CHAPTER4 TECHNICAL COOPARATION OUTPUTS

4.1 UFW Reduction Activities

4.1.1 Basic Policy

This project has a clear target of "Unaccounted-for water (UFW) is reduced in the pilot project areas" through UFW reduction activities and basic policies for UFW reduction activities were set up in the course of formulation of "Action Plan" and implementation of the actions.

(1) Countermeasures for UFW Reduction Activity

In general, unaccounted-for water (UFW) reduction activity is divided into the following three (3) countermeasures.

- Preliminary works : to conduct water balance analysis for obtaining the current situation of distributed water volume and UFW volume accurately.
- On-site works : to detect and repair visible or invisible (or underground) leakage points on the spot.
- Preventive works : to replace old pipes based on a renewal plan on which much leakage is expected in the future.

In order to reduce UFW steadily, these three countermeasures should be conducted by combining them properly.

Figure 4.1-1 shows the relation among those three countermeasures conceptually.

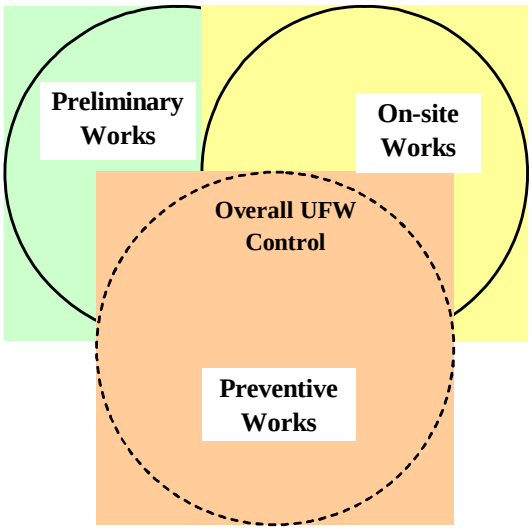


Figure 4.1-1 Relation among Three Countermeasures for UFW Reduction Activity

In this Project, preliminary works and on-site works are most important. As preventive works, the experts of the Japanese side and C/P team will collaboratively formulate a distribution block plan and a long-term distribution pipe renewal plan during the Project for improvement of UFW ratio through continuous UFW reduction activity by SHAPWASCO after the Project.

The methodology for conducting the above three countermeasures is as shown in Table 4.1-1 below.

In general, as shown in Figure 4.1-2 mentioned below, UFW reduction countermeasures are divided into six (6) stages from the first stage with more than 30% of UFW ratio as the stage of launching UFW reduction activity to the sixth stage as stabilized period of leakage with 4 to 8% of UFW ratio (excluding apparent losses such as metering inaccuracies, water theft, etc.).

UFW reduction activity to be conducted in the Project shall cover up to the third stage as recurrent period of leakage. SHAPWASCO is requested to tackle preventive works continuously from the forth to the sixth stage for further reduction of UFW ratio.

Table 4.1-1 Methodology for Three Countermeasures against UFW Reduction

Countermeasure	Item
1. Preliminary work	Preparation of leakage protection work
	Survey of current conditions
	Proper control of water meter
2. On-site work	Prevention work of on-the-ground leakage
	Prevention work of underground leakage
3. Preventive work	Improvement of pipelines
	Improvement of service pipe
	Water pressure regulation

Position of the Project in the Whole UFW Reduction Activity is shown in Figure 4.1-2.

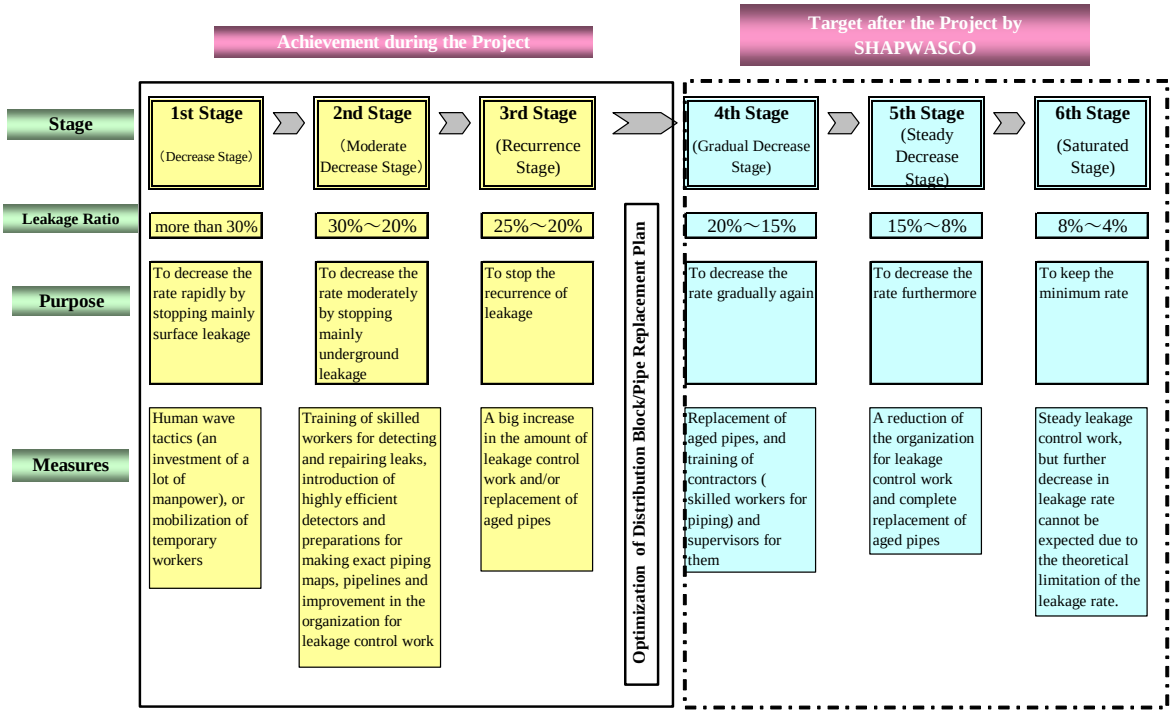
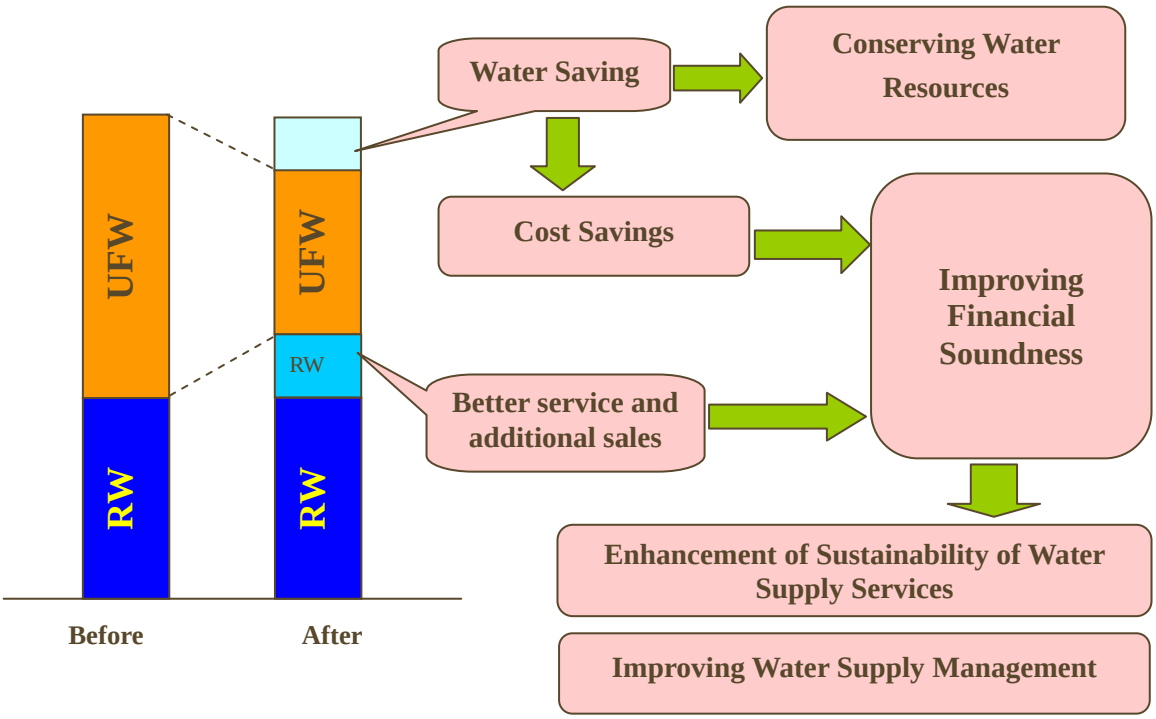


Figure 4.1-2 Position of the Project in the Whole UFW Reduction Activity

(2) Benefits of UFW reduction activity

The benefits of reducing UFW are as indicated in Figure 4.1-3.



Source :Prepared by C/P team and JICA expert team

Figure 4.1-3 Benefits of Reducing UFW

Reducing UFW ratio shall increase the revenue water quantity that means additional sales to SHAPWASCO. This increase in revenue water could be used to increase the level of service and/or the coverage area of service. Another quantity of water could be available after UFW reduction. Such quantity of water, if not needed by the customers, may conserve water resources and hence extend the life time of the resources especially in well water. In addition to water savings, other savings from the un-required capital investments in adding new water production facilities and/or renovation and upgrading of existing one.

These savings shall improve the financial soundness of SHAPWASCO and enhance the sustainability of the water supply facilities that improve the water supply management and service.

4.1.2 Action Plan

In order to achieve the target, following fourteen (14) actions were formulated in a form of "UFW Action Plan" in March 2007 as shown in Table 4.1-2.

Table 4.1-2 Action Plan of UFW reduction activity

Action	Description
U1	Conducting training of C/P staff at Mostrod Training Center
U2	Conducting leakage (minimum night flow: MNF) survey for candidate areas
U3	Determining nine (9) pilot project areas
U4	Preparing GIS drawings
U5	Learning experiences of Jordan UFW reduction project
U6	Making field survey of distribution network
U7	Surveying working conditions of water meters and conducting meter readings
U8	Measuring metering error for working meters and water wastage in the house
U9	Conducting MNF survey
U10	Making water balance analysis before repair works
U11	Conducting leakage detection survey
U12	Repairing leaking parts
U13	Conducting MNF survey (including meter readings) after repair works
U14	Making water balance analysis after repair works and its evaluation

Flow of Actions for UFW Reduction Activity is shown in Figure 4.1-4.

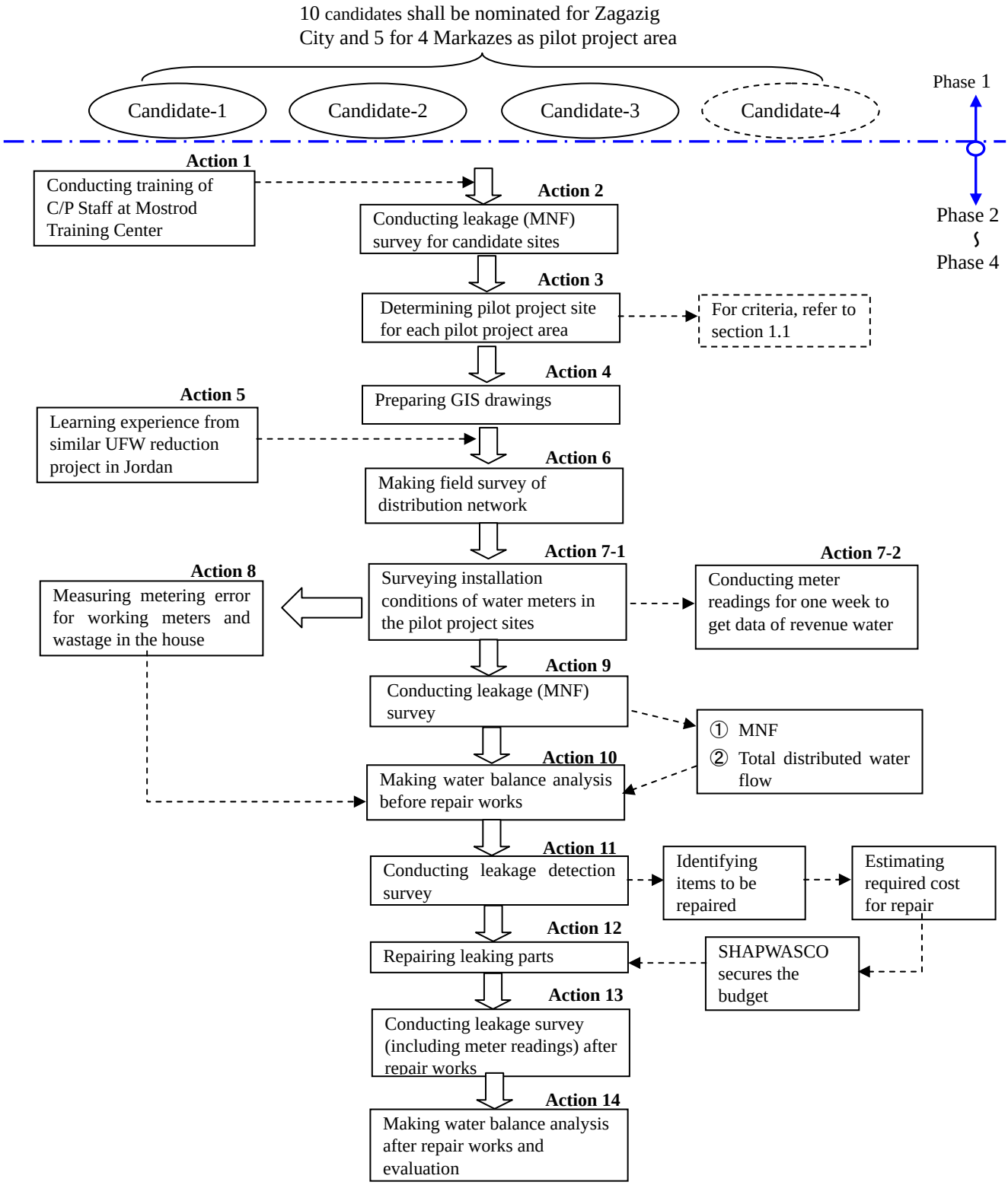


Figure 4.1-4 Flow of Actions for UFW Reduction Activity

4.1.3 Common Actions (Actions U1 to U5)

Action U1 (Conducting training of C/P staff at Mostrod Training Center)

(1) Conducting training of C/P staff at Mostrod Training Center

1) Participants

UFW team members nominated in Phase-1 took a training course of leakage survey technique at Mostrod Training Center in Cairo. The course was divided into the following:

- Class room training: Engineers and supervisors of 16 UFW teams (total 31 participants) attended.
- Field training at Mostrod Training Center: UFW/HQ team and UFW team members in the Pilot Project Areas (total 12 participants) attended.

2) Training Schedule and Program

The schedule and program of the training course are as shown in Table 4.1-3.

