fiscal Year

(1) Major Milestones of Project in 3rd Fiscal Year

Project activities of the 3rd Fiscal Year commenced from April 2013. The 4th JCC was held at the beginning of the 3rd Fiscal Year in May 2013 and attendants of the JCC agreed that all remaining activities related to PPA should be completed by end of June 2013 and expediting DMA activities.

One of the reason of delay of NRW ratio calculation was identified as the delay of getting billing data from billing company which was subcontracted by PWD Goa. Meeting was held amongst officers concerned from PWD and billing companies to discuss smooth availability of billing data. Since the level of NRW ratio might be more than the target level 20%, according to the preliminary NRW ratio calculations, the counterpart team initiated second leak detection in PPA.

JET have informed the PWD many times that the actual progress of project activities is delayed from original schedule. To recover the delay of the project activities, PWD established "NRW Monitoring Committee" on September 23, 2013 under chairmanship of PWD Minister and first meeting of the committee was held on September 25, 2013. The Minister of PWD and higher officers of the PWD confirmed that to avoid further delay of the project, the committee will monitor the project activities and give timely support and advices to the project.

To install flow meters several meter pits were excavated in DMA areas. JET found that security of these pits is not sufficient to avoid any accidents. Therefore, the JET instructed respective team leaders to confirm security measures required for excavated mete pits and confirm safe situation at the site.

From November 18 to 22, 2013, Terminal Evaluation was conducted. The evaluation team was headed by Mr. Ichiguchi, Deputy Chief Representative, JICA India office from Japanese side. The Team conducted field investigation, analysis of questionnaire, and interview with PWD officers concerned including JICA Expert. Discussions between Japanese side and Indian side was conducted and progress of establishing exclusive organization which will control NRW and related activities. Workshop was also held at this time to present progress of project activities. Conclusions and recommendations of the mid term review were as shown below. On November 22, 2013, JCC meeting was held and the results of the evaluation were reported by the Joint Evaluation team.

(2) Work for the 3rd Year: Work in India

Item【In2-1】OJT on Preliminary Works for NRW Reduction in Pilot Areas (Continued) (Activity 2-2)

(1) Isolation of Pilot Project Area

To measure total water consumption and leakage volume in the pilot project area, the pilot project area should be isolated from neighboring area by installing flow meter on its boundary. Although, in the 2nd Fiscal Year, this isolation work was conducted, it was found that the isolation was not completed in Ponda PPA. Isolation of the area was implemented again and closing the boundary water flow was measured again.

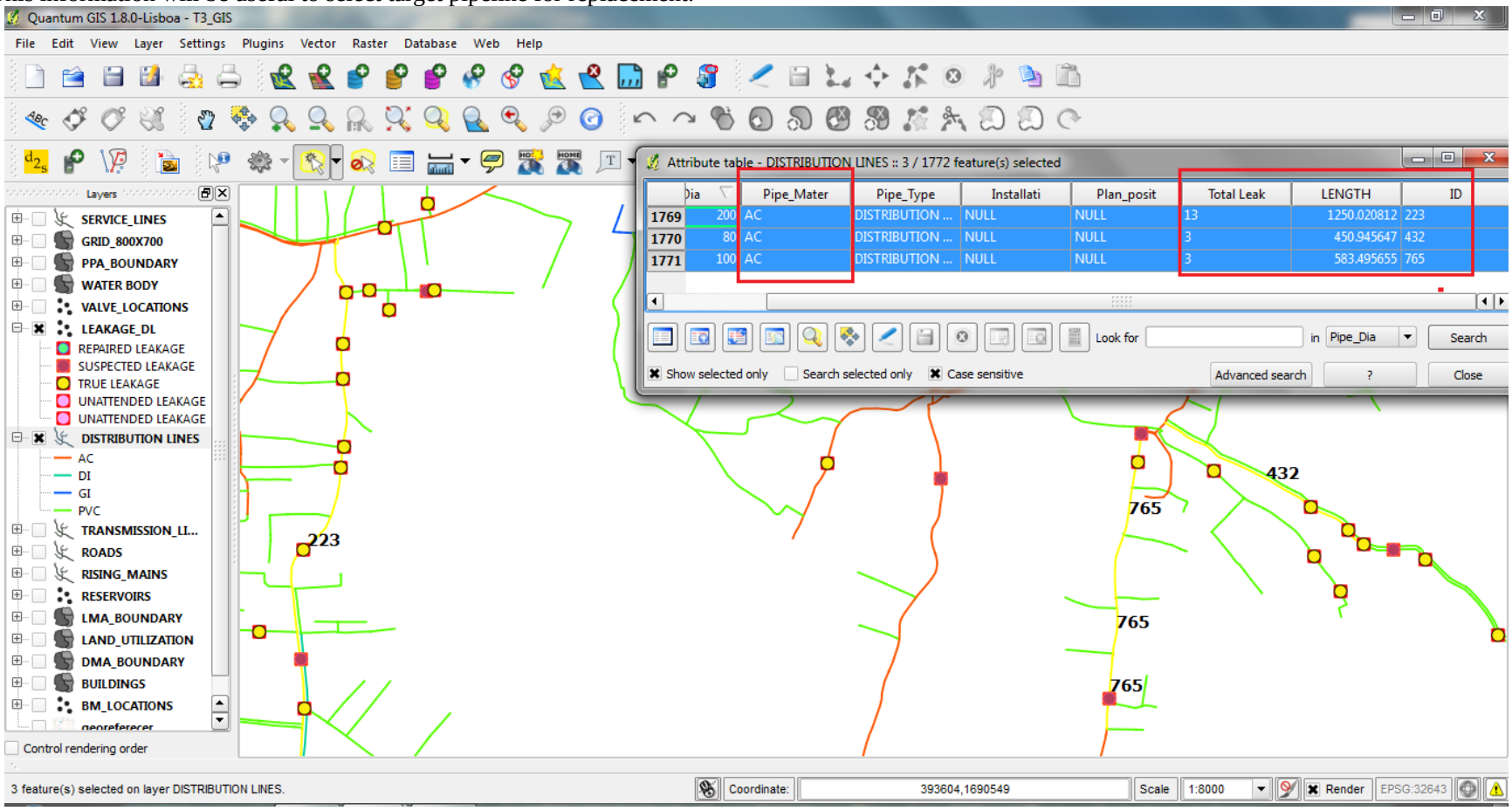
(2) Preparation of Map and Pipe Network Drawings

Map of pilot project area and pipe network drawings are prepared using GIS（Geographic Information System）based on the results of house hold survey and pipeline survey. Data base of customer was also updated by the results of the household survey. Billing data, location of leak repair were also included in the GIS system.

Samples of GIS map are as shown below.

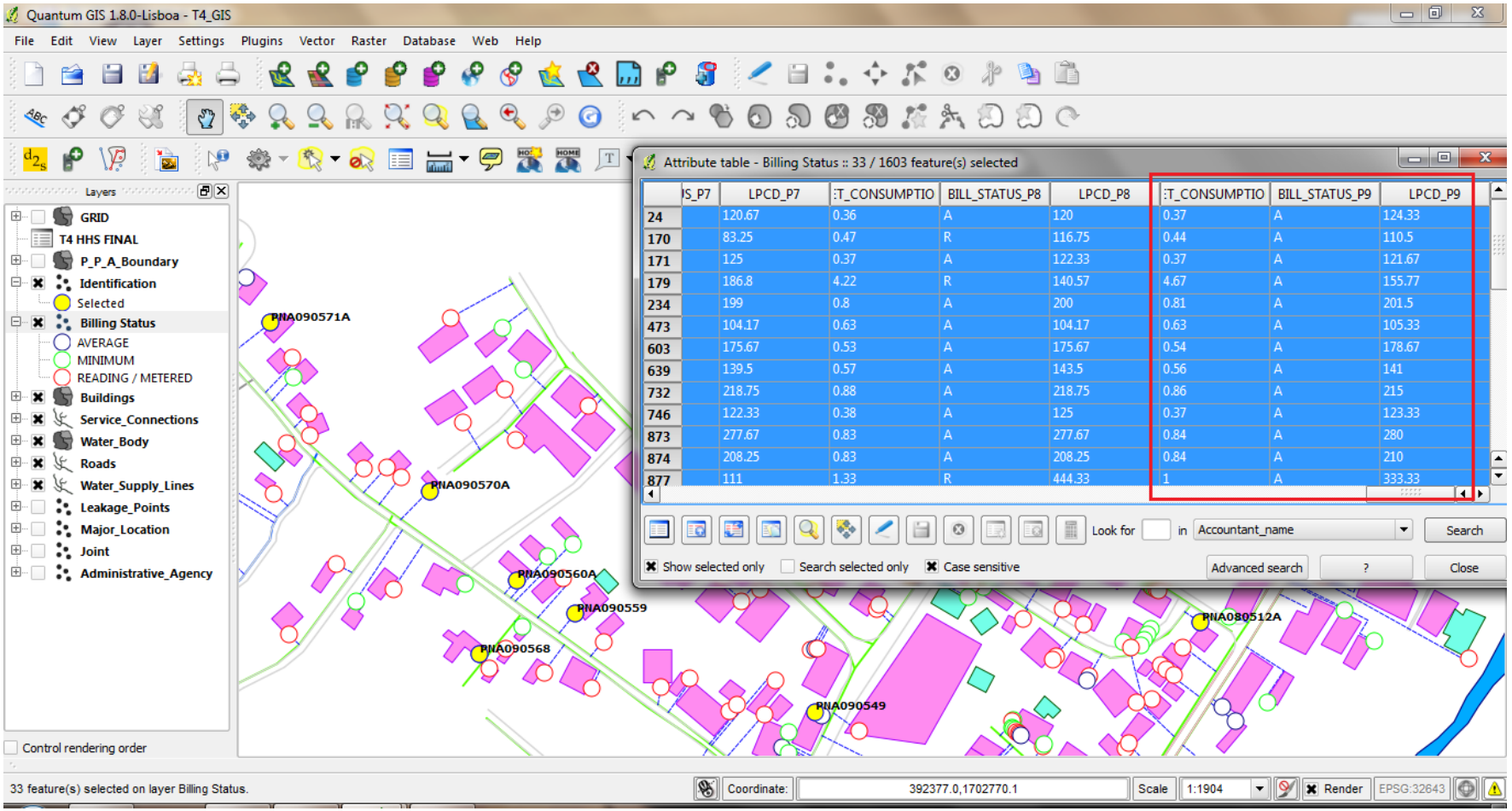
1) Location of leakage found

This information will be useful to select target pipeline for replacement.



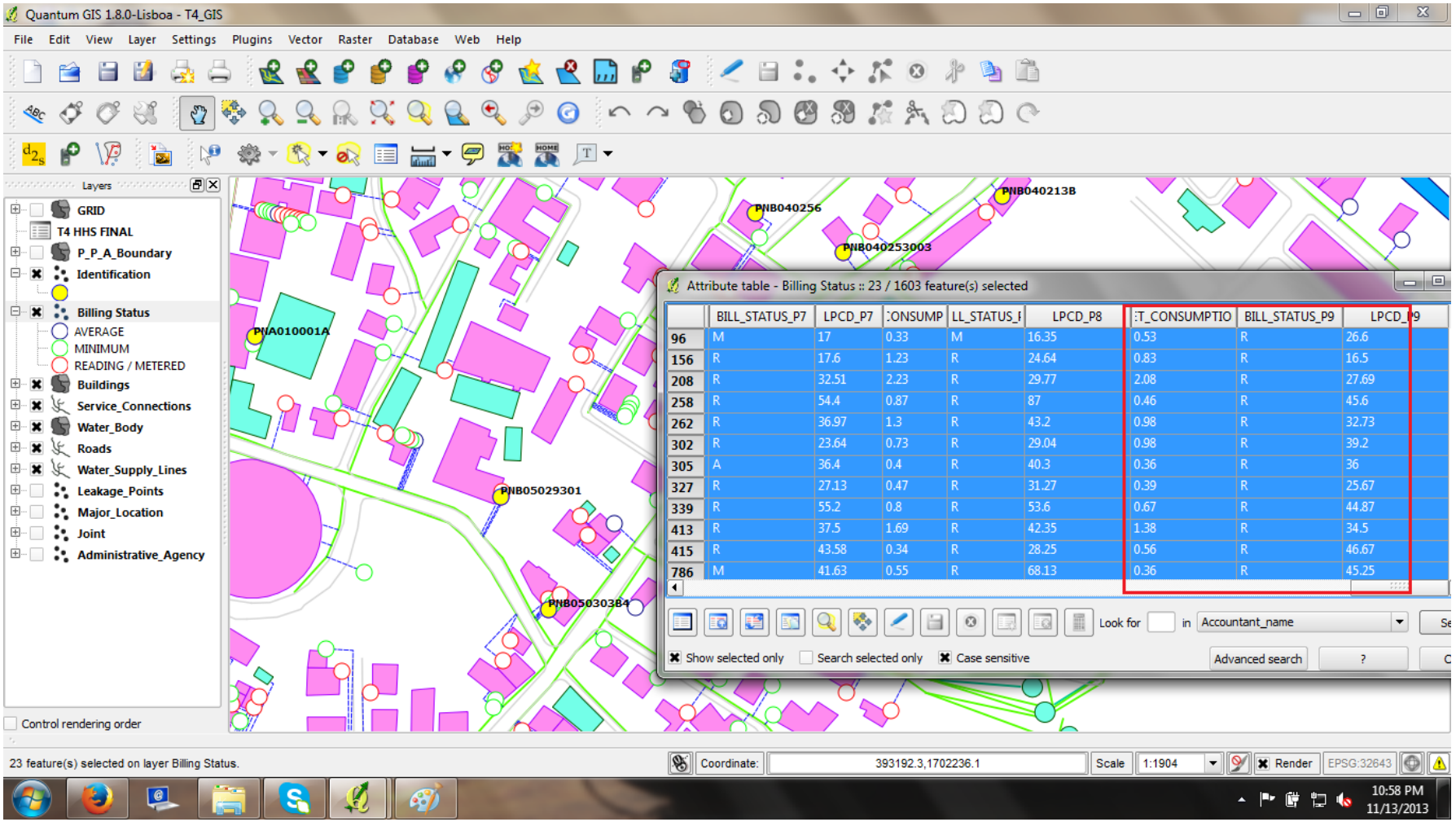
2) Customer list of which water meter was not read

Such customers should be checked at site.



	S_P7	LPCD_P7	:T_CONSUMPTIO	BILL_STATUS_P8	LPCD_P8	:T_CONSUMPTIO	BILL_STATUS_P9	LPCD_P9
24		120.67	0.36	A	120	0.37	A	124.33
170		83.25	0.47	R	116.75	0.44	A	110.5
171		125	0.37	A	122.33	0.37	A	121.67
179		186.8	4.22	R	140.57	4.67	A	155.77
234		199	0.8	A	200	0.81	A	201.5
473		104.17	0.63	A	104.17	0.63	A	105.33
603		175.67	0.53	A	175.67	0.54	A	178.67
639		139.5	0.57	A	143.5	0.56	A	141
732		218.75	0.88	A	218.75	0.86	A	215
746		122.33	0.38	A	125	0.37	A	123.33
873		277.67	0.83	A	277.67	0.84	A	280
874		208.25	0.83	A	208.25	0.84	A	210
877		111	1.33	R	444.33	1	A	333.33

3) Customer list of which consumption is very low (less than 50 lpcd)
Such customers should be checked at site.



(3) Setting up Leak Management Area (LM) in Pilot Project Area

There are several elevated tanks and ground reservoirs in the pilot project area. Each tank or reservoir has certain jurisdiction of water distribution and these respective area was defined as LMA However, some areas are connected by several distribution pipes and if they are difficult to be separated, combined area was considered as one LMA.

Item【In2-2】 OJT on the On-Site Works for NRW Reduction in each DMA (Activity 2-3)

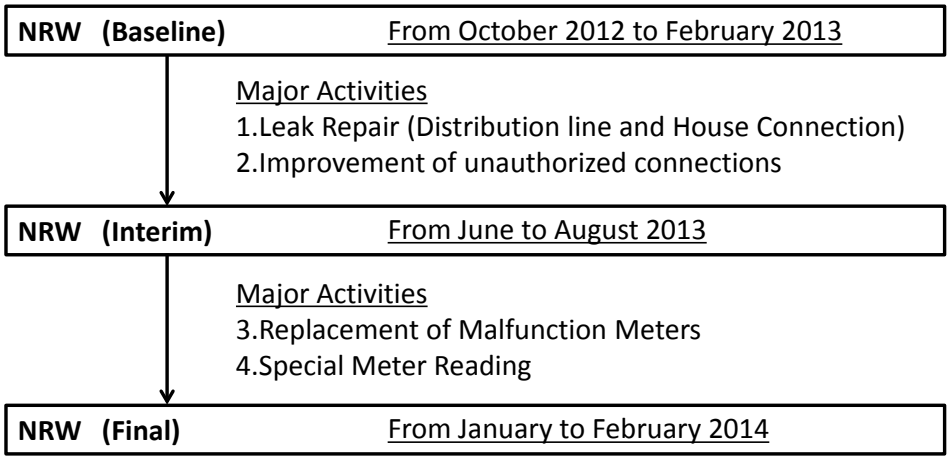
The item of OJT of NRW reduction measures are as shown below. In situ training of these items to the PWD C/P as part of the pilot project activities. Was given.

1) Physical isolation of DMAs and analysis of the present condition
2) Detection & repair of leakage
3) Replacement of distribution & service connection pipes
4) Repair and replacement of meters
5) Legalization of unauthorized connection if any

These OJT activities were continued from the 2nd Fiscal Year.

Item【In2-3】 Measurement of NRW Reduction in the Pilot area (Activity 2-4)

NRW reduction activities, which include leak detection, leak repair, improvement of metering errors including malfunctioning meter replacement, and measurement of system input volume, were implemented in respective PPA. Calculation/ estimation of NRW ratio after PPA activities are described in this section. NRW ratio is calculated/ estimated in three stages as shown in the following diagram.



- Replacement of malfunction meters was conducted before Interim, but the number of replacement was very small in this period.
- A few leak repairs were actually conducted between the Interim and Final. However, saved water quantities were very low.

1) Initial NRW before PPA Activities (Baseline)

NRW volume and ratio in respective pilot project area before PPA activities are shown in following table. Input volume was measured by Ultra-Sonic flow meters. Billed water consumption was

calculated after converted to average consumption per day in the billing data.

Baseline			Pilot Project Area		
			Salaulim	Opa	Assonora
			Curtorim	Khadpaband	Moira
			Team 3	Team 4	Team 5
Input Volume		m3/day	3,054	4,452	3,412
Billed Water Consumption	Domestic Connenction	m3/day	1,583	963	1,304
	Multi-Family Connection	m3/day	74	708	296
	Non-Domestic Connection	m3/day	21	168	4
	Total	m3/day	1,678	1,839	1,604
NRW		m3/day	1,376	2,613	1,808
NRW Ratio		%	45.1%	58.7%	53.0%

Respective area shows higher NRW ratio than predicted NRW prior to activities.

Complete data of input volume to each PPA in the period of "Interim" and "Final" were not obtained due to repeated breakdowns of Ultra-Sonic and Electro-Magnetic flow meters. Therefore input volume of "Baseline" was applied to the calculation of NRW ratio at "Interim" and "Final", considering that water supply condition was not significantly changed among "Baseline", "Interim" and "Final". Generally, input volume in the area will be decreased after leak repair. When NRW ratio at "Interim" and "Final" is calculated with input volume of "Baseline", the figure will show higher than the calculation with input volume of the original period. Therefore NRW ratio at "Interim" and "Final" using "Baseline" input volume will indicate results on more tough condition.

2) NRW during the NRW Reduction Activities (Interim)

NRW ratio (Interim) during PPA activities in respective pilot project area is shown in the table below. Billed water consumption was calculated using billing data

Interim			Pilot Project Area		
			Salaulim	Opa	Assonora
			Curtorim	Khadpaband	Moira
			Team 3	Team 4	Team 5
Input Volume		m3/day	3,054	4,452	3,412
Billed Water Consumption	Domestic Connenction	m3/day	1,853	1,099	1,727
	Multi-Family Connection	m3/day	93	279	247
	Non-Domestic Connection	m3/day	35	861	5
	Total	m3/day	1,981	2,239	1,979
NRW		m3/day	1,073	2,213	1,433
NRW Ratio		%	35.1%	49.7%	42.0%

NRW reduction activities at "Baseline" and "Interim" are summarized in the following table.

NRW Ratio (%)

				Baseline	Interim	Reduction*
Pilot	Salaulim	Curtorim	Team 3	45.1%	35.1%	10.0%
Project	Opa	Khadpaband	Team 4	58.7%	49.7%	9.0%
Area	Assonora	Moira	Team 5	53.0%	42.0%	11.0%

* Baseline-Interim

It is considered that reduction of NRW in the table is mainly by leak repairs taking into account of the activities executed during the period. NRW reduction by the leak repairs is about from 9% to 11%.

3) Condition of meter and Situation of billing

In the case meter reading cannot be properly implemented (due to meter malfunctioning, failure of access and buried meter), average billing of the past three months is applied.

If the water consumption per one connection is less than 16 cubic meters per month, minimum billing is applied. Once the minimum billing is applied, it is assumed that minimum billing will be continued regardless of actual water consumption.

Therefore, in order to get adequate billed water consumption, average billing and minimum billing need to be minimized to replace with proper meter reading. Replacement of malfunction meters and capacity-building of meter readers will be required.

Current billing conditions in PPA are shown in the table below. There are many average billing and minimum billing connections. NRW ratio may be raised by these flat rate connections since customers do not care about volume of their water consumption.

After the PPA activities, these flat rate connections should be minimized and billing consumption increase and then NRW ratio will be reduced.

		Pilot Project Area		
		Salaulim	Opa	Assonora
		Curtorim	Khadpaband	Moira
		Team 3	Team 4	Team 5
		Mar-Apr '13	Apr-Jun '13	Feb-Apr '13
Billed by Actual Consumption	nos.	1,033	748	951
(Working Meter)	ratio (%)	48.7%	55.5%	52.1%
Average Billing	nos.	267	149	41
	ratio (%)	12.6%	11.1%	2.2%
Minimum Billing	nos.	822	451	835
	ratio (%)	38.7%	33.5%	45.7%
Average + Minimum Billing	nos.	1,089	600	876
	ratio (%)	51.3%	44.5%	47.9%
Total	nos.	2,122	1,348	1,827
	ratio (%)	100.0%	100.0%	100.0%

4) NRW After Special Meter Reading (Final)

It is fond that meter reading for billing is not adequately done in many cases as mentioned above. Therefore Special Reading, in which customer meters are read as the project activities in PPA, was executed instead of usage of billing data for calculation of final NRW.

In the Special Meter Reading, all the customer meters are read two times before and after a certain period in order to calculate water consumption in the area.

Special Reading was conducted once in November/ December 2013 but the results could not be used because they include lots of insufficient data such errors in meter reading and not-read meters. Therefore methods of Special Reading are reviewed and improved by introducing detailed explanation to meter readers, cross check of reading by team members, and others. The period from the first reading to the second reading is two weeks in the Special Reading.

NRW (Final) is calculated using the results of water consumption in Special Meter Reading as shown in the table below.

Final			Pilot Project Area		
			Salaulim	Opa	Assonora
			Curtorim	Khadpaband	Moira
			Team 3	Team 4	Team 5
Input Volume*		m3/day	3,054	4,452	3,412
Billed Water Consumption	Domestic Connenction	m3/day	2,316	1,633	2,077
	Multi-Family Connection	m3/day	133	1,033	97
	Non-Domestic Connection	m3/day	54	256	7
	Total	m3/day	2,503	2,921	2,181
NRW		m3/day	551	1,531	1,231
NRW Ratio		%	18.0%	34.4%	36.1%

Water consumption in Special Meter Reading is increased from "Baseline" and "Interim". The increase of consumption leads to NRW reduction and Special Meter Reading is considered effective.

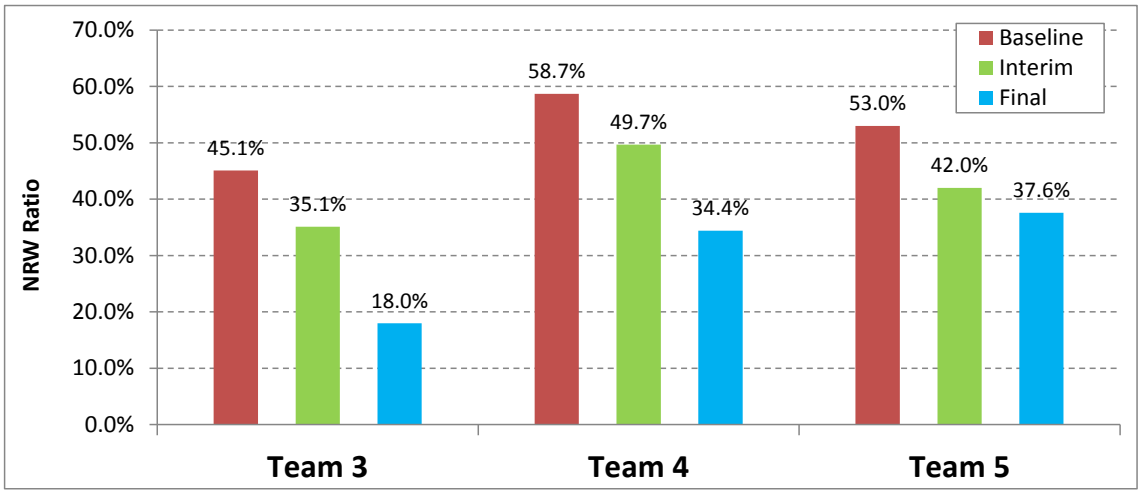
It shall be noted that Special Meter Reading is different from the actual billing. If the same level of meter reading as Special Meter Reading is conducted for billing purpose, the actual NRW can be reduced in the same level shown in the table above.

NRW of the Special Meter Reading is the final figure in the Project. NRW of "Baseline", "Interim" and "Final" is summarized in the table and figure below.

NRW Ratio (%)

				Baseline	Interim	Final	Reduction*
Pilot Project Area	Salaulim	Curtorim	Team 3	45.1%	35.1%	18.0%	27.1%
	Opa	Khadpaband	Team 4	58.7%	49.7%	34.4%	24.3%
	Assonora	Moira	Team 5	53.0%	42.0%	36.1%	16.9%

* Baseline-Final



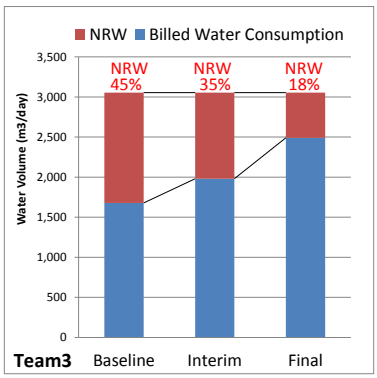
Team 3 achieved the set target of NRW which is less than 20%. It is important to improve the ordinal meter reading for billing to the level of Special Reading.