Table 4.1-3 Schedule and Program of Training at Mostrod Training Center

Date	Place	Attendant	Program
5th May 2007	Workshop Room at SHAPWASCO, Zagazig	1 from UFW/HQ team 2 from each UFW team (Total: 31 persons)	Class room training Learning theory of flow measurement, mechanism of leakage, etc.
6th May 2007	Mostrod Training Center, Cairo	1 from UFW/HQ team 3 from Zagazig City 2 from Zagazig Markaz 2 from Hihya Markaz 2 from Ibrahimiya Markaz 2 from Diarb Nigm Markaz (Total: 12 persons)	Field training Learning usage of leakage survey equipments such as noise detector, metal detector, pressure recorder, etc.
7th May 2007	Mostrod Training Center, Cairo	Ditto	Field Training Learning leakage detection work at the network yard.

3) Details of the Course Program

Main topics of the course are as follows:

a) Target of the course

- How to calculate unaccounted-for water
- How to plan for leak detection
- How to operate and use leak detection instruments

b) Flow meters

- Types, characteristics of flow, outputs of flow meters, precautions during installation, etc

c) Other topics

- Basics for leak detection using instruments
- Factors affecting leak noise
- Tools and equipments for leak detection and its defects
- Preparing leak detection plan (target, period, etc.)

- Making annual plan for leak detection
- Data which have to be obtained in the network maps
- Pressure estimation curve in the network
- Action plan and data analysis
- How to make a leak detection project
- Explaining a basic experiment for determining leak

(2) Conducting training of C/P staff at SHAPWASCO Training Yard for UFW Activities

1) Participants

UFW team members of 3 additional Markaz, Zagazig West and Diarb Nigm Markaz nominated in Phase-1 took a training course of leakage survey technique at **SHAPWASCO Training Yard for UFW Activities** built at the end of January, 2009 in Hihya Markaz. The course was divided into the following:

- Class room training: Engineers and supervisors of UFW team members for 4 Markaz (total 15 participants) attended.
- Field training at **SHAPWASCO Training Yard for UFW Activities**: UFW team members for 4 Markaz (total 16 participants) attended.

2) Training Schedule and Program

The schedule and program of the training course are as shown in Table 4.1-4.

Table 4.1-4 Schedule and Program of Training at SHAPWASCO Training Yard

Date	Place	Attendant	Program
18th January 2009	UFW HQ Leader's Room at SHAPWASCO, Zagazig	4 from Zagazig West 4 from Abu Hamad Markaz 3 from Menia Alqamah Markaz 4 from Bilbais Markaz (Total: 15 persons)	Class room training Learning theory of flow measurement, mechanism of leakage, etc.
19th January 2009	UFW HQ Leader's Room at SHAPWASCO, Zagazig	4 from Abu Hamad Markaz 4 from Menia Alqamah Markaz 4 from Bilbais Markaz (Total: 12 persons)	Class room training Learning theory of flow measurement, mechanism of leakage, etc.
5th February 2009	SHAPWASCO Training Yard for UFW Activities in Hihya Markaz	4 from Diarb Nigm Markaz 4 from Abu Hamad Markaz 4 from Menia Alqamah Markaz 4 from Bilbais Markaz (Total: 16 persons)	Field training Learning usage of leakage survey equipments such as noise detector, metal detector, pressure recorder, etc.
6th February 2009	SHAPWASCO Training Yard for UFW Activities in Hihya Markaz	4 from Diarb Nigm Markaz 4 from Abu Hamad Markaz 4 from Menia Alqamah Markaz 4 from Bilbais Markaz (Total: 16 persons)	Field training Learning usage of leakage survey equipments such as noise detector, metal detector, pressure recorder, etc.

3) Details of the Course Program

Main topics of the course are as follows:

a) Target of the course

- How to calculate unaccounted-for water
- How to plan for leak detection
- How to operate and use leak detection instruments

b) Flow meters

- Types, characteristics of flow, outputs of flow meters, precautions during installation, etc.

c) Other topics

- Basics for leak detection using instruments
- Factors affecting leak noise
- Tools and equipments for leak detection and its defects
- Explaining a basic experiment for determining leak

Action U2 (Conducting MNF survey for candidate areas)

(1) Candidate Areas

The pilot project sites in each pilot area shall be determined by the results of leakage survey (or minimum night flow survey) for the candidate areas for pilot project sites. The candidate areas for pilot project sites have been nominated in Phase-1 for six pilot project areas and in Phase-3 for additional three pilot project areas (Abu Hamad Markaz, Menia Alqamah Markaz, Bilbais Markaz) as shown in Table 4.1-5.

Table 4.1-5 List of Nominated Candidate Areas for Pilot Project Sites

City/Markaz Name	Candidate Area		Number of House Connection
Zagazig City – East	Aera-1	El Zend	501
	Area-2	El Husienia	900
	Area-3	Manshiat El Husienia	1,200
	Area-4	El Henawy	962
	Area-5	Hai Mubarak	489
Zagazig City – West	Aera-1	Hai El Salam	365
	Area-2	Abu Areiba	546
	Area-3	El Zagazig El Buhari	600
	Area-4	Hassan Saleh (1)	450
	Area-5	Hassan Saleh (2)	1,361
Zagazig Markaz	Aera-1	Kafr El Hamam	2,012
	Area-2	Bana Yous	2,410
	Area-3	El Messalamia	1,000
	Area-4	Sharwida	900
	Area-5	Tahlet Bordain	850
Hihya Markaz	Aera-1	South-western area of Hihya City	3,560
	Area-2	South-eastern of Hihya City	1,414
	Area-3	El Shbraween	564
	Area-4	El Mosalami	795
	Area-5	El Mahdiah	2,095
Ibrahimiya Markaz	Aera-1	Ibrahimiya City	1,025
	Area-2	El Halawat	1,097
	Area-3	El Seds	584
	Area-4	Kafr Abo El Deeb	697
	Area-5	El Habsh	1,126
Diarb Nigm Markaz	Aera-1	Diarb Nigm City (El Kosailah El Bahryiah)	1,500
	Area-2	Bahnya	1,800
	Area-3	Gemezat Bani Amr	1,430
	Area-4	Sahbarah	1,030
	Area-5	El Sania	850
Abu Hamad Markaz	Aera-1	Abu Hamad City	1,589
	Area-2	El Saadia	1,027
	Area-3	Manshiat El Abbasa	1,143
	Area-4	Arab El Fadan	813
	Area-5	Saft El Hena	950
Menia Alqamah Markaz	Aera-1	Menia El Qamah City	1,730
	Area-2	El Godaida	880
	Area-3	Malames	1,420
	Area-4	Sanhout	1,300
	Area-5	Kardida	1,233
Bilbais Markaz	Aera-1	Bibais City (Al Manshya)	680
	Area-2	Al Kabarya	835
	Area-3	Al Salam	1,139
	Area-4	Al Saeddya	1,100
	Area-5	Met Hamal	2,153

Note : The number of house connection above is for reference only and the approximate number will be confirmed before making field survey of the candidate area.

Results of MNF survey for the forty five (45) candidate areas are shown in Table 4.1-6.

Table 4.1-6 Results of MNF Survey for Candidate Areas for the Pilot Project

City/Markaz Name	Area		Number of House Connection	Date of Survey	Total Flow 24H (L)	Leakage Volume 24H (L)	MNF (Leakage) Ratio (%)
Zagazig City-East	Area-1	El Zend	501	18-19Aug	1,706,504	983,704	57.64
	Area-2	El Husienia	900	27-28May	1,261,680	564,813	44.77
	Area-3	Manshiat Husienia	1,200	17-18Jun	1,801,177	915,791	50.84
	Area-4	El Henawy	962	19-20Jun	1,119,298	621,457	55.52
	Area-5	Hai Mubarak	489	26-27May	2,207,948	1,141,652	51.71
Zagazig City-West	Area-1	Hai El Salam	365	4-5Dec	1,160,427	659,468	56.83
	Area-2	Abu Areiba	546	5-6Dec	836,647	291,807	34.88
	Area-3	El Zagazig El Buhari	600	22-23May	738,584	360,461	48.80
	Area-4	Hassan Saleh (1)	450				NA
	Area-5	Hassan Saleh (2)	1,361	21-22May	667,865	413,522	61.92
Zagazig Markaz	Area-1	Kafr El Hamam	2,012	3-4June	2,279,650	886,284	38.88
	Area-2	Bana Yous	2,410				NA
	Area-3	EL Messalania	1,000	2-3Aug	562,950	193,982	34.46
	Area-4	Sharwida	900	4-5Aug	782,111	457,146	58.45
	Area-5	Tahlet Bordain	850	6-7June	933,638	513,518	55.00
Hihiya Markaz	Area-1	South-western area of Hihya City	3,560	4-5 June	4,249,753	1,869,776	44.00
	Area-2	South-eastern area of Hihya City	1,414	5-6 June	1,084,957	364,954	33.64
	Area-3	El Shbraween	564	2-3 June	721,613	187,824	26.03
	Area-4	El Mosalami	795				NA
	Area-5	El Mahdiah	2,095	29-30May	1,468,940	371,553	25.29
Ibrahimiya Markaz	Area-1	Ibrahimiya City	1,025	18-19June	1,333,366	483,871	36.29
	Area-2	El Halawat	1,097	16-17June	636,463	125,800	19.77
	Area-3	El Seds	584	23-24June	658,152	361,041	54.86
	Area-4	Kafr Abo El Deeb	697				NA
	Area-5	El Habsh	1,126	23-24June	746,347	335,349	44.93
Diarb nigm Markaz	Area-1	Diarb Nigm City (El Kosailah El Bahryiah)	1,500	8-9Aug	1,060,726	538,372	50.76
	Area-2	Bahnya	1,800	11-12Aug	1,847,791	750,256	40.60
	Area-3	Taha El Marg	1,430	12-13Aug	947,985	214,887	22.67
	Area-4	Sahbarah	1,030	10-11Aug	723,501	195,427	27.01
	Area-5	El Sania	850	19-20Aug	1,094,365	372,520	34.04
Abo-Hamad Markaz	Area-1	Abo Hamad City	1,589				NA
	Area-2	El saadia	1,027	27-28Oct	651,724	172,515	26.47
	Area-3	Manshiat El Abbasa	1,143	22-23Oct	1,048,494	504,300	48.10
	Area-4	Arab El Fadan	813	22-23Oct	867,449	337,081	38.86
	Area-5	Saft El Hena	950	6-7Nov	832,394	296,801	35.66
Minia Alqamah Markaz	Area-1	Menia El Qamah City	1,730	20-21Nov	1,456,865	533,385	36.61
	Area-2	El Godaida	880	24-25Nov	1,377,109	693,375	50.35
	Area-3	Malames	1,420	16-17Nov	553,874	174,147	31.44
	Area-4	Sanhout	1,300	17-18Nov	737,767	337,915	45.80
	Area-5	Kardida	1,233				NA
Bilbais Markaz	Area-1	Bilbais City (Al Manshya)	1,513				NA
	Area-2	Al Kabarya	1,311				NA
	Area-3	Al Salam	1,335				NA
	Area-4	Al Saedya	1,100	23-24Dec	896,353	155,254	17.32
	Area-5	Met Hamal	2,153	21-22Jan	1,857,317	742,819	39.99
						Average	41.12%

As shown on the table, the average MNF ratio in current status is about 41.12 %. It should be noted that this MNF ratio does not represent the leakage ratio because it was found after the MNF survey

that leakage volume in 24 hours (considered as "leakage" during the survey) actually may include continuous consumption during the midnight hours in ordinary houses, public facilities, etc.

Therefore, in the implementation stage of the Pilot Project, it is necessary to make a field survey of the consumption during the midnight hours.

Action U3 (Determining 9 pilot project sites)

(1) Evaluation and Determination of the Results of MNF Survey

The result of MNF survey is shown in Table 4.1-6 described above and the main criteria for selecting the Pilot project site to determine 9 pilot project sites is the following:

- The value of the MNF is very close to the average value in the all candidate areas.
- The area has a variety of water use as government sector (schools) and hospital.
- The number of water meter is near the required range 1000-1500 connections.
- The number of non working water meter is not large.
- The average pressure is at least 1.5 bars.

Based on the above mentioned criteria, following sites have been selected as the Pilot Project sites as shown in Table 4.1-7

Table 4.1-7 Selected Pilot Project Sites

Pilot Project Area	Selected Site	Pilot Project Site	Note
Zagazig East	Area-1	El Zend	Phase-2
Zagazig West	Area-3	El Zagazig El Buhari	Phase-2
Zagazig Markaz	Area-1	Kafr Hamam	Phase-2
Hihya Markaz	Area-2	South-eastern area of Hihya City	Phase-2
Ibrahimiya Markaz	Area-1	Ibrahimiya City	Phase-2
Diarb Nigm Markaz	Area-2	Bahnia	Phase-3
Abu Hamad Markaz	Area-3	Manshiat El Abbasa	Phase-3
Menia Alqamah Markaz	Area-3	Malames	Phase-3
Bibais Markaz	Area-4	Al Saedya	Phase-3

(2) Results of Leakage Survey for Selected Pilot Project Sites

Results of leakage survey for the selected Pilot Project sites in UFW reduction activity are shown in Table 4.1-8.

Table 4.1-8 Results of Leakage Survey for Selected Pilot Project Sites

Pilot Project Area	Selected Site	Pilot Project Site	MNF*[1] (L/s)	Leakage Volume*[2] (m^3/day)	Water Volume Supplied into Site (m^3/day)	Leakage Ratio (%)
				(A)	(B)	(A/B)
Zagazig East	Area-1	El Zend	11.56	983.7	1,706.5	57.6
Zagazig West	Area-3	El Zagazig El Buhari	4.48	360.5	783.6	48.8
Zagazig Markaz	Area-1	Kafr Hamam	11.48	886.3	2,279.7	38.9
Hihya Markaz	Area-2	South-estern area of Hihya City	3.96	365.0	1,085.0	33.6
Ibrahimiya Markaz	Area-1	Ibrahimiya City	5.24	483.9	1,333.4	36.3
Diarb Nigm Markaz	Area-2	Diarb Nigm City	6.38	538.4	1,060.7	50.8
Abu Hamad Markaz	Area-3	Manshiat El Abbasa	4.71	504.3	1,048.5	48.1
Menia Alqamah Markaz	Area-3	Malames	1.5	174.1	553.8	31.44
Bibais Markaz	Area-4	Al Saedya	1.03	155.25	896.35	17.32

Notes:
1. MNF (Minimum Night Flow) shows minimum flow at a certain time after midnight measured by flow meter and this MNF contains real water losses due to leakage, water wastage and water consumption during midnight in house. Accordingly, real losses due to leakage shall be calculated by deducting the water wastage and water consumption from MNF.
2. As for leakage volume, MNF in 24 hours is the result of accumulation of the calculated MNF in 1 hour adjusted taking into consideration of the pressure fluctuation (refer to equation mentioned below). Consequently, leakage volume in 24 hours is not equal to the volume calculated by the equation of "MNF x 60 x 60 x 24 hour".

The equivalent leakage flow during the day could be determined by the following equation

$$Q_1 = \sqrt{\frac{p_2}{p_1}} Q_2$$

Where;
Q1 = equivalent minimum night flow
P2 = Average pressure at minimum night flow time
P1 = Average pressure at the time of equivalent minimum night flow
Q2 = Minimum night flow at a certain pressure

Action U4 (Preparing GIS drawings)

(1) Training of C/P Staff

GIS Center has been established in SHAPWASCO HQ and three (3) employees were assigned as a GIS C/P staff when GIS Center was established at the beginning of May, 2007. Then, additional GIS staffs were assigned from the beginning of January, 2008.

GIS expert of JICA expert team has trained GIS staff for six (6) months from 1 May to 31 October, 2007 and then GIS staff has continued to provide GIS drawings by their effort from the beginning of November, 2007 according to the schedule shown in Table 4.1-9.

Table 4.1-9 Training Schedule of GIS Staff by JICA GIS Expert

Item	Working Days of GIS Trainers	1st week	2nd Week						3rd Week							4th Week							5th week							June to end Oct-07	After Nov. 07	Training Center	Remarks
		Apr & May-07	May-07																													
		29Apr-2May	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				
		Sun-Wed	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu				
Surveying on the current situation of GIS Center of C/P																															GIS Training Center of C/P	1. Evaluation of GIS Staff of C/P 2. Evaluation of GIS hardware and software 3. Evaluation of raw data
To prepare Training material and Pre-GIS trainung at GIS Center	3 days a week																														GIS Training Center of C/P	1. Preparing training material 2. Pre GIS training
Intensive GIS Training Course	5 days a week																														GIS Training Center of C/P	Some data entry by using ArcGIS: using sample data for nominated candidate areas in Zagazig East
OJT and data entry for the Pilot Project Sites	3 days a week																														GIS Training Center of C/P	Data entry from Zagazig City (east & west) and followed by other Pilot Project Sites, if possible
To prepare GIS maps by C/P	none																														GIS Training Center of C/P	C/P shall contnue GIS map preparation by his own effort to complete whole Governorate.

(2) Information/Data incorporated in GIS Drawings

SHAPWASCO has provided the following base maps, software and plotter relating with the activity for preparing GIS drawing:

- SHAPWASCO has purchased GIS base maps prepared by using aerial photos which are developed under the assistance of USAID.
- GIS software (ArcEditor and ArcView) with permanent licenses were provided by USAID.
- Plotter for printing large size drawings such as A0 size was provided by USAID.

The location of the existing valves, fire hydrants, tees and the information of the pipe such as diameter, material, length connecting with the existing water transmission and distribution pipelines more than 100mm in diameter have been incorporated in GIS drawings (the scale of 1 to 5,000).

SHAPWASCO has purchased GIS base maps (scale: 1 to 5000) covering whole Sharqiya Governorate as shown in the following list in Table 4.1-10.

Table 4.1-10 GIS Base Maps for Sharkia Governorate

No.	City and Markaz
1	Zagazig
2	El Asher (Tenth of Ramadan)
3	Abu Kabier
4	Awlad Saqr
5	Bilbais
6	Diarb Nigm
7	El Qourain
8	Faqus
9	El Huseinia
10	Ibrahimiya
11	Kafr Saqr
12	Mashtool El Sooq
13	Menia Alqamah
14	El Qinaiat
15	El Salehia
16	Abu Hamad
17	Hihya

(3) GIS Network Drawings Prepared

Although GIS drawings are prepared for the selected Nine (9) pilot project sites in each City/Markaz according to the original plan, they will be prepared for all forty five (45) Nominated Candidate areas taking into consideration the possibility of the development of GIS activity for the whole Sharkia Governorate in future.

The list of GIS Network Drawings prepared currently is shown in Table 4.1-11. Also main pile for water network in Sharkia governorate was prepared by GIS.

Table 4.1-11 List of GIS Network Drawings Prepared

City/Markaz Name	Candidate Area		Implementation	Remarks
Zagazig City – East	Aera-1	El Zend	Phase-2	**Pilot project site**
	Area-2	El Husienia	Phase-2	
	Area-3	Manshiat Husienia	Phase-2	
	Area-4	El Henawy	Phase-2	
	Area-5	Hai Mubarak	Phase-2	
Zagazig City – West	Aera-1	Hai El Salam	Phase-2	
	Area-2	Abu Areiba	Phase-2	
	Area-3	El Zagazig El Buhari	Phase-2	**Pilot project site**
	Area-4	Hassan Saleh (1)	Phase-2	
	Area-5	Hassan Saleh (2)	Phase-2	
Zagazig Markaz	Aera-1	Kafr El Hamam	Phase-2	**Pilot project site**
	Area-2	Bana Yous	Phase-3	
	Area-3	El Messalamia	Phase-3	
	Area-4	Sharwida	Phase-3	
	Area-5	Tahlet Bordain	Phase-3	
Hihya Markaz	Aera-1	South-western area of Hihya City	Phase-2	
	Area-2	South-eastern area of Hihya City	Phase-2	**Pilot project site**
	Area-3	El Shbraween	Phase-2	
	Area-4	El Mosalami	Phase-2	
	Area-5	El Mahdiah	Phase-2	
Ibrahimiya Markaz	Aera-1	Ibrahimiya City	Phase-3	**Pilot project site**
	Area-2	El Halawat	Phase-3	
	Area-3	El Seds	Phase-3	
	Area-4	Kafr Abo El Deeb	Phase-3	
	Area-5	El Habsh	Phase-3	
Diarg Nigm Markaz	Aera-1	Diarb Nigm City (El Kosailah El Bahryiah)	Phase-3	
	Area-2	Bahnya	Phase-3	**Pilot project site**
	Area-3	Gemezat Bani Amr	Phase-3	
	Area-4	Sahbarah	Phase-3	
	Area-5	El Sania	Phase-3	
Abu Hamad Markaz	Aera-1	Abu Hamad City	Phase-3	
	Area-2	El Saadia	Phase-3	
	Area-3	Manshiat El Abbasa	Phase-3	**Pilot project site**
	Area-4	Arab El Fadan	Phase-3	
	Area-5	Saft El Hena	Phase-3	
Menia Alqamah Markaz	Aera-1	Menia El Qamah City	Phase-3	
	Area-2	El Godaida	Phase-3	
	Area-3	Malames	Phase-3	**Pilot project site**
	Area-4	Sanhout	Phase-3	
	Area-5	Kardida	Phase-3	
Bilbais Markaz	Aera-1	Bibais City (Al Manshya)	Phase-3	
	Area-2	Al Kabarya	Phase-3	
	Area-3	Al Salam	Phase-3	
	Area-4	Al Saeddya	Phase-3	**Pilot project site**
	Area-5	Al Adlia	Phase-3	

Action U5 (Learning experiences of Jordan UFW reduction project)

(1) Participants

Participants in this Action are five (5) members from SHAPWASCO and two (2) members from JICA Expert Team as shown in Table 4.1-12.

Table 4.1-12 Participants in Action U5

No.	Team	Name	Position
1	SHAPWASCO	Dr. Salah Bayoumi	Chairman of SHAPWASCO
2	SHAPWASCO	Mr. Eng. Alae El Din Mohamed	Manager, Economic Analysis and Planning Department (UFW Headquarters Team)
3	SHAPWASCO	Mr. Eng. Salama Mahmoud Abd El Alae	Manager, Network of Zagazig City Branch (UFW Team of Zagazig City-East)
4	SHAPWASCO	Mr. Eng. Mahdy Fathy Ahmed	Manager, Network of Hihya Markaz Branch (UFW Team of Hihya Markaz)
5	SHAPWASCO	Mr. Mohamed Mohamed Sabry	Supervisor, Network of Zagazig Markaz Branch (UFW Team of Zagazig Markaz)
1	JICA Expert Team	Mr. Masahiro Takeuchi	Chief Advisor/Water Supply Planning
2	JICA Expert Team	Mr. Eng. Mohamed Nagi	Facilitator

(2) Schedule

SHAPWASCO Counterpart Team (5 members) and JICA Expert Team (2 members) went to Jordan for exchanging experiences for UFW reduction activities in Egypt and Jordan. The teams stayed in Jordan from 11th June to 15th June 2007 as shown in Table 4.1-13.

Table 4.1-13 Schedule for Action U5

Date	Activity	Remarks
June 11 (Mon) '07	Leaving Cairo at 13:45 by RJ502 Arriving in Amman at 15:05	
June 12 (Tue)	**(Morning)** ・ Courtesy call on JICA Jordan Office ・ Courtesy call on WAJ head office **(Afternoon)** ・ Presentation on the achievements in the Jordan project by the Jordanian side (WAJ and JICA expert team) ・ Presentation on the project outline and the first stage achievement by the Egyptian side (SHAPWASCO and JICA expert team)	Discussions between the Jordanian side and the Egyptian side on the project achievement and methodology of UFW reduction activity
June 13 (Wed)	**(For the whole day)** ・ Visit to the Pilot Project Areas ・ Discussion with WAJ branches involved in the Pilot Project	
June 14 (Thu)	**(Morning)** ・ Discussions after the site visits by the Egyptian side **(Afternoon)** ・ History and the current situation of UFW reduction activity by UFW Department of WAJ	Questions from the Egyptian side to the Jordanian side Advice from the Jordanian side to the Egyptian side for UFW reduction activity
June 15 (Fri)	Leaving Amman at 11:30 by RJ501 Arriving in Cairo at 13:00	

(3) Results from this Action

1) Presentation by the Jordanian Side

C/P learned the current situation of UFW reduction activities done in Jordan through the presentation by the Jordanian side (WAJ and JICA Expert Team) about the Jordanian experience of Non Revenue Water (NRW) reduction and brief report about "Capacity Development Project for NRW Reduction in Jordan" (JICA technical cooperation).

2) Presentation by the Egyptian Side

- SHAPWASCO make a presentation briefly about the achievement of the project.
- Expert Team explained about the project components.

3) Information about the shortage of water resources in Jordan

- Jordan has a severe shortage of water resources, the available average for whole purposes (irrigation and water supply) / Capita is 160 cubic meter/ Year.
- The main resources of water in Jordan are wells. Jordan exceeded the safe limit of using well water and reached to 150% of the safe limit.
- The average shortage of water in Jordan reaches to 350 Million cubic meter/ Year.
- 90% of Jordan population is served with water supply.
- Due to the shortage of water resources, the supply of water to citizens is once or twice a week for each zone to provide the service for the whole citizens.

4) Information about NRW in Jordan

- In 1999 the NRW percentage was 58%.
- NRW percentage was improved to 49% in 2006.
- The yearly target of WAJ is to reduce NRW by an amount of 3% every year and reach to 35% by the year 2011.
- Jordan is planning to reduce the NRW to 15% by the year 2019.
- WAJ staff acquired much experience in the field of NRW by the activities which have been done since 1997.
- WAJ is using the latest models of necessary equipment for leak detection and measuring flow and pressures, etc.
- WAJ is utilizing up-to-date international indicators for NRW and performance indicators.

5) What has been learnt through this Action

Through this Action, SHAPWASCO Counterpart Team has learnt as follows:

- Methodology applied in this project is not so different from the one applied in Jordan and it is effective for UFW reduction.
- Capacity of GIS unit should be improved.
- New department for NRW should be established in SHAPWASCO.

4.1.4 Implementation of Pilot Project (Action U6 - U14)

4.1.4-1 Outline of each action

Action 6 Making field survey of distribution network

Field survey shall be executed for the selected pilot project sites as follows:

- Detecting visible leakage and making record in the map
- Confirming location and conditions of valves at site and recording in the map
- Confirming location of public taps, fire hydrant and governmental buildings, if any

Action 7 Surveying installation conditions of water meters

Conditions of the existing water meters shall be checked at site to clarify non-working meters and the customers without water meters. In case non-working meters or the connection without water meters are found, new water meters shall be replaced or installed.

Action 8 Measuring metering error of water meter and wastage in the house

Metering error (or meter insensitive water volume) shall be estimated by the method shown in Figure 4.1-5 below. Work for measuring metering error will be conducted in parallel with the activities in Action U6 to U11 mentioned in Table 4.1-2. In order to measure the metering error more accurately, wastage of water in the house (leakage at taps, toilet equipment, etc.) will also be measured.

Procedures for measuring metering error and wastage in the house are as follows:

[1st Step : Measuring metering error]

1. Select 20 to 30 working meters randomly in the pilot project site.
2. Close all the taps in the house.
3. Set the hands of the water meter at zero point.
4. Open one tap and close all other taps in the house. Measurement shall be done by the following three cases for the degree of tap opening:
   - Case 1 : Full opening
   - Case-2 : Half opening
   - Case-3 : Quarter opening
5. Keep running water into the measuring tank for one minute and close the tap.
6. Reopen the tap for one minute and close.
7. Repeat items 5 and 6 until water level shows 20L or other readings (10L and 15L which will be determined taking into account the work progress at site and situation of the house).
8. Close the tap and read the meter.
9. Record the time of the measurement (from item 3 to 5)
10. Repeat the procedure from item 3 to 6 for all cases.

[2nd Step : Measuring wastage of water in the house]

1. Close all the taps in the house.
2. Set the hands of the water meter at zero point again.
3. Wait until the time recorded in item 7 above has elapsed.
4. Read the meter.

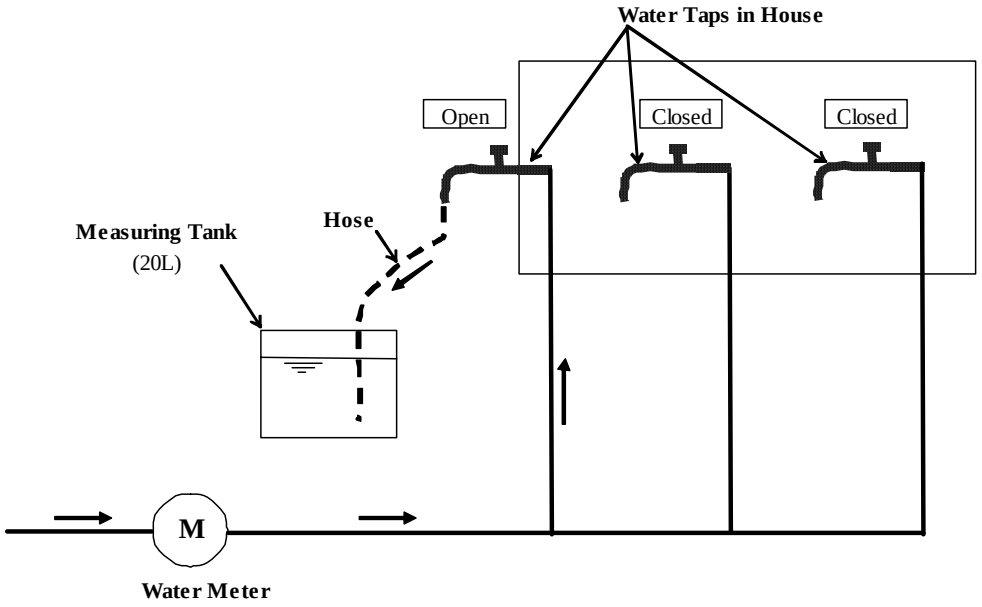


Figure 4.1-5 Method of Measuring Metering Error

Action 9 Conducting leakage (MNF) survey

(1) Method of Minimum Night Flow Measurement

When the network is formed in the tree shape and it has only one distribution pipeline supplying to the area, one (1) flow meter will be installed as shown in Figure 4.1-6.