Team4 reduced NRW but could not achieve the NRW target of less than 20%. However NRW is reduced by 23.4% and the activities can be judge as effective considering high initial NRW (Baseline), and congested pipelines in city area. It is expected to continue the NRW reduction activities for further reduction of NRW. It is also important to improve the ordinal meter reading for billing to the level of Special Reading.

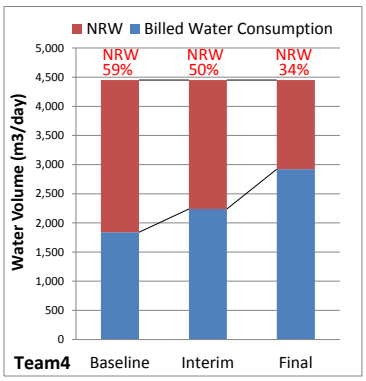
Team 5 could not achieve the NRW target of less than 20%. The reduction of NRW is 16.9%, which is relatively small compared with other teams. The reason is that the reduction of NRW from "Interim" to "Final" is small. This is because Special Meter Reading by meter readers of Team 5 is not improved much. The effective meter reading is only about 60% and the remaining 40% is calculated using Billing Data. It is essential to improve the meter reading for billing. The leakage reduction is almost the same level with other teams and it is also expected to continue the NRW reduction activities.

5) Water Audit

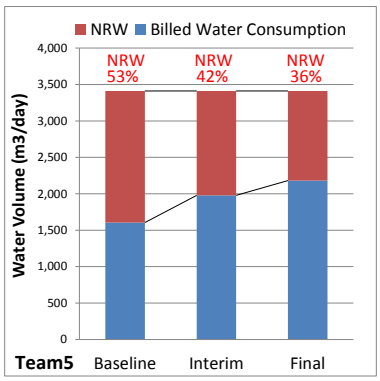
Analysis of each NRW factor will be effective for finding priority activities to be executed for NRW reduction. Therefor each factor of NRW is analyzed for each PPA. Percentage of the NRW and Revenue Water is shown below.



Team3



Team4



Team5

Each factor of NRW cannot be measured and known accurately. Therefore portion of each factor is estimated based on the PPA results, hearing from C/P and other information.

At first, the reduced NRW is analyzed considering the PPA activities executed.

Major activities for NRW reduction were leak repair and disconnection of unauthorized consumption during the period from "Baseline" to "Interim". On the other hand, the major activities contribute to reduction of NRW were metering errors composed of replacement of malfunctioning meters and improvement of meter reading by Special Reading during the period from "Interim" to "Final". Based on this fact /idea, each factor of the reduced NRW during the Project is analyzed as shown in the following table.

Period	Contents of activities	Reduction of NRW Volume		
		Team3	Team4	Team5
Baseline-Interim	1. Leak Repair	303 (10%)	356 (8%)	341 (10%)
	2. Unauthorized Connections	0 (0%)	44 (1%)	34 (1%)
Interim-Final	3. Replacement of Malfunction Meters 4. Special Meter Reading	522 (17%)	682 (15%)	202 (6%)

(m^3/day)

*Ratio shown in ( ) is the portion to the system input volume to each PPA.
*Unauthorized Connection was calculated from the number of detected unauthorized connection.

NRW is summarized based on baseline volume in the following table.

Component		Team3		Team4		Team5	
NRW	1. Leak Repair	303	10%	356	8%	341	10%
	2. Improvement of Unauthorized Connections	0	0%	44	1%	34	1%
	3. Replacement of Malfunction Meters 4. Special Meter Reading	522	17%	682	15%	202	6%
	Others	551	18%	1,532	35%	1,231	36%
RW	Billed Water Consumption	1,678	55%	1,839	41%	1,604	47%
Total		3,054	100%	4,452	100%	3,412	100%

In the Next, the remaining NRW after the Project (NRW in the "Final") is analyzed.
The hatched part is the remaining NRW in the Final. Each factor of NRW is analyzed as shown in the table below.

Item	NRW ratio	Remarks
1. Unbilled Authorized Consumption	Team3：1.0％ of system input (Public Stand-post, tanker) Team4：0.5％ of system input	The ratio is based on hearing results from C/P

		(Public Stand-post) Team5：0%	
2. Unauthorized Consumption		Each Team : 1.0% of system input volume. (Unauthorized connection which was not found in the PPA activities)	Assumed based on the results and the methods of the PPA activities
3. Metering Inaccuracy		Estimate each breakdown	－
	1) Malfunctioning Meter	Team33.6% of system input Team4：4.7% of system input Team5：2.8% of system input	Estimated from (Number of malfunctioning mete at Final) x (Average consumption)
	2) Inaccuracy of Meter	Each Team : 5% of system input	Assumed half of Unavoidable NRW 10 %
	3) Errors in Meter reading	Team3, 4：2% of system input * Team5 ：12%* of system input	Refer to note below. Special Meter Reading
4. Real Loss		The remaining of the above	Calculated from Total NRW and above figures

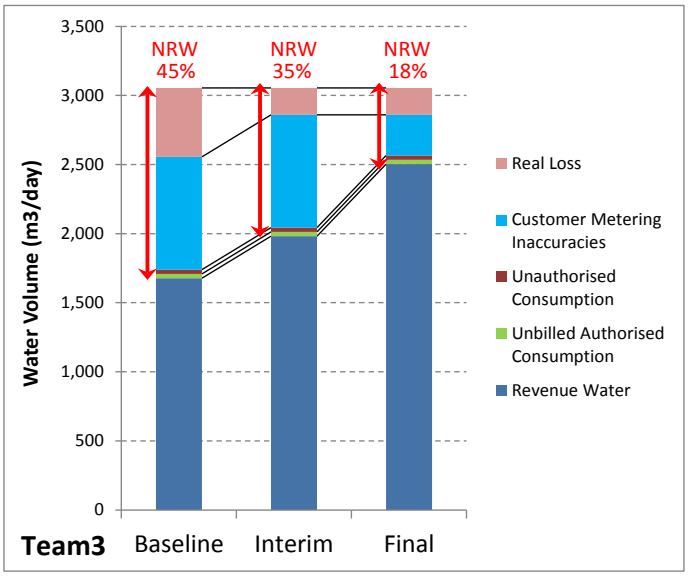
*The ratio of Errors in Meter Reading is assumed based on the results of Special Meter Reading. Some meters are not read in the Special Meter Reading. The ratio is assumed 2% for Team 3 and 4. The ratio of meters which are not read was high in Team 5. The ratio of reduction in Team 5 is about 10% less than the other teams.

Based on the above estimation, factors of NRW in each PPA are analyzed as summarized in the table below.

Team3

Item	Baseline		Interim		Final	
Revenue Water	1,678	55%	1,981	65%	2,503	82%
Unbilled Authorised Consumption	31	1%	31	1%	31	1%
Unauthorised Consumption	31	1%	31	1%	31	1%
Customer Metering Inaccuracies	816	27%	816	27%	294	10%
Real Loss	498	16%	195	6%	195	6%
Total	3,054	100%	3,054	100%	3,054	100%

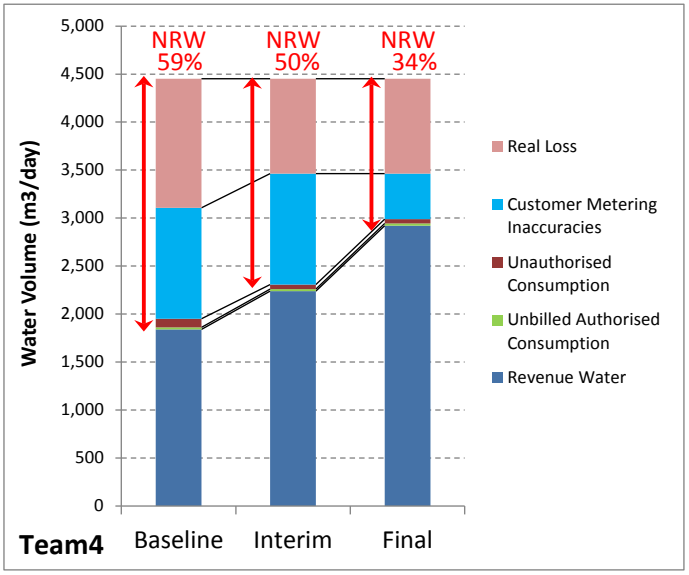
(m3/day)



Team4

Item	Baseline		Interim		Final	
Revenue Water	1,839	41%	2,239	50%	2,921	66%
Unbilled Authorised Consumption	22	1%	22	1%	22	1%
Unauthorised Consumption	89	2%	45	1%	45	1%
Customer Metering Inaccuracies	1158	26%	1158	26%	476	11%
Real Loss	1344	30%	988	22%	988	22%
Total	4,452	100%	4,452	100%	4,452	100%

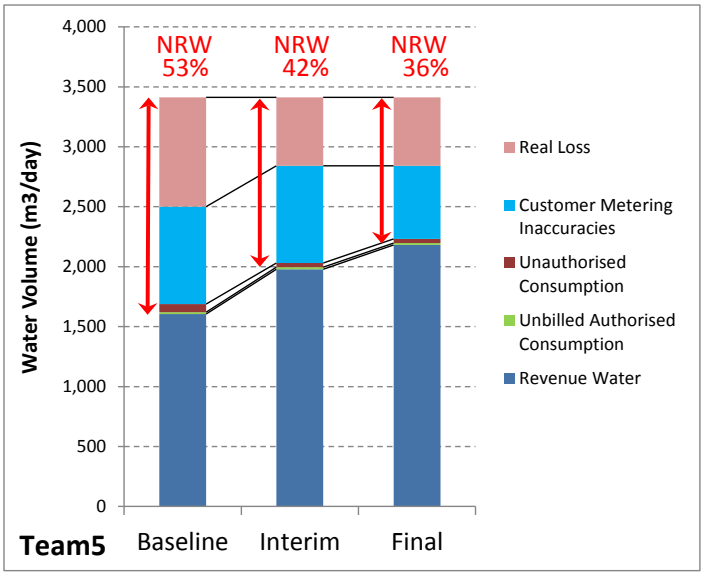
(m3/day)



Team5

Item	Baseline		Interim		Final	
Revenue Water	1,604	47%	1,979	58%	2,181	64%
Unbilled Authorised Consumption	17	1%	17	1%	17	1%
Unauthorised Consumption	68	2%	34	1%	34	1%
Customer Metering Inaccuracies	811	24%	811	23%	609	17%
Real Loss	912	26%	571	17%	571	17%
Total	3,412	100%	3,412	100%	3,412	100%

(m3/day)



It is found that the major factors of NRW in “Baseline” are leakage (real loss) and metering inaccuracy, the ratios of both are almost same level in PPA.

It is also found that PPA activities for reduction of leakage and the replacement of meters together with improvement of metering will contribute to NRW significantly.

In Team 3, leakage and metering inaccuracy (meters and meter reading) is reduced to achieve NRW target of less than 20%.

In Team 4, leakage and metering inaccuracy (meters and meter reading) is reduced. However NRW is still high since initial NRW was high. The results of Water Audit show that more than half of NRW is leakage after the PPA activities.

In Team 5, leakage is reduced but reduction of metering inaccuracy is not much. The results of Water Audit show that NRW is high due to leakage and metering inaccuracy (meters and meter reading).

Item【In2-4】 Preparation of a Manual (Activity 3-1)

Manual preparation was completed in the last fiscal year and the manual was printed and distributed

to PWD staff who will work for DMA activities.

Item【In2-5】 Review of Long-Term NRW Reduction Plan and Formulation of Annual NRW Reduction Plan (Activities 1-4 and 1-5)

Draft Long-Term NRW Reduction plan was discussed among PWD high ranking officers and Team 2 members and the plan was finalized. Further, the Plan was checked by Project Director and revised again based on his comments. The Plan was again discussed among PWD SEs and AEs and agreed as final on October 4, 2013.

The Plan was submitted to Government of Goa and the Plan was finally approved by the Government.

Item【In2-7】 NRW Reduction Activities to Areas outside of the Pilot areas (Activity 3-2)

DMA activities are executed with the initiative of PWD in 10 DMA, which was selected 10 using NRW Reduction Manual. However tendering process takes long time and has not been completed in spite of frequent discussion between PWD and JET. The tendering for meter pit construction, procurement of equipment and leak repair is essential for the project to proceed.

PDD members has executed the activities, which can be started before completion of tendering, such as Household Survey, input of the data, Pipeline Survey, preparation of GIS Base Map and GIS data input in addition to preparation of tender document.

Each team executed hydraulic isolation of each DMA, measurement of system input volume by using ultrasonic flow meter procured for PA activities and calculation of initial NRW which is baseline before DMA activities. However, in DMA2 flow measurement for system input volume has not been done because sufficient number of flow meters is not available due to malfunctioning flow meters. NRW has not been calculated in some DMA because it takes long time to obtain relevant billing data. The calculation results of initial NRW (baseline data) are summarized in the table below.

DMA No	1	2	3	4	5	6	7	8	9	10
Initial NRW (Base Line)	35%	-	39%	38%	36%	34%	40%	48%	35%	52%

Note : The figures are informed by leader of each DMA.
System input volume in DMA2 is not available now due to malfunctioning flow meters.

Leak detection was executed after the measurement of system input volume. The results of the leakage detection are shown in the following table together with progress of meter replacement.

DMA No	Leakages On Distribution	Leakages On Service Connection	Replacement Of Consumer Meter	Remark
1	12	80	0 out of 192	Replacement of malfunctioning meters will be taken up under JICA ODA LOAN Project
2	_	35	0 out of 103	
3	23	38	0 out of 108	
4	14	44	0 out of 96	Meters are Out of Stock
5	10	26	75 out of 120	Completed
6	21	13	88 out of 105	Completed
7	7 (*)	11	21 out of 300	Leak detection on distribution pipes is not completed.
8	8(*)	130	59 out of 110	Leak detection on distribution pipes is not completed.
9	29	32	300 out of 467	Completed
10	27	52	108 out of 108	Completed
Note: 1)* Marked are partialy completed Leak				

Overall progress of DMA is summarized in the following table.

Acitivities	Progress	Progress Monitoring Date									
		No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10
Printing of Map (A0/A3 Size)	Progress (%)	100	100	100	100	100	100	100	100	100	100
Preparing of Listening stick	Progress (%)	100	100	100	100	100	100	100	100	100	100
Household Survey	Number	1299	800	800	600	700	575	982	977	755	1000
	Progress (%)	100	100	100	100	100	100	100	100	100	100
Data Input of Household Survey	Progress (%)	100	60	75	100	95	100	40	100	100	100
Confirmation of Account Number	Progress (%)	0	0	0	0	0		0	0	0	0
Pipeline Survey	Progress (%)	100	70	100	100	100	100	75	100	100	100
Mapping of Pipeline in Base Map	Progress (%)	100	60	50	50	100	100	80	100	100	100
Schematic Drawing	Progress (%)	100	100	100	100	100	100	100	100	100	100
Submission of Cost Estimate	Progress (%)	100	100	100	100	100	100	100	100	100	100
PWD's Process	Progress (%)	100	0	0	0	100	0	0	0	0	0
Tendering	Progress (%)	50	0	0	0	50	0	0	0	0	0
Evaluation / Contract	Progress (%)	0	0	0	0	0	0	0	0	0	0
Confirmation of Isoration	Progress (%)	0	0	0	0	0	0	80	100	100	100
Pit Construction, installation	Progress (%)	0	0	0	0	0	0	0	0	0	0
Collection of Billing Data	Progress (%)	100	100	100	100	100	100	100	100	100	100
Flow Measurement	Progress (%)	100	0	100	100	100	100	100	100	100	100
Calculation of NRW Ratio	Progress (%)	100	0	100	100	100	100	100	100	100	100
Leak Detection on H.Connection	Progress (%)	100	100	100	100	100	100	100	100	100	100
Leak Detection of D. Pipe	Progress (%)	100	0	40	0	100	100	10	0	100	100
Repair order sheet	Progress (%)	0	0	0	0	0	100	0	0	0	0
Leak Repair (D. Pipe)	Progress (%)	0	0	0	0	0	100	0	0	0	0
Leak Repair (H. Connection)	Progress (%)	0	0	0	0	0	0	0	0	0	0
Collection of Billing Data	Progress (%)	0	0	0	0	0	0	0	0	0	0
Flow Measurement	Progress (%)	0	0	0	0	0	0	0	0	0	0
Calculation of NRW Ratio	Progress (%)	0	0	0	0	0	0	0	0	0	0
GIS Base Map	Progress (%)	100	100	100	100	100	100	100	100	100	100
GIS Pipeline Route	Progress (%)	100	40	30	40	40	100	30	50	100	90
GIS House Connection	Progress (%)	100	40	30	40	40	100	30	10	100	90
GIS Meter Condition	Progress (%)	100	40	30	40	0	100	30	10	100	90
GIS Leak Location	Progress (%)	0	0	0	0	0	0	0	0	100	0
GIS Linkage to Customer Data	Progress (%)	0	0	0	0	0	0	0	0	0	0

Item【In3-2】 Workshops in the Third Year (Activity 3-3)

During the 3rd Fiscal Year, following two workshops were held.

10th Workshop, November 20, 2013 at PWD Conference Hole.

Objectives of the Workshop: To share progress of project activities, and interim results of PPA

Agenda :

1. Progress and contents of PPA and DMA
2. Interim results of PPA
3. Further actions required for PPA
4. Evaluation of project activities
5. Summary of the workshop and way foreword

This workshop was held to share the results of PPA. Since final figure/ratio of NRW in PPA was not yet obtained, interim NRW ratio which was estimated from available data was presented.

At the end of the project, wrap-up workshop was held on February 18, 2014 as follows.

11th Last, Wrap-up Workshop, February 18, 2014, at Hotel Marriott
Objectives of the Workshop: Summarize all activities and results of the Project

Agenda :

1. Outline of the Project
2. Project activities and results
   - Current situation of NRW in Goa
   - Preparation of NRW Reduction Plan
   - Pilot Project Activities
   - DMA Activities
3. Award Ceremony
4. Way forward for future NRW Reduction in Goa

Item【In3-3】 Workshops with another state (Activity 4-1)

Workshop was held to share knowledge and technologies/skills for NRW reduction with another state (Rajasthan State) from September 5 and 6, 2013 for two days in Goa. PWD Goa counterparts explained scope of the project, what they learned in the course of the project, methodologies and practices of NRW reduction to the audience.

3 Issues, Countermeasures, and Lessons Learnt During Project Implementation

3.1 Methodology of Project Implementation

Issues, countermeasures, and lessons learnt during the project implementation in respect of its methodology are as follows.

	Issues	Countermeasures
1	It is necessary to have mature ownership of the project by PWD Goa. Counterpart felt difficulties for participating in the project activities because of lack of understanding of the Project by superior of the counterpart.	To mature the ownership of the project and promote understanding of the Project widely, workshops were held more frequently than scheduled.
2	It is necessary to increase interest of counterparts.	For nomination as trainee for training in Japan, high priority should be given to actively participated counterparts.
3	Delay of pilot project activities because of election scheduled on March 3rd, 2012.	To recover the delay, • Several activities which were schedule to be implemented stage wise basis should be implemented simultaneously as much as possible. • Ultrasonic flow meter (for temporary measurement) will be used as substitution for permanent flow measurement to recover delay caused because of delay in water meter procurement. • Working days of project activities should be increased as much as possible from current level of 2 to 3 days.
4	GIS system developed by JICA Loan project covers major PWD assets such as transmission mains and distribution pipes. Additional information such as location of house connection, water meter, and information of customers was added by this Project	This additional information should be included in GIS system in future.

Lesson Learnt

Approval Procedures for Training in Japan

In the first fiscal year, training in Japan was conducted in January 2012. To dispatch selected trainees from Goa, approval procedures by Goa State Government and Central Government took very long time and final approval was issued just one day before the departure date to Japan. Therefore, the approval procedures should be commenced well in advance. Furthermore, the approval procedure should be simplified.

Holding Monthly Progress Meetings

As mentioned in the above table, monthly progress meetings were held during the 2nd fiscal year. These meetings were very effective and contributed to increase PWD's ownership of the Project.

Mid-Term Review

Mid-Term Review was conducted in February 2013. Although timing of the review was little delay from the actual mid-term of the project, it was very good opportunity to review the contents of PDM carefully by PWD side and PWD counterparts.

3.2 System of Project implementation

Issues, countermeasures, and lessons learnt during the project implementation in respect of its system are as follows.

	Issues	Countermeasures
1	It is difficult that all working group members (totally 56 personnel from 28 sub-division offices) work together at the same time.	Working group members were divided into five teams and each team was assigned to respective pilot project activities.
2	It is necessary to has matured ownership of the project by PWD Goa. Counterparts felt difficulties for participating project activities because of lack of understanding of the Project by superiors of the counterparts.	Monthly progress meetings chaired by Chief Engineer I (PHE) were held to present progress of project activities by each of theteams and to share the problems encountered. Executive Engineers who are supervisor of counterparts are also to attend the monthly progress meeting and their cooperative mind for the Project is matured.
3	It is necessary to increase incentive of counterparts.	During the monthly progress meetings, necessity of the incentives was discussed. As a conclusion of the

		meetings, it was decided to propose incentives for the counterpart project teams to PWD higher authorities.
4	Delay of project activities during absence of Japanese Experts	Significant delay of activities was observed during absence of Japanese expert. To avoid such delay, detailed schedule and target until next coming back of Japanese expert was discussed with PWD counterparts.

Lesson Learnt

In the Minutes of Discussion and Minutes of Meeting of this project agreed between JICA and PWD Goa, totally 56 counterparts would be assigned to this project in full time basis. However, these 56 counterpart people has routine work and it was almost impossible to assign them in full time basis. From the beginning of this project, more realistic number of counterpart who would be actually assigned to the project full time basis should be considered

4 Status of Achievement of Project Objectives

4.1 Results of Mid-Term Review

From February 2 to 16, 2013, Mid-Term Review was conducted as mentioned above. During the 1st week of the Review, Japanese evaluation consultant appointed by JICA conducted interview with JET, PWD higher authorities, counterparts, questionnaire survey, field investigations, and information collection. From the 2nd week, JICA officers from Tokyo and India Office joined the Review. Since this is the "joint" review, four officers from PWD including Project Director and Chief Engineer also joined the Review. Conclusions and recommendations of the mid term review were as shown below.

Conclusions

Conclusions are based on a series of interviews and discussions with counterparts together with a questionnaire and literature review.

The Project experienced serious delays and a number of setbacks during the initial stage; partially, due to somewhat limited interest amongst staff members of PWD. However, JICA trainings in Japan and JET's input within the country (OJT and workshops), together with a Central NRW Control Unit under the chairmanship of Chief Engineer-I (PHE), achieved enthusiasm in counterparts and created positive attitude towards the Project. Therefore, now the Project is progressing well, and the Team concluded that the overall level of achievement on the Project is satisfactory, as at the mid-term review juncture. In order to ensure achievement of the Project Purposes by completion of the Project, the following recommendations are made for consideration.

Recommendations

(1) Early preparation for procurement: Recommendation to PWD

Procurement of materials and equipment, and contracting for pit construction for three pilot areas, was delayed due to the complex procurement processes to be followed in Goa and also, due to the elections held in 2011. In light of this, the Team recommends that the procurement processes should be started as soon as possible for the nine areas outside of the initial pilot areas, so that the procurement of all necessary equipment and construction of pits is completed by the end of May 2013.

(2) Budget allocation and mechanism of NRW reduction: Recommendation to PWD

To assure sustainability of the achievements of the Project, it is highly recommended that a budget allocation towards NRW reduction activities and the creation of NRW reduction unit, be realized as soon as possible, even before the completion of the Project.

(3) Increase in the input level: Recommendation to JICA

The Project has recently started to recover from serious delays and a number of setbacks during the initial stages, to further strengthen this recovery, it would be highly advisable to increase the level of Japanese experts' input from JICA into the Project.

(4) Further dialogue for deciding the future direction of the NRW reduction: Recommendation to JICA/PWD

All people interviewed appealed to JICA to continue with its involvement in NRW reduction. Therefore, the Team suggests that both JICA and PWD continue their dialogue regarding future cooperation in this field.

(5) Review and minor changes of the PDM: Recommendation to JET/JCC

It is highly recommended that a review of indicators in the current PDM be undertaken immediately as shown in Attachment-8 Suggestion and/or reasons for revising the PDM.

(6) Workshop quality Assessment: Recommendation to JET

To accurately assess the satisfaction levels of the workshops held by JET, it is advised, that in future, a short questionnaire be produced for participants to complete at the end of each workshop.

4.2 Results of Terminal Evaluation

From November 18 to 22, 2013, Terminal Evaluation was conducted. The evaluation team was headed by Mr. Ichiguchi, Deputy Chief Representative, JICA India office from Japanese side. The Team conducted field investigation, analysis of questionnaire, and interview of PWD officers concerned including JICA Expert. Discussion between Japanese side and Indian side was conducted and progress of establishing exclusive organizational set up which will control NRW and related activities was discussed. Workshop was also held at this time to present progress of project activities. Conclusions and recommendations of the terminal evaluation were as shown below.

Conclusions

After examination of the Project Performance and the Project Implementation Process, the Evaluation Team assessed, the relevance of the project as very high, the Effectiveness as high, Efficiency as fair, Impact as relatively high, and potential sustainability as high.

The project had experienced serious delays and a number of setbacks during the initial stage, partially, due to lack of awareness amongst staff members of PWD. However, training of counterparts in Japan and JET's input within the country (OJT and workshops), together with the NRW control unit under the chairmanship of Chief Engineer-I (PHE), boosted enthusiasm among counterparts and created a positive attitude towards the Project.

The evaluation Team concluded that the Project would achieve the project purposes before completion of the Project. Therefore, it is appropriate that the Project terminates as planned in the

Record of Discussions.

Recommendations
To ensure the sustainability of the Project, the Indian side and Japanese side shared the following recommendations.