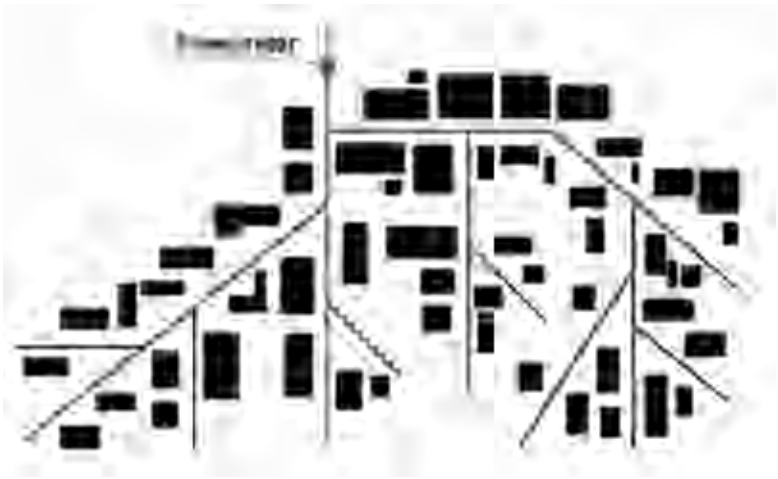


Figure 4.1-6 Flow Meter Installation for Tree Shape Network

When the network is located in the highly-populated area, one flow meter will be installed after isolating the area by closing all the valves as shown in Figure 4.1-7.

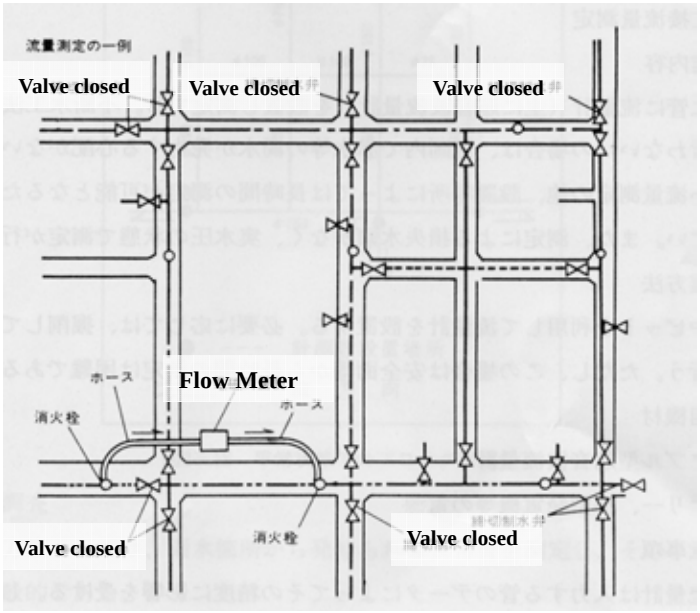


Figure 4.1-7 Flow Meter Installation for Network in Highly-Populated District

(2) Type of Flow Meter

The minimum night flow shall be measured by ultrasonic flow meter (refer to Figure 4.1-8). The ultrasonic flow meter can measure flow in pipes by catching variation in the velocity of ultrasonic waves, as they exactly depend on the rate of flow in the pipeline. It can be installed on/around water pipe without interrupting water supply.

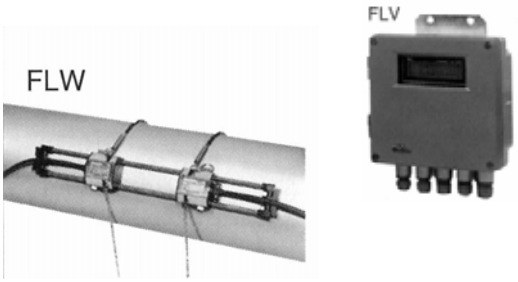


Figure 4.1-8 Ultrasonic Flow Meter

(3) Measurement of water pressure

This device is used for recording water pressure for 24 hours (refer to Figure 4.1-9). It will be installed at the inlet point of the pilot project site and highest point of the site (at taps or hydrants) to measure average water pressure in the site.

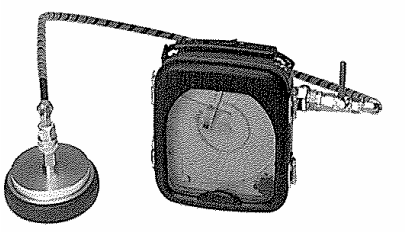


Figure 4.1-9 Water Pressure Recorder

Action 10 Making Water balance analysis (before repair works)

Water balance analysis is essential in preliminary work for UFW reduction activity. Following data shall be collected for the analysis.

- Water production volume
- Water distribution volume
- Authorized water consumption
  - Billed authorized consumption
  - Unbilled authorized consumption
- Water losses
  - Apparent losses (consumption by illegal connection, metering error, etc.)
  - Real losses (leakage in the water supply system)

The water balance analysis considered water supply service in SHAPWASCO is shown in Table 4.1-14.

Table 4.1-14 Water Balance Analysis Sheet taking into account Water Supply Service by SHAPAWSCO

<table>
<tr><td rowspan="9">Raw Water</td><td rowspan="8">Water Distribution Volume</td><td rowspan="3">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (Subtract over-registration volume)</td><td>Sold Water</td><td>Revenue Water (RW)</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td>Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="2">Commercial Loss</td><td rowspan="6">Non Revenue Water or Unaccounted-for Water (UFW)</td></tr>
<tr><td rowspan="5">Water Losses</td><td>Unbilled Unmetered Consumption</td></tr>
<tr><td>Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td></td><td>Metering Inaccuracies</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and/or Distribution Mains</td><td rowspan="3">Physical Loss</td></tr>
<tr><td>Leakage and Overflows at Utility’s Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to point of Customer metering</td></tr>
<tr><td colspan="4">Treatment Losses (Backwash, etc.)
Evaporation</td><td colspan="2">Categorized as UFW</td></tr>
</table>

Action 11 Conducting leakage detection survey

Leakage detection survey shall be conducted by means of the following methods:

(1) Detection of leaking sound by Acoustic Rod or Digital Sound Detector

When leakage occurs, leaking sound spreads through the pipe. At the point where valves are available, acoustic rod or digital sound detector will be useful for detecting the sound. The method of leaking sound detection is shown on Figure 4.1-10.

Figure 4.1-10 Detecting by Acoustic Rod or Digital Sound Detector

(2) Detection of leaking points by Leak Detector

The location of the leaking points will be identified by Leak Detector. The detection work by Leak Detector is shown in the picture.

Figure 4.1-11 Work by Leak Detector

The mechanism of detecting leaking point is explained in Figure 4.1-12

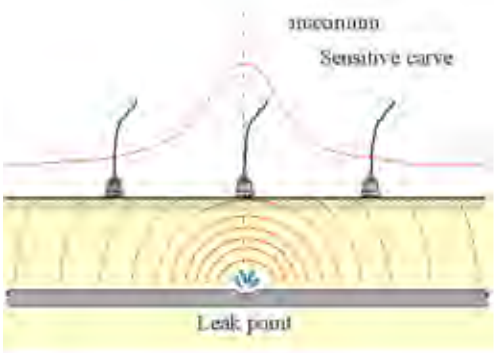


Figure 4.1-12 Mechanism of Detecting Leaking Point

The typical leak detector is as shown in Figure 4.1-13.

Figure 4.1-13 Typical Leak Detector

(3) Detection by Leak Sound Correlator

Leak Sound Correlator will be applied to confirm the leaking point when leak sound is detected in two points. This equipment identifies the location of leaks by intercepting leak noise that is caught by a sensor at two valves or hydrants (refer to Figure 4.1-14 and Figure 4.1-15). It measures the difference in transmission time between two points, and processes the data by computer. Thus, it exactly shows the leaking point.

Figure 4.1-14 Leak Sound Correlator

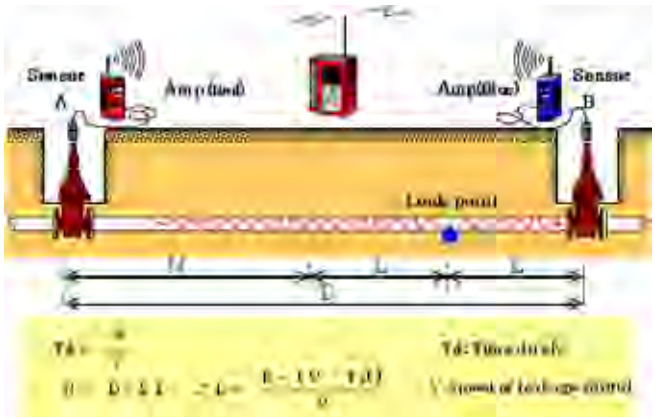


Figure 4.1-15 Method of Detecting Leakage by Leak Sound Correlator

(4) Confirmation of Leak Point by Acoustic Rod

After detecting leak point, some holes are drilled at the detected leak points and acoustic rod will be inserted in the hole to confirm the exact location of the leak point (refer to Figure 4.1-16).

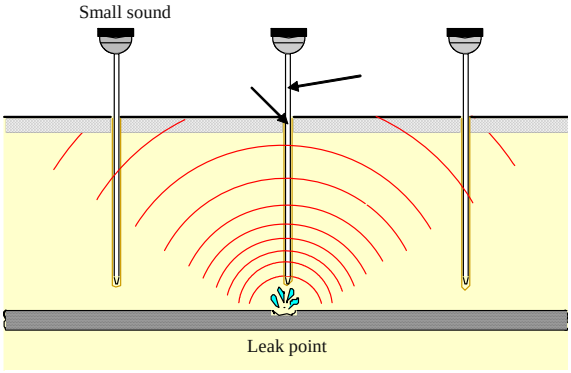


Figure 4.1-16 Method of Confirming Exact Location of Leak Point

(5) Pipe Locating Devices

When the buried pipes are not identified, following devices will be applied.

Pipe & Cable Locator

This device is used for locating pipes and cables under the ground.

Figure 4.1-17 Pipe & Cable Locator

Metal Locator

A sensor of this device detects the location of hidden iron-made structures such as valve boxes and stop valves. As iron creates a magnetic field, the suitable sensors can detect it.

Figure 4.1-18 Metal Locator

Action 12 Repairing leaking parts

After leak detection work, items to be repaired for stopping leakage shall be listed with priority and the cost estimation shall be done. The repairing work will be executed for the leakage parts according to the priority within the budget of SHAPWASCO.

Action 13 Conducting leakage survey (after repair works)

In order to confirm the effectiveness of the repairing work (or reduction percentage of leakage ratio), MNF survey shall be carried out after the repairing work of the leaking parts. Before conducting MNF survey, meter readings for one week shall be conducted.

Action 14 Making water balance analysis after repair works and evaluation

Water balance analysis shall be conducted using data obtained after the repairing works of the leak points and effect of the reduction works shall be evaluated.

4.1.4-2 Results of each Pilot Project in Pilot Project Site

(1) Results of UFW and Leakage ratio in each Pilot Project area

Results of UFW and Leakage ratio in each Pilot Project area are shown in Table 4.1-15.

Table 4.1-15 Results of UFW and Leakage Ratio in each Pilot Project Area

No.	Pilot Project Area	UFW ratio (%)			Leakage ratio (%)		
		Before repair (1)	After repair (2)	(1)-(2) (reduction point)	Before repair (3)	After repair (4)	(3)-(4) (reduction point)
PP1	Zagazig City East	40.8	20.8	20.0	37.2	17.5	19.7
PP2	Hihya Markaz	27.5	16.6	10.9	24.3	13.4	10.9
PP3	Zagazig City West	35.4	19.4	16.0	30.7	14.8	15.9
PP4	Zagazig Markaz	39.2	14.1	25.1	35.7	11.3	24.4
PP5	Ibrahimia Markaz	30.0	14.0	16.0	26.8	10.8	16.0
PP6	Diarb Nigm Markaz	26.2	18.6	7.6	21.7	14.1	7.6
PP7	Abu Hamad Markaz	39.2	29.7	9.5	36.2	26.7	9.5
PP8	Menia Alqamah Markaz	29.2	23.4	5.8	26.4	20.6	5.8
PP9	Bilbais Markaz	21.3	12.8	8.5	18.3	9.8	8.5
Expansion1	Zagazig Markaz	30.7	23.0	7.7	27.5	19.8	7.7
Expansion2	Ibrahimia Markaz	19.9	12.8	7.1	11.1	4.0	7.1
	Average (PP1-PP9)	**31.3**	**18.9**	**12.4**	**27.8**	**15.4**	**12.4**
	Average (All Sites)	**31.0**	**18.8**	**12.2**	**27.3**	**15.2**	**12.1**

As shown in Table 4.1-15, the difference between UFW ratio and leakage ratio is small as 4 points and the difference between reduction point of UFW ratio and that of leakage ratio is almost the same. Reasons for these are described as follows:

1) Difference between UFW ratio and leakage ratio is small

- The difference between UFW ratio and leakage ratio is considered as a commercial loss. In general, the commercial loss consists of the following:
  (a) Water theft by illegal connection
  (b) Metering inaccuracy
  (c) Water usage in the utility itself
  (d) Fire hydrant water

- In the Project, it has been found that commercial loss is produced in the case (b) and the metering inaccuracy consists of the following three types.
  (a) Start flow (the minute flow which is imperceptible by customer water meter)
  This flow will be caused by leakage in toilets and washing in the midnight. It was found in midnight when people do not use water. As a result of conducting mid night flow survey, start flow for each water meter is set as 36L.
  (b) Under registration in water meter reading
  This is caused by old water meters and in general the water reading becomes less than the actual water usage volume.
  (c) Over registration in water meter reading
  This is caused by old water meters and/or settlements in the meters when water quality is inadequate. Meter reading becomes more than the actual water usage volume. It is because propeller in the meter rotates faster than the normal condition due to the increased velocity inside the meter and the reading becomes bigger than the actual consumption.
- For the above three cases, field survey was done and metering errors were measured. As a result, following values have been applied to each pilot project.

Item	Applied Value	Consideration in Water Balance Analysis
Start flow	－36L/meter	Categorized as apparent loss
Under registration	－0.18% (for distributed volume)	Categorized as apparent loss
Over registration	＋4% (for distributed volume)	Subtracted from billed metered consumption

2) Difference between reduction point of UFW ratio and that of leakage ratio is almost the same

- Metering errors are found at normal water meters. Therefore, metering errors are almost the same between before-activities and after-activities.

- Non-working meters were replaced or cleaned during the Project. For water consumption of customer with non-working meter, estimated amount was applied before replacement of the water meter. As a result, the estimated volume is not so different from the metered volume.

- Therefore, difference of reduction points for two cases was very small.

(2) Results of Leakage Detection Survey in each Pilot Project Area

Results of leakage survey in each Pilot Project area are shown in Table 4.1-16 and Table 4.1-17.

Table 4.1-16 Information in each Pilot Project Area

No.	Pilot Project Area City/Markaz	Pilot Project Site Name	Area (ha)	Length of Dist. Main (m)	Diameter of Inlet Pipe (mm)	Pipe Material	Average Supply Pressure (bar)	No. of Connection or Customer (nos.)	Population Served (person)
1	Zagazig City East	Area-1(El-zand)	22	3,588	200	AS	2.73	501	3,006
2	Hihya Markaz	Area-2 (South eastern of Hihya City	77	10,480	300	PVC	2.84	1,414	8,484
3	Zagazig City West	Area-3 (El Zagazig El Baharia)	61	5,463	100	AS	2.24	600	3,600
4	Zagazig Markaz	Area-1 (Kafr El Hamam)	63	9,391	150	PVC	1.45	2,012	12,072
5	Ibrahimia Markaz	Area-1 (Ibrahimia City)	228	6,387	250	PVC	2.44	1,025	6,150
6	Diarb Nigm Markaz	Area-2 (Bahnia)	82	14,489	150	PVC	3.18	1,800	10,800
7	Abu Hamad Markaz	Area-3 (Manshiet El Abbzsa)	125	11,832	150	PVC	1.89	1,119	6,714
8	Menia Alqamah Markaz	Area-3 (Malames)	67	15,147	150	PVC	1.78	1,420	8,520
9	Bilbais Markaz	Area-4 (Al Saeddya)	23	6,061	150	PVC	1.90	928	5,568
10	Zagazig Markaz	Area-5 (Tahlet Bordain)	20	6,267	150	PVC	1.95	933	5598
11	Ibrahimia Markaz	Area-2 (El Halawat)	44	9,168	150	PVC	2.08	1234	7404

Table 4.1-17 Results of Leakage Survey in each Pilot Project Area

No.	Activity	Unit	Scope of the Project									Expansion		Total
			PP-1	PP-2	PP-3	PP-4	PP-5	PP-6	PP-7	PP-8	PP-9	PP-10	PP-11	
1	Leakage found and repair	case	5	19	5	9	8	2	2	2	3	2	3	62
	On distribution mains	case	0	1	0	0	0	0	1	0	1	0	0	3
	On service pipes	case	5	18	5	9	8	2	1	2	2	2	3	59
2	Distribution main replaced	m	0	2	0	0	0	0	1	0	0	0	0	3
3	Service pipe replaced	case	10	36	10	18	16	4	2	4	4	4	6	118
4	Illegal connections found and rectified	case	3	0	0	0	0	0	0	0	0	0	0	3
5	Customer meter replaced	no.	63	160	188	243	45	10	209	2	250	150	70	1415
6	Customer meter cleaned	no.	270	200	183	0	0	0	0	10	0	0	0	663
7	Customer meter repositioned, realigned	no.	3	6	10	12	3	1	10	3	13	8	4	75

(3) Detailed results of leakage detection survey in each Pilot Project area

Detailed results of leakage detection survey in each Pilot Project area are shown in Annex.

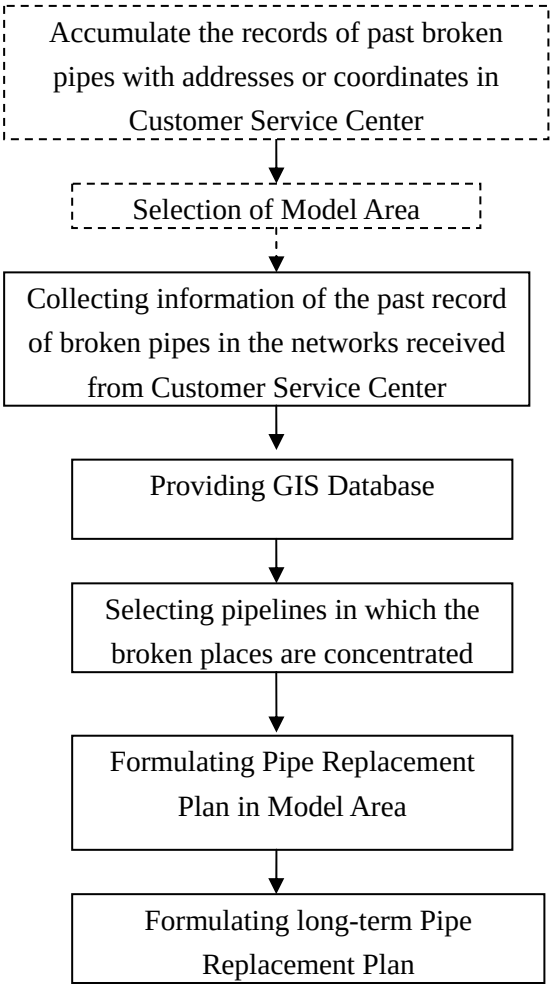
4.1.5 Formulating Long-term Pipe Replacement Plan for Preventive Works

4.1.5-1 Methodology and results

Formulating long-term pipe replacement plan has been conducted in the following manner:

At present, Customer Service Center of SHAPWASCO (dial number 125) has been receiving the Customer's complaints and the information about the broken pipes around-the-clock basis since 2006. Expert team and UFW/Head Quarter (HQ) team have requested the Customer Service Center to accumulate the information of the broken pipes with addresses or coordinates so as to input the places of broken pipes into GIS drawings.

Since SHAPWASCO has been provided with GIS Drawings for nine (9) Pilot Project areas and also whole Zagazig City- East, Zagazig City-East area will be selected as a model area for formulating long-term pipe replacement plan.



: Customer Service Center of SHAPWASCO has received the information of the broken pipes on a round the clock basis.

: Location, diameter, material of the broken pipes are indicated in GIS Drawings.

: The following pipelines will be selected for replacement

(1) Pipelines where frequent broken pipe accidents are reported.

(2) Piping material is of Asbestos Cement.

(1) Objectives

Since the existing pipelines in Zagazig City-East Area are constructed in 1980 and the material of pipes are mixed with Asbestos Cement and PVC, the existing old pipelines having large numbers of past broken records and the existing asbestos cement pipes should be replaced by new pipe by priority.

(2) Procedure

The pipelines to be replaced in the Zagazig City-East area will be selected according to the following procedures:

- The existing pipelines in SHAPWSCO were constructed in 1980s.
- Asbestos cement pipes (ACP) are still remained in the existing pipelines.
- To accumulate the information of past broken records with addresses or coordinates in Customer Service Center.
- To input the places of past broken record into GIS Drawings for Zagazig City –East Area.
- To select the pipelines having large numbers of past broken records.
- To select the pipelines with Asbestos Cement
- To decide the pipelines to be replaced.

(3) Result

The pipelines to be replaced are as follows:

- Pipelines in High Mobarak 1 area in Zagazig City-East and location of broken pipes are as shown in Figure 4.1-19 and Figure 4.1-20 respectively.

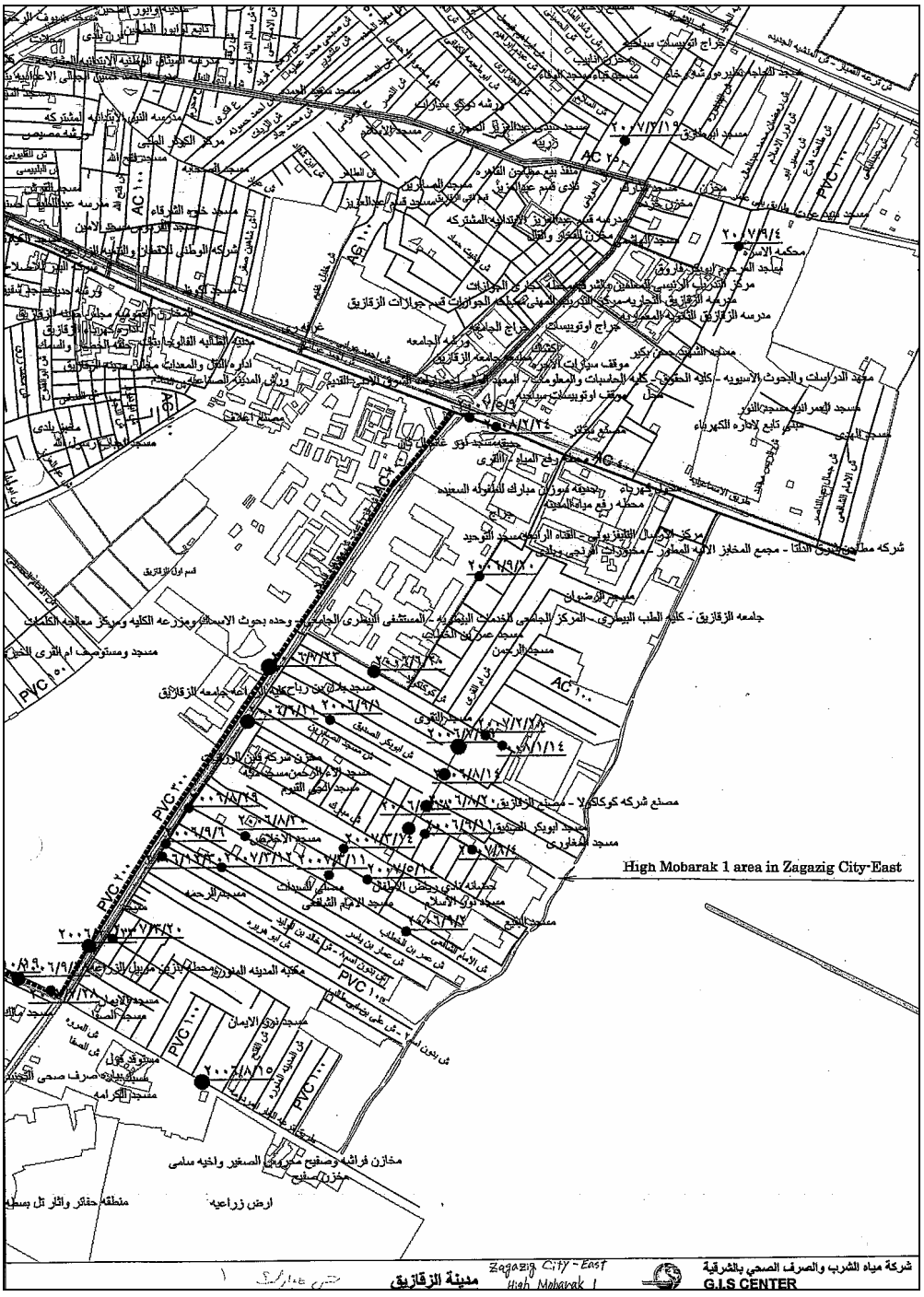


Figure 4.1-19 Pipelines in High Mobarak 1 area in Zagazig City-East

Figure 4.1-20 Location of Broken Pipes in Zagazig City-East

(4) Planning for long-term pipe replacement

Although pipelines for Zagazig City East Area was selected as the model area, it is very important to continue accumulating the information of past broken pipes with addresses or coordinates in Customer Service Center and to input the places of broken pipes into GIS Drawing covering whole Sharkia Governorate.

UFW/HQ team should make a plan for long-term pipe replacement according to the result of GIS Drawings and secure the budget for pipes replacement according to the priority.

4.1.5-2 Training for small contractors and plumbers to improve the quality of skills

Since it was found as a result of UFW reduction activity that leakages have been concentrated in the house connections and branching works of installing house connection done by the small contractors and plumbers might cause leakages problems due to lack of skills, SHAPWASCO expressed that he will train the small contractors and plumbers periodically in order to improve the quality of the construction works through the water conservation campaign including workshop.

4.1.6 Formulating a Plan for Expanding UFW Reduction Activity to the whole Governorate

In the Project, out of 15 branches for SHAPWASCO, 8 branches are ready to do UFW reduction activity through the experience in the pilot projects. From now on, it is expected for SHAPWASCO to procure the leakage survey equipment for all the UFW teams and conduct activities for achieving long-term target for UFW ratio.

In this Project, a plan for expanding UFW reduction activity to the whole Governorate was formulated by JICA expert and C/P team members (refer to “Supporting Report”). SHAPWASCO is now working for establishing UFW department based on the plan.

4.1.7 Internal Workshop for UFW Reduction Activities

Under the UFW activity in the Project, following five internal workshops were held to accomplish the activity and to confirm the achievements during the project period.

Table 4.1-18 Internal Workshop for UFW Reduction Activities Done

No.	Date	Subject of Workshop
1	Feb. 24 to Mar. 1, 2007	Formulation of UFW Action Plan
2	Apr. 15, 2007	Explaining the importance & necessity of the Project
3	May 17, 2007	Explaining implementation method and schedule for Action Plan
4	Jul. 1, 2007	Training for meter reading
5	Sept. 11, 2007	Class room training and field training for leak detection method

(1) Feb. 24 to Mar. 1, 2007: Workshop for Formulation of UFW Action Plan

Objectives:

- to understand the targets and outputs of the project
- to clarify the methodology of UFW reduction activity
- to select candidate areas for pilot project sites where UFW reduction activity is conducted during the project

Attendants:

Thirty-one (31) persons attended as SHAPWASCO UFW teams of headquarters and 13 Markazes (1 from UFW/HQ team, 2 from Zagazig-East, 2 from Zagazig-West and 2 from 13 Markazes).

Material:

- Presentation by JICA expert team for the following:
  - Necessity of UFW reduction activity
  - Criteria for selecting Pilot Project area
  - Water balance analysis
  - Organizing UFW team in SHAPWASCO for the project
  - Outline of the project (project purpose, outputs, activities, schedule, etc.)
- Draft Copy of the suggested Action Plan.

(2) Apr. 15, 2007: Workshop for explaining the importance & necessity of the Project

Objectives:

- To expand the knowledge of SHAPWASCO staff

Attendances:

- SHAPWASCO Chairman
- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Managers , Water Facilities Managers)
- Local Staff of JICA Experts team for the project

Material:

- The handouts explaining the 14 actions included in UFW reduction activity

Main Topics of discussion:

- The Chairman explained and confirmed the background, importance and necessity, activities done by SHAPWASCO staff under the assistance of the Project's Experts.
- Mr. Khalaf and Dr. Sobhy explained the detailed programs of the Project

(3) May 17, 2007: Explaining implementation method and schedule for Action Plan

Objectives:

- to explain UFW team members about methodology to be applied in UFW reduction activities
- to confirm schedule for MNF surveys in the candidate sites for the pilot project

Attendants:

- UFW/HQ team
- Representatives of UFW teams from Zagazig City and 13 Markazes

Material:

- Power point

Main Topics of discussion:

- Functions of leakage survey equipment
- Schedule of MNF survey for thirty (30) candidate areas for the Pilot Project

(4) July 1, 2007: Training for meter reading

Objectives:

- To give training UFW team members for meter reading that is one of the important actions in UFW reduction activities.

Attendants:

- UFW/HQ team
- Representatives of UFW teams from Zagazig City and 13 Markazes

Material:

- Typical water meter for ordinary houses
- Power point for explaining functions of water meter

Main Topics of discussion:

- Type of water meters
- How to read a meter
- How to distinguish working meters and non-working meters

(5) Sept. 11, 2007: Class room training and field training for leak detection method

Objectives:

- To give training UFW team members for leak detection method theoretically and practically (class room training and field training were conducted).