(1) Activities prior to the completion of the Project
In further reducing NRW in the pilot project areas, the Project should concentrate more on the reductiono0f apparent losses. In doing so, the current practice of minimum and average billing on account of faulty meters should be avoided. (Project Team)

To measure and calculate NRW ratio in pilot project areas (Project Team)

To prepare and compile the progress on 10 DMA's NRW reduction activities (Project Team)

The details regarding provided equipment should be documented and will be handed over to PWD (JET)

(2) To establish exclusive organizational set up under the control of Chief Engineer-I (PHE) consisting of Central NRW Control Unit and Regional NRW Reduction Cells including assignment of sufficient staff members and budget (PWD)

(3) To review periodically the roles and responsibilities of Central NRW Control Unit and Regional NRW Reduction Cells, and to prepare detailed job description of PWD staff members assigned to the control unit and cells (PWD)

(4) To establish a mechanism to enhance and maintain motivation of PWD staff members assigned to the control unit and the cells for effective implementation of the Long-term NRW Reduction Plan (PWD)

(5) To plan and initiate procurement process pertaining to NRW reduction activities well in advance (PWD)

4.3 Improvement of Knowledge and Technical Skills of Counterparts for NRW Reduction

In order to achieve the Overall Goal and the Project Target, improvement of capacity of the counterparts is planned and executed throughout the Capacity Development Project. The major aspects of capacity development are listed below:

- Definitions of NRW
- NRW Reduction Technologies
- Utilization of Instruments for NRW Reduction
- Preparation of NRW Reduction Plan
- Organization for NRW reduction

Develop of capacity of individual counterpart is targeted in some of the above aspects and the capacity of PWD as an organization in others. The current status of capacity

developed in each of the above aspects after the project completion is summarized in the table below:

		Before Project	After Project
Definitions of NRW			
	Definitions of NRW and Water Balance	NRW was recognized by very limited number of staff of P"WD.	C/P understood definitions of NRW, balance of system input volume and billed water consumption. C/P also understood that NRW is water which will not create any revenue to the PWD.
	Component of NRW	Component and meaning of respective component of the NRW were not recognized.	Component of Water Audit was understood by counterparts. C/P understood there are real loss and apparent loss. Different measures to reduce those losses are also understood by the C/P.
	Purpose of NRW Reduction	Purpose of NRW reduction was not recognized	C/P recognized that NRW was not recovered by water tariff and NRW should be reduce to increase water revenue. Magnitude of the NRW was big enough which equivalent to construction of new WTP.
	Effects of NRW Reduction	Effects of NRW Reduction was not recognized.	C/P understood that reduction of NRW will lead ・ Reduction of investments for water resource development ・ Reduction of construction costs for WTP ・ Increase water tariff revenue ・ Improvement of operation and maintenance ・ Improvement of customer services
NRW Reduction Technologies			
	Work flow of NRW Reduction Activities	NRW reduction technologies were not available in PWD.	Overall NRW reduction activities were explained to counterparts and each step was conducted together with JICA Expert Team.

	Isolation of NRW reduction activity area		Since the NRW is evaluated by water balance, certain area should be isolated to calculate water balance. Necessity of the isolation was understood by the C/P. At the selection of the area, pipe network drawings are indispensable. C/P understood the importance of such drawings.
	Household Survey		C/P visited every housed in the area, Household Survey. C/P confirmed meter conditions and water leak on house connection. C/P also cross checked with customer list which was provided by billing section.
	Leak Sound Detection Survey		C/P understood that leakage is found by searching sounds created by leak points. Although many experience is required to find leakage by sound listening, the C/P found many leakage during the project.
	Leak Repair and Meter Replacement		C/P recognized importance of the system to repair/replace found leak points and malfunctioning water meters.
	Water Flow Measurement		Water flow into and flow out from the area was measured by ultrasonic flow meter or electro-magnetic flow meter by the C/P.
	Collection of billing data		C/P understood that the water balance between system input volume and billed water consumption becomes NRW. The billed water consumption was calculated based on collected billing data.
	Calculation and Evaluation of NRW		C/P can calculate NRW quantity from system input volume to the area and billing data of the area. C/P can also estimate breakdown of real and apparent losses.

Utilization of Instruments for NRW Reduction			
	Listening rod, Leak detector	The situation was that C/P didn't recognize the instrument itself introduced by this project and they also didn't know purpose of use.	< Common in all instrument> Most of the C/P understood purpose of use and acquired how to handle the instrument through the workshop for handling equipment and OJT in sites. Thus C/P has come to exert activities for NRW reduction by themselves. C/P gradually adjusted to handle listening rod and leak detector despite site survey by those equipment demand a certain level of experiences.
	Water pressure gauge		It is necessary to control water pressure in Goa state since land features have highs and lows. Water pressure in water supply system was the first measurement for many C/P.
	Pipe locator, Metal locator		Information of existing pipeline is significantly limited due to deficiency of pipeline map. Pipe and metal locators were utilized to identify the locations of pipeline and valves.
	Ultra-Sonic flow meter		C/P has come to measure flow rate in the place where they want to measure by Ultra-Sonic flow meter which is portable tool.
Preparation of NRW Reduction Plan			
	Achievement of previous Plan	Achievement of previous plan was not followed up	C/P has collected scattered data at each sub division. Through the activities C/P understands importance of compiling data.
	The Items to be included in the Plan	C/P has ideas of issues to be included in the plan they were not comprehensive.	Ideas of C/Ps are listed up by execution of brain-storming and they are compiled to prepare contents. C/Ps learned how to compile the ideas to make comprehensive contents.
	Importance of Preparation of the Plan	C/Ps knew the importance to preparation of plan but it was not so concrete.	C/Ps understand that it is important to prepare plan which can be executed. Capacity of

			C/Ps for preparation of the plan is improved
	Possibility of Realization of the Plan	There was not clear vision on how to realize the plan	Concurrence of the plan was obtained by the Ministry to realize the plan. PDW is now moving for execution of the plan.
	Necessity of Review of the plan	PWD knew the necessity of reviewing the plan but does not considered the execution so seriously.	The concern of PWD and the Ministry on NRW reduction is increasing. Therefore monitoring the execution of the plan becomes much important.
Organization for NRW reduction			
	Existing Organization	Each sub-division office takes responsibility of visible leak repair.	PWD considers that it is difficult to execute active leakage control, meter replacement and improvement of meter reading in the existing organization.
	Understanding on Necessity of New Organization for NRW reduction	There was no understanding.	PWD understands that it is difficult to execute ordinal busy tasks and NRW reduction activities simultaneously. PWD now expects establishment of New organization for NRW reduction.
	Future Action	There was not clear vision for the future activities.	Long term plan, including establishment of new organization, was approve by the Ministry. PWD is moving to establishment of the new organization and has started selection of staff for new organization for NRW reduction.

5 Recommendations for Achievement of Overall Goal

5.1 Overall Goal and Project Purpose

Overall goal and project purpose are as follows.

(1) Overall Goal	Non revenue water (NRW) is reduced in the State of Goa
(2) Project Purpose	Capacity of PWD to reduce NRW is strengthened.

5.2 Recommendations for Achievement of Goal and Purpose

Establishment of standard house connection and water meter installation

According to the results of household survey in the pilot project areas, many leakages were found at house connection pipes and water meters. Reason of many leakages was lack of standard installation for house connection and water meter and basic techniques of installation. Capacity development of these installations will be required including establishment of standard house connections and water meters, preparation of standard drawings, and selection of suitable materials and quality workmanship.

Specially, more attention should be paid on water meter quality. According to the information from PWD staff, many meters become our of order in very short period, less than one year. Better quality meters should be procured.

Periodical meter replacement which is implemented in Japan also recommended to reduce an Apparent Loss caused by meter error. This is also included in the Long-Term NRW Reduction Plan.

Improvement of meter reading system and billing system

In the course of pilot project activities, many malfunctioning meters were replaced and many meters were installed on house connection without meters. However, these improvements were not reflected to the next meter reading and billing data showing the meters were still not working, minimum charge or average charge were still applied to the connection.

Meter reading system and billing system should be improved through the continuous meter reader training, for example.

Establishment of exclusive organizational unit for NRW reduction

Organizational setup solely assigned for NRW reduction should be established in PWD Goa. This is discussed and included as part of Long-Term NRW Reduction Plan.

Motivation of PWD Staff

Maintaining high motivation of PWD staff for NRW reduction is indispensable to extend the NRW reduction activities to entire water service area in Goa State on sustainable basis. Introduction of incentive mechanism such as additional salary or promotion conforming to individual efforts for NRW reduction will contribute to maintain motivation at high level. Additional salary, overtime, should be secured for extra work such as leak sound detection during night time. Not only introduction of such incentive mechanism but also overtime payment seems difficult under current practice of PWD Goa.

Under such situation, it is considered effective to cultivate sane competitive spirit by awarding best performing PWD staff based on fair and objective evaluation of his/her contribution to reduce NRW. For arriving at the objective evaluation, metering system and SCADA system for the accurate water balance analysis, accurate monitoring of NRW, should be applied to every sub-division office. It will take some time to materialize these arrangements and may not be introduced during this capacity development project. This will be considered after completion of this project.

Attachments

Attachment

Attachment-1 PDM

Amendment

The latest version of Project Design Matrix (PDM_1), which summarizes overall goal, project purpose, output, objectively verifiable indicators, activities, input is shown in the next page.
PDM was mutually agreed between JICA and PWD on September 7, 2010, included in "Record of Discussion (RD)" and is numbered as "PDM_0".

"PDM_0" is revised and amended as "PDM_1"in the 4th JCC held on May 14th, 2013 reflecting the recommendations of the Mid-term Evaluation of the Project executed from February 2nd to February 16th, 2013. The recommendations do not include any fundamental change in the concept or contents. However, some figures of verifiable indicators are added in order to check easily the achievement of the activity during the Terminal Evaluation.

In addition to above, it was agreed to include a new output in "PDM_1", since "Output 4: Knowledge and technologies/skills for NRW reduction can be shared with another state" was introduced form the 3rd Fiscal Year Project.

PDM$_1$

Project Design Matrix (PDM)

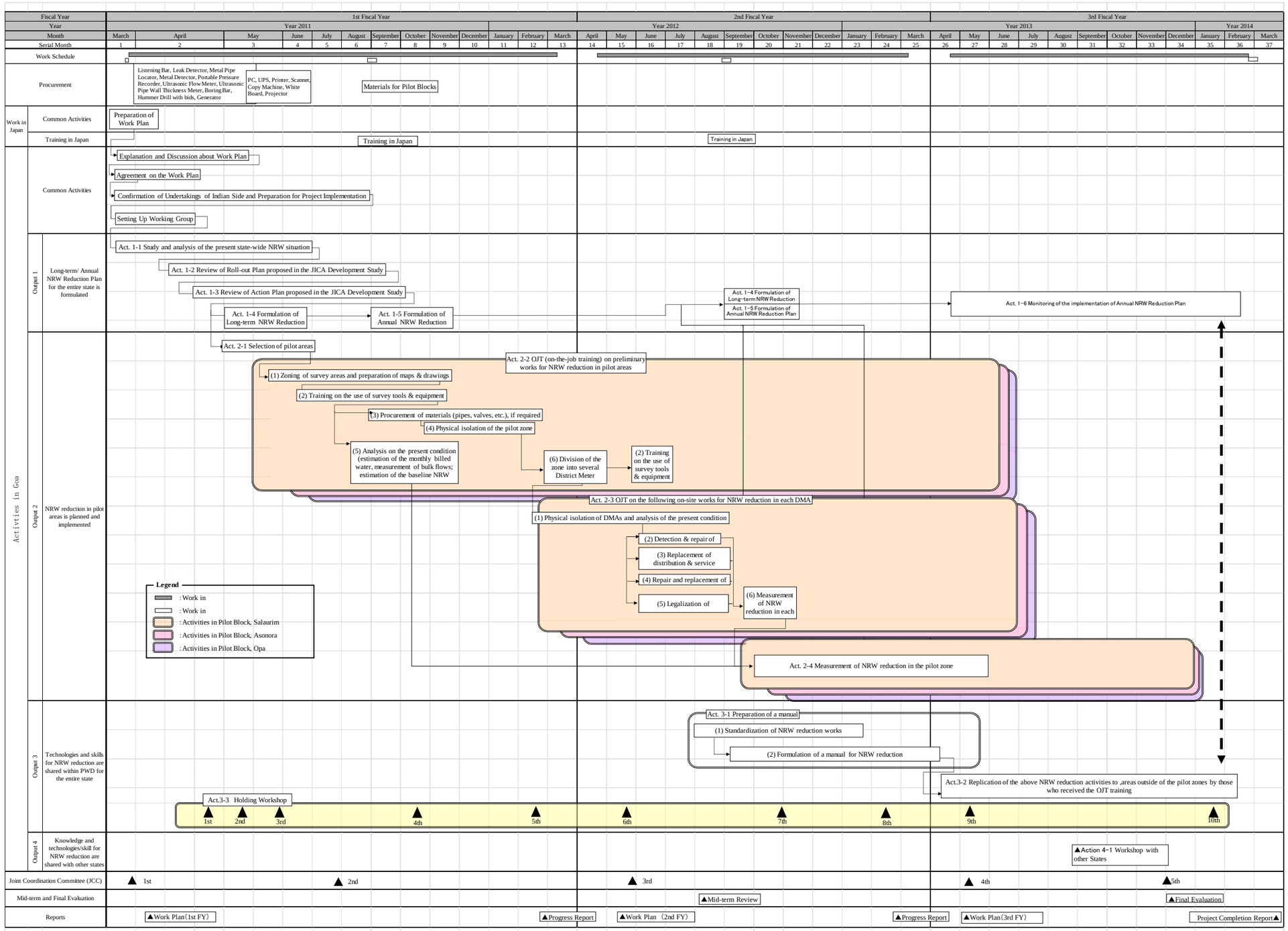
Project Name: Capacity Development Project for Non Revenue Water Reduction in Goa
Project Site: State of Goa, India

Duration of the Project: 3 years
Target Group: PWD staff members related to NRW reduction

Narrative Summary	Objectively Verifiable Indicators	Means or Verification	Important Assumptions
[Overall Goal] Non revenue water (NRW) is reduced in the State of Goa	- NRW ratio in the State of Goa reduces average of 2 % per year till reaching the target (< 23%).	- Statistical reports standardized in consultation with JICA - Records in each Division/ Sub-division Office	- Senior management of PWD continue with its commitments and support for the Project - Major political event(s) do not occur and/nor halt the Project.
[Project Purpose] Capacity of PWD to reduce NRW is strengthened.	- NRW ratio in the pilot areas (<20%) - NRW reduction initiatives are undertaken in nine (9) areas by PWD outside of the pilot areas - At least one staff in each sub-division is in a position to utilize the equipment to detect leakage without assistance. - At least one staff in each sub-division is confident to teach his/her colleagues and/or staff members the technique to conduct NRW reduction activities.	- Project records - Survey of PWD staff members	- PWD declares that the Long-term NRW Reduction Plan will be approved, adopted, and becomes effective within PWD. - Equipment to be procured by the Loan Projects is fully and effectively utilized by the Project.
[Outputs] 1. Long-term/ Annual NRW Reduction Plan for the entire state is formulated 2. NRW reduction in pilot areas is planned and implemented 3. Technologies and skills for NRW reduction are shared within PWD for the entire state 4. Knowledge and technologies/skills for NRW reduction can be shared with another state	1-1 Formulation of Long-term NRW Reduction Plan 1-2 Formulation of the first Annual Action Plan for NRW reduction 1-3 Mechanism to monitor the implementation of Annual NRW Reduction Plan is established 2-1 Number of participants whom Team leaders recognized based on their active involvement in pilot projects is at least 50% of team member. 2-2 NRW ratio in all the pilot areas are measured. 2-3 NRW reduction rate in all the pilot areas are measured. 3-1 Manuals are distributed to all sub-divisions for utilization by the staff members. 3-2 Number of Sub-Divisions which initiate their own NRW reduction activities reaches nine (9) other than pilot project areas. 3-3 Over 50% of C/Ps participates in each seminar, and over 80% of participants satisfied with the quality of the seminars. 4-1 At least ten(10) staffs can share knowledge and technology/skills for NRW reduction with another state in workshops.	- Project records	- PWD staff members who acquire NRW technologies and skills are not transferred
[Activities] 1. Formulation of NRW Reduction Plan for the entire state 1-1 Study and analysis of the present state-wide NRW situation 1-2 Review of Roll-out Plan proposed in the JICA Development Study 1-3 Review of Action Plan proposed in the JICA Development Study 1-4 Formulation of Long-term NRW Reduction Plan 1-5 Formulation of Annual NRW Reduction Plan 1-6 Monitoring of the implementation of Annual NRW Reduction Plan 2. NRW Reduction Pilot Projects 2-1 Selection of pilot areas 2-2 OJT (on-the-job training) on preliminary works for NRW reduction in pilot areas (1) Zoning of survey areas and preparation of maps & drawings (2) Training on the use of survey tools & equipment	**[Inputs]** <u>Japanese side</u> 1. Experts to be dispatched • Chief Advisor/Water Supply Planning • NRW Reduction • Leak Detection 1 • Leak Detection 2 • Organization Dissemination 2. Counterpart Training in Japan 3. Equipment Procurement	<u>Indian side</u> 1. Assignment of counterpart personnel to Japanese experts 2. Office space and facilities for the Japanese experts 3. Salaries and other allowances including transportation cost, accommodation and honorarium for Indian counterpart personnel, if necessary, for training to be conducted in the Project 4. Provision of necessary data and information to the Japanese side 5. Budget allocation for NRW reduction works under the pilot projects	- Inputs by Indian side are secured and placed for the Project Implementation

(3) Procurement of materials (pipes, valves, etc.), if required (4) Physical isolation of the pilot area (5) Analysis on the present condition (estimation of the monthly billed water, measurement of bulk flows; estimation of the baseline NRW ratio in the zone) (6) Division of the zone into several District Meter Areas .(DMAs) 2-3 OJT on the following on-site works for NRW reduction in each DMA (1) Physical isolation of DMAs and analysis of the present condition (2) Detection & repair of leakage (3) Replacement of distribution & service connection pipes (4) Repair and replacement of meters (5) Legalization of unauthorized connection if any (6) Measurement of NRW reduction in each DMA 2-4 Measurement of NRW reduction in the pilot area 3. Organizational Sharing of NRW Reduction Expertise 3-1 Preparation of a manual (1) Standardization of NRW reduction works (2) Formulation of a manual for NRW reduction 3-2 Replication of the above NRW reduction activities to ,areas outside of the pilot areas by those who received the OJT training 3-3 Organization of seminars 4. Workshops with another state 4-1 Organization of workshops with another state			**[Pre-conditions]** - Information on the Project is shared and well understood among the PWD staff members - Counterpart (Indian side) is assigned.

Attachment-2 Project Activity Flowchart



Attachment-3

Plan of Operation (PO_0 and PO_1)

Capacity Development Project for Non Revenue Water Reduction in Goa

Plan of Operation (PO)

: **PO_0 agreed on Sep. 7, 2010**　　: **PO_1 (revised PO_0)**

Project Activities \ Time Line		2011												2012												2013												2014		
		1st Fiscal Year												2nd Fiscal Year												3rd Fiscal Year														
		3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
【Work in Japan】	Preparation of WorkPlan Training in Japan	□				□													□																					□
【Work in India】	Explanation and Discussion about Work Plan Setting up Working Group																																							
【Output 1】 Long-term/ Annual NRW Reduction Plan for the entire state is formulated	Act. 1-1 Study and analysis of the present state-wide NRW situation																																							
	Act. 1-2 Review of Roll-out Plan proposed in the JICA Development Study																																							
	Act. 1-3 Review of Action Plan proposed in the JICA Development Study																																							
	Act. 1-4 Formulation of Long-term NRW Reduction Plan																																							
	Act. 1-5 Formulation of Annual Action Plan for NRW Reduction																																							
	Act. 1-6 Monitoring of the implementation of Annual Action Plan																																							
【Output 2】 NRW reduction in pilot areas is planned and implemented	Act. 2-1 Selection of pilot areas																																							
	Act. 2-2 OJT on preliminary works for NRW reduction in pilot areas																																							
	(1) Zoning of survey areas and preparation of maps & drawings																																							
	(2) Training on the use of survey tools & equipment																																							
	(3) Procurement of materials (pipes, valves, etc), if required																																							
	(4) Physical isolation of the pilot zone																																							
	(5) Analysis on the present condition																																							
	(6) Division of the zone into several District Meter Areas (DMA)																																							
	Act. 2-3 OJT on the following on-site works for NRW reduction in each DMA																																							
	(1) Physical isolation of DMAs and analysis of the present condition																																							
	(2) Detection & repair of leakage (3) Replacement of distribution &service connection pipes (4) Repair and replacement of meters (5) Legalization of unauthorized connections																																							
	(6) Measurement of NRW reduction in each DMA																																							
	Act. 2-4 Measurement of NRW reduction in the pilot zone																																							
【Output 3】 Technologies and skills for NRW reduction are shared within PWD for the entire state	Act. 3-1 Preparation of manual																																							
	(1) Standardization of NRW reduction works																																							
	(2) Formulation of manual for NRW reduction																																							
	Act. 3-2 Replication of NRW reduction activities to areas outside of the pilot zones																																							
	Act. 3-3 Organization of workshops		①	②③									④			⑤		⑥							⑦											⑧			
Submission of Work Plan		▲													▲										▲														
Progress Report													▲											▲																
Project Completion Report																																							▲

Legend : Work in Japan　▲ Report Submission

Attachment-4　Record of Expert Assignment

インド国ゴア州無収水対策プロジェクト

Capacity Development Project for Non Revenue Water Reduction in Goa, Republic of India

	担当業務 Title	氏名 Name	2010/2011年度 (Fiscal Year)												2012年度 (Fiscal Year)											
			2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
現地業務 (Work in India)	総括/上水道計画 Chief Advisor/Water Supply Planning	間宮健匡 Takemasa Mamiya	3/20-4/11 0.77		4/24-5/7 0.47				8/28	9/24 0.93				2/2	3/16 1.47			6/3		7/28 1.87	9/2	10/5 1.13				1/15	3/15 2.00	
	副総括 Deputy Chief Advisor	小林伸吉 Shinkichi Kobayashi	3/20-4/11 0.77					7/20 0.90	8/15	10/4	11/3 1.03													11/11 1.37	12/22	1/11	3/15 2.13	
	無収水対策 NRW Reduction	シバクマール S. M. Shivakumar						7/22 2.50		10/9	10/17 2.50		12/30	1/16	3/15 2.00		5/15		7/13 2.0		9/2		10/31 2.0		1/15	3/15 2.0	
	漏水対策1 Leak Detection 1	坂岡功 Isao Sakaoka			4/5 1.33	5/14		7/21			10/19 3.03			1/11	3/15 2.17		6/8			9/5 3.00		9/21	11/19 2.00		1/30	3/15 1.5	
	漏水対策2 Leak Detection 2	大庭 祐樹 Yuki Oba			4/11 1.00	5/10				9/20 1.50	11/3			1/22	3/15 1.80		6/28 1.0	7/27		8/27 2.0			10/25		1/15	3/15 2.0	
	組織内普及/業務調整 Organization Dissemination	中村恵美/青木 徹 Megumi Nakamura /Toru Aoki			4/5 0.87	4/30					10/11 1.17	11/14					6/3 1.0	7/2				10/9 1.0	11/7					
																											小計	
	報告書 提出時期 (Reports)				▲ワークプラン										業務進捗報告書 ▲		▲	ワークプラン（第2年次）								業務進捗報告書	▲
	国内作業（人・月計）(M/M in Japan)		1.1														0.5										

	担当業務 Title	氏名 Name	2013年度 (Fiscal Year)												2010/11年度 (Fiscal year)		2012年度 (Fiscal Year)		2013年度 (Fiscal Year)		合計 (Total)	
			4	5	6	7	8	9	10	11	12	1	2	3	現地 India	国内 JPN	現地 India	国内 JPN	現地 India	国内 JPN	現地 India	国内 JPN
現地業務 (Work in India)	総括/上水道計画 Chief Advisor/Water Supply Planning	間宮健匡 Takemasa Mamiya	4/28 0.93	5/25			8/26 1.57	10/11	11/13 1.07	12/14		1/25 1.07	2/25		3.64		5.00		4.64		13.28	
	副総括 Deputy Chief Advisor	小林伸吉 Shinkichi Kobayashi	4/28 1.83	6/21	7/22 1.63	9/8	10/23 1.97	12/20	1/16 1.36	2/25					2.70		3.50		6.80		13.00	
	無収水対策 NRW Reduction	シバクマール S. M. Shivakumar	4/28 2.0	6/26		9/3 3.5			12/16	1/11 1.0	2/9				7.00		6.00		6.50		19.50	
	漏水対策1 Leak Detection 1	坂岡功 Isao Sakaoka		5/29 1.1	6/30		8/21 2.5			11/3	12/16 1.9	2/10			6.53		6.50		5.50		18.53	
	漏水対策2 Leak Detection 2	大庭 祐樹 Yuki Oba	5/8 1.0	6/6	7/3 1.0	8/1	8/11 1.0	9/9	10/27 1.3	12/4					4.30		5.00		4.30		13.60	
	組織内普及/業務調整 Organization Dissemination	中村恵美/青木 徹 Megumi Nakamura /Toru Aoki	5/8 1.40	6/18					10/23 1.5		12/6	1/16 1.36	2/25		2.04		2.00		4.26		8.30	
														小計	**26.20**		**28.00**		**32.00**		**86.20**	
	報告書 提出時期 (Reports)		▲	ワークプラン（第3年次）									業務完了報告書	▲	**26.20**	**1.10**	**28.00**	**0.50**	**32.00**	**1.50**	**86.20**	**3.10**
	国内作業（人・月計）(M/M in Japan)		1.5												**27.30**		**28.50**		**33.50**		**89.30**	

Assignment Record of Japanese Experts

30.0

専門家		FY	Date			Days	Months	FY1	FY2	FY3	Total
Chief Advisor/ Water Supply Planning	Takemasa Mamiya	FY1	Mar-20	-	Apr-11	23	0.77	3.64			13.27
			Apr-24	-	May-7	14	0.47				
			Aug-28	-	Sep-24	28	0.93				
			Feb-02	-	Mar-16	44	1.47				
		FY2	Jun-3	-	Jul-28	56	1.87		5.00		
			Sep-02	-	Oct-05	34	1.13				
			Jan-15	-	Mar-15	60	2.00				
		FY3	Apr-28	-	May-25	28	0.93			4.63	
			Aug-26	-	Oct-11	47	1.57				
			Nov-13	-	Dec-14	32	1.07				
			Jan-25	-	Feb-25	32	1.07				
Deputy Chief Advisor	Shinkichi Kobayashi	FY1	Mar-20	-	Apr-11	23	0.77	2.70			13.00
			Jul-20	-	Aug-15	27	0.90				
			Oct-04	-	Nov-03	31	1.03				
		FY2	Nov-11	-	Dec-22	41	1.37		3.50		
			Jan-11	-	Mar-15	64	2.13				
		FY3	Apr-28	-	Jun-21	55	1.83			6.80	
			Jul-22	-	Sep-08	49	1.63				
			Oct-23	-	Dec-20	59	1.97				
			Jan-16	-	Feb-25	41	1.37				
NRW Reduction	Shivakumar	FY1	Jul-27	-	Oct-09	75	2.50	7.00			19.50
			Oct-17	-	Dec-30	75	2.50				
			Jan-16	-	Mar-15	60	2.00				
		FY2	May-15	-	Jul-13	60	2.00		6.00		
			Sep-02	-	Oct-31	60	2.00				
			Jan-15	-	Mar-15	60	2.00				
		FY3	Apr-28		Jun-26	60	2.00			6.50	
			Sep-03	-	Dec-16	105	3.50				
			Jan-11	-	Feb-09	30	1.00				
Leak Detection 1	Isao Sakaoka	FY1	Apr-5	-	May-14	40	1.33	6.53			18.53
			Jul-21	-	Oct-19	91	3.03				
			Jan-11	-	Mar-15	65	2.17				
		FY2	Jun-08	-	Sep-05	90	3.00		6.50		
			Sep-21	-	Nov-19	60	2.00				
			Jan-30	-	Mar-15	45	1.50				
		FY3	May-29	-	Jun-30	33	1.10			5.50	
			Aug-21	-	Nov-03	75	2.50				
			Dec-16	-	Feb-10	57	1.90				
Leak Detection 2	Yuki Oba	FY1	Apr-11	-	May-10	30	1.00	4.30			13.60
			Sep-20	-	Nov-03	45	1.50				
			Jan-22	-	Mar-15	54	1.80				
		FY2	Jun-28	-	Jul-27	30	1.00		5.00		
			Aug-27	-	Oct-25	60	2.00				
			Jan-15	-	Mar-15	60	2.00				
		FY3	May-08	-	Jun-06	30	1.00			4.30	
			Jul-03	-	Aug-01	30	1.00				
			Aug-11	-	Sep-09	30	1.00				
			Oct-27	-	Dec-04	39	1.30				
Orgnazation Dissemination	Megumi Nakamura	FY1	Apr-5	-	Apr-30	26	0.87	2.04			8.30
			Oct-11	-	Nov-14	35	1.17				
		FY2	Jun-3	-	Jul-2	30	1.00		2.00		
			Oct-16	-	Nov-14	30	1.00				
	Toru Aoki	FY3	May-08	-	Jun-18	42	1.40			4.27	
			Oct-23	-	Dec-06	45	1.50				
			Jan-16	-	Feb-25	41	1.37				
Total								26.20	28.00	32.00	86.20