Attendants:

- UFW/HQ team
- Representatives of UFW teams from Zagazig City and 13 Markazes

Material:

- Power point for explaining how to operate the leak detecting equipment
- Leak detection equipment for field training

4.2 SOP Activities

4.2.1 Basic Policy

4.2.1.1 Basic Policy of SOP Activities

This project has a clear target of "Operation and maintenance capacity of water supply facilities is strengthened through SOP activities" and basic policies for the SOP activities were set up in the course of formulation of "Action Plan" and implementation of the actions. Basic policies mentioned are shown as follows;

(1) Extent of SOPs covering operation, maintenance and water quality control

Generally SOP in Egypt deals operation and maintenance procedures of the facilities but in this SOP activity of SHAPWASCO, water quality control shall be fully collaborated to the operation and maintenance activities in order to persuade the further efficiency and economy in the management of water supply facilities.

In this context, SOP documents prepared in the Project shall be consisted of three categories, i.e. "Operating Procedures", "Maintenance Procedures" and "Water Quality Control Procedures".

(2) SOP based on the understanding of the process and system of the facility

According to the site survey on current O&M practices, the water supply facilities in SHAPWASCO are generally operated continuously and maintaining continuous operation is important and difficult however current O&M are lacking followings;

- Proper records of daily O&M
- Criteria for proper O&M
- Understanding of the correct treatment process and system of the facility concerned

Therefore in the preparation of SOPs, emphasis on understanding of overall system and relations between processes shall be placed for the first activity and detailed procedures inside the component equipment shall be discussed and prepared later.

In other words, while SOP documents considered in the water supply facilities have wide range form the facility overview describing basic details such as design flow and single line diagram to the detail operating procedures such as water level measurement and valve operation, SOPs for former part shall be prepared at first.

(3) Safety equipment for chlorine gas handling

In most water treatment plants, Booster pump stations and well stations of SHAPWASCO, safety measures for chlorine gas handling equipment such as chlorine gas leakage detector, warning devices, chlorine gas neutralization equipment are not functioning .

There is neither law nor clear regulation for the safety measure of chlorine gas handling equipment, however, it may cause a fatal accident and the SOP activity of the project can not ignore the fact. Urgent remedial works are recommended and SOP activity shall be proceeded with under the understanding of implementation of the remedial works.

(4) New Potable Water Quality Standards

Egyptian Potable Water Standards were revised and issued in October 2007 as Decree 458 and it contains comprehensive strengthening from the present standards as hereunder tabled typically. But some of the present water treatment plants can not fulfill these new requirements and it is urgently required for SHPWASCO to clarify whether the existing plants may fulfill the standards or not while detailed application procedures are being prepared, for instance, "meaning of color Nil" and a certain grace or transition period was given to the application of the decree. SOP activity is affected that operation according to the prepared SOPs may not be appropriate for some plants.

Table 4.2-1 Typical Changes in Present and New Potable Water Standards

	Decree 458	Present
Color	Nil	20-30
Turbidity	5/10 NTU	1 NTU
TDS	1,000	1,200
Iron	0.3 mg/l	0.3 mg/l
Manganese (groundwater)	0.4 mg/l	0.70 mg/l

(5) Free Residual Chlorine of the Water in the Network

For the water supplied by SHAPWASCO, free residual chlorine is not properly maintained in many places although the regulation by Ministry of Health clearly requires 2.0 mg/l of free residual chlorine at the outlet of the facility and 0.5 mg/l at the furthest tap. There are some technical reasons or explanations for this situation for the facilities of which sources of water supply are well groundwater in addition to the delay of chlorination equipment deployment by financial reason. And they are;

- Generally groundwater is clear and safe.
- Groundwater containing Fe or Mn causes color problem when chlorine is dosed by oxidization.

Even though these reasons or explanations are made, omission of the chlorine dosing should not be allowed and countermeasures for Fe and Mn are requested to be materialized. Therefore, SOPs are prepared under the understanding that necessary chlorine and treatment equipment will be prepared in due time.

(6) Application of SOPs commenced by Selected Themes

Water treatment facilities are consisted of many processes generally and the numbers of prepared SOP packages are many accordingly. Therefore for the application of these SOPs to the facility cannot be done at one time. In the activity of the project, to understand SOP in depth, one or two themes are selected through the discussion between SOP/HQ team and SOP/MF team members. They are called trial operations in OJT. For example in the water treatment plant filtering system was selected and detailed operation procedures of filter washing and maintenance of filter media are examined as standard. Once these trial operations successes, application of SOP packages to the other equipment can be easily extended by only SOP/MF team members.

(7) Development of SOPs to the Remaining Facilities

In the course of Action S6, application of SOPs in the model facilities, it was found that preparation of SOP documents for the whole plant needs much time while there are many keen issues exist in the major equipment such as filter system in water treatment plant or free residual chlorine control in Fe Mn removal plant. In this SHAPWASCO decided to organize task force to tackle with these issues in other facilities and they prepare SOP documents limited to the particular issues and apply them prior to the development and application of overall SOPs.

(8) Rehabilitation for unified forms for O&M recording

Through the site survey in Phase-1, it was understood that there were many kinds of facilities and equipment on which O&M records should be unified for both of the facility management and management of water supply division of the company. In order to concentrate the efforts and see the effect, the record system of high priority items may be started for the first stage and expand the activities to the other items for the later stages along the progress of SOP activity. Through the discussion in some internal workshop, the following two operation and maintenance items were selected for high priority items to be addressed for the first stage of the activity. Forms of the following items were prepared in Phase-2 and measurements and recordings were conducted in Phase-3 and 4.

Operation records

- Records of raw water and production volumes including pump operation records
- Chemical consumptions of water supply facilities
- Energy (electrical) consumptions of water supply facilities

Maintenance records

- Records of actual repair and maintenance
- Regular inspection rules of major equipment

(9) Protection circuit for electrical equipment

At the initial stage of electrical SOP activity, i.e. survey for the preparation of single line diagram of the facilities at Abassa WTP and Zeraa Well Station, it was found and reported by the expert (Progress Report 2) that electrical equipment of these facilities were under quite dangerous situation and urgent repair were required before fatal accident. It was concluded that SOP activity under this condition was impossible and SHAPWASCO would start comprehensive repair works. But actually these repair works were not completed at end of Phase-4.

Abassa WTP

- Protection circuit of medium voltage is not functioning
- DC power supply for the protection circuit is completely out of order
- Some SF6 switchgears are out of order

Zeraa Well Station

- Electric power supply equipment for the pumps are completely degraded

4.2.1.2 Implementation Flow of SOP Activities

SOP activities were carried out along with the flow chart below.

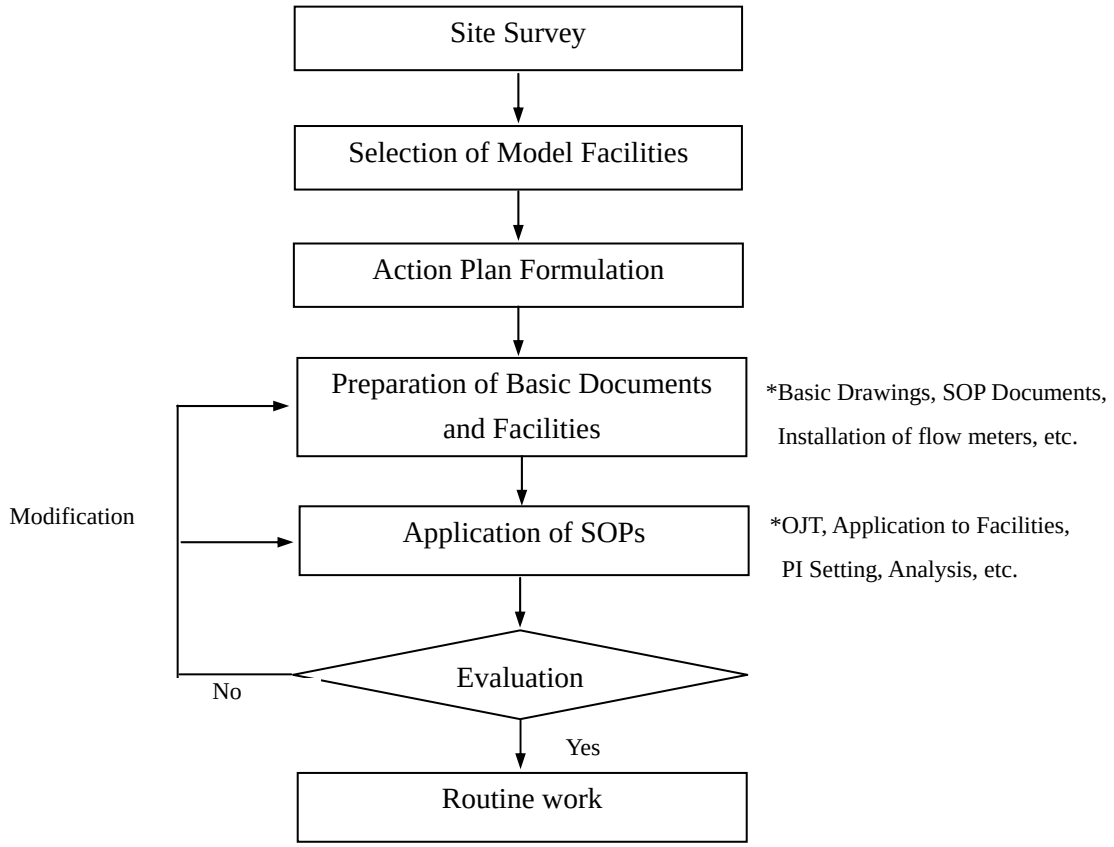


Figure 4.2-1 Implementation Flow

4.2.1.3 Model Facilities

Model facilities for the SOP activities were selected from the various types and process of facilities in the SHAPWASCO and they are as follows.

- Abassa WTP, Abu Hamad Markaz
- Zagazig WTP, Zagazig City
- Kafr Farag Fe/Mn Plant, Minea Al Qamah Markaz
- Bilbais BPS. Bilbais Markaz
- Aslougi Well Station, Zagazig Markaz
- Network in Hihya for Distribution Control and Hydraulic Analysis

Zagazig WTP was selected as model facility in phase-3 due to delay of handing-over of New Faqus WTP to SHAPWASCO which was selected in phase-1. Additionally the situation of facilities in Zerra well station where was selected in phase-1 was recognized that it was terrible miserable and it was judged that applying of SOP was impossible. Therefore model facility of well station was changed from Zerra to Aslougi.

4.2.2 Action Plan

Actions

Following ten (10) actions formulated in March 2007 as "SOP Action Plan" are as follows;

Action-S1 Preparation of basic system drawings
Action-S2 Preparation of unified forms of O&M records and reports
Action-S3 Measurement/records of Intake and Production Water Volume at Seven WTPs
Action-S4 Development of SOPs for Model Facilities
Action-S5 SOP activities for Water Distribution Control in the Network
S5-1 Pilot Project for Distribution Control in Small Areas
S5-2 Hydraulic analysis of water supply and distribution network
Action-S6 O&M applying the SOP
Action-S7 Development of SOPs for the Remaining Facilities
Action-S8 Preparation of O&M Plan
Action-S9 Development of Water Quality Control Program
Action-S10 Well Monitoring

Monitoring Items

For the actions formulated in "Action Plan", monitoring items and targets of the activities were set up as "Objectively verifiable indicators" and approved in the JCC (Joint Coordinating Committee). Objectively verifiable indicators for the SOP activities and achievements are as shown in Table 4.2-2.

Table 4.2-2 Objectively Verifiable Indicators and Achievements

1	Basic system drawings of the facilities are prepared and updated at five (5) model facilities (2 WTPs, 1 FMRP, 1 BPS and 1 well station) which represent the facilities of SHAPWASCO.	Yes, basic drawings are ready for all the model facilities.
2	Manuals for management of O&M are developed and updated as SOPs by the following SOP packages for plant components and for three activity categories, i.e. Operation, Maintenance and Water Quality Control for each model facility. Not less than twenty (20) SOP packages at WTP Not less than five (5) SOP packages at FMRP, BPS and well stations.	WTP 34 packages FMRP 20 packages BPS 9 packages Well station 8 packages
3	For the application of SOPs to the field operation, class room training and OJT to operators are conducted at all the five (5) model facilities.	Yes by selected themes of each facility
4	Not less than eighty (80) percent of SOP/HQ and SOP/MF members acquire the ability to apply knowledge and skills of SOP.	Yes
5	O&M Plan is developed at not less than one (1) WTP.	Abbasa WTP
6	Water quality control program applying the new HCWW regulation is prepared.	Yes
7	Well inventory is prepared with a standard form and the first round of investigation is conducted for all the SHAPWASCO well stations.	Well Inventory 2007 and 2008
8	Hydraulic analysis is done for not less than two pilot project areas.	Pilot areas for Hihiya and Zagazig

4.2.3 Each SOP Action

4.2.3.1 Action S1 (Preparing basic system drawings)

For the first step of the activities, system drawings of the facilities shall be prepared and they are;

- Overview of the facility
- Layout
- Schematic hydraulic drawings
- P&ID
- Electrical single-line diagram

(1) Output from the action

Output-1: Drawing preparation

Drawing preparation for the model facilities were completed including site survey, preparing hand writing sketches, and digitization by CAD as shown in Table 4.2-3 in case of Abassa WTP.

Table 4.2-3 Basic Drawings prepared for Abbasa WTP

No.	Drawing	No.	Drawing
1	P&ID for the facility	10	Satellite Image
2	P&ID for Chlorination facility	11	Schematic Hydraulic
3	P&ID for Alum Dosage facility	12	Sand Filters
4	General Layout		
5	Piping Route		
6	Cable Route		
7	Electrical Single Line		
8	Mechanical Equipment List		
9	Electrical Equipment List		

Output-2 Drawing preparation of the Qenayat FMRP

Along with the development of SOP activity to the remaining facilities (Action S7), basic drawings were prepared at Qenayat FMRP and Abu Metana FMRP.

Figure 4.2-2 Situation of Qenayat FMRP

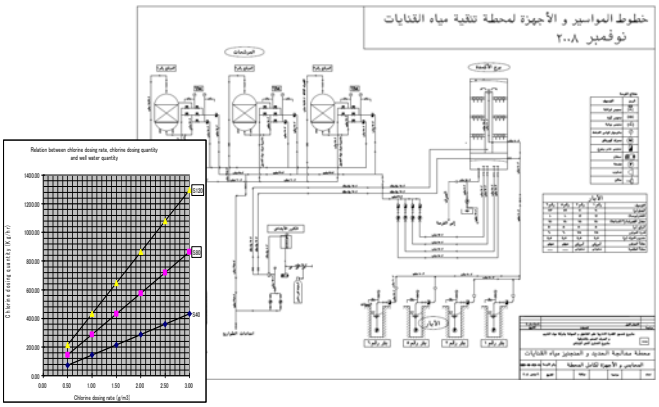


Figure 4.2-3 P&ID and Graphs for to calculate the quantity of chemicals for Qenayat FMRP

Output-3 Capacity development

PCs for SOP activity were allocated to the all model facilities and utilization of basic drawings at site became one of the common practices.

The P&ID has been developed thorough internal workshop meetings by SHAPWACO staffs of SOP team under instruction of Japanese expert team. As the results, the participants of these meetings acquired the capacity which a drawing reads.