Attachment-5 Training in Jana

1st Fiscal Year

Capacity Development Project for Non RevenueWater Reduction in Goa, Republic of India

List of Trainee of Training in Japan

	Name of Trainee	Field	Period	Training Program and Hosting Institutions	Position When Accepted	Present Position
1	Chodankar Laxmikant M	JICA ODA Loan Project	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Assistant Surveyor of Works	
2	Shenvi Haresh Kakodkar Ramdas	Works Division XII (PHE-SWSP)	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
3	Lawande Ameya V	Sub Division I / Works Division III (PHE-N), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
4	Paste Eknath Pandurang	Sub Division V / Works Division III (PHE-N) PWD / PONDA – Goa	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.		
5	Pagi Sanjay Shanker	Works Division IX (PHE)	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
6	Viraj Vishnu Patil	Sub Division II / Works Division IX (PHE), Public Works	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant (Civil)	
7	Kudalkar Prachi Prajot	Sub Division V / Works Division XVII (PHE-N), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer (Electronic)	
8	Bhende Vishwamber Jagannath	Works Division IX (PHE), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant (Civil)	
9	Dessai Yogesh Yeshwant	Works Division IX (PHE), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant (Civil)	
10	Gaude Pradeep Laxman	Sub Division III / Works Division XXI, Vidhyanagar, Margao	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant (Civil)	
11	Naik Tari Kalpita Gurudas	Works Division XII (PHE-SWSP), Sanguem, Goa	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
12	Chiramel Lonappan George	Sub Division II / Works Division III (PHE-N), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
13	Porobo Vassudeva Ladu	JICA ODA Loan Project	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
14	Vaghurmekar Anand Ghanshyam	Sub Division I / Works Division IX (PHE), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant (Civil)	
15	Pai Kakode Rohan Ramakant	Sub Division II / Works Division XVII (PHE-N), Public Works Department	Jan. 15 – Jan. 28, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	

2nd Fiscal Year

Capacity Development Project for Non RevenueWater Reduction in Goa, Republic of India

List of Trainee of Training in Japan (2nd Fiscal Year)

	Name of Trainee	Field	Period	Training Program and Hosting Institutions	Position When Accepted	Present Position
1	Deelip M. Dhavalikar	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Executive Engineer	
2	Rajendra J. Borcer	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Assistant Engineer	
3	Krishana R. Shetye	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
4	Yeshwant P. Mapari	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
5	Manoj D. Naik	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
6	Jaiwant N. Bhat Prabhu	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
7	Santosh M. Prabhu Desai	Division III (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
8	Mohan S. Naik	Division IX (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
9	Truptesh K. Shet Shirsat	Division IX (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
10	Maheshwar S. Opekar	Division IX (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
11	Siddesh T. Pawasker	Division XX (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
12	Dipesh Y. Gaude	Division XX (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
13	Gurudas R. Gokhale	Division XVII (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Junior Engineer	
14	Rohidas M. Naik	Division XVII (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
15	Madan M. Dessai	Division XVII (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	
16	Prashant G. Gaude	Division XVII (PHE)	Nov. 24 – Dec. 8, 2012	Nihon Sudio Consultants Co., Ltd.	Technical Assistant	

Attachment-6 List of Equipment Procured and Handed Over to PWD Goa

(1) Japanese Input

c. Equipment Procurement and Present Status-1 (Procured by JICA Expert Team)

Sl No.	Date of Purchase	Fiscal Year	Equipment (Specification)		Section Using	Installation Place	Usage of the Equipment
1	Mar-2011	2011	Projector	Panasonic	JET	JET Office	Good
2	Apr-2011	2011	PC	Compac CQ1-1030IN	JET	JET Office	Good
3	Apr-2011	2011	UPS		JET	JET Office	Good
4	Apr-2011	2011	UPS		C/P	JET Office	Good
5	Apr-2011	2011	UPS		C/P	JET Office	Good
6	Apr-2011	2011	UPS		C/P	JET Office	Good
7	Apr-2011	2011	Copy, Printer, Scanner	Canon C2020H	JET	JET Office	Good
8	Aug-2011	2011	PC （Lap Top)	Dell Inspiron N4010	C/P	PWD	Good
9	Aug-2011	2011	PC （Lap Top)	Dell Inspiron N4010	C/P	PWD	Good
10	Aug-2011	2011	PC （Lap Top)	Dell Inspiron N4010	C/P	PWD	Good
11	Feb-2012	2011	Copy, Printer, Scanner	Epson	C/P	PWD	Good
12	Feb-2012	2011	Copy, Printer, Scanner	Epson	C/P	PWD	Good
13	Feb-2012	2011	Copy, Printer, Scanner	Epson	C/P	PWD	Good
14	Feb-2012	2011	Printer Ink (Consumable)	Epson	C/P	PWD	-
15	Feb-2012	2011	White Board		C/P	PWD	Good
16	Feb-2012	2011	White Board		C/P	PWD	Good
17	Feb-2012	2011	White Board		C/P	PWD	Good
18							
19							
20							
21							
22							
23							

(1) Japanese Input

c. Equipment Procurement and Present Status-2

Sl No.	Date of Purchase	Equipment (Specification)		Price		Section for the equipment to be used	Installation Place	Usage of the Equipment
1	Dec-2011	Listening Rod (30 pcs)	Fuji Techom			PWD	PWD	Good
2	Mar-2012	Leak Noise Detector (24 units)	Fuji Techom			PWD	PWD	Good
3	Mar-2012	Pipeline & Cable Locator (24 units)	Fuji Techom			PWD	PWD	Good
4	Mar-2012	Metal Locator (15 units)	Fuji Techom			PWD	PWD	Good
5	Mar-2012	Portable Water Pressure Recorder (15 units)	Fuji Techom			PWD	PWD	Good
6	Mar-2012	Ultra Sonic Flow Meter (15 units)	Primayer			PWD	PWD	Good
7	Mar-2012	Ulthra Sonic Pipe Wall Thickness Meter (15 units)	Primayer			PWD	PWD	Good
8	Aug-2012	Gate Valve (50mm) (1 set)	I.S.14846			PWD	PWD	Good
9	Aug-2012	Gate Valve (100mm) (3 sets)	I.S.14846			PWD	PWD	Good
10	Aug-2012	Gate Valve (150mm) (5 sets)	I.S.14846			PWD	PWD	Good
11	Aug-2012	Gate valve (200mm) (3 sets)	I.S.14846			PWD	PWD	Good
12	Aug-2012	Gate Valve (250mm) (1 set)	I.S.14846			PWD	PWD	Good
13	Aug-2012	Gate Valve (300mm) (3 sets)	I.S.14846			PWD	PWD	Good
14								

Attachment-7 Minutes of Meeting of Joint Coordination Committee (JCC)

1st JCC

MINUTES OF MEETING
ON
THE FIRST JOINT COORDINATING COMMITTE MEETING
FOR
CAPACITY DEVELOPMENT PROJECT
FOR NON REVENUE WATER REDUCTION IN GOA

The Japan International Cooperation Agency (hereinafter referred to as "JICA") through its India Office and the authorities concerned of the Government of India (hereinafter referred to as "GOI") and Government of Goa (hereinafter referred to as "GOG") exchanged the Record of Discussions (hereinafter referred to as the "R/D") and the Minutes of the Meetings (hereinafter referred to as the "M/M") on Japanese Technical Cooperation for the Capacity Development Project for Non Revenue Water Reduction in GOA (hereinafter referred to as "the Project") on 7th September 2010 and 15th April, 2009 respectively. Based on R/D and M/M, JICA Expert Team of the Project was dispatched to Goa and commenced the Project from the end of March 2011. At the time of commencement, the first Joint Coordination Committee (hereinafter referred to as "JCC") to discuss the contents of the Work Plan of the Project was held on 5th April, 2011, chaired by Mr. Wachasundar, Project Director of JICA Project of the office of Project Director JICA, PWD Altinho, Panaji, Goa, Goa. Those who attended the meeting are listed in "Annex" attached hereto.

The main points discussed, comments and agreements reached during the meeting are as Attached Document.

GOA on 26th April 2011

Mr. Takemasa Mamiya
Chief Advisor
JICA Expert Team

Mr. A.W. Wachasundar
Project Director of JICA Project
Public Works Department
Government of GOA

The Attached Document

Mr. Wachasundar, Project Director of JICA Project, opened the meeting emphasizing the importance of NRW reduction activities in order to secure 24 hour continuous water supply and elaborating the expectations from the Project.

The JICA Expert Team (hereinafter referred to as "JET") explained the main contents of the Work Plan. JCC agreed the contents of the Work Plan with some comments as follows.

1. Target of NRW ratio

Project Design Matrix (hereinafter referred as "PDM") agreed in R/D shows the target of NRW ration in the pilot areas as less than 20% and NRW ratio in the State of GOA as less than 23%. Detailed discussions were made on the target figures and it was concluded that discussion on the figures should be continued during the execution of the Project since NRW ratio depends on the capacity and efforts of the PWD counterparts as well as the existing NRW situation and the magnitude of budget allocation to the NRW reduction activities such as for pipe replacement, valve improvement, improvement in house service connection system including water meter quality improvement, leaking reservoir improvement.

2. Member of JCC

It was agreed to add the following personnel as members of JCC.

1. Principal Chief Engineer
2. Superintending Engineer (PHE), Circle VI, the Coordination Officer of the Project

3. Workshop

It was confirmed that the first workshop will be held on 8th April 2011 for the 56 members of the Working Group, 2 staff from each 28 sub-division.

Annex

List of Participants

【Indian side, PWD Goa】

Mr. A.M. Wachasundar	Project Director of JICA Project, chairman JCC
Mr. J.J.S. Rego	Principal Chief Engineer, member JCC
Mr. V. Santhanam	Superintending Engineer (PHE), Circle V, member JCC
Mr. A.A Patil	Superintending Engineer (PHE), Circle VI, member JCC and Project Coordination Officer
Mr. G.M.N. Parrikar	Executive Engineer/Surveyor of Works (JICA), member JCC

【Japanese side】

JICA India Office

Ms Kaori Iwata	Programme Specialist
Mr. Mihir Sorti	Senior Development Specialist

JICA Expert Team

Mr. Takemasa Mamiya	Chief Advisor
Mr. Shinkichi Kobayashi	Deputy Chief Advisor
Mr. V.M. Nainadurai	NRW Reduction
Mr. M.B.Subramanyam	Assistant

2nd JCC

MINUTES
OF
THE 2nd JOINT COORDINATING COMMITTEE MEETING
ON
THE PROJECT FOR CAPACITY DEVELOPMENT
ON NRW REDUCTION IN GOA

The second Joint Coordination Committee (hereinafter referred to as "JCC") meeting was held on 26 June 2012 at the office of the Project Director JICA Project, Public Works Department Altinho, Panaji, Goa under the Chairmanship of Project Director JICA Project, Public Works Department (hereinafter referred to as "PWD"), State Government of Goa with the presence of members stipulated in the Record of Discussion.

Both sides agreed to make this Minutes of Meeting in order to confirm the mutual understanding reached through the discussion as attached hereto.

June 2012
Panaji, India

Mr.A. M. Wachasundar
Project Director of JICA project,
Public Works Department
Government of GOA

Mr.Shinichi Yamanaka
Chief Representative,
India Office,
Japan International Cooperation Agency(JICA)

ATTACHED DOCUMENTS

As a result of the meeting, the Committee agreed on the following points.

1. Project Progress and schedule of FY2012
   Both sides confirmed the progress of the first year and the activities of the second year of the project which were described in the "Work Plan for Second Fiscal Year" presented by JICA Expert Team (JET) covering following major items.
   - Project goal, purpose, outputs and project areas
   - Project Design Matrix
   - Rolls of PWD and JET
   - Project implementation schedule and JET assignment schedule
   - Personnel of JET and PWD Counter Part (C/P) personnel
   - Progress of 1st fiscal year
   - Schedule and Scope of 2nd fiscal year

2. Training in Japan
   Both sides agreed to conduct training in Japan in October, 2012 and for 16 personnel from PWD team.

3. Mid-term review
   Both sides agreed to conduct mid-term joint evaluation in February, 2013.

4. Information shearing with line ministry
   Both sides agreed that Project Director will brief the progress of project to the line ministry, namely Ministry of Urban Development (MOUD) Delhi, along with JET representative in July 2012. JICA will attend the meeting.

5. Extension of pilot sites
   PWD proposed for total 18 project sites. This was discussed in details considering the practicability. It was decided to select new 9 number of project sites each having 1,000 households approximately.

6. Bottlenecks in implementation and countermeasure actions
   JET members raised some bottlenecks in implementation of the project. PWD agreed to consider the countermeasures as below;
   - Incentives for NRW reduction activities based on JET recommendations.
   - Formulation of Central NRW Control Unit (under chairmanship of Chief Engineer, SEs and EEs of PHE and JET)
   - Monthly progress review meeting of the Control Unit (first meeting will take place in July 2012)
   - Facilities of transportation and required material/construction facilities required for NRW reduction activities to be made available to C/P.

7. Extension of project period
   PWD requested extension of Project period and corresponding availability of JET for additional period of about 6 to 12 months so as to achieve effective technology transfer to PWD C/P from JET and to maintain sustainability of NRW reduction activities more firmly.

JICA expressed that extension of the project period would be difficult considering availability of funds under NRW component in the JICA ODA Loan Project (ID-P 189). PWD was therefore requested to utilize these funds allocated for NRW expert (375 million JPY) for NRW reduction activities subsequent to end of TC project. However, PWD requested JICA for a further discussion on this issue during midterm evaluation in February 2013.

8. Opportunity of Training in Japan in 3rd Fiscal Year

The PWD requested for the Training in Japan for third batch of C/P in 3rd Fiscal Year also. JICA informed that provision of training in 3rd year entails change of existing scope and would be difficult to accommodate within the existing resource allocation. However, the same could be discussed during mid term evaluation in Feb 2013.

List of Participants

【Indian side, PWD Goa】

Mr. A.M. Wachasundar Project Director of JICA Project, chairperson of JCC

Mr. D.J.S. Borkar	Chief Engineer I, member of JCC
Mr. A.A Patil	Superintending Engineer (PHE), Circle VI, member of JCC and
Mr. G.M.N. Parrikar	Executive Engineer/Surveyor of Works (JICA), member of JCC
Mr. L.M. Chodankar	Assistant Surveyor of Works (JICA)

【Japanese side】

JICA India Office

Ms. Doyle Emi	Programme Specialist
Mr. Mihir Sorti	Senior Development Specialist

JICA Expert Team

Mr. Takemasa Mamiya	Chief Advisor
Mr. S.M. Shivakumar	NRW Reduction
Mr. Isao Sakaoka	Leak Detection 1
Ms. Megumi Nakamura	Organization Dissemination

3rd JCC

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATINAL COOPERATION AGENCY
AND
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF INDIA
ON JAPANESE TECHNICAL COOPERATION
FOR
CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER REDUCTION IN GOA

The Japanese Mid-term Evaluation Team (hereinafter referred to as "the Japanese Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") visited Goa from the 3rd of February to 14th of February 2013 for the purpose of conducting a mid-term review of "Capacity Development Project for Non Revenue Water (NRW) Reduction in Goa" (hereinafter referred to as "the Project").

During its stay in Goa, the Team evaluated the progress and achievement of the Project and had a series of discussions including Joint Coordinating Committee (JCC) with the Public Works Department of Goa (hereinafter referred to as "PWD").

As a result of the discussions, the Japanese Team and PWD agreed to the matters in the documents attached hereto.

Panaji, February 2013

Mr. Hiroshi SUZUKI
Senior Representative
JICA India Office
Japan International Cooperation Agency
Japan

Mr. A.M. WACHASUNDAR
Project Director
Public Works Department
Government of Goa
India

Mr. Sadanobu SAWARA
Senior Advisor (Global Environment Department)
Japan International Cooperation Agency
Japan

Mr. D.J.S. Borkar
Chief Engineer-I
Public Works Department
Government of Goa
India

THE ATTACHED DOCUMENT

Through the discussions regarding the progress of the Project with the PWD and related organizations in Goa and JICA experts, the Mid-term Review Team compiled the result of the Mid-term Review as a Mid-Term Review Report attached hereto. At the same time, both Indian and Japanese sides agreed the following points discussed during the consultations and JCC.

1. PWD side agreed that there will be no changes of the project duration as it was stipulated (three (3) years from the initial assignment of Japanese experts) in the Record of Discussion (R/D) dated on the seventh of September, 2010. However, they expressed their strong wish to request a new technical cooperation project (phase II) regarding to NRW reduction.

2. JICA side explained that the phase II project shall not be just repeating the on-going project, and emphasized that the mechanism of NRW reduction should be established prior to the commencement of the phase II project.

3. PWD side explained NRW reduction cells will be attached under sub-divisions, and hopefully be established by fiscal year 2014/15, once the Long-term NRW Reduction Plan is approved.

4. JICA side requested to find a solution to a matter of the incentives for the staff members of PWD working for NRW reduction activities.

ATTACHMENT

JOINT MIDTERM EVALUATION REPORT

ON JAPANESE TECHNICAL COOPERATION

FOR

CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER REDUCTION IN GOA

Panaji, February 2013

Japan – India Joint Midterm Review Team

Table of Contents

1. Outline of the Project

1-1 Background of the Project

In the State of Goa, over recent years, there has developed an urgent need to improve water supply and sewage systems due to an expanding local population and increasing levels of tourism; both of which have reinforced a general demand for a better standard of life. There are many challenges, such as, a shortage of water supply (average hours of water supply per day: 8 hours), lack of appropriate maintenance systems for the existing facilities, and pollution of underground and sea water due to inadequate sewage facilities.

JICA conducted a development study "The Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India" from March 2005 to November 2006, based on a request from the Government of India (GOI). In the course of the development study, a feasibility study (F/S) was carried out regarding the priority projects identified in the master plan for water supply and sanitation. Based on results from this feasibility study, a request for a Yen Loan Project "Goa Water Supply and Sewerage Project" was submitted to the Government of Japan (GOJ) by GOI in March, 2007, and, after examination, a Loan Agreement was mutually signed in September, 2007. Currently, the Loan Project is under implementation by the GOI.

In the development study, many problems regarding operation and maintenance of waterworks were pointed out. In particular, high Non-Revenue Water (NRW) (at approximately 40%) was raised as a serious issue. To reduce the NRW level, the GOI requested implementation of the technical cooperation project "Capacity Development Project for Non Revenue Water Reduction in Goa" as a complementary project to the Yen Loan Project "Goa Water Supply and Sewerage Project".

In April 2011, the Japan International Cooperation Agency (JICA), together with the Public Works Department (PWD) of Goa State as the counterpart, commenced the "Capacity Development Project for Non Revenue Water Reduction in Goa" with a planned duration of 3 years. The project is currently slightly beyond mid-point; therefore, a Mid-term Review Survey team is being dispatched to review the progress of the Project.

1-2 Summary of the Project

Item	Narrative Summary	
Overall Goal	Non revenue water (NRW) is reduced in the State of Goa. Indicator: NRW ratio in the State of Goa (< 23%)	
Project Purpose	Capacity of PWD to reduce NRW is strengthened. Indicator 1: NRW ratio in the pilot areas (< 20%) Indicator 2: Number of NRW reduction initiatives undertaken by PWD outside of the pilot areas	
Outputs	[Output 1] Long-term/ Annual NRW Reduction Plan for the entire state is formulated	[Activity1-1] Study and analysis of the present state-wide NRW situation
		[Activity1-2] Review of Roll-out Plan proposed in the JICA Development Study
		[Activity1-3] Review of Action Plan proposed in the JICA Development Study
		[Activity1-4] Formulation of Long-term NRW Reduction Plan
		[Activity1-5] Formulation of Annual NRW Reduction Plan
		[Activity1-6] Monitoring of the implementation of Annual NRW Reduction Plan
	[Output 2] NRW reduction in pilot areas is planned and implemented	[Activity2-1] Selection of pilot area
		[Activity2-2] OJT (on-the-job training) on preliminary works for NRW reduction in pilot areas (1) Zoning of survey areas and preparation of maps & drawings (2) Training on the use of survey tools & equipment (3) Procurement of materials (pipes, valves, etc.), if required (4) Physical isolation of the pilot zone (5) Analysis on the present condition (estimation of the monthly billed water; measurement of bulk flows; estimation of the baseline NRW ratio in the zone) (6) Division of the zone into several District Meter Areas (DMAs)
		[Activity2-3] OJT on the following on-site works for NRW reduction in each DMA (1) Physical isolation of DMAs and analysis of the present condition (2) Detection & repair of leakage (3) Replacement of distribution & service connection pipes (4) Repair and replacement of meters (5) Legalization of unauthorized connections if any (6) Measurement of NRW reduction in each DMA
		[Activity2-4] Measurement of NRW reduction in the pilot zone
	[Output 3] Technologies and skills for NRW reduction are shared within PWD for the entire state	[Activity3-1] Preparation of a manual (1) Standardization of NRW reduction works (2) Formulation of a manual for NRW reduction
		[Activity3-2] Replication of the above NRW reduction activities to areas outside of the pilot zones by those who received the OJT training
		[Activity3-3] Organization of seminars

2. Objectives and methods of the evaluation

2-1 Objectives of the evaluation

To review actual inputs, activities and implementation process, and compare the project purpose and output achievement levels against the latest Project Design Matrix (PDM) and the Plan of Operations (P/O). Through sharing evaluation findings and discussion with the Joint Coordinating Committee (JCC) a consensus on a direction for the remaining period of the project should be achieved.

2-2 Methods of the evaluation

Review activities were conducted by the Team which was composed of both Japanese and Indian members. Activities included reviewing project documents, such as the Record of Discussions (R/D), the latest PDM (Annex-1), the PO and progress reports, minutes of meetings, questionnaire survey, interviews and discussions with the people and parties concerned. The Team undertook a series of site visits/interviews which included all pilot areas (Currtorim, Ponda and Moira-Assonora). The results obtained from the site visits were used to scrutinize consistency with interviews held with project experts and counterparts of PWD.

The Team analyzed the collected data based on an examination of the project performance and implementation process, and the five evaluation criteria listed in the following table.

(1) Examination of the project performance and implementation process

Examination of the project performance	・ Were the inputs implemented as planned? ・ Were the outputs produced as planned? ・ Will the project purpose be achieved? ・ Is there any prospect that the overall goal will be achieved?
Examination of the project implementation process	・ Were activities implemented as planned? ・ Were there any problems in the method for capacity development? ・ Were there any problems in the project management system? (i.e. monitoring, communication within the project, etc.) ・ Does the project have a high recognition level within implementing organizations and counterpart organizations? ・ Did any problems occur during the process of implementing the project, or any other factors that influenced effectiveness?

(2) Five Evaluation Criteria

Items	Difinitions
Relevance	Relevance of the Project is reviewed by the validity of the Project Purpose and Overall Goal in connection with the Government development policy and the needs of the target groups and/or ultimate beneficiaries in the Philippines.
Effectiveness	Effectiveness is assessed as to what extent the Project has achieved its Project purpose, clarifying the relationship between the Project Purpose and Outputs.
Efficiency	Efficiency of the Project implementation is analyzed with emphasis on the relationship between Outputs and Inputs in terms of timing, quality and quantity.
Impacts	Impact of the Project is assessed in terms of positive/negative, and intended/unintended influence caused by the Project.
Sustainability	Sustainability of the Project is assessed in terms of institutional, financial and technical aspects by examining the extent to which the achievements of the Project will be sustained after the Project is completed.

(Source: JICA Project Evaluation Guideline, 2004, JICA)

2-3 Procedures of the Mid-Term Review

(1) To review and analyse progress of the project including, the appropriateness of inputs and the level of achievement of project objectives and outputs.

(2) To examine and agree upon evaluation questions, and to create an Evaluation Grid in accordance with the five evaluation criteria (Relevance, Effectiveness, Efficiency, Impacts and Sustainability).

(3) To evaluate and analyse the project based on the results of a questionnaire, site visits and interviews with concerned parties, with the goal of creating a comprehensive evaluation report.

(4) To inform the Indian and Japanese sides of the results of the survey and to sign a Minutes of Meeting (M/M) after both parties have agreed upon the results.

2-4 Members and schedule of the Team

Japanese side		
Name	Designation	Title and Affiliation
Hiroshi SUZUKI	Leader	Japan International Cooperation Agency (JICA) India Office Senior Representative
Sadanobu SAWARA	Technical Advisor	JICA Senior Advisor (Global Environment Department)
Emi DOYLE	Cooperation Planning	JICA India Office Programme Specialist
Mihir SORTI	Cooperation Planning	JICA India Office Lead Development Specialist
Atsuko ORIMOTO	Evaluation Analysis	Japan Development Service Co., Ltd. Consultant, Consulting Division

Goa side		
Name	Designation	Title and Affiliation
A.M. Wachasundar	Evaluation Analysis	Project Director JICA ODA Loan/Technical Cooperation Project Public Works Department
D.J.S. Borkar	Evaluation Analysis	Project Manager Public Works Department Chief Engineer-I
A.A Patil	Evaluation Analysis	Project Coordinator Public Works Department Superintending Engineer VI
G.M.N. Parrikar	Evaluation Analysis	Senior Project member Public Works Department Executive Engineer XXIV

2-5 The Schedule of the evaluation

Date		Activities
4 Feb.	Mon.	• Meeting with JET Experts • Meeting with Joint Evaluation Committee • Meeting with JET Experts • Meeting with Project Director
5 Feb.	Tue.	• Meeting with Project Manager • Meeting with Project Coordinator and Project • Workshop (Progress presentation by Team 1,2,3,4 and 5) • Interviews with team leaders (Team 1 and Team 2) • Interviews with team leaders (Team 3, Team 4, and Team 5)
6 Feb.	Wed.	• Site visit and interviews (Team 3: Currtorim) • Site visit and interviews (Team 4: Ponda)
7 Feb.	Thurs.	• Site visit and interviews (Team 5: Moira-Assanora) • Documentation
8 Feb.	Fri.	• Follow up of Team 4 interviews • Meeting with Resident Project Manager for Loan Project 'The Project for Water Supply and Sewage development in Goa'
9 Feb.	Sat.	• Preparation of the Evaluation Report
10 Feb.	Sun.	• Preparation of the Evaluation Report
11 Feb.	Mon.	• Meeting with JET • The 1st Joint Evaluation meeting
12 Feb.	Tue.	• Site visit (Team 3: Curitorim)
13 Feb.	Wed.	• Meeting with JET • The 2nd Joint Evaluation meeting
14 Feb.	Thurs.	• The 3rd Joint Evaluation meeting • JCC meeting
15 Feb.	Fri.	• Report to JICA India Office

3. The Project Performance and the Project Implementation Process

3-1 The Project performance

3-1-1 Input

(1) Japanese side

The Team considers that overall inputs by the Japanese side have been appropriate in quality, quantity and timing. However, the Indian side expressed a concern that, without JET, it would be difficult to maintain a similar level of progress, prior to PWD starting separate cells for NRW reduction.