(2) Issues to be addressed for the next step

Issue-1 Modifications

In the course of SOP OJT and application to the equipment O&M, some additions, modifications and/or corrections were required to the prepared basic drawings. Proper and immediate modification and notification to the relevant sections are quite important. Therefore it is necessary to prepare a structure and procedures to carry out these actions.

4.2.3.2 Action S2 (Preparing unified forms of O&M records and reports)

Unified forms of O&M records and reports were prepared in Phase-2 for each kind of facility including the standardization of calculation/measurement methods of production/ transmission volume of water, chemical/energy consumption or other O&M record items. These forms are used in the ordinary O&M of the model facilities.

(1) Output from the action

Output-1 Development for high priority and additional record forms

Based on the discussions in the internal workshop, high priority items of measurements and records were decided for water treatment plant and forms for records were formulated. These items are as follows;

- Raw water intake and treated water volumes including major pump operation
- Chemical consumption (alum and chlorine)
- Power consumption

Additionally, in the course of SOP OJT and application to the equipment O&M, following two (2) forms were developed through the discussion among expert, SOP/HQ and SOP/MF team members. Forms are now kept in PCs of the facilities concerned and used fully for the daily O&M.

- Record form for turbidity control for the filter backwash water (WTP)
- Record form for water quality control, free residual chlorine control and turbidity control (WTP and FMRP)

Output-2 Capacity development

Through the activity, the importance of measurements and recordings of the operation and maintenance of the facility was understood among the O&M members and above additional forms were developed.

These forms may be improved locally by SOP/MF team members according to the actual application proficiency as well as SOPs.

(2) Issues to be addressed for the next step

Issue-1 Review and improvement of forms

Unified forms have been used more than one year. These are prepared by SHAPWASCO but it takes a certain time and therefore full application of the unified forms will be kept until the completion of these works. Moreover, rehabilitations of existing equipment are definitely required for the proper measurement of basic flow rate and chemical/electricity consumptions.

4.2.3.3 Action S3 (Measuring intake/production water volume at seven (7) WTPs)

For the management of the water supply service of SHAPWACO, grasping the intake and transmission water volume from the major WTPs is quite important as very basic figures. In this project actual measurement/record of raw water intake and production water volume at seven WTPs shall be practiced including repair and new installation of bulk flow meters.

(1) Output from the action

Output-1: New installation and repair of bulk flow meters

The first five (5) bulk flow meters were provided in 2006 and the remaining sixteen (16) bulk flow meters were provided on May in 2008 by this project. Thereby SHAPWASCO has installed bulk flow meters to new/existing chamber or aqua duct through planning of installation location and modification. Meanwhile, SHAPWASCO repaired existing four flow meters in Kafr Saqr water treatment plant and New Faqus water treatment plant by proposal of Japanese Expert.

Figure 4.2-4 Installation Situation of Bulk Flow Meter in Abbasa WTP

Output-2: Measurement and Record of Raw water and transmission water volume

SHAPWASCO has measured and recorded the volume of raw water and treated water.

Measurement interval is once per day by hand writing record and thirty minutes by data roger.

A location of data logger is the place where it is difficult to take a record every day or a key location such as raw water in Abbasa WTP.

The measurement of two flow meters is waiting for commitment of rehabilitation and water distribution. Statuses of all the flow meters as of end of Project are summarized in Table 4.2-4 below.

Table 4.2-4 Location for Flow Meters at Seven (7) WTPs

(As of November 1, 2009)

Plant name	Place	Route	Diameter	Material	Data Logger	Cominucation Base	Note	GIS coordinates of Installation		Records
Old Zagazig WTP	Inside	Raw water		400	SP			Plant under Rehabiliation	30 34 59.6	31 29 3.2	Ready
Abbasa	Inside	Raw water-1		800	SP	1		Existing Chamber	30 31 36	31 42 29.3	Start
		Raw water-2		800	SP	2		Existing Chamber	30 31 35.9	31 42 27.3	Start
		Treated water-1	Zagazig	900	SP	3		New Chamber	30 31 36.3	31 42 18.7	Start
		Treated water-2	Faqus	600	SP	4		New Chamber			Start
		Treated water-3	Abu Humad-1	800	SP		1	New Chamber	30 31 37.6	31 42 35.8	Start
		Treated water-4	Abu Humad-2	600	SP			New Chamber	30 31 36.8	31 42 34.5	Start
		Treated water-5	Bilbais	600	ACP			New Chamber			Start
	Outside	Branch-1	Unserrved villege	800	SP			Existing Chamber	30 31 38.3	31 42 35.6	Start
		Branch-2	Zagazig	500	CIP	5		Aqua duct	30 33 44.7	31 35 59.7	Start
		Branch-3	Abu Kabier-1	400	CIP	6		Aqua duct	30 38 36.7	31 40 15.7	Start
		Branch-4	Abu Kabier-2	300	CIP	7		Aqua duct			Start
New Faqus	Outside	Branch-1	Abu Kabier	400	ACP	8	2	New Chamber	30 41 13.81	31 44 8.45	Start
Old Faqus	Inside	Raw water		500	SP			Plant under Rehabiliation	30 43 47.4	31 44 8.45	Ready
Husainia	Inside	Raw water		800	SP			Existing Chamber	30 47 27.6	32 03 54.2	Start
		Treated water		800	SP			New Chamber	30 47 29.3	32 03 55.24	Start
Kafr Saqr	Outside	Branch-1		1000	SP	9	3	Aqua duct	30 47 28.5	31 37 47.9	Start
		Branch-2	Abu Kabier	800	SP	10		Aqua duct	30 49 12.3	31 37 30.9	Start
Bil Bais	Inside	Al Mohada Line	Supply to Belbis Cit	300	ACP	11	4	New Chamber	30 24 24.4	31 33 39.8	Start
	Outside	El Adlia	Supply to Belbis Cit	300	ACP			New Chamber	30 24 30.8	31 33 35.8	Start
Kafr Farag F/M	Outside	Treated water		500	SP			New Chamber	30 30 56	31 20 20	Start

Notes:
1- SHAPWASCO has installed four Ultrasonic flow meters (Model Omega- USA) on the raw and treated water of New Faqoua WTP & Kafr Saqr WTP through their own budget. The records of Kafr Saqr WTP has been started.
2- SHAPWASCO has calibrated existing flow meters on the raw water and treated water of New Zagazig. The records of New Zagazig has been started.

3-Rehabilitation work of SHAPWASCO includes new flow meter installation on terated water in Old Zagazig WTP and Old Faqus WTP.

Output-3: Collecting of measurement record and analysis

At the moment head quarter team has collected the original record from manager of water treatment plant and directly collected the data of data roger at the site. And head quarter team has input the data to PC and compiled the data. Head quarter team periodically has analyzed the total volume of raw water and treated water in New Zagzaig water treatment plant and Abbasa water treatment plant in this phase. By these results, Expert team sets the following performance indicator.

- Ratio of production water volume to intake water volume
- Power consumption per unit production water volume
- Chlorine consumption per unit production water volume
- Alum consumption per unit production water volume
- Measured produced water per employee

Output-4: Capacity development

Planning and document preparation for major flow rate measurement of this activity which includes preparation of network of inter-Markaz treated water transmission lines were conducted by Expert team and SOP/HQ team. Though the discussion with Chairman of SHAPWASCO for the expanding the measurement points, SOP/HQ team modified original plan and prepared plans for Fe/Mn removal plant and major pump stations by themselves.

And SHAPWASCO has planning of flow meter installation on rehabilitation of water treatment plant. Through this action, C/P have acquired 1) Utilizing records of basic water flow rate to the calculation of PIs, 2) Planning of installation of bulk meter for extension, 3) Taking correct records.

(2) Issues to be addressed for the next step

Issue-1: Man power planning for Data collecting, input to PC and analysis

The data collecting and inputting to PC should be conducted by manager/engineer of each facility. Therefore data analysis should be conducted by manager/engineer of each facility as well as head quarter team. Performance indicator should be planed by them through analysis, by so doing they will operate the facilities efficiently.

Issue-2: Rehabilitation of Plant and operation start

Remaining two (2) flow meters were already installed, but measurement didn't start yet due to incompletion of rehabilitation and no distribution water. Measurement should be conducted as soon as operation will start at Old Zagazig and Old Faqus WTP.

Issue-3: Development of data base for water volume

The location of flow meter and these measurement records should administrate on data base system such as GIS data or chart in monthly data. Database will be useful for utilizing water flow rate data.

4.2.3.4 Action S4 (Developing SOPs for Model Facilities)

Standard Operating Procedures (SOPs) are a set of documents describing operating and maintenance steps to be followed by the staff of the facilities either in the normal operation, planned emergency or unexpected emergency situation. SOP packages consist of 3 kinds of category, these are operation, maintenance and water quality control. SOPs for water treatment facility were prepared in Phase-2 and SOPs preparation of all the other model facilities were continued and completed August 2008 in Phase-3.

(1) Output from the action

Output-1 SOP Headlines and SOP package (Draft Final SOP)

In order to secure the earlier commencement of field application, SOPs of some minor equipment were not prepared and left for the future activity by the facility. For this, "SOP Headlines" were prepared for each model facility and specific issues to be addressed in the facility were sorted out in Phase-2. Accordingly, total 71 packages of SOPs were prepared through SOP applying out of 50 packages mentioned in "SOP Headlines" as summarized in Table 4.2-5 below.

Table 4.2-5 Total Number of SOPs prepared through Phase-3

Model Facility	Number of SOP packages prepared in Action S4	Number of SOP packages sorted out in Headlines
Water treatment Facility (WTP)	34	21
Fe/Mn Removal Plant (FMRP)	20	12
Booster Pump Station (BPS)	9	9
Well Pump Station (WPS)	8	8
Total	71	50

In parallel with the development of above SOPs, electrical SOPs were also prepared with electrical O&M members of the team. Four (4) electrical SOP packages for each model facility became available to apply in Phase-3.

SOPs are generally consisted of the following component documents shown in Figure 4.2-5 below;

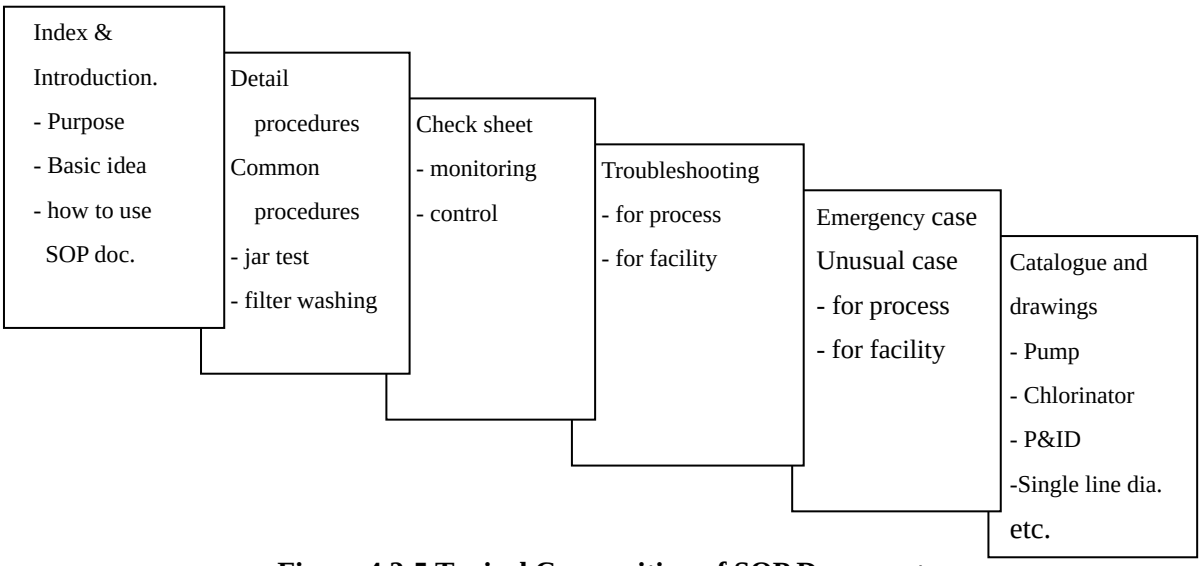


Figure 4.2-5 Typical Composition of SOP Documents

Prepared SOPs were introduced for discussion in the open workshop held in June 2008. Attendants of this open workshop were not only the related personnel inside SHAWASCO but personnel from HCWW and other affiliate water companies were invited.

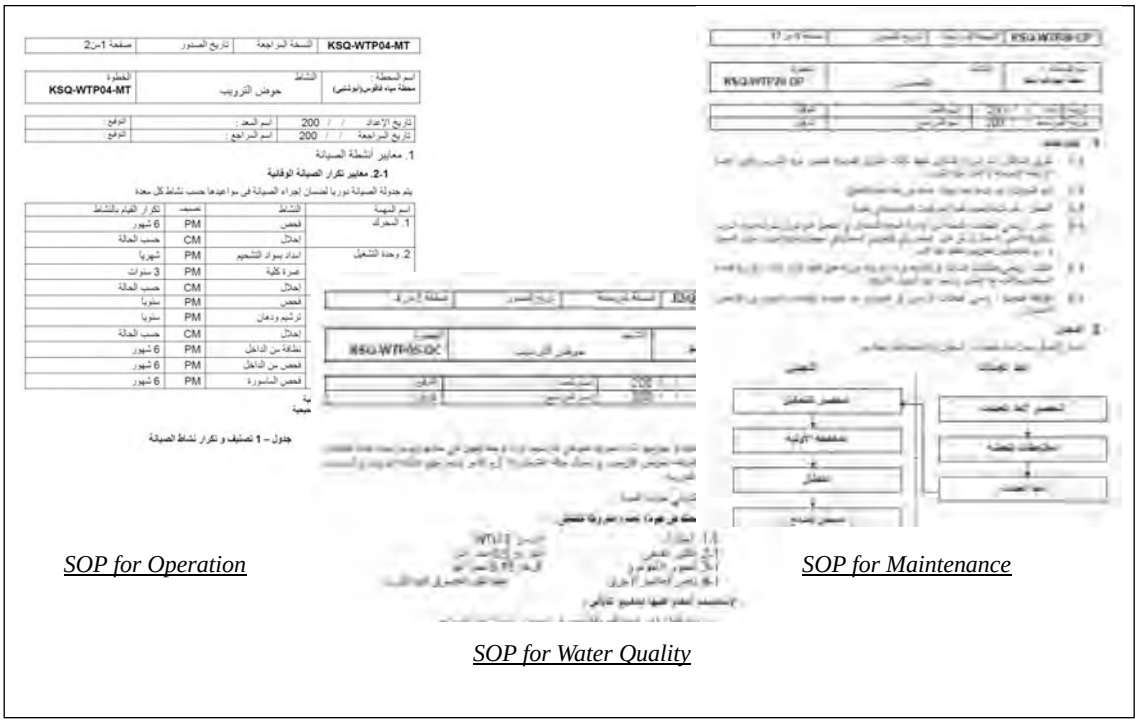


Figure 4.2-6 Example for SOP Documents in Arabic (SOP Package)

Output-2 SOPs of Electrical Equipment

After the prior site investigation and preparation of system drawings such as “Single Line Diagram”, electrical SOPs were prepared separately from the operational SOPs for the

following five (5) facilities.