A summary of inputs by the Japanese side is as follows. Details of the inputs are shown in the Evaluation Grid (Annex-2) and the inputs from JICA's side (Annex-6).

Inputs by the Japanese Side, Planned and Actual

Plan (as per R/D of September 2010)	Actual (as of January 2013)
Teams of experts (numbers, duration, and expertise were not specified)	Teams of experts (Shuttle type of dispatch. Duration and timing of dispatch were confirmed between experts and counterparts after consideration of other aspects of the Project, such as, equipment, training and counterparts' schedule.) - One (1) Chief Advisor / Water Supply Planning - One (1) Deputy Chief Advisor - One (1) NRW Reduction - One (1) Leak Detection 1 - One (1) Leak Detection 2 - One (1) Organisational Dissemination
Equipment and materials - Listening Rod - Leak Noise Detector - Portable Water Pressure Gauge and Recorder - Metal Pipe and Cable Detector - Metal Locator - Ultrasonic Flow Meter (The details will be subject to change depending upon the subsequent decision making process of JICA during the course of the Project)	Equipment and materials - 30 listening rods - 24 leak noise detectors - 15 portable water pressure recorders - 24 pipeline & cable locators - 15 metal locators - 15 Ultrasonic pipe wall thickness meters - 16 sets of gate valves (size: 50 – 300mm) - 16 sets of electromagnetic flow meters (size: 50 – 300mm) - 17 items including office equipment such as PCs, copiers, etc. Actual expenses of the Project for equipment and materials to date: approx.: 18,898,318(Rp.)[1] (See Annex-6)

[1] Equipment purchased in USD and JPY is calculated with the rate of 1 INR = 1.72 JPY

Plan (as per R/D of September 2010)	Actual (as of January 2013)
Activity cost - Cost of training in Japan and in Goa (except for domestic transportation cost of trainees) - Production cost of training, educational and promotional materials	Activity cost (See Annex-6) - A total of 31 persons were trained on courses in Japan. - Workshops in country[2]: a total of 6 workshops were held and total of 233 participants attended the workshops in Goa. (See Annex-6) (See Annex-6)
Operational cost Not mentioned	Operational cost - Office space and Utility cost of the project office (electricity, water, communication, etc.) - Salary of support staff - Other general expenses Actual expenses of the Project for operational cost to date: : approx.: 5,639,534(Rp.)[3]

(2) Goa side

The Team considers that overall inputs by the Indian side have been appropriate both in quantity and timing.

A summary of inputs by the Indian side is as follows. Details of the counterparts are shown in the list of Counterparts (Annex-5)

Inputs by the Indian Side, Planned and Actual

Plan (as per R/D of September 2010)	Actual (as of January 2013)
Human resources - 6 counterparts are stipulated as project management members - Additional assignment of counterpart personnel will be assigned as needs arise	Human resources - One (1) Project Director - One (1) Project Manager - One (1) Project Coordination Officer - Ten (10) Central NRW Control Unit Members - Total no. of 57 personnel is listed as counterparts for field activities (active members: approx. 40). Two members got transferred, but one is still active on site. (See Annex-5)

[2] The cost of workshops in country is funded by PWD except the venue fee of the first workshop.
[3] Rate used: 1 INR = 1.72 JPY

Plan (as per R/D of September 2010)	Actual (as of January 2013)
Facilities - Project office space and facilities near PWD headquarters - Three (3) liaison office spaces for implementation of pilot projects nearby each pilot area - Other facilities that are necessary and mutually agreed for implementation of the Project	Facilities - Project office space and facilities have not been provided by the Indian Side - Three (3) liaison offices spaces have been provided for pilot areas.
Activity cost - Salaries and other allowances including transportation cost, accommodation and honorarium for Indian counterpart personnel, if necessary, for training to be conducted in the Project. - Budget allocation for NRW reduction works under the pilot projects	Activity and material cost - The cost in relation to six (6) workshops including travel expense for the participants - Travel expense for on the field training and other NRW reduction activities - Construction of pits (56 pits in three pilot areas) - Material to repair the detected leakage - Home meters Estimated expenses of activity and material cost to date: approx.. 20 million Rp.
Others Provision of necessary data and information to the Japanese side	Others Provision of necessary data and information to the Japanese side

3-1-2 Outputs

The Project struggled to carry out many scheduled activities on time, due to the election at the beginning of the Project. However, the Team considered that a notable recovery had been made during the last seven months, and some indicators have been accomplished in accordance with the latest PDM (signed on the 7th of September, 2010).

There are some indicators that may not be appropriate for assessing the achievement of outputs (details described in the relevant paragraph below).

<Output 1> Long-term/ Annual NRW Reduction Plan for the entire state is formulated.

Some of the activities have been completed, and the Long-term NRW Reduction Plan for the entire state is now in the refining stage. A draft Annual NRW Reduction Plan will be introduced and implemented in the third year of the Project, after consultation with and the approval of PWD.

No indicator to verify the effect of the activity "1-6 Monitoring of the implementation of Annual NRW Reduction Plan" is included under this output.

Indicator 1-1 Formulation of Long-term NRW Reduction Plan

The Long-term NRW Reduction Plan is currently version 1.8, and is about to complete. This indicator will most likely be achieved soon.

Indicator 1-2 Formulation of the first Annual Action Plan for NRW reduction

The first Annual Action Plan for NRW Reduction is about to be created. This indicator will most likely be achieved.

<Output 2> NRW reduction in pilot areas is planned and implemented.

A combination of several factors has caused a delay in the progress of Output 2; however, most activities under this output are now proceeding well. All the counterparts interviewed were confident that ***Output 2*** will be attained soon.

Indicator 2-1 Number of participants in pilot projects

There were motivational problems at the beginning of the Project. Most participants found it difficult to manage a doubled work load; however, team leaders confirmed that most counterparts are now committed to the Project, and, with support and recognition from their managers, the number of participants who are actively involved in pilot projects has been increased.

This indicator needs to be more specific and made verifiable.

Indicator 2-2 Measurement of NRW ratio in the pilot areas

Initial NRW ratio in the pilot areas has been measured. This indicator has been accomplished.

This indicator needs to be more specific and made verifiable.

Indicator 2-3 Measurement of NRW reduction rate in the pilot areas

The NRW reduction rate will be measured after all the activities are complete, such as, construction of pits, replacement of non-working home meters, leakage detection and repair work for leakages.

This indicator needs to be more specific and made verifiable.

<Output 3> Technologies and skills for NRW reduction are shared within PWD for the entire state.

Most activities are planned to be undertaken in the third year. All the counterparts interviewed were confident that Output 3 will be attained before completion of the Project.

Indicator 3-1 Distribution of manuals in PWD

A user-friendly Manual/Handbook for NRW reduction will be formulated soon. The team leaders for Team 1 and Team 2 recommended that the manual should be treated as mandatory for all PHE staff members and revised on demand.

This indicator needs to be more specific.

Indicator 3-2 Number of Sub-Divisions which initiate their own NRW reduction activities

Nine (9) areas (plus 2 candidate areas) have been appointed to initiate NRW reduction activities. Most activities are planned for the third year; however, it will be necessary to proceed with procurement in advance for the smooth implementation of the project.

This indicator seems similar to the ***Indicator 2 Number of NRW reduction initiatives undertaken by PWD outside of the pilot areas*** from the Project Purpose. This indicator needs to be more specific and made verifiable.

Indicator 3-3 Number of participants to the seminar

Total numbers of 233 participants have already participated in six workshops, and 3 more seminars are planned to be held.

This indicator needs to be more specific and made verifiable.

3-1-3 Achievement of the project purpose

<Project Purposes> Capacity of PWD to reduce NRW is strengthened.

Overall, the level of attainment of outputs seems adequate, with all team members and most counterparts interviewed confident that both indicators under the Project Purposes should be accomplished, thus, the Project Purposes will be achievable at completion of the Project. However, these indicators may be insufficient to fully assess the achievement of the Project.

Indicator 1 NRW ratio in the pilot areas (< 20%)

It is too early to assess accomplishment of this indicator; however, all team members and most counterparts interviewed were confident that this indicator will be accomplished before completion of the Project.

Indicator 2 Number of NRW reduction initiatives undertaken by PWD outside of the pilot areas

Nine (9) areas (plus 2 candidate areas) have been appointed to initiate NRW reduction activities outside of the pilot areas.

This indicator seems similar to ***Indicator 3-2 Number of Sub-Divisions which initiate their own NRW reduction activities*** from Output 3. This indicator needs to be more specific and made verifiable.

3-1-4 Prospect of achieving the overall goal

<Overall Goals> Non revenue water (NRW) is reduced in the State of Goa.

It remains too early to assess if the Project will have achieved the Overall Goals three years after project completion. However, the Team strongly suggests that the target rate should be reviewed, in light of the alteration of baseline data (30% to 42%).

Indicator NRW ratio in the State of Goa (< 23%)

This NRW ratio is discrepant with the ratio in the latest draft Long-term NRW Reduction Plan. The target NRW Reduction ratio in the Long-term NRW Reduction Plan is 2% per year, and therefore it will not be possible to achieve 23% until year 2022 (8 years after completion of the Project). It will be necessary to adjust the figure for the latest plan.

3-2 The Project implementation process

3-2-1 Activities

Although there was a substantial delay at the beginning of the Project, the Team confirmed that the Project has begun to improve, and many activities are currently underway. Details of activities are shown in the Plan of Operation (Annex-3).

3-2-2 Methods of technical transfer

The Project has provided a package of comprehensive technical coverage. There have been combined activities with regard to technology transfers, such as, JICA trainings in Japan, OJT, seminars and workshops by JET staff members. No problems were found with the methods used for technology transfers, and all activities relating to the transfers were highly regarded by the counterparts concerned.

Satisfaction levels seemed very good regarding assistance received from all methodologies. However, there was some reference to the challenges caused by the burden of both routine work and the NRW reduction work necessary to carry

out successful implementation of the project, such as night leak detection work.

3-2-3 Project management aspects

The Team confirmed that there had been problems, at the beginning of the Project, due to insufficient involvement of senior/middle management of PWD. However, the situation dramatically changed after the Project Manager, Chief Engineer-I, issued an order to create a Central NRW Control Unit consisting of all Superintending Engineers and Executive Engineers. Therefore, the Team considered that there were no current problems with project management.

At the initial stage of the Project, there was little involvement and interest amongst senior and middle management of PWD, due to; i) the concept of NRW being new in Goa (and in India), and the importance of NRW reduction was unappreciated, also; ii) the Project's explicit target of enhancing technical skills and knowledge of Assistant Engineers and Junior Engineers at Sub-Division level. Only very limited participation was observed in the beginning of the Project, as the Project's activities were considered as being outside of their normal duties. Many Assistant Engineers and Junior Engineers struggled with project participation, not only due to the burden of routine work but also, due to lacking understanding and support from their seniors.

As has previously been described, this problem was resolved by the Project Manager, Chief Engineer-I, establishing a Central NRW Control Unit, membership of which, consists of all Superintending Engineers and Executive Engineers. The Unit holds monthly meetings to, review progress achieved, schedule tasks/targets ahead, and to identify problems or difficulties inhibiting implementation of the Project.

JET acts as the Member Secretary for the Committee and it was unanimously agreed that the Japanese experts and counterparts have worked very closely together and that the work of the Japanese experts was highly appreciated by the counterparts.

3-2-4 Project recognition

All the personnel from the counterpart organisations interviewed, and those which returned the questionnaire, had a high recognition level with regard to the Project. The Secretary of PWD was aware of the Project, and expressed his appreciation of the cooperation of JICA in this sector.

3-2-5 Promoting factors influencing the effectiveness of the Project

Goa is abundant with water, and is aiming to become the first state in India to achieve 24 x 7 (24 hours a day and 7 days a week) water supply throughout the

state. Since NRW reduction has started to be recognised as a crucial element necessary to achieve a 24 x 7 water supply; potentially, this will draw more commitment from Goa State towards support of its activities.

All counterparts interviewed expressed their enthusiasm and emphasise the importance of the Project. With the strong project management, through the Central NRW Control Unit, it has become strong promoting factor.

3-2-6 Prohibiting factors influencing the effectiveness of the Project

It was unanimously agreed that the election, held during the first year of the Project, affected the pilot areas' activities greatly. All tendering processes were stopped for six months and, in some pilot areas, the house hold survey had to be halted because of safety concerns (the activity could have been viewed as political promotion). This delay was so significant that the Project is still recovering; however, all counterparts interviewed were confident that they will soon be able to complete all the activities within the pilot areas.

PWD provided 57 listed counterparts for field training; however, they are not exclusively NRW officers, and it is physically and mentally challenging to manage a doubled work-load without incentives. The increased support and interest from their managers has made it possible for them to participate with the activities; however, all team members interviewed shared the view that this is unsustainable over the longer term. The doubled burden placed on the Technical Assistants and Junior Engineers could negatively affect the long term effectiveness of the Project.

3-2-7 Collaborative activities

The Project was designed to complement water supply component of a Yen-Loan Project, "Goa Water Supply and Sewerage Project". Original demarcation of two projects is shown in table below.

	Loan Project (WS component)	Technical Cooperation Project (TCP)
Target Area	• Salalium Water Supply Scheme • State wide (Publication and awareness)	• State wide (Long and Short term Plan, manual) • Pilot projects at Salalium, Opa, and Assonora)
NRW activities	• Installation of meters • Installation of flow meters, control valves and float valves • Procurement of NRW equipment • Asset management / GIS mapping • Publication and awareness	• Formulation of Long and Short term Plan • Implementation of OJT through pilot projects • Support for expansion of the NRW reduction activities outside of the pilot areas • Creation of a manual

		• Procurement of NRW equipment for pilot projects
Collaboration	• The pipe network extended and rehabilitated by the Loan Project shall be included in the Long-term NRW Plan. • Capacity building will be under the Technical Cooperation Project (OJT, manual) • Publication and awareness will include pilot areas to promote water conservation and the reduction of illegal connection. • The equipment for NRW procured by the Loan Project shall be utilised by PWD to implement NRW activities outside of pilot areas.	

(Source: The Report for Detailed Plan Survey on Capacity Development Project for Non Revenue Water Reduction in Goa, 2010, JICA)

All, senior counterparts, JET members, and the Resident Project Manager of the Loan Project, agreed that both projects were complementary, and collaborate in accordance to the designed demarcation. Particularly, both projects worked closely for GIS mapping, since the Loan Project needs data collected by the Project. Moreover, the brochure created and printed by the Loan Project was utilised during the house hold survey of the pilot areas. Team members from the pilot project expressed the view that it was helpful to have such promotional materials to raise customers' awareness of NRW thus promoting water conservation.

The Resident Project Manager of the Loan Project emphasised the importance of capacity building in PWD, and noted that the assistance provided by the Project was worth-while. The Project Manager, Chief Engineer-I, stated that the Project might have a positive impact on motivating the Loan Project towards accelerating its progress.

4. Evaluation results in accordance with the Five Evaluation Criteria

The evaluation was conducted based on the Five Evaluation Criteria (Relevance, Effectiveness, Efficiency, Impact, and Sustainability). The detailed results of the evaluation are presented in the Evaluation Grid (Annex-2) and summarized below.

4-1 Relevance

The Project is highly relevant for the following reasons:

4-1-1 Consistency with the development plan of India and Goa

Water has been one of the priorities in the development plan of both India and Goa, and the Project is consistent with the Five Year Plans of both India and Goa.

In the Eleventh Five Year Plan 2007-2012, the Indian Government stated that the targets of Rural Water Supply was "to provide clean drinking water for all" and "to provide 100% coverage of water supply to rural schools", and that the target of Urban Water Supply as being "to provide 100% water supply accessibility to the entire urban population".

The Twelfth Five Year Plan 2012-2017 has been drafted and the importance of "water" has increased emphasis in comparison with the 11th Plan. Moreover, 25 core indicators, from 7 sectors, such as, Economic Growth, Poverty and Employment, Education, Health, Infrastructure, Including Rural Infrastructure, Environment and Sustainability, and Service Delivery, are used to reflect a vision of rapid, sustainable and more inclusive growth. The indicator of water is listed under, Infrastructure Including Rural Infrastructure, as being "Ensure 50 per cent of rural population has access to 55 LPCD (litter Per Capita Day) piped drinking water supply and 50 per cent of *gram panchayats* achieve the Nirmal Gram Status by the end of Twelfth Five Year Plan".

In the Eleventh Five Year Plan 2007-12 of the Government of Goa, the objectives of water supply are (i) to increase the supply level to 100 LPCD in rural areas and 150 LPCD in urban areas together with emphasis for 24x7 water supply in the Eleventh Plan Period, (ii) to provide assured source of drinking water supply in rural areas priority to partially covered habitations to attain 100% coverage of water supply.

4-1-2 Appropriateness of the target group and the consistency with the needs of the people

Goa is a popular tourist destination both internationally and domestically, and a stable water supply is essential to keep the industry competitive.

The target group was selected by PWD, and no one expressed any objections. "PWD staff members related to NRW reduction" are recognised as being the target group in PDM. The Project, in particular, targeted Technical Assistants and Junior Engineers to transfer skills and knowledge. These are the engineers responsible in-the-field, and seemed to be the most suitable recipients for the Project. However, there appears to be a necessity for greater awareness of NRW across all level of PWD, and it may be more appropriate to include all levels of PWD staff members working on water and sanitation.

The people living in the three pilot areas will be direct beneficiaries from the results of the Project, and they should be included in the target group.

4-1-3 Consistency with Japan's policy for assistance

The 'Country Assistance Program for India' (as of January 2006), specifies three priority areas; these being, "the Promotion of Economic Growth", "Improvement of Poverty and Environment Issues" and "the Expansion and Enhancement of Human Resources Development and Exchange".

In the Rolling Plan (as of June 2011), "the Promotion of Economic Growth", "Poverty Reduction and Social Sector Development", and "Environment, Climate

Change and Energy" appear to be upgraded priority areas. The Project was recognized under "Water Quality and Water Resource Management Programme" which is categorized in "Conservation and Improvement of Urban Environment" under a priority area, "Environment, Climate Change and Energy".

4-1-4 Comparative superiority of Japanese technology and experience in NRW reduction

Japan's NRW ratio is approximately 10%, which is one of the lowest levels in the world. Moreover, JICA has also been implementing NRW reduction projects in countries, such as Jordan, Brazil, and Bangladesh, and it has accumulated experience with assisting in this field.

4-2 Effectiveness

The duration of the Project is about two thirds of the way towards completion, and some effectiveness has already started to emerge, despite a substantial delay at the initial stage of the Project.

4-2-1 Achievement level of the Project Purpose

There is good prospective to achieve the Project Purpose before the completion of the Project, if all the procurements of equipment, materials and construction of pits for nine additional areas are completed as planned, as described in the ***Achievement of the project purpose (3-1-3)*** and also in the Evaluation Grid (Annex-2).

4-2-2 Contribution of Outputs for achieving Project Purposes

There are three Outputs designed to achieve the Project Purposes. All three Outputs correlate with the Project Purpose, however additional indicators are necessary to assess the attainment of some of the Outputs.

4-2-3 Factors inhibiting or promoting the progress of the Project

Several factors could have affected progress of the Project and these are described in ***Promoting Factors influencing the effectiveness of the Project (3-2-5)***, and ***Prohibiting Factors influencing the effectiveness of the Project (3-2-6)***.

4-2-4 Correctness of Important Assumptions at the level of Outputs

The Loan Project is not on schedule; however, the Project has found alternative ways to overcome this situation. "The Loan Project is implemented as scheduled" may no longer be a relevant assumption.

4-3 Efficiency

The efficiency of this Project was assessed as fair due to the following reasons:

4-3-1 Level of achievement of Outputs

There were some delays to produce outputs being implemented fully as planned, as described in ***Output (3-1-2)*** as well as in the Evaluation Grid (Annex-2). However, most activities are progressing well, and there is good prospective to attain the Outputs of the Project.

4-3-2 Quality, quantity and timing of Inputs to achieve Outputs

As described in ***Input (3-1-1),*** most inputs were appropriate in quantity and quality; however, timings for some inputs were delayed.

Materials and equipment preparation by the Goa PWD side, and the contracting of pit construction, were delayed due to the complex procurement processes required in India and also by the pause caused by the elections held in 2011. Most equipment provided by JICA was timely, except for the electromagnetic flow meters and gate valves, which JICA accepted as an additional request from Goa PWD. Due to complicated procurement rules, for the third country purchases, the provision of electromagnetic flow meters and gate valves became delayed.

A total of 57 counterparts are listed as pilot project team members, and approximately 40 members are actively involved with the Project. Since they are permanent staff members from Sub-Divisions, they already have full-time routine work, and it is not realistic to assume that they can be assigned as "full-time" counterparts as initially anticipated in the R/D. Active involvement by counterparts is essential in this project and motivation levels amongst counterparts has grown, with a noticeably larger numbers of committed members, than at the initial stage of the Project.

4-3-3 Collaboration with the Yen Loan Project

As described in ***Collaborative activities (3-2-7)***, the Project is complementary to the Yen Loan Project, "Supply and Sewage development in Goa", and this contributes towards efficiency through the demarcation of work.

4-2-4 Correctness of Important Assumptions at the level of Activities

The existing important assumption, "Inputs by Indian side are secured and placed for the Project implementation" is still valid. It would be recommendable to add "Senior management of PWD continue with its commitments and support for the Project" and "Major political event(s) do not occur and/nor halt the Project".

4-4 Impacts

It is too early to fully examine Impacts of the Project; however, the Team observed that some positive impacts have been emerging.

4-4-1 Prospective to achieve the Overall Goal of the Project

It appears too early to reasonably assess a probability for achieving the overall goal as described in the ***Achievement of the overall goal (3-1-4)*** and also in the Evaluation Grid (Annex-2).

4-4-2 Positive and/or negative impacts

There were no negative impacts observed in the Project. Positive impacts are listed as follows:

- Awareness of the importance of saving water and NRW reduction has been spread among users, meter readers, and plumbers in the pilot areas.
- Engineers in the Sub-Divisions learnt of the problems and needs of users directly through the House Hold Survey (HHS) and, potentially, this will improve the quality and service delivery of water supply in the future.
- Some of the counterparts have started to share and teach the skills and knowledge, acquired through technical transfers from the Project, to colleagues and plumbers in their Divisions and/or Sub-Divisions and this may potentially create a spill-over effect.
- Some of the counterparts have voluntarily started NRW reduction activities, including HHS, outside of their pilot areas.
- Through strengthening the capacity of PWD, regarding NRW water supply infrastructure outside of the pilot areas; including water supply infrastructure from the Loan Project, future management and maintenance should be more appropriate and effective.

4-4-3 Correctness of Important Assumptions at the level of Project Purpose

Both Important Assumptions remain valid; however, one of the Important Assumptions "PWD does not make changes in its NRW reduction plan" could be altered to authorise aspects of the Plan; i.e. "The Long-term NRW Reduction Plan is approved by, adopted, and becomes effective within PWD".

4-5 Sustainability

It may be too early to fully assess the level of Sustainability; however, potential Sustainability of the Project seems reasonably high, as long as some of the conditions described below are met within a reasonable time span.

4-5-1 Political and institutional aspects

The State of Goa remains committed towards achieving 24 x 7 (24 hours a day and 7 days a week) water supply across the entire state (a first in India). Since NRW reduction has begun to be seen as an essential part of achieving a 24 x 7 water supply, support for NRW reduction will most probably remain consistent.

Although the Project faced difficulties at the initial stage of the Project, PWD Goa is seen as a capable and committed counterpart organisation to work alongside. In the draft Long-term NRW Reduction Plan (ver.1.8), the organisational change, for the establishment of separate cells, has been included. All the people interviewed unanimously agreed that dedicated, separate resources, to support and manage NRW reduction activities will be essential to ensure sustainability after completion of the Project.

4-5-2 Financial aspects

Historically, Water and Sanitation has enjoyed a prioritized budget allocation within PWD. The range of budget and actual expenditure for Water and Sanitation has been within 30,000 – 46,000 Rs. (in lakhs) since the fiscal year 2009-10. However, as a ratio within the total PWD budget this is decreasing. There is an expectation to establish new cells, and this aspect should be carefully monitored.

The Loan Project contains a NRW component and it is hoped that this will secure the necessary inputs and provide support towards future development of newly established NRW reduction cells.

4-5-3 Technical aspects

The Project has provided a comprehensive package of technical transfers, including training in Japan, as well as OJT, seminars and workshops by JETs. Furthermore, a long-term / Annual NRW Reduction Plan is about to be finalised together with an initial version of a NRW reduction manual created in a way that staff members can easily utilise in the field. It is deemed that the technical package has contributed towards enhancing sustainability of technical aspects of the Project.

The capacity of the counterparts has been greatly enhanced and they now appear confident in their ability to continue with technical aspects of NRW reduction activities after completion of the Project; even if this is at a somewhat reduced level. A significant concern remains that all counterparts have other full-time duties, and it may prove extremely difficult for them to further enhance NRW reduction activities without some form of additional NRW reduction

management, the area in which JET is currently undertaking primary responsibility.

5. Conclusions and Recommendations

5-1 Conclusions

Conclusions are based on a series of interviews and discussions with counterparts together with a questionnaire and literature review.

The Project experienced serious delays and a number of setbacks during the initial stage; partially, due to somewhat limited interest amongst staff members of PWD. However, JICA trainings in Japan and JET's input within the country (OJT and workshops), together with a Central NRW Control Unit under the chairmanship of Chief Engineer-I, achieved enthusiasm of counterparts and created positive attitude towards the Project. Therefore, now the Project is progressing well, and the Team concluded that the overall level of achievement on the Project is satisfactory, as at the mid-term review juncture. In order to ensure achievement of the Project Purposes by completion of the Project, the following recommendations are made for consideration.

5-2 Recommendations

(1) Early preparation of procurement: Recommendation to PWD

Procurement of materials and equipment, and contracting of pit construction for three pilot areas, was delayed due to the complex procurement processes required in India and also, due to the elections held in 2011. In light of this, the Team recommends that the procurement processes start as soon as possible for the nine areas outside of the initial pilot areas, so that the procurement of all necessary equipment and construction of pits completed by the end of May 2013.

(2) Budget allocation and mechanism of NRW reduction: Recommendation to PWD

To assure sustainability of the achievements of the Project, it is highly recommended that a budget allocation towards NRW reduction activities and the creation of NRW reduction cells, be realised as soon as possible, even before the completion of the Project.

(3) Increase input level: Recommendation to JICA

The Project has recently started to recover from serious delays and a number of setbacks during the initial stages, to further strengthen this recovery, it would be highly advisable to increase the level of Japanese experts' input from JICA into the Project.

(4) Further dialogue for deciding the future direction of the NRW reduction: Recommendation to JICA/PWD

All people interviewed appealed for JICA to continue with its involvement in NRW reduction. Therefore, the Team suggests that both JICA and PWD continue their dialogue regarding future cooperation in this field.

(5) Review and minor changes of the PDM: Recommendation to JET/JCC

It is highly recommended that a review of indicators in the current PDM be undertaken immediately as shown in ***Annex-8 Suggestion and/or reasons for revising the PDM.***

(6) Workshop quality Assessment: Recommendation to JET

To accurately assess the satisfaction levels of the workshops held by JET, it is advised, that in future, a short questionnaire for participants to complete at the end of each workshop be produced.

(END//)

4th JCC

MINUTES
OF
THE 4th JOINT COORDINATION COMMITTEE MEETING
ON
THE PROJECT FOR CAPACITY DEVELOPMENT
ON NRW REDUCTION IN GOA

The forth Joint Coordination Committee (hereinafter referred to as "JCC") meeting was held on 14th May, 2013 at the office of the Project Director JICA Project, Public Works Department, Altinho, Panaji, Goa under the Chairmanship of Project Director JICA Project, Public Works Department (hereinafter referred to as "PWD), State Government of Goa. The list of officers presented is as per Annex – 2.

Both side agreed to make this Minutes of Meeting in order to confirm the mutual understanding reached through the discussion as attached hereto.

May 2013
Panaji, India

Mr. A. M. Wachasundar
Project Director of JICA Project,
Public Works Department
Government of Goa

Ms. Emi Doyle
Programme Specialist
JICA India Office

ATTACHED DOCUMENTS

As a result of the meeting, the Committee agreed on the following points.

1. Revision of Project Design Matrix (PDM)

The meeting discussed about “Annex-8 Suggestions for revising the PDM” included in “JOINT MIDTERM EVALUATION REPORT ON JAPANESE TECHNICAL COOPERATION FOR CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER REDUCTION IN GOA, Panaji, February 2013, Japan – India Joint Midterm Review Team” and all parties agreed to revise the PDM as attached as Annex -1 of these minutes.

2. Work Plan of the 3rd Fiscal Year

JICA Expert Team explained the Work Plan of the 3rd fiscal year and all parties confirmed that DMA activities, major activities of the 3rd fiscal year, should be completed by the end of December 2013. Regarding remaining work from the last 2nd fiscal year, Pilot Project Activities, all parties agreed to complete these work by the end of June 2013.

Annex – 1 Revised Project Design Matrix (PDM)

5th JCC

MINUTES OF MEETING
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF INDIA
ON JAPANESE TECHNICAL COOPERATION
FOR
CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER REDUCTION IN GOA

The Japanese Terminal Evaluation Team (hereinafter referred to as "the Japanese Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") visited Goa from the 18th to 22nd of November 2013 for the purpose of conducting a terminal evaluation of "Capacity Development Project for Non Revenue Water (NRW) Reduction in Goa" (hereinafter referred to as "the Project").

During its stay in Goa, the Team evaluated the progress and achievement of the Project and had a series of discussions including Joint Coordinating Committee (JCC) with the Public Works Department of Goa (hereinafter referred to as "PWD").

As a result of the discussions, the Japanese Team and PWD agreed to the matters in the documents attached hereto.

Panaji, 22nd November 2013

Mr. Tomohide ICHIGUCHI
Senior Representative
JICA India Office
Japan International Cooperation Agency
Japan

Mr. A.M. WACHASUNDAR
Project Director
Public Works Department
Government of Goa
India

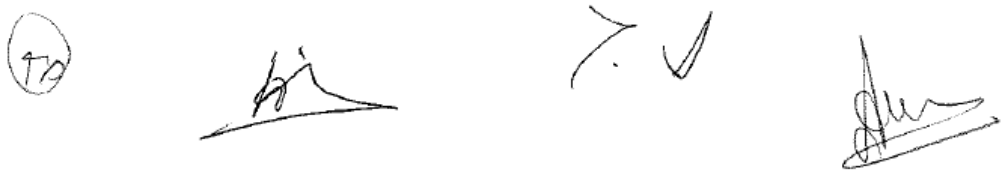
Mr. Sadanobu SAWARA
Senior Advisor (Global Environment Department)
Japan International Cooperation Agency
Japan

Mr. D.J.S. Borker
Chief Engineer-I
Public Works Department
Government of Goa
India

THE ATTACHED DOCUMENT

1. Both Indian and Japanese sides agreed on the contents of Joint Terminal Evaluation Report.

2. Both Indian and Japanese sides agreed to continue the dialogue regarding further cooperation in NRW reduction in Goa, and Indian side will inform the progress of recommendation stated in the Joint Terminal Evaluation Report; "To establish exclusive organisational set up under the control of Chief Engineer (PHE) consisting of Central NRW Control Unit and Regional NRW Reduction Cells with sufficient staff members and budget".



ATTACHMENT

JOINT TERMINAL EVALUATION REPORT

ON JAPANESE TECHNICAL COOPERATION

FOR

CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER REDUCTION IN GOA

Panaji, November 2013

Japan – India Joint Terminal Evaluation Team

Table of Contents

Abbreviations

List of Annex

Abbreviations

DMA	District Meter Area
F/S	Feasibility Study
GIS	Geographical Information System
GOI	Government of India
GOJ	Government of Japan
HHS	Household Survey
JCC	Joint Coordinating Committee
JET	JICA Expert Team
JICA	Japan International Cooperation Agency
MM	Minutes of Meeting
M/M	Man Months
NRW	Non-Revenue Water
NSC	Nihon Suido Consultants Co., Ltd.
OJT	On the Job Training
PDM	Project Design Matrix
PHE	Public Health Engineering
PO	Plan of Operation
PPA	Pilot Project Area
PWD	Public Works Department
R/D	Record of Discussion
TOT	Training of Trainers
TOR	Terms of Reference

1. Outline of the Project

1-1 Background of the Project

In the State of Goa, over recent years there has developed an urgent need to improve water supply and sewage systems due to an expanding local population and increasing levels of tourism; both of which have reinforced a general demand for a better standard of life. There are many challenges, such as, a shortage of water supply (average hours of water supply per day: 8 hours), lack of appropriate maintenance systems for the existing facilities, and pollution of underground and sea water due to inadequate sewage facilities.

JICA conducted a development study "The Study on Augmentation of Water Supply and Sanitation for the Goa State in the Republic of India" from March 2005 to November 2006, based on a request from the Government of India (GOI). In the course of the development study, a feasibility study (F/S) was carried out regarding the priority projects identified in the master plan for water supply and sanitation. Based on results from this feasibility study, a request for a Yen Loan Project "Goa Water Supply and Sewerage Project" was submitted to the Government of Japan (GOJ) by GOI in March, 2007, and, after examination, a Loan Agreement was mutually signed in September, 2007. Currently, the Loan Project is under implementation by the GOI.

In the development study, many problems regarding operation and maintenance of waterworks were pointed out. In particular, high levels of Non-Revenue Water (NRW) (at approximately 40%) was raised as a serious issue. To reduce the NRW level, the GOI requested implementation of the technical cooperation project "Capacity Development Project for Non Revenue Water Reduction in Goa" as a complementary project to the Yen Loan Project "Goa Water Supply and Sewerage Project".

In April 2011, the Japan International Cooperation Agency (JICA), together with the Public Works Department (PWD) of Goa State as the counterpart, commenced the "Capacity Development Project for Non Revenue Water Reduction in Goa" with a planned duration of 3 years. The project is expected to be completed in March 2014, and a Terminal Evaluation Team has been dispatched to evaluate the project.

1-2 Summary of the Project

Item	Narrative Summary	
Overall Goal	Non revenue water (NRW) is reduced in the State of Goa. Indicator: NRW ratio in the State of Goa reduces average of 2 % per year till reaching the target (< 23%).	
Project Purpose	Capacity of PWD to reduce NRW is strengthened. Indicator 1: NRW ratio in the pilot areas (< 20%) Indicator 2: NRW reduction initiatives are undertaken in nine (9) areas by PWD outside of the pilot areas Indicator 3: At least one staff in each sub-division is in a position to utilize the equipment to detect leakage without assistance. Indicator 4: At least one staff in each sub-division is confident to teach his/her colleagues and/or staff members the technique to conduct NRW reduction activities.	
Outputs	[Output 1] Long-term/ Annual NRW Reduction Plan for the entire state is formulated	[Activity1-1] Study and analysis of the present state-wide NRW situation
		[Activity1-2] Review of Roll-out Plan proposed in the JICA Development Study
		[Activity1-3] Review of Action Plan proposed in the JICA Development Study
		[Activity1-4] Formulation of Long-term NRW Reduction Plan
		[Activity1-5] Formulation of Annual NRW Reduction Plan
		[Activity1-6] Monitoring of the implementation of Annual NRW Reduction Plan
	[Output 2] NRW reduction in pilot areas is planned and implemented	[Activity2-1] Selection of pilot area
		[Activity2-2] OJT (on-the-job training) on preliminary works for NRW reduction in pilot areas (1) Zoning of survey areas and preparation of maps & drawings (2) Training on the use of survey tools & equipment (3) Procurement of materials (pipes, valves, etc.), if required (4) Physical isolation of the pilot zone (5) Analysis on the present condition (estimation of the monthly billed water; measurement of bulk flows; estimation of the baseline NRW ratio in the zone) (6) Division of the zone into several District Meter Areas (DMAs)
		[Activity2-3] OJT on the following on-site works for NRW reduction in each DMA (1) Physical isolation of DMAs and analysis of the present condition (2) Detection & repair of leakage (3) Replacement of distribution & service connection pipes (4) Repair and replacement of meters (5) Legalization of unauthorized connections if any (6) Measurement of NRW reduction in each DMA
		[Activity2-4] Measurement of NRW reduction in the pilot zone
	[Output 3] Technologies and skills for NRW reduction are shared within PWD for the entire state	[Activity3-1] Preparation of a manual (1) Standardization of NRW reduction works (2) Formulation of a manual for NRW reduction
		[Activity3-2] Replication of the above NRW reduction activities to areas outside of the pilot zones by those who received the OJT training
		[Activity3-3] Organization of seminars
	[Output 4] Knowledge and technologies/skills for NRW reduction can be shared with another state	[Activity4-1] Organization of workshops with another state

2. Objectives and methods of the evaluation

2-1 Objectives of the evaluation

The main purpose of the evaluation is to examine if the project can achieve the project purposes before ending in March 2014. Actual inputs, activities and the implementation process will be reviewed and compared with the project purpose and output achievement levels and against the latest Project Design Matrix (PDM) and the Plan of Operations (P/O). Through sharing evaluation findings and discussion with the Joint Coordinating Committee (JCC) a consensus on a direction for the remaining period of the project should be achieved.

2-2 Methods of the evaluation

Due to time constraints and the fact that a mid-term review was carried out only nine months ago the major part of the evaluation was undertaken as a document analysis and questionnaire survey prior to the field survey. The Joint Evaluation Team was composed of both Japanese and Indian members, and it verified the findings of the terminal evaluation through dialogue with people concerned with the Project. Documents analysed included the Minutes of Meetings from the Mid-term Evaluation, the Record of Discussions (R/D), the latest PDM (Annex-1), the PO and progress reports. The Evaluation Team undertook interviews with key personnel from the Project, and the results obtained from the interviews were analysed to scrutinize consistency with the draft Terminal Evaluation Report.

The Evaluation Team analysed the collected data based on an examination of the project performance and implementation process, and the five evaluation criteria listed in the following table.

(1) Examination of the project performance and implementation process

Examination of the project performance	・ Were the inputs implemented as planned? ・ Were the outputs produced as planned? ・ Will the project purpose be achieved? ・ Is there any prospect that the overall goal will be achieved?
Examination of the project implementation process	・ Were activities implemented as planned? ・ Were there any problems in the method for capacity development? ・ Were there any problems in the project management system? (i.e. monitoring, communication within the project, etc.) ・ Does the project have a high recognition level within implementing organizations and counterpart organizations? ・ Did any problems occur during the process of implementing the project, or any other factors that influenced effectiveness?

(2) Five Evaluation Criteria

Items	Difinitions
Relevance	Relevance of the Project is reviewed by the validity of the Project Purpose and Overall Goal in connection with the Government development policy and the needs of the target groups and/or ultimate beneficiaries in Goa.
Effectiveness	Effectiveness is assessed as to what extent the Project has achieved its Project purpose, clarifying the relationship between the Project Purpose and Outputs.
Efficiency	Efficiency of the Project implementation is analyzed with emphasis on the relationship between Outputs and Inputs in terms of timing, quality and quantity.
Impacts	Impact of the Project is assessed in terms of positive/negative, and intended/unintended influence caused by the Project.
Sustainability	Sustainability of the Project is assessed in terms of institutional, financial and technical aspects by examining the extent to which the achievements of the Project will be sustained after the Project is completed.

(Source: JICA Project Evaluation Guideline, 2004, JICA)

2-3 Procedures of the Terminal Evaluation

(1) To review and analyse progress of the project including, the appropriateness of inputs and the level of achievement of project objectives and outputs.

(2) To examine and agree upon evaluation questions, and to create an Evaluation Grid in accordance with the five evaluation criteria (Relevance, Effectiveness, Efficiency, Impacts and Sustainability).

(3) To evaluate and analyse the project based on the results of a questionnaire, site visits and interviews with concerned parties, with the goal of creating a comprehensive evaluation report.

(4) To inform the Indian and Japanese sides of the results of the survey and to sign a Minutes of Meeting (M/M) after both parties have agreed upon the results.

2-4 Members and schedule of the Evaluation Team

Japanese side		
Name	Designation	Title and Affiliation
Tomohide ICHIGUCHI	Leader	Japan International Cooperation Agency (JICA) India Office Senior Representative
Sadanobu SAWARA	Technical Advisor	JICA Senior Advisor Global Environment Department
Emi DOYLE	Cooperation Planning	JICA India Office Programme Specialist

Mihir SORTI	Cooperation Planning	JICA India Office Lead Development Specialist
Momo FUKUSHIMA	Cooperation Planning	JICA Global Environment Department
Atsuko ORIMOTO	Evaluation Analysis	Japan Development Service Co., Ltd. Senior Consultant, Consulting Division

Goa side		
Name	Designation	Title and Affiliation
A.M. Wachasundar	Evaluation Analysis	Project Director JICA ODA Loan/Technical Cooperation Project Public Works Department
D.J.S. Borker	Evaluation Analysis	Project Manager Public Works Department Chief Engineer-I (PHE)
A.A Patil	Evaluation Analysis	Project Coordinator SIDCGL[1] Managing Director
G.M.N. Parrikar	Evaluation Analysis	Senior Project member Public Works Department Superintending Engineer

2-5 The Schedule of the evaluation

Date		Activities
18 Nov.	Mon.	・ Meeting with JET Experts ・ 1st Joint Evaluation Committee Meeting
19 Nov.	Tue.	・ Field investigation ・ Interview with C/P personnel
20 Nov.	Wed.	・ Field investigation ・ Workshop by C/Ps ・ Interviews with C/P personnel
21 Nov.	Thurs.	・ Documentation (finalizing survey result and M/M) ・ 2nd Joint Evaluation Committee Meeting (finalizing joint terminal evaluation report)
22 Nov.	Fri.	・ Joint Coordination Committee (JCC) Meeting ・ Signing the M/M

[1] SIDCGL: Sewerage and Infrastructure Development Corporation of Goa Ltd.

3. Revision of the Project Design Matrix (PDM)

The Project Design Matrix (PDM) for the Project was revised and formally approved by the JCC in May 2013; thus, this latest version of the PDM was confirmed as PDM Version 1.0. Major changes are described in the following table:

Outputs		
Output 4	Ver 1	*<ADDED>* Knowledge and technologies/skills for NRW reduction can be shared with another state
Indicator 1-3	Ver 1	*<ADDED>* Mechanism to monitor the implementation of Annual NRW Reduction Plan is established
Indicator 2-1	Ver 0	Number of participants in pilot projects
	Ver 1	Number of participants whom Team leaders recognized based on their active involvement in pilot projects is at least 50% of team member.
Indicator 2-2	Ver 0	Measurement of NRW ratio in the pilot areas
	Ver 1	NRW ratio in all the pilot areas are measured.
Indicator 2-3	Ver 0	Measurement of NRW reduction rate in the pilot areas
	Ver 1	NRW reduction rate in all the pilot areas are measured.
Indicator 3-1	Ver 0	Distribution of manuals in PWD
	Ver 1	Manuals are distributed to all sub-divisions for utilization by the staff members.
Indicator 3-2	Ver 0	Number of Sub-Divisions which initiate their own NRW reduction activities
	Ver 1	Number of Sub-Divisions which initiate their own NRW reduction activities reaches nine (9) other than pilot project areas.
Indicator 3-3	Ver 0	Number of participants to the seminars
	Ver 1	Over 50% of C/Ps participates in each seminar, and over 80% of participants satisfied with the quality of the seminars.
Indicator 4-1	Ver 1	*<ADDED>* At least ten (10) staffs can share knowledge and technology/skills for NRW reduction with another state in workshops.
Project Purpose		
Indicator 2	Ver 0	Number of NRW reduction initiatives undertaken by PWD outside of the pilot areas
	Ver 1	NRW reduction initiatives are undertaken in nine (9) areas by PWD outside of the pilot areas
Indicator 3	Ver 1	*<ADDED>* At least one staff in each sub-division is in a position to utilize the equipment to detect leakage without assistance.
Indicator 4	Ver 1	*<ADDED>* At least one staff in each sub-division is confident to teach his/her colleagues and/or staff members the technique to conduct NRW reduction activities.
Overall Goal		
Indicator	Ver 0	NRW ratio in the State of Goa (< 23%)
	Ver 1	NRW ratio in the State of Goa reduces average of 2 % per year till reaching the target (< 23%).
Important Assumptions		
Output Level	Ver 0	The Loan Project is implemented as scheduled.
	Ver 1	*<Deleted>*
Project Purpose Level	Ver 0	PWD does not make changes in its NRW reduction plan.
	Ver 1	PWD declares that the Long-term NRW Reduction Plan will be approved, adopted, and becomes effective within PWD.
Overall Goal Level	Ver 1	*<ADDED>* - Senior management of PWD continue with its commitments and support for the Project - Major political event(s) do not occur and/nor halt the Project.

4. The Project Performance and the Project Implementation Process

4-1 The Project performance

4-1-1 Input

(1) Japanese side

The Evaluation Team considers that overall inputs by the Japanese side have been appropriate in quality, quantity and timing.

A summary of inputs by the Japanese side is as follows. Details of the inputs are shown in the Evaluation Grid (Annex-2) and the inputs from JICA's side (Annex-6).

Inputs by the Japanese Side, Planned and Actual

Plan (as per R/D of September 2010)	Actual (as of September 2013)
Teams of experts (numbers, duration, and expertise were not specified)	Teams of experts (Shuttle type of dispatch. Duration and timing of dispatch were confirmed between experts and counterparts after consideration of other aspects of the Project, such as, equipment, training and counterparts' schedule.) - One (1) Chief Advisor / Water Supply Planning - One (1) Deputy Chief Advisor - One (1) NRW Reduction - One (1) Leak Detection 1 - One (1) Leak Detection 2 - One (1) Organisational Dissemination
Equipment and materials - Listening Rod - Leak Noise Detector - Portable Water Pressure Gauge and Recorder - Metal Pipe and Cable Detector - Metal Locator - Ultrasonic Flow Meter (The details will be subject to change depending upon the subsequent decision making process of JICA during the course of the Project)	Equipment and materials - 30 listening rods - 24 leak noise detectors - 15 portable water pressure recorders - 24 pipeline & cable locators - 15 metal locators - 15 Ultrasonic pipe wall thickness meters - 16 sets of gate valves (size: 50 – 300mm) - 16 sets of electromagnetic flow meters (size: 50 – 300mm) - 17 items including office equipment such as PCs, copiers, etc. Actual expenses of the Project for equipment and materials to date: approx.: INR 18,898,318[2] (See Annex-6)

[2] Equipment purchased in USD and JPY is calculated with the rate of 1 INR = 1.72 JPY as of 14 February 2013

Activity cost - Cost of training in Japan and in Goa (except for domestic transportation cost of trainees) - Production cost of training, educational and promotional materials	Activity cost - A total of 31 persons were trained on courses in Japan. - Workshops in country[3]: a total of 8 workshops were held and total of 428 participants attended the workshops in Goa. - A two-day workshop with another state: Workshop for Non- Revenue Water Reduction in India was held in Goa in September 2013. (Actual expense of the two-day workshop: approx. 4,243,269 Rp. [4]) (See Annex-6)
Operational cost Not mentioned	Operational cost - Office space and utility cost of the project office (electricity, water, communication, etc.) - Salary of support staff - Other general expenses Actual expenses of the Project for operational cost to date: approx.: INR 15,366,859[5]

(2) Indian side

The Evaluation Team considers that overall inputs by the Indian side have been appropriate both in quantity and timing, other than the office space and utility cost of the project office.

A summary of inputs by the Indian side is as follows. Details of the counterparts are shown in the list of Counterparts (Annex-5)

Inputs by the Indian Side, Planned and Actual

Plan (as per R/D of September 2010)	Actual (as of September 2013)
Human resources - 6 counterparts are stipulated as project management members - Additional assignment of counterpart personnel will be assigned as needs arise	Human resources - One (1) Project Director - One (1) Project Manager - One (1) Project Coordination Officer - Ten (10) Central NRW Control Unit Members - Total no. of 67 personnel is listed as counterparts for field activities. (See Annex-5)

[3] The cost of workshops in country is funded by PWD except the venue fee of the first workshop.
[4] Rate used: 1 INR = 1.60 JPY as of 20 November 2013
[5] Ditto.

Facilities - Project office space and facilities near PWD headquarters - Three (3) liaison office spaces for implementation of pilot projects nearby each pilot area - Other facilities that are necessary and mutually agreed for implementation of the Project	Facilities - Project office space and facilities have not been provided by the Indian Side - Three (3) liaison offices spaces have been provided for pilot areas.
Activity cost - Salaries and other allowances including transportation cost, accommodation and honorarium for Indian counterpart personnel, if necessary, for training to be conducted in the Project. - Budget allocation for NRW reduction works under the pilot projects	Activity and material cost - The cost in relation to ten (10) workshops including travel expense for the participants - Travel expense for on the field training and other NRW reduction activities - Construction of pits (56 pits in three pilot areas) - Material to repair the detected leakage - Consumer meters Estimated expenses of activity and material cost to date: approx. INR 20 million.
Others Provision of necessary data and information to the Japanese side	Others Provision of necessary data and information to the Japanese side

4-1-2 Outputs

The Project had struggled to carry out many scheduled activities on time during the initial stage of the Project, primarily due to elections at the beginning of the Project. Indicators for the PDM were modified in accordance with recommendations from the mid-term evaluation and a PDM Ver 1.0 was approved at the 4th JCC in May 2013. Some of activities remain behind schedule; however, the Evaluation Team consider that the Project has substantially overcome the delays, and many indicators have been accomplished in accordance with the latest PDM.

<Output 1> Long-term/ Annual NRW Reduction Plan for the entire state is formulated.

Most activities have been completed, and the Long-term NRW Reduction Plan for the entire state including the Annual Plan of NRW Reduction have been formulated. The Long-term NRW Reduction Plan was approved by the Hon. Minister for PWD in October 2013. The Annual Plan is currently ready to commence implementation and a monitoring mechanism is being proposed in the Action Plan. Output 1 has been attained.

Indicator 1-1 Formulation of Long-term NRW Reduction Plan

The Long-term NRW Reduction Plan has been formulated and approved by the Hon. Minister for PWD in October 2013. This indicator has been accomplished.

Indicator 1-2 Formulation of the first Annual Action Plan for NRW reduction

The Annual Plan of NRW Reduction has been created. It constitutes an integral part of the Long-term NRW Reduction Plan, which was approved by the Hon. Minister for PWD in October 2013. This indicator has been accomplished.

Indicator 1-3 Mechanism to monitor the implementation of Annual NRW Reduction Plan is established. <A newly added indicator>

A mechanism to monitor implementation of the Annual Plan of NRW Reduction has been proposed within the Annual Plan. Monitoring of progress of the annual plan implementation will be conducted by the Central NRW Control Unit at PWD Headquarters through monthly or bi-monthly (every two months) meetings.

As the Central NRW Control Unit has yet to be established, monitoring is carried out through monthly progress review meetings.

This indicator has been accomplished.

<Output 2> NRW reduction in pilot areas is planned and implemented.

There was a delay with progress of Output 2 at the mid-term juncture due to a combination of several factors; however, most activities were completed. Unfortunately, many ultra-sonic flow meters broke down during the third year and it has taken a long time to replace them overseas. This has caused delays with measurement of NRW reduction in the Pilot Project Areas (PPAs).

Although some team members are found to be inactive, NRW reduction in the PPAs has been planned and implemented through the commitment of dedicated team members. The Evaluation Team considers that Output 2 will be most-likely attained.

Indicator 2-1 Number of participants whom Team leaders recognized based on their active involvement in pilot projects is at least 50% of team member.

There had been motivational problems at the beginning of the Project and there remain some difficulties with the management of dual workloads by counterparts; however, it was confirmed that more than 50% of counterparts were committed to the Project. This indicator has been accomplished.

Indicator 2-2 NRW ratios in all the pilot areas are measured

Initial NRW ratios in all the pilot areas have been measured. This indicator has been accomplished.

NRW Ratio (%)

				Before PP**
PPA*	Salaulim	Curtorim	Team 3	45.1%
	Opa	Khadpaband	Team 4	62.1%
	Assonora	Moira	Team 5	53.0%

*PPA: Pilot Project Area
**PP: Pilot Project

Indicator 2-3 NRW reduction rate in all the pilot areas are measured

Preliminarily measurements for NRW reduction in all the pilot areas have been carried out, and final measurements are planned to take place just before completion of the Project. This indicator will be most-likely achieved before completion of the Project.

NRW Ratio (%)

				Before PP**	Preliminarily Reading
PPA*	Salaulim	Curtorim	Team 3	45.1%	33.2%
	Opa	Khadpaband	Team 4	62.1%	46.8%
	Assonora	Moira	Team 5	53.0%	44.5%

*PPA: Pilot Project Area
**PP: Pilot Project

<Output 3> Technologies and skills for NRW reduction are shared within PWD for the entire state.

The activities under Output 3 have been completed except a workshop which will be held in January 2014. The Evaluation Team considers Output 3 has already been achieved.

Capacity of the counterparts has been greatly enhanced and, in the newly targeted DMAs for NRW reduction, counterparts who participated in pilot projects have become the core of activities in their respective DMAs. These counterparts with enhanced capacity now appear confident to implement NRW reduction activities outside of the PPAs.

Indicator 3-1 Manuals are distributed to all sub-divisions for utilization by the staff members

A user-friendly Manual/Handbook for NRW reduction has been created, distributed, and is being utilised in all-sub-divisions. In the mid-term review, the team leaders for Team 1 and Team 2 recommended that the manual should be treated as mandatory for all PHE staff members and revised on demand. This indicator has been accomplished.

Indicator 3-2 Number of Sub-Divisions which initiate their own NRW reduction activities reaches nine (9) other than pilot project areas

NRW reduction activities have started in ten (10) areas. The Project has exceeded the number of DMAs targeted in the latest PDM. Moreover, NRW reduction activities have not only been initiated but, to date, have also progressed to some degree. This indicator has been accomplished.

Indicator 3-3 Over 50% of C/Ps participates in each seminar, and over 80% of participants satisfied with the quality of the seminars

A total number of 428 participants participated in nine workshops. Over 50% of C/Ps participation was achieved at eight workshops. Questionnaire surveys were carried out at two workshops and the satisfaction level was 100% at both

workshops. Only one seminar failed to reach a counterpart participation rate of over 50%; however, the Team considered that the rate (47%) for that particular workshop has not significantly affected achievement of Output 3.

<Output 4> Knowledge and technologies/skills for NRW reduction can be shared with another state. <A newly added output>

A workshop involving other states was held on the 5th and the 6th of September, 2013. All the counterparts and project members involved in this activity, and who answered the questionnaire, considered that Output 4 had already been achieved.

Indicator 4-1 At least ten (10) staffs can share knowledge and technology/skills for NRW reduction with another state in workshops. <A newly added indicator>

More than 20 staff members shared knowledge and skills with other states at a workshop in September 2013. This indicator has been achieved.

4-1-3 Achievement of the project purpose

<Project Purpose> Capacity of PWD to reduce NRW is strengthened.

Overall, the level of attainment of outputs seems appropriate with most counterparts and project members, who answered the questionnaire, confident that the majority of indicators under the Project Purpose would be accomplished. Therefore, the Project Purpose will most-likely be achieved by the end of the Project. In the former PDM Ver. 0, Indicator 2 was not appropriate for assessing achievement of the Project Purpose, and was modified with additional indicators (Indicator 3 & 4) added to the revised PDM.

Indicator 1 NRW ratio in the pilot areas (<20%)

A preliminarily estimate would suggest that this indicator seems unattainable in Khadpaband PPA, but attainable in Curtorim PPA and Moira PPA as shown below; however, it will take further time to obtain billing data after replacement of the malfunctioning water meters. A final NRW ratio for the post pilot project is expected to be available after January 2014.

NRW Ratio (%)

				Before PP**	During PP	After PP(Est.)
PPA*	Salaulim	Curtorim	Team 3	45.1%	33.2%	8.9%
	Opa	Khadpaband	Team 4	62.1%	46.8%	28.8%
	Assonora	Moira	Team 5	53.0%	44.5%	12.8%

*PPA: Pilot Project Area
**PP: Pilot Project

Indicator 2 NRW reduction initiatives are undertaken in nine (9) areas by PWD outside of the pilot areas.

NRW reduction activities in ten (10) areas outside of the pilot areas, are under implementation. The Project has exceeded the number of DMAs targeted in the latest PDM.

Indicator 3 At least one staff in each sub-division is in a position to utilize the equipment to detect leakage without assistance. <A newly added indicator>

This indicator has been accomplished.

Indicator 4 At least one staff in each sub-division is confident to teach his/her colleagues and/or staff members the technique to conduct NRW reduction activities. <A newly added indicator>

This indicator has been accomplished.

4-1-4 Prospect of achieving the overall goal

<Overall Goal> Non revenue water (NRW) is reduced in the State of Goa.

The prospective of achieving the Overall Goal for the Project is high.

Indicator NRW ratio in the State of Goa reduces average of 2 % per year till reaching the target (< 23%)

This indicator will be most-likely fulfilled so long as the Long-term NRW Reduction Plan including the Annual Plan is implemented as scheduled.

4-2 The Project implementation process

4-2-1 Activities

Although there was a substantial delay at the beginning of the Project, the Evaluation Team confirmed that the Project has proceeded well after the mid-term review, and many activities have already been completed and/or are on-going. Details of activities are shown in the Plan of Operation (Annex-3).

4-2-2 Methods of technical transfer

The Project has provided a package of comprehensive technical coverage. There have been combined activities with regard to technology transfers, such as, JICA trainings in Japan, OJT, seminars and workshops by JET staff members. No

problems were found with the methods used for technology transfers, and all activities relating to the transfers were highly regarded by the counterparts concerned.

Satisfaction levels seemed very good regarding assistance received from all methodologies. However, the burden of both routine work and the NRW reduction work, such as night leak detection, still remains as a major challenge for the counterparts in carrying out successful implementation of the project.

4-2-3 Project management aspects

The Project overcame a problem of insufficient involvement of senior/middle management of PWD faced at the beginning of the Project, and the Evaluation Team now considers that there are no problems with project management.

At the initial stages of the Project, there was little involvement and interest amongst senior and middle management of PWD, because,

i) the concept of NRW being new in Goa (and in India), and the importance of NRW reduction was not understood, also;
ii) the Project's emphasis was on enhancing technical skills and knowledge of Assistant Engineers and Junior Engineers at Sub-Division level.

This problem was resolved by establishing an NRW control unit under the Project Manager, Chief Engineer-I, which consists of all Superintending Engineers and Executive Engineers. The unit continues monthly meetings to review progress achieved, schedule tasks/targets ahead, and to identify problems or difficulties inhibiting implementation of the Project.

It was unanimously agreed that the Japanese experts, project assistants and counterparts have worked very closely together and that the work of the project team was highly appreciated by the counterparts.

4-2-4 Project recognition

It was confirmed during the mid-term review survey that all personnel from the counterpart organisations interviewed, and those which returned the questionnaire, had a high recognition level with regard to the Project. There has been little alteration in project recognition, therefore this has not been considered as a focus for this evaluation.

4-2-5 Promoting factors influencing effectiveness of the Project

There has been little change regarding promoting factors for the Project since the mid-term review.

Goa is abundant in water resources, and is aiming to become the first state

in India to achieve 24 x 7 (24 hours a day and 7 days a week) water supply throughout the state. Since NRW reduction is recognised as a crucial element necessary to achieve a 24 x 7 water supply; potentially, this will draw more commitment from Goa State towards support of these activities.

All counterparts interviewed expressed their enthusiasm and emphasised the importance of the Project. Strong project management, through the Central NRW management unit, is considered to be a significant promoting factor.

4-2-6 Prohibiting factors influencing effectiveness of the Project

During the first year of the Project, the election affected the pilot areas' activities greatly, in particular, in relation to tendering processes.

Counterparts are not exclusively NRW officers, and it is physically and mentally challenging to manage a double work-load without incentives, especially as engineers have to oversee an average 5,000 - 9,000 connections. All people who returned the questionnaire, or were interviewed, shared the view that the double burden placed on the Technical Assistants and Junior Engineers could negatively affect the long term effectiveness of the Project. There is an expectation that the establishment of the NRW reduction cells will alleviate this burden.

4-2-7 Collaborative activities

The Project was designed to complement the water supply component of a Yen-Loan Project, the "Goa Water Supply and Sewerage Project". Original demarcation between the two projects is shown in table below.

	Loan Project (WS component)	Technical Cooperation Project (TCP)
Target Area	• Salalium Water Supply Scheme • State wide (Publication and awareness)	• State wide (Long and Short term Plan, manual) • Pilot projects at Salalium, Opa, and Assonora)
NRW activities	• Installation of meters • Installation of flow meters, control valves and float valves • Procurement of NRW equipment • Asset management / GIS mapping • Publication and awareness	• Formulation of Long and Short term Plan • Implementation of OJT through pilot projects • Support for expansion of the NRW reduction activities outside of the pilot areas • Creation of a manual • Procurement of NRW equipment for pilot projects
Collaboration	• The pipe network extended and rehabilitated by the Loan Project shall be included in the Long-term NRW Plan. • Capacity building will be under the Technical Cooperation Project (OJT, manual)	

	• Publication and awareness will include pilot areas to promote water conservation and the reduction of illegal connection. • The equipment for NRW procured by the Loan Project shall be utilised by PWD to implement NRW activities outside of pilot areas.

(Source: The Report for Detailed Plan Survey on Capacity Development Project for Non Revenue Water Reduction in Goa, 2010, JICA)

Most senior counterparts, JET members, and the Resident Project Manager of the Loan Project, suggested that both projects were generally complementary, and that they were able to collaborate in accordance to the designed demarcation, regarding GIS mapping and publication in particular.

5. Evaluation results in accordance with the Five Evaluation Criteria

The evaluation was conducted based on the Five Evaluation Criteria (Relevance, Effectiveness, Efficiency, Impact, and Sustainability). The detailed results of the evaluation are presented in the Evaluation Grid (Annex-2) and summarized below.

5-1 Relevance

The relevance of the Project is very high, and there has been no change in relevance since the mid-term review. Therefore, the relevance of the Project was not re-examined in this evaluation.

5-1-1 Consistency with the development plan of India and Goa

Water has been one of the priorities in the development plan of both India and Goa, and the Project is consistent with the Five Year Plans of both India and Goa.

In the Eleventh Five Year Plan 2007-2012, the Indian Government stated that the target of Rural Water Supply was "to provide clean drinking water for all" and "to provide 100% coverage of water supply to rural schools", and that the target of Urban Water Supply as being "to provide 100% water supply accessibility to the entire urban population".

The Twelfth Five Year Plan 2012-2017 has been drafted and the importance of "water" has increased emphasis in comparison with the 11th Plan. Moreover, 25 core indicators, from 7 sectors, such as, Economic Growth, Poverty and Employment, Education, Health, Infrastructure, Including Rural Infrastructure, Environment and Sustainability, and Service Delivery, are used to reflect a vision of rapid, sustainable and more inclusive growth. The indicator of water is listed under, Infrastructure Including Rural Infrastructure, as being "Ensure 50 per cent of rural population has access to 55 LPCD (litter Per Capita Day) piped drinking water supply and 50 per cent of *gram panchayats* achieve the Nirmal Gram Status by the end of Twelfth Five Year Plan".

In the Master Plan on Augmentation of Water Supply and Sanitation for the State of Goa, it is stated that the objectives of water supply are (i) to increase the supply level to 100 LPCD in rural areas and 150 LPCD in urban areas together with emphasis for 24x7 water supply, (ii) to provide assured source of drinking water supply in rural areas priority to partially covered habitations to attain 100% coverage of water supply.

5-1-2 Appropriateness of the target group and the consistency with the needs of the people

Goa is a popular tourist destination both internationally and domestically, and a stable water supply is essential to keep the industry competitive.

The target group was selected by PWD, and no objections were recorded as having been expressed. "PWD staff members related to NRW reduction" is recognised as being the target group in the PDM. The Project, in particular, targeted Technical Assistants and Junior Engineers to transfer skills and knowledge. These are the engineers responsible in-the-field, and seemed to be the most suitable recipients for the Project. However, there appears to be a necessity for greater awareness of NRW across all levels of PWD, and it may be more appropriate to include all levels of PWD staff members working on water and sanitation.

The people living in the three pilot areas will be direct beneficiaries from the results of the Project, and they should be included in the target group.

5-1-3 Consistency with Japan's policy for assistance

The 'Country Assistance Program for India' (as of January 2006), specifies three priority areas; these being, "the Promotion of Economic Growth", "Improvement of Poverty and Environment Issues" and "the Expansion and Enhancement of Human Resources Development and Exchange".

In the Rolling Plan (as of June 2011), "the Promotion of Economic Growth", "Poverty Reduction and Social Sector Development", and "Environment, Climate Change and Energy" appear to be upgraded priority areas. The Project was recognized under the "Water Quality and Water Resource Management Programme" which is categorized in "Conservation and Improvement of Urban Environment" under a priority area, "Environment, Climate Change and Energy".

5-1-4 Comparative superiority of Japanese technology and experience in NRW reduction

Japan's NRW ratio is approximately 10%, which is one of the lowest levels in the world. Moreover, JICA has also been implementing NRW reduction projects in countries, such as Jordan, Brazil, and Bangladesh, and it has accumulated experience with assisting in this field.

5-2 Effectiveness

The effectiveness of the Project is high for the following reasons, though there was a substantial delay at the initial stage of the Project:

5-2-1 Achievement level of the Project Purpose

Indicator 2 was found not to be appropriate for assessing achievement of the Project Purpose, and was therefore modified and additional indicators (Indicator 3 & 4) added in accordance to the recommendations of the mid-term review.

The Project Purpose will most-likely to be achieved before completion of

the Project, since the level of attainment of outputs was considered appropriate by most counterparts and project members who answered questionnaire. Most were confident that the majority of indicators under the Project Purposes could be accomplished, as described in the ***Achievement of the project purpose (4-1-3)*** and also in the Evaluation Grid (Annex-2).

5-2-2 Contribution of Outputs for achieving Project Purposes

There are three Outputs designed to achieve the Project Purposes. All three original Outputs, together with the newly added output, correlate with the Project Purpose.

5-2-3 Factors inhibiting or promoting the progress of the Project

Several factors could have affected progress of the Project and these are described in ***Promoting Factors influencing the effectiveness of the Project (4-2-5)***, and ***Prohibiting Factors influencing the effectiveness of the Project (4-2-6)***.

5-2-4 Correctness of Important Assumptions at the level of Outputs

The Important Assumption, "PWD staff members who acquire NRW technologies and skills are not transferred" remains valid.

5-3 Efficiency

The efficiency of this Project was assessed as fair due to the following reasons:

5-3-1 Level of achievement of Outputs

There were some delays inhibiting outputs being implemented fully as planned, at the initial stage of the Project, as described in ***Output (4-1-2)*** as well as in the Evaluation Grid (Annex-2). However, most activities were completed, with Output 2 close to being accomplished and Output 1, 3 & 4 having already been achieved.

5-3-2 Quality, quantity and timing of Inputs to achieve Outputs

As described in ***Input (4-1-1),*** most inputs were appropriate in quantity and quality; however, timings for some inputs were delayed.

Materials and equipment preparation and the contracting of pit construction and leak repair by the Goa PWD side, had been delayed due to the complex procurement processes required in India and also by the pause caused by the elections held in 2012. Due to these reasons, implementation of the pilot projects which had originally been scheduled to be completed in the second year, has dragged on into the third year of the Project.

Most equipment provided by JICA was timely, except for the

electromagnetic flow meters and gate valves, which JICA accepted as an additional request from Goa PWD. Unfortunately, many ultra-sonic flow meters, used in replacement of electromagnetic flow meters, broke down in the third year of the Project and repair and replacement of the ultra-sonic flow meters was possible overseas and has taken a considerable period of time.

Active involvement by counterparts is essential in this project and motivation levels amongst counterparts has increased, with a noticeably larger numbers of committed members, than at the initial stage of the Project. However, all 67 counterparts listed are permanent staff members from Sub-Divisions, who already have full-time routine work, and it is not realistic to assume that they can be assigned as "full-time" counterparts, as initially anticipated in the R/D.

5-3-3 Collaboration with the Yen Loan Project

As described in ***Collaborative activities (4-2-7)***, the Project is complementary to the Yen Loan Project, "Goa Water Supply and Sewerage Project". For example, the GIS base maps, with some modification, and publication materials are being utilized by the Project.

5-3-4 Correctness of Important Assumptions at the level of Activities

The existing important assumption, "Inputs by Indian side are secured and in place for the Project implementation" is still valid.

5-4 Impact

The impact of the Project is considered to be relatively high.

No negative impacts have been observed, and the positive impacts from the Project are emerging.

5-4-1 Prospective to achieve the Overall Goal of the Project

As described in the ***Achievement of the overall goal (4-1-4)*** and also in the Evaluation Grid (Annex-2), the Overall Goal will be most-likely fulfilled; so long as the Long-term NRW Reduction Plan, including the Annual Plan, is implemented as scheduled.

5-4-2 Positive and/or negative impacts

There were no negative impacts observed from the Project. Positive impacts are listed as follows:

- The Long-term NRW Reduction Plan, prepared under the Project, was approved by the Hon. Minister for PWD in October 2013. The Plan

includes creation of exclusive organisational set up under control of Chief Engineer (PHE), consisting of Central NRW Control Unit and Regional NRW Reduction Cells, incentive mechanism, annual plan, and expenditure plan.

- NRW reduction activities have started in ten (10) areas other than the pilot project areas, which exceeded the number targeted in the latest PDM. Moreover, NRW reduction activities have not only been initiated, but have also progressed to some degree to date.
- Awareness of the importance of saving water and NRW reduction has been spread among meter readers, and plumbers in the pilot areas.
- Awareness among end users and general public has substantially increased due to media coverage and public awareness initiatives.
- Engineers in the Sub-Divisions learnt of the problems and needs of users directly through the House Hold Survey (HHS) and, potentially, this will improve the quality and service delivery of water supply in the future.
- Some of the counterparts started to share and teach the skills and knowledge, acquired through technical transfers from the Project, to colleagues and plumbers in their Divisions and/or Sub-Divisions and this may potentially create a spill-over effect.
- Some of the counterparts have voluntarily started NRW reduction activities, including HHS, outside of their pilot areas.

5-4-3 Correctness of Important Assumptions at the level of Project Purpose

Both Important Assumptions, "PWD declares that the Long-term NRW Reduction Plan will be approved, adopted, and becomes effective within PWD" and "Equipment to be procured by the Loan Project is fully and effectively utilized by the Projects" remain valid.

5-5 Sustainability

The potential sustainability of the Project seems high.

To ensure sustainability of the Project, it is essential that, exclusive organisational set up under control of Chief Engineer (PHE), consisting of Central NRW Control Unit and Regional NRW Reduction Cells, is established with sufficient staff members, and that the annual budget to implement the Long-term NRW Reduction Plan approved by the Hon. Minister for PWD, is secured.

5-5-1 Political and institutional aspects

The Long-term NRW Reduction Plan, which includes establishment of the

exclusive organisation set up, incentive mechanism, Annual Plan, and an expenditure plan, was approved by the Hon. Minister for PWD. Moreover, a NRW Management Monitoring Committee is established in September 2013, headed by the Hon. Minister for PWD to monitor progress of NRW Management activities. These measures indicate a strong commitment by PWD Goa towards NRW reduction.

The State of Goa remains committed towards achieving 24 x 7 (24 hours a day and 7 days a week) water supply across the entire state (a first in India). Since NRW reduction has begun to be seen as an essential part of achieving a 24 x 7 water supply, support for NRW reduction is expected to be consistent.

Although the Project faced difficulties at the initial stage, PWD Goa is seen as a capable and committed counterpart organisation to work alongside. All the people interviewed unanimously agreed that dedicated, separate resources, to support and manage NRW reduction activities will be essential to ensure sustainability after completion of the Project.

5-5-2 Financial aspects

Historically, Water and Sanitation has enjoyed a prioritized budget allocation within PWD. The range of annual budget and actual expenditure for Water and Sanitation has been within INR 300 – 460 Crores since the fiscal year 2009-10.

According to PWD, it is likely that a first year budget for implementation of the Long-term NRW Reduction Plan will be allocated in the next fiscal year from this annual budget.

5-5-3 Technical aspects

The Project has provided a comprehensive package of technical transfers, including training in Japan, as well as OJT, seminars and workshops by JET together with a user-friendly NRW reduction manual.

The capacity of the counterparts has been greatly enhanced, and some counterparts who participated in pilot projects, have started NRW reduction activities in their DMAs under their own initiatives. NRW reduction activities have started in ten (10) areas other than the pilot project areas, which has exceeded the number of sub-divisions (9) targeted in the latest PDM. They are confident to continue with technical aspects of NRW reduction activities after completion of the Project, despite the fact that all counterparts have their own routine full-time duties.

6. Conclusions and Recommendations

6-1 Conclusions

After examination of the Project Performance and the Project Implementation Process, the Evaluation Team assess, the Relevance of the Project as very high, the Effectiveness as high, Efficiency as fair, Impact as relatively high, and potential sustainability as high.

The Project had experienced serious delays and a number of setbacks during the initial stage; partially, due to lack of awareness amongst staff members of PWD. However, JICA trainings in Japan and JET's input within the country (OJT and workshops), together with the NRW control unit under the chairmanship of Chief Engineer-I, boosted enthusiasm among counterparts and created a positive attitude towards the Project.

The Evaluation Team concluded that the Project would achieve the project purposes before completion of the Project. Therefore, it is appropriate that the Project terminates as planned in the R/D.

6-2 Recommendations

To ensure the sustainability of the Project, the Indian side and the Japanese side shared the following recommendations.

(1) Activities prior to the completion of the Project

- In further reducing NRW in the pilot project areas, the Project should concentrate more on the reduction of apparent losses. In doing so, the current practice of minimum and average billing on account of faulty meters should be avoided. (Project Team)
- To measure and calculate NRW ratio in pilot project areas (Project Team)
- To prepare and compile the progress on 10 DMAs' NRW reduction activities (Project Team)
- The details regarding provided equipment should be documented and will be handed over to PWD (JET)

(2) To establish exclusive organisational set up under the control of Chief Engineer (PHE) consisting of Central NRW Control Unit and Regional NRW Reduction Cells with sufficient staff members and budget (PWD)

(3) To review periodically the roles and responsibilities of Central NRW Control Unit and Regional NRW Reduction Cells, and to prepare detailed job description of PWD staff members assigned to the control unit and the cells (PWD)

(4) To establish a mechanism to enhance and maintain motivation of PWD staff members

assigned to the control unit and the cells for effective implementation of the Long-term NRW Reduction Plan (PWD)

(5) To plan and initiate procurement process pertaining to NRW reduction activities well in advance (PWD)

6-3 Lessons Learnt

In order to set a realistic target in the PDM, target value should be determined after confirmation of baseline value.

(END//)

Handover to PWD GOA

February 19, 2014

Chief Representative,
Japan International Cooperation Agency
JICA India Office, New Delhi

Project: **Capacity Development Project for Non Revenue Water Reduction in Goa, Republic of India**

Subject: **Receipt of Equipment**

We received equipment shown on attachment, which were procured by the JICA Expert Team, in order to utilize them by PWD Goa.

Mr. A. M. Wachasundar
Project Director,
JICA Project,
Public Works Department
Government of Goa

Attachment: List of Equipment

Attachment List of Equipment

Description	Brand	Quantity
Personal Computer (Desktop) with display and key board	COMPAQ CQ1-1030IN	1
Personal Computer (Laptop)	Dell Inspiron N4010	3
UPS	-	4
Printer/Scanner/Copy machine	Canon C2020H	1
Printer/Scanner/Copy machine	EPSON L-200	3
White Board	-	4
Projector	Panasonic LCD Projector PT-LB1EA	1

Project Director
JICA ODA Loan Project
Public Works Department
Altinho, Panaji - Goa

13/2/2014

Attachment -8 Other Executed Activities

8.1 Major Activities in Each Year

1) Major Activities in the 1st Fiscal Year

Date	Activities
FY 2011 March 20	Arrival to Delhi for starting the Activities in India
March 21	Discussion with JICA India Office Submission of Work Plan, Explanation of overall schedule, Schedule of initial activities in Goa
March 21	Courtesy Call to Japan Embassy General Explanation of the Project
March 22	Arrival at Goa
March 23	Discussion with CE and Mr.Chimulkar of PWD Request for opening of JCC, assignment of C/P, office space etc.
March 23	Discussion with Mr. Wachasundar, PD of JICA project of PWD. Necessity was discussed on confirmation by JICA, whether PD of the Project could be Mr. Wachasundar.
March 23	Confirmation with Ms. Iwata, JICA India Office, on PD position. JICA accepted Mr. Wachasundar as PD of the Project (considering previous involvement and power balance in GOA PWD etc.
March 24	Arrangement of schedule of JCC and workshop with Mr. Parrikar and Mr. Wachasundar.
March 25	Courtesy call on Mr. Rego, Principal Chief Engineer, PWD
April 5	1st JCC Meeting
April 8	1st Workshop
April 28	Conference with PWD to confirm assignment of working group members
May 5	2nd Workshop
August 11	3rd Workshop
September 22	4th Workshop
October 11	Start preparation of Long Term NRW Reduction Plan with working group
January 15 –	Training in Japan

January 28, 2012	
March 12	5th Workshop

2) Major Activities in the 2nd Fiscal Year

Date	Activities
May 7, 2012	Contract for the 2nd Fiscal Year
May 15	Start the service of 2nd Fiscal Year by the advisors
June 11	Discussion of slow progress especially during the absence of JET with Project Director, Project Coordination Officer, Chief Engineer I, Team Leaders (3,4, and 5), and JET. It was decided for Project Coordination Officer to call Team3,4,5 and relevant EEs for discussion to settle the issues and to improve the situation.
June 13	Project Coordination Officer initiated a discussion with Team 5 and the EE in charge.
June 14	Project Coordination Officer initiated a discussion with Team 4 and the EE in charge.
June 15	Project Coordination Officer initiated a discussion with Team 3 and the EE in charge.
June 25	PD and CE1 held a meeting to instruct EEs and AEs and confirmed cooperation of EE and AE, informing the results of series of meetings from June 11-15.
June 26	2nd JCC Meeting
June 26	6th Workshop
July 2 – July 4	Training by manufacturer of ultrasonic flow meter (Mr. Jacoby, Primayer)
July 6	1st Monthly Progress Meeting (MPM)
July 9 - July 11	Training by manufacturer of leak detection equipment (Mr. Rajasekhar and Mr. Rochesh Mande, Taisei International)
July 24 -August 30	GIS training to members of Team3, 4 and 5
July 27	Discussion with Ms. Veena, Director, MOUD on request for

	cooperation to training in Japan.
September 7	2nd MPM
September 12	Discussion with PWD management on construction schedule of meter pit, DMA areas to be selected for the activities in 3rd Fiscal year, etc.
September 13	Discussion with PWD management and Team 3, 4, 5 on construction schedule of meter pit.
October 23	3rd MPM
November 22	4th MPM
December 14	Discussion on delay of activities
January 15, 2013	5th MPM
February 2 -February 16	Mid-term Evaluation
February 5	7th Workshop
February 14	3rd JCC Meeting (Results of Mid-term Review)
February 20	6th MPP
March 12	8th Workshop

3) Major Activities in the 3rd Fiscal Year

Date	Activities
April 17	Contract for 3rd Year
April 28	Arrival to India for stating 3rd Year Project
May 8	Discussion on the catchup methods of delay and plan of 3rd FY activities with high ranked officers of PWD
May 14	4th JCC Meeting
May 21	9th Workshop
May 30	Completion of NRW Reduction Manual
June 14	Discussion on catchup methods of the delay of the Project with higher ranked officers of PWD
July 25	Discussion on slow progress of the Project activities with higher ranked officers of PWD
August 22	7th MPM
September 5	Workshop with other states of India on NRW

-September 6	Hand-on training of equipment
September 23	Establishment of RW Management Monitoring Committee, chaired by PWD Minister
September 25	1st meeting of NRW Management Monitoring Committee
October 4	Discussion on Long Term NRW Reduction Plan to be officially submitted to Goa State Government
October 12	2nd Meeting of NRW Management Monitoring Committee
November 18 -November 22	Terminal Evaluation
November 20	10th Workshop
November 22	5th JCC Meeting (Terminal Evaluation)
November 29	8th MPP
January 30	9th MPM
February 18	11th Workshop

8.2 Progress of Roll-Out Plan and Action Plan

CHECK LIST FOR NRW ROLL-OUT PLAN

Sl. No.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
	Description	Priority	Comments		Implemented/ Executed	Not Yet	
1	Agree Owenership for Roll-out Plan.	Urgent	Suggest CE I is 'owner' and places responsibility on the SE's to 'champion' within each region. PWD Secretary to 'sponsor' efforts.	They are agreed in principle	✓		
2	Agree Terms of Reference (TOR) for Roll-out Programme.	Urgent	This will specify objectives, targets, procedures, resources, budgets and responsibilities for all involved with the roll-out programme.	They are agreed in principle	✓		
3	Identify staff to be involved within each region, provide training euipment and to identify a 'Pilot area' within each region to gain experience.	Urgent	SE's to form teams. Training to be provided by the Santa Cruz study team.			✓	Two Persons from each Division are identified for providing equipment Training. Three Pilot areas are identified namely Opa, Assonora & Salaulim for Technical Cooperation Project by JICA in 2011.
4	Determine if 'Assistance' is required to build up capacity	Urgent	Rolling-out the pilot will require planning, management and supervisory expertise. There are a number of benefits to be gained in securing additional assistance to ensure maximise success, benefits and sustainability of the roll-out programme. Refer to 4.5.2 below.	Requested Technical Coopertion Project regarding NRW reduction to JICA.	✓		
5	Procure equipment for each Pilot study with in each region. Tackle "apparent" (commercial) and 'Real' (physical) losses.	Short term	SE's to 'champion' supported by Santa Cruz team 'Commercial' teams to be established to resolve metering/meter reading problems, eliminate illegal connections and ensure 100% billing	One set of equipment procured during the Pilot Study is being used, subsequently for other areas as & when required. Additional equipment will also be procured under Loan Project	✓		
6	Benefits of Pilot study to be shared with other region of state.	Short term	SE's to organise regional and central presentations of findings.	The lessons from the Pilot study have been shared with the collegues from other Water supply Offices	✓		

Sl.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
No.	Description	Priority	Comments		Implemented/ Execued	Not Yet	
7	Identify further areas that would benefit from an 'active' NRW reduction approach and Roll-out within each region across all supply schemes.	Short to medium term	SE's to 'champion' and share benefits state-wide.	Additional revenue, Water auditing & Consumer satisfaction etc.	✓		
8	Institutionalise NRW reduction strategy and mitigation measures within each region	Medium term	PWD Secretary to 'sponsor', CE I 'owns' and Regional SE's 'champion'. Decide if external assistance is required. It is becoming common practice to let contracts for enabling works such as installation of DMA's and to bring UFW within acceptable limits and then to continue the effort in-house. Refer to 4.5.3 below.			✓	

CHECK LIST FOR NRW REDUCTION - 'ACTION PLAN'

Sl. No.	DESCRIPTION	PRIORITY		S.E. / E.E's Reply	STATUS		REMARKS
					Ready	Not Yet	
1	Replace all defective meters	Urgent	Use good quality class 'B' or 'C'meters that comply with international standards	They are replacing all defective Meters on regular basis. Now they are replacing all 'Water Meters' in South Goa with New Meters	✓		
2	Replace all defective (leaking) House service connections	Urgent	Use improved materials instead of galvanised pipes and fittings	This is being done regularly	✓		
3	Agree standards for new connections including standard specifications for materials, fittings, meters, layouts, non-return valves, sealing, testing and calibration etc.	Urgent	Introduce a 'metering policy' that specifies materials and equipment to be used with specified periods for calibration, maintenance, replacement etc.			✓	
4	Setup 'meter inspection team' in each Division to improve management, supervision and control.	Urgent	Carry out a random audit of 1% of meter readings per reading cycle and provide training to meter readers where needed. Ensure that suspected or actual fraudulent activity is dealt	This is being done within each Division	✓		Revenue Cell is functioning in each Division, Headed by E.E., Every 6 months the Water Meters are inspected and every month Bulk Meters are inspected by J.E. / T.A.
5	Audit the billing system to ensure 100% billing	Urgent	Conduct surveys to ensure that all who have a connection receive a bill	All those who have connections are receiving bills	✓		Every Bill was audited and on unpaid Bills are to imposing penality at 2% per month
6	Improve Debt collection	Urgent	Conduct audits to ensure that divisions have the resource to economically chase debt	This is being done	✓		Debt Collection bills are to be action taken by Revenue Recovery Court Act
7	Review Commercial / Institutional meter sizing.	Short term	Ensure that all meters are sized correctly, calibrated and tested for accuracy		✓		Meter Size are fixed by using of water by Consumer

FIRST AID'

Sl. No.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
	Description	Priority	Comments		Implemented/ Execued	Not Yet	
1	Repair of all existing visible leaks	Urgent	Use existing manpower resource or works contracts already in place or introduce new incentivised contracts	All visible leaks are being attended immediately and other leaks are also attended on priority	✓		All visible leaks are attended regularly
2	Ensure that, all leaks are repaired only once	Short term	Ensure that the correct materials are in stock to avoid making temporary repairs and that good quality repair materials such as clamps and other fittings are specified and use		✓		All Materials with ISI mark are being used to repair the leaks
3	setup monotoring system to ensre that 80% of all leaks are repaired within 24hours and all other leaks are repaired within 5 working days.	Short term	Will need to implement a database forrecording and tracking repairs, materials used, burst data etc. (preferably a computerised system)	Helpline is 2420069 & 2420070 help in receiving the complaint from the Consumers including feed back on the action taken by the Department with in 24 hrs.		✓	Manualy recorded in the Register
4	Stop all reservoirs and water towers from overflowing by inlet control, level indicator etc.	Short term	Set up a project team within each Region to investigate and implement appropriate solutions	Ensured by installing water monitoring Pressure Gauges at all the Reservoirs & Towers etc.	✓		Persons available on 24 Hours basis in the Water Supply Treatment Plants and Reservoirs

PREVENTION' (UNDER NRW ACTION PLAN)

Sl. No.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
	Description	Priority	Comments		Implemented/ Execued	Not Yet	
1	Ensure all contractors are 'qualified' (Certified) to work on PHE networks both existing and new	Medium term	Introduce a system of contractor certification or accreditation, set appropriate standards of repair and enforce standards	Only qualified Contractors are being registered with PWD and renewal of their registration, will be done, every three years, after verifying their credentials	✓		J.E. checking the quality of work, also 3rd party Quality Control checking is being done
2	Ensure that all materials used are in accordance with agreed standard specifications.	Medium term	Introduce a system of new improved standard specifications for pipes, materials, fittings and equipment and ensure compliance by staff and contractors	Only material with marking of BIS, ISO are selected. Goa Schedule of Rates (SR) is also followed for this purpose	✓		Only Materials with ISI mark are used
3	Consider adopting suitable "Byelaws" to prevent waste and preserve water quality	Medium term	Review existing bylaws and ensure that these are 'policed'	The existing Bye-Laws would be taking care of preventive measures		✓	Water Supply Act revised in the Year 2003 and the same has to be submitted to Government of Goa for approval. Revised Bye-Law Rule is under process
4	Prepare Strategic mains plans	Medium term	Digitise all networks starting with the strategic mains	The same is in progress	✓		Being covered under GIS mapping through JICA Project
5	Exercise "Key" valves	Medium term	To ensure operability in times of need		✓		All Key Valves are in operating condition
6	Setup an emergency store in each Division of all appropriate repair materials and equipments and ensure it is available to PHE staff and Contractors.	Short term	Ensure that staff and contractors are equipped to get the job done without delay and that H&S issues are taken into account	The 'emergency store' are already there with in each Division to undertake the repairs as & when required	✓		Store available on 24 hours X 7 days basis

CHECK LIST FOR ENABLING WORKS

Sl. No.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
	Description	Priority	Comments		Implemented/ Execued	Not Yet	
1	Ensure that all Source works have reliable and accurate metering	Urgent	This is mandatory in many countries. This provides the knowledge of the basic supply of product to the customer and will help improve network management including service delivery and control of UFW	Reliable and accurate metering system are already in place at all source works	✓		Every day recording of Metersis being done
2	All Source meters are checked for accuracy every two years	Short Term	Carried out by clamp on ultrasonic or insertion type flow meter	Calibration of Meters is being done on regular basis	✓		3 & above 3 Years old Meters every year Calibration by respective Companies
3	Consider the introduction of a system to capture spatial information	Medium term	As part of the IS strategy, consider introduction of a Geographical Information System (GIS) as well as other systems for asset management such as a computerised maintenance management system (CMMS)	Covered under GIS mapping under taken through JICA Project		✓	
4	Ensure networks are analysed for optimum flows/pressures	Medium term	Introduce appropriate software and train staff on network analysis. This will require installation of flow and pressure measuring devises at 'critical control points'	This is being done and as now, introduced SCADA systrem in OPA Sector of Goa	✓		Adopted Bentily Software. Modified Hazen Williams and Mannings Formulae
5	Design zones and DMA's for 24 Hour supply systems	Medium term	Where networks are supplying on a 24 hour basis, installation of district meters will aid the management and control of the network as well as aid the monitoring and control of UFW			✓	No
6	Evaluate each DMA or supply zone for potential pressure reduction	Medium term	The potential for pressure management is substantial due to its topography. Minimising pressures will help reduce leakage	Not yet ready		✓	No

Sl.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
No.	Description	Priority	Comments		Implemented/ Execued	Not Yet	
7	Install Telemetry for DMA meters and pressure transducers	Long term	This will help to optimise network performance and service delivery	Not yet ready		✓	No
8	Conduct a Pilot UFW reduction program	Short Term	This is to be completed during the feasibility study phase. Will need to decide if this is conducted in-house or by contract; or a combination of the two	The same is in progress		✓	No
9	Roll-out UFW reduction across all networks	Medium term	Will need to decide if this is conducted in-house or by contract. It is preferable to let a contract for enabling works such as installation of DMA's and to bring UFW within acceptable limits and then to continue the effort inhouse	This is being done		✓	Is under process

CHECK LIST FOR ACTIVE LEAKAGE DETECTION

Sl. No.	2006 Roll-Out Plan, Action Plan in Feasibility Study			Currnet Situatin (Reply from PDW)	Current Status		Remarks from PWD
	Description	Priority	Comments		Implemented/ Execued	Not Yet	
1	Set up active leakage Teams within each Divisionn or Region with appropriate tools to do the join to find and fix leaks	Short Term	Introduce targets and monitoring system to ensure that UFW is brought within and maintained at economic levels. For 24 hour systems, teams will need to work at night	Teams are attending leaks immediately on report at Sub-Division level headed by Junior Engineer	✓		
2	Provide training and euipment for each team	Short Term	Initial training was provided as part of the pilot UFW reduction program. Equipment will include: pipe locators, listening rods, leak noise correlators, basic tools, vehicles, pressure and flow measuring devices, data loggers etc.	The equipment supplied are used for imparting Training on Leak Deduction activities during the breakdowns / leakages	✓		To be made more effective
3	Introduce a 'Leakage Database' to monitor leakage activities and performance	Short Term	The database (preferably computerised) will record and track detection team performance, repair team performance, locations, failure types, repairs, materials used, burst data etc. as well as parameters necessary to maintain UFW within economic limits	Proper records are generated through the registers at site & maintained manually at site	✓		
4	Introduce a system of key performance measures	Short Term	Monitor performance against agreed targets for each team/division/region			✓	It is planned to introduce Key performance future measures
5	Set up dedicated 'leak line' to enable customers to report leaks	Short Term	This should be toll-free	The dedicated 'leak line' is already functioning within PWD	✓		Already existing and avilable a person to receive the complaints
6	Introduce new technology to improve leakage detection/reduction	Medium term	Including the use of: Noise Loggers, Hydrogen Gas Injection, ground Penetrating Radar.			✓	Partially introduce

Attachment-9 List of Counterparts

Team 3		**Pilot Project Team for Salaulim WSS**							
No.		**Name**	**Position**	**Division**	**Sub-Division**	**Title**	**Remarks**	**Working Period**	**Remarks**
1	Mr.	Nagesh Varak		XII	I	Technical Assistant		April 2011 to date	
2	Mr.	Diwakar Faldesai		XII	I	Junior Engineer		April 2011 to date	
3	Mr.	Prasad R. Sakhardande		XII	II	Junior Engineer		April 2011 to date	
4	Mr.	Krishnaraj D. Shetkar		XII	II	Technical Assistant	(Team 1)	April 2011 to date	
5	Mr.	Anand Mauze		XII	III	Technical Assistant	(Team 1)	April 2011 to date	
6	Mr.	Ramnam A.S. Lotlikar		XII	II	Junior Engineer		April 2011 to date	
7	Mr.	Kalpit Tari		XII	IV	Technical Assistant		April 2011 to date	
8	Mr.	Haresh R.S. Kakodkar		XII	II	Junior Engineer		April 2011 to date	
9	Mr.	Sahit R.Bakhale		XXI	I	Junior Engineer		April 2011 to date	
10	Mr.	Paradeep Gaude		XXI	I	Technical Assistant		April 2011 to date	
11	Mr.	Prakash Pai		XXI	II	Junior Engineer		April 2011 to date	
12	Mr.	Thomas Lendes		XXI	II	Junior Engineer		April 2011 to date	
13	Mr.	G.G. Rabinal		XXI	III	Junior Engineer		April 2011 to date	
14	Mr.	Mohan S.Naik		IX	I	Technical Assistant		April 2011 to date	
15	Mr.	Viraj Patil		IX	II	Technical Assistant	(Team 1 Sub-Leader)	April 2011 to date	
16	Mr	Yougesh Y. Dessai		IX	A.S.W. Section	Technical Assistant		April 2011 to date	
17	Mr.	Sanjay Pagi	Sub-Leader	IX	III	Technical Assistant	(Team 2)	April 2011 to date	
18	Mr.	Truptesh Shirsat		IX	III	Technical Assistant		April 2011 to date	
19	Mr.	Vishwambar Bhende	Leader	IX	I	Assistant Engineer	(Team 2, Sub-Leader)	April 2011 to date	
20	Mr.	Maheshwar Opkar		IX	IV	Junior Engineer	(Team 1)	April 2011 to date	
21	Mr.	Ivo Fernandes		IX	V	Junior Engineer		April 2011 to date	
22	Mr.	Anand Waghurmekar		IX	I	Technical Assistant	(Team 2)	April 2011 to date	
23	Mr.	Dipesh Gaude		IX	V	Junior Engineer		April 2011 to date	
24	Mr.	Shanu Gaonkar		XX	I	Junior Engineer		April 2011 to date	
25	Mr.	Devidas Gaude		XX	I	Junior Engineer		April 2011 to date	
26	Mr.	P.S. Yarnal		XX	II	Junior Engineer		April 2011 to date	
27	Mr.	Prashant Naik		XX	II	Junior Engineer		April 2011 to date	
28	Mr.	Vinayak Shenvi		XX	III	Junior Engineer		April 2011 to date	
29	Mr.	Sidesh Pawaskar		XX	III	Technical Assistant		April 2011 to date	
30	Mr.	Sarvesh Padte		XX	IV	Junior Engineer		April 2011 to date	
31	Mr.	Dinesh Gaude		XX	IV	Junior Engineer	(Team 1)	April 2011 to date	
32	Mr.	Ajay N. Patil		XXI	II	Junior Engineer		July 2012 to date	added on July 30
33	Mr.	Vasuraj Karmalkar		XX	III	Junior Engineer			
34	Mr.	Praveen Desai		IX	II	Junior Engineer			
35	Mr.	Vivek Kudchadkar		IX	II	Junior Engineer			
36	Mr.	Rosalina Borges		IX	A.S.W. Section	Technical Assistant			

Team 4		Pilot Project Team for Opa WSS							
No.		**Name**	**Position**	**Division**	**Sub-Division**	**Title**	**Remarks**	**Working Period**	**Remarks**
37	Mr.	Amey Lawande		III	I	Junior Engineer	(Team 2 Leader) (Team 2, Leader)	April 2011 to date	
38	Mr.	Rajendra Borkar	Sub-Leader	III	I	Junior Engineer		April 2011 to date	
39	Mr.	Andrew Cardoso		III	I	Junior Engineer	(Team 1)	April 2011 to date	
40	Mr.	C.L. George		III	II	Junior Engineer		April 2011 to date	
41	Mr.	Rajendra Khanna		Circle VI	_	Technical Assistant		April 2011 to date	
42	Ms.	Pritam P.Khandolkar		III	III	Technical Assistant	(Team 2)	April 2011 to date	
43	Mr.	Krishna Shetye		III	III	Junior Engineer		April 2011 to date	
44	Mr.	Santhosh Bhimagaude		C.E. 1	_	Junior Engineer		April 2011 to date	
45	Mr.	Yeshwant Mapari	Leader	III	IV	Junior Engineer		April 2011 to date	
46	Mr.	Manoj D. Naik		III	IV	Technical Assistant	(Team 1)	April 2011 to date	
47	Mr.	Eknath Paste		III	V	Junior Engineer	(Team 1)	April 2011 to date	
48	Mr.	Jaiwant N.B. Prabhu		III	V	Junior Engineerg	(Team 2) (Team 2)	April 2011 to date	
49	Mr.	Dinkar F.Malekar		III	V	Junior Engineer		April 2011 to date	

Team 5		Pilot Project Team for Assonora WSS							
No.		**Name**	**Position**	**Division**	**Sub-Division**	**Title**	**Remarks**	**Working Period**	**Remarks**
50	Mr.	Rohan Pai Kakode		XVII	III	Junior Engineer		April 2011 to date	
51	Mr.	Sandeep Morajkar		XVII	III	Technical Assistant		April 2011 to date	
52	Mr.	Shakesphere J. Fernandes	Sub-Leader	XVII	III	Technical Assistant	(Team 1)	April 2011 to date	
53	Mr.	S.S. Mushigiri		XVII	III	Junior Engineer	(Team 1)(Team 2)	April 2011 to date	
54	Mr.	Gurudas R.Gokhale		XVII	III	Technical Assistant	(Team 2)	April 2011 to date	
55	Mr.	Damodar Shirodkar		XVII	V	Technical Assistant		April 2011 to date	
56	Mr.	Suraj Shet		XVII	V	Junior Engineer		April 2011 to date	
57	Mrs.	Prachi Kudalkar	Leader	XVII	V	Junior Engineer		April 2011 to date	
58	Mr.	Rohidas Naik		XXIV	I	Junior Engineer		April 2011 to date	
59	Mr.	Nandakishor Kesarkar		XXIV	I	Technical Assistant		April 2011 to date	
60	Mr.	Madan Dessai		XXIV	II	Junior Engineer		April 2011 to date	
61	Mr.	Preashant Gaude		XXIV	II	Junior Engineer		April 2011 to date	
62	Mr.	K. Gopalan		XXIV	–	Executive Engineer	(Team 1, Leader)(Team 2)	April 2011 to date	

Team 1		Current Situation Investigation							
No.		**Name**	**Position**	**Division**	**Sub-Division**	**Title**	**Remarks**	**Working Period**	**Remarks**
15	Mr.	Viraj Patil	Sub-Leader	IX	II	Technical Assistant	(Team 3)	April 2011 to date	
4	Mr.	Krishnaraj D. Shetkar		XII	II	Technical Assistant	(Team 3)	April 2011 to date	
5	Mr.	Anand Mauze		XII	III	Technical Assistant	(Team 3)	April 2011 to date	
31	Mr.	Dinesh Gaude		XX	IV	junior Engineer	(Team 3)	April 2011 to date	
20	Mr.	Maheshwar Opkar		IX	IV	Junior Engineer	(Team 3)	April 2011 to date	
39	Mr.	Andrew Cardoso		III	I	Junior Engineer	(Team 4)	April 2011 to date	
47	Mr.	Eknath Paste		III	V	Junior Engineer	(Team 4, Leader)	April 2011 to date	
46	Mr.	Manoj D. Naik		III	IV	Technical Assistant	(Team 4)	April 2011 to date	
62	Mr.	K. Gopalan	Leader	XXIV		Executive Engineer	(Team 5)(Team 2)	April 2011 to date	
53	Mr.	S.S. Mushigiri		XVII	III	Junior Engineer	(Team 5)	April 2011 to date	
52	Mr.	Shakesphere J. Fernandes		XVII	III	Technical Assistant	(Team 5, Sub-Leader)	April 2011 to date	

Team 2		Planning Long-Term NRW Reduction Plan							
No.		**Name**	**Position**	**Division**	**Sub-Division**	**Title**	**Remarks**	**Working Period**	**Remarks**
19	Mr.	Vishwanber Bhende	Sub-Leader	IX	I	Assistant Engineer	(Team 3, Leader)	April 2011 to date	
22	Mr.	Anand Waghurmekar		IX	I	Technical Assistant	(Team 3)	April 2011 to date	
17	Mr.	Sanjay Pagi		IX	III	Technical Assistant	(Team 3)	April 2011 to date	
37	Mr.	Amey Lawande	Leader	III	I	Junior Engineer	(Team 4)	April 2011 to date	
48	Mr.	Jaiwant N.B. Prabhu		III	V	Junior Engineer	(Team 4)	April 2011 to date	
42	Ms.	Pritam P.Khandolkar		III	III	Technical Assistant	(Team 4)	April 2011 to date	
62	Mr.	K. Gopalan		XXIV	_	Executive Engineer	(Team 5)(Team 1)	April 2011 to date	
53	Mr.	S.S. Mushigiri		XVII	III	Junior Engineer	(Team 5)	April 2011 to date	
54	Mr.	Gurudas R.Gokhale		XVII	III	Junior Engineer	(Team 5)	April 2011 to date	

Counterparts for DMA Activities (1/2)

No.	Team	Taluka	Name of DMA	Members	Position	Division	Sub Division	Title	Working Period	Remarks
1	III	Salcete	**Colva**	Mr. Viraj Patil	Leader	IX	II	Technical Assistant		
				Mr. Yogesh Dessai		IX	A.S.W. Section	Technical Assistant		
				Mr. Praveen Dessai		IX	II	Junior Engineer		
				Mis. Rosalina Borges		IX	A.S.W. Section	Technical Assistant		
				Mr. Vivek Kudchadkar		IX	II	Junior Engineer		
2		Quepem	**Curchorem**	Mr. Devidas Gaude	Leader	XX	I	Junior Engineer		
				Mr. Shailesh Usgaonkar		XX	I	Technical Assistant		
				Mr. Shanu Gaonkar		XX	I	Junior Engineer		
				Mr. Sandeep Gaude		XX	I	Junior Engineer		
				Ms. Vrushali Naik		XX	I	Junior Engineer		
				Mr. Vinayak Shenvi		XX	III	Junior Engineer		
				Mr. Siddesh Pavaskar		XX	III	Technical Assistant		
3		Sanguem	**Sanguem**	Mr. P S Yarnal	Leader	XX	II	Junior Engineer		
				Mr. Kalpit Tari		XII	IV	Technical Assistant		
				Mr. Anand Mauze		XII	III	Technical Assistant		
				Mr. Gurunath Bisalhalli		XX	II	Junior Engineer		
				Mr. Sudan Desai		XX	II	Junior Engineer		
4		Canacona	**Canacona Muncipality**	Mr. Sarvesh Phadte	Leader	XX	IV	Junior Engineer		
				Mr. Prakash Bhangle		XX	IV	Junior Engineer		
				Mr. Dinesh Gaude		XX	IV	Junior Engineer		
				Mr. Deepraj Naik		XX	IV	Junior Engineer		
				Mr. Pradeep Pagi		XX	IV	Junior Engineer		

Counterparts for DMA Activities (2/2)

No.	Team	Taluka	Name of DMA	Members	Position	Division	Sub Division	Title	Working Period	Remarks
5		Tiswadi	**Miramar**	Mr. Rajendra Borkar	Leader	III	I	Assistant Engineer		
				Mr. Amay lawande		III	I	Junior Engineer		
				Mr. Deepak Borkar		III	I	Junior Engineer		
				Mr. Andrew Cardoso		III	I	Junior Engineer		
				Mr. Varad Surlakar		III	I	Technical Assistant		
				Mr. Vibhav Pai		III	I	Technical Assistant		
				Mr. C.L.George		III	II	Junior Engineer		
				Mr. Krishna Shetye		III	III	Junior Engineer		
	IV			Mr. Ghanashyam Gaude		III	I	Technical Assistant		
				Mrs. Shridevi Badami		III	A.S.W. Section	Junior Engineer		
6		Ponda	**Maracaim**	Mr. Yashawant Mapari	Leader	III	IV	Junior Engineer		
				Mr. Manoj Naik		III	V	Technical Assistant		
				Mr. Yatin Naik		III	IV	Technical Assistant		
				Mr. Narayan Naik Gaonkar		III	IV	Technical Assistant		
				Mr. Manoj Sawant		III	IV	Junior Engineer		
				Mr. Kashinath Saraf		III	IV	Junior Engineer		
				Mr. Suraj Kochrekar		III	IV	Technical Assistant		
7		Bardez	**Parvorim**	Mr. Suraj Shet	Leader	XVII	V	Technical Assistant		
				Mr. Damodar Shirodkar		XVII	V	Junior Engineer		
				Mrs. Prachi Kudalkar		XVII	V	Junior Engineer		
8		Pernem	**Pernem Muncipality**	Mr. Sandeep Morajkar	Leader	XVII	III	Technical Assistant		
				Mr. Rohan Kakode		XVII	III	Junior Engineer		
				Mr. Shakespear Fernandes		XVII	III	Technical Assistant		
	V			Mr. Gurudas Gokhale		XVII	III	Junior Engineer		
9		Bicholim	**Mayem**	Mr. Prashant Gawas	Leader	XXIV	I	Junior Engineer		
				Mr. Rohidas Naik		XXIV	I	Technical Assistant		
				Mr. Nandakishor Kesarkar		XXIV	I	Junior Engineer		
10		Valpoi	**Valpoi Muncipality**	Mr. Prashant Gaude	Leader	XXIV	II	Technical Assistant		
				Mr. Madan Desai		XXIV	II	Technical Assistant		
				Mr. Yogesh Sawant		XXIV	II	Junior Engineer		