- Abbasa Water Treatment Plant
- New Faqus Water Treatment Plant
- Kafr Farag Fe/Mn Removal Plant
- Bilbais Booster Pump Station
- Aslougi Well Pump Station

According to the characteristic of the electrical O&M of the water supply facilities, maintenance procedures including testing and quality control were much focused in the electrical SOPs than the operations.

Output-3 Additions and modifications of SOPs after first draft distribution

According to the progress of OJT and field application (Action S6), detailed SOPs were developed by team members as follow;

1. Filter Basin
   1-1 Recovery procedure of the degraded filter media
   1-2 Checking method of filter media cleaning effect
   1-3 Rinsing procedure
   1-4 Daily inspection

2. Free residual chlorine control for water treatment plant
   2-1 Basic idea of free residual chlorine control
   2-2 Flow of free residual chlorine control and determination of chlorine injection rate
   2-3 Correlation graph of injection rate-process water volume-injection amount

3. Dosage control for coagulant for water plant
   3-1 Correlation graph of injection rate-raw water volume-injection amount

Output-4 Capacity development

C/P of SOP team acquired the descriptions which should be included in SOPs and procedures for revision of the descriptions in SOPs. C/P of SOP team can develop the SOPs for the remaining facilities to be extended SOP activities.

(2) Issues to be addressed for the next step

Issue-1 Modifications and detailed SOPs

According the progress of the SOP activities, O&M members feel the necessity of modification of existing SOPs. SOP/HQ and SOP/MF teams shall discuss the modifications and enhance the contents of SOPs.

And then outputs shall be shared among all the SHAPWASCO facilities through internal workshops or publications.

Issue-2 SOPs for remaining equipment

SOPs for the equipment related directly to water quality and operation efficiency were

prepared for the first step. Once the SOP activity will be established, SOPS for the remaining equipment also shall be prepared by SOP/HQ and SOP/MF teams and outputs shall be shared among all the SHAPWASCO facilities through internal workshops or publications.

According the progress of the SOP activities, O&M members feel the necessity of more detailed procedures for particular equipment. SOP/HQ and SOP/MF teams shall discuss the development of detailed SOPs and enhance the contents of SOPs.

4.2.3.5 Action S5 (Examining water distribution control in the network)

4.2.3.5-1 Action S5-1 (Pilot project for distribution control in small areas)

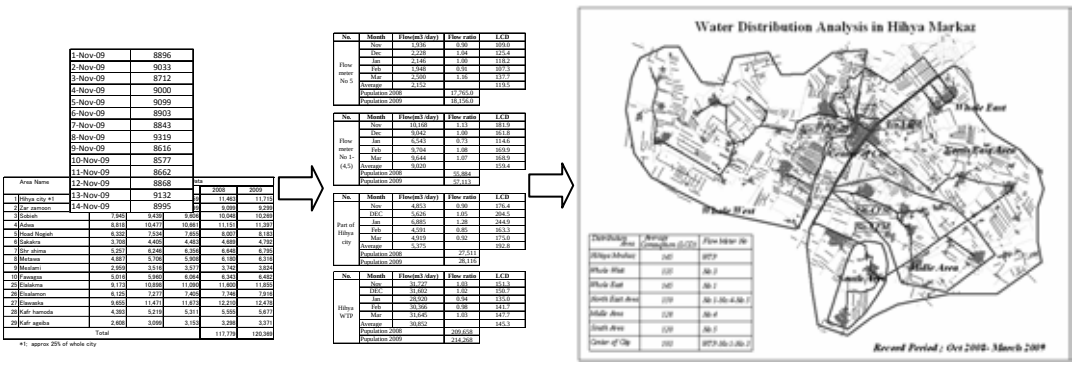
(1) Output from the action

Output-1: New installation of bulk flow meters

Total five (5) new installations by the Project were planned considering the inter-Markaz water transmission in Phase-2. Five (5) bulk flow meters already installed and data has recorded at each flow meter. The civil work of was already finished. However one (1) construction of water line where is located Al Salamon village is not distributed yet due to new distribution line.

Output-2: Collecting of measurement record and analysis

Four (4) flow meters have been measured, head quarter team has collected and analyzed actual flow rate which is data of six months from October, 2008 until March, 2009. Team could grasp the actual volume litter per capita par day in Hihya and could understand the analysis method by using actual data and population data. It is important to grasp these basic data which is current supply water for future planning of network in SHAPWASCO.



Data collecting of Flow Rate and Population *Data Analysis* *Preparation of Drawing*

Figure 4.2-7 Data Analysis in Hihya

Output-3: Preparation of SOP document for Distribution Network Management

SOP document for distribution network management was prepared, which is mentioning the purpose of distribution control in small areas and method of utilization for flow meter at boundary of Markaz. It is difficult to understand the supply volume in each Markaz, because supply water form water treatment plant is transmitted to another Markaz. For example,

treated water of Kafr Sakr WTP is transmitted Kafr Sakr Markaz, Abu Kabier Markz, and though Awlad Sakr Markaz to Huseinia Markaz. SHAPWASCO can grasp unit water supply LCD (litter per capita per day) by learning supply volume at each Markaz and can calculate approximate UFW by comparing with customer water consumption.

Output-4: Capacity development

Head quarter team have understood an importance for grasping of water volume in some district and an utilization for design in the future, moreover they can calculate it by using actual water volume.

(2) Issues to be addressed for the next step.

Issue-1: Manpower planning of Collecting of measurement record

Head quarter team has directly collected the data of data roger at the site. However head quarter team is limited persons, so data collecting should be conducted by sector.

4.2.3.5-2 Action S5-2 (Hydraulic analysis of water supply and distribution)

(1) Output from the action

Output-1: Analysis in Zagazig City

Minimum Night Flow (MNF) survey was conducted at UFW activity in Zagazig City Area. For corporation with UFW activity, three (3) counterparts have learnt the utilization of its result to hydraulic analysis. Therefore hydraulic analysis conducted at pilot area Zazagiz City Area-4 by using actual flow volume and pressure. Following is enabled by this process;

- Utilization of GIS drawing
- Calculation of demand
- Utilization of actual flow volume and pressure
- Basic operation method on Water Cad
- Method of pipe replace planning

Output-2: Analysis in Hihya Markaz and Modifications

Counterpart had learned calculation method and hydraulic analysis was done in Hihya Markaz in phase-2. Additionally actual water volume has been measured in Hihya in phase-3. As a result of comparison with actual flow volume and volume by analysis, it was the approximately same and became the result that there was the propriety as present situation analysis. And peak factor for hourly maximum flow was calculated by actual flow volume. Moreover, since part of piping network has replaced in Hihya Markaz, counter part periodically has conducted modification to current situation on Water Cad.

Output-3: Capacity development

C/P of SOP team acquired the operation skills of application software of Water Cad for hydraulic analysis. C/P of SOP team can conduct hydraulic analysis by operation of application

software of Water Cad.

(2) Issues to be addressed for the next step.

Issue-1: Expansion of analysis area

As supply water form water treatment plant is transmitted to another Markaz or there are many water supply resources, distribution network is very complicated; therefore it is assumed an analysis is not easy. However it is important that analysis area shall be expanded at all by counterpart by utilizing basic data such as data on action 5-1.

Issue-2: Staff number of hydraulic analysis and organization

For the moment, staff number of hydraulic analysis is not sufficient. C/P is required to make efforts to increase a number of hydraulic analysis staff for expansion of analysis area. It is desirable for it to be belonged to a Planning Department as for them if possible.

In order to measure actual flow volume or pressure and to evaluate water distribution network, cooperation between network analysis staff and UFW team is required. In case that distribution network is connected with another Markaz, it is necessary in the network analysis to grasp the flow volume to another Markaz. Moreover, preparing and updating of GIS data is also indispensable on hydraulic analysis.

4.2.3.6 Action S6 (Applying SOPs in O&M)

When the prepared SOPs would be applied to the facility concerned, two methods were taken. One is selection of one or two specific operation/maintenance themes to be tackled immediately. The other is SOP application through OJT by experts. The aim of this OJT is not only to explain the procedures of operation and maintenance written in SOPs but to assist the O&M members to understand the issues and meanings of procedures with PDCA cycle;

- Understanding overall functions, operation and maintenance of the water treatment or supply facility
- Selecting trial application themes, (high priority parts of the operation or maintenance) for SOP application OJT
- Sorting out the current status and issues of the selected maneuvers and related equipment
- Understanding the stipulated procedures and relations to the issues (P: plan)
- Conducting O&M according to the SOP (D： do)
- Checking the results (C: check)
- Reviewing the SOP and modifying it if necessary (A: take action)

This SOP application through OJT was conducted at four (4) model facilities and two (2) facilities selected for Action S7 “extending SOP activity to other facilities” as follows;

Model Facility

- Abbasa WTP
- Zagazig WTP

- Kafr Farag FMRP
- Bilbais BPS
- Aslougi WP

Extended Facility

- Kafr Saqr WTP
- New Faqus WTP
- Qenayat FMRP
- Abu Metanna FMRP

(1) Output from the action

Output-1: Abbasa/Zagazig water treatment plant

Almost all the activities have been conducted in parallel with Abbasa WTP and Zagazig WTP.

A. Selected trial application themes
   1) Maintenance of filter media of filter basin, refreshment of filter media and cleaning basin
   2) Coagulator dosage control in the treatment process
   3) Free residual chlorine control in the treatment process
   4) Raw water production water flow rates control

B. Trial Application through OJT
   1) Maintenance of filter media of filter basin, i.e. refreshment of filter media and cleaning basin

      Filter basins of the facility are operated with the degraded filter media and causes lower production efficiency and lower water quality. Improvement of continuous filtering time by proper filter media refreshment and maintaining good condition of filter media by proper basin cleaning were conducted according to the prepared SOP.
   2) Coagulator dosage control in the treatment process

      At present, insufficient coagulation sedimentation is considerably affecting to the latter filtering process due to lack of proper coagulant dosage control. Continuous control of coagulant dosage was applied through the procedures by determination of dozing rate depend on the raw water quality and raw water flow rate.
   3) Free residual chlorine control in the treatment process

      For the safe potable water supply, residual free residual chlorine control in the network is essential and the free residual chlorine concentration of filtered water shall be maintained in stable condition. For this, over all chlorine control including injection rate and consumption at pre-chlorination stage and actual chlorine concentration data at various process points were applied.
   4) Raw water production water flow rates control

      As the very basic operation item of the water treatment facility, raw water and production water flow rate measurements, recording and utilization for the improvement of chemical injection, chlorine injection control and so on were introduced.


Figure 4.2-8 Lecture and study on filter refreshment to the plant managers

Output-2: Kafr Farag/Qenayat Fe/Mn removal plant

(1) Trial application at Kafr Farag Fe/Mn removal plant

Trial application was conducted for Kafr Farag FMRP at first and then for Qenayat FMRP. All most of the activities were same but as the results, the aimed water treatment could not be achieved and some maintenance works were recommended at Kafr Farag as follows;

Two trial operations were conducted by SOP/facility team.

- Operation-1 Increasing free residual chlorine residual (target 1.0 mg/l) at filter inlet and analyzing process water qualities at various points
- Operation-2 Activating filter media by chlorine and repeat operation-1

Results of first two trial operations are not good caused by oxidation function insufficiency of filter sand. Maintenance work for the filter with total replacement of the media was decided in SHAPWACO HQ.

(2) Trial application at Qenayat Fe/Mn removal plant

Qenayat FMRP was added as an extended facility for SOP activity. The aimed water treatments were conducted at Qenayat.

A. Selected trial application themes
   1) Free residual chlorine control in the process water and treated water
   2) Procedures of filter media refreshment in the filter tank

B. Trial Application through OJT
   1) Free residual chlorine control in the process water and treated water

   Iron/manganese removal plant is a treatment plant reducing the iron and manganese contents contained in the source ground water by applying the aeration and chlorine oxidization and contact oxidization filtering process. Free residual chlorine control is most important operational item for not only efficiency of Fe/Mn treatment but color and free residual chlorine of product water.

   According to the SOPs, 1-Modifyinng of chlorine dosing point from inlet of aeration tower to outlet of aeration tower, 2-determination of chlorine injection rate based on the raw well water quality and chlorine demand for oxidization, 3-consideration of chlorine injection rate

by required residual free residual chlorine for the treated water, 4-monitoring well water flow rate and chlorine injection amount, 5-Free residual chlorine control of process water were applied through OJT.

2) Procedures of filter media refreshment in the filter tank

At present, filter media refreshment or backwashing are conducted periodical basis indicated by manufacture but proper backwashing and rinsing drain time and interval shall be decided considering the raw well water quality and actual turbidity of backwashing water and rinsing drain as stipulated in SOPs.

Figure 4.2-9 Site Situation of Qenayat Fe/Mn

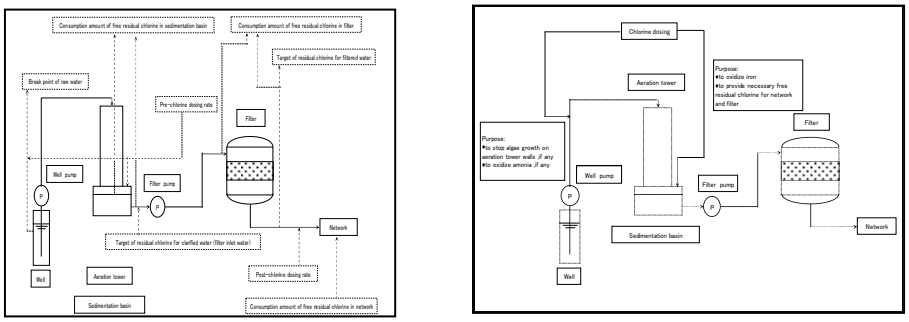


Figure 4.2-10 Basic Idea and Function of Chlorine Dose Control in Qenayat Fe/Mn

Output-3: Bilbais booster pump station

A. Selected trial application themes

1) Operation control of booster pumps

B. Trial Application through OJT

1) Operation control of booster pumps

Currently operation control by number of pumps is done at this pump station but an enhanced operation control of main booster pumps considering flow rate information, pressure and demand information in the network is required.

In this trial application, procedures for control the water pressure in the network by control of discharge volume from booster pumps were examined.

Output-4: Aslougi well pump station

A. Selected trial application themes

1) Free residual chlorine control
2) Control of well pumps

B. Trial Application through OJT

1) Free residual chlorine control

At this well pump station, groundwater is pumped up and distributed to the city through network and it has a chlorination facility.

For the first trial application to this WPS, "Activation of existing chlorine facility" was aimed and a set of water quality survey in the network was conducted taking into the consideration of effect caused by existence of iron in the raw well water.

As it was discussed in the workshop on June 11th organizing operation members of the station, Zagazig Markaz Branch chemists and SOP/HQ team, results of water quality survey shown that the existence of iron in the raw well water is high but reduced to an acceptable level in the network pipes.

SOP/HQ team concluded that chlorine injection to the water supply pipe will cause color problem by not allowable level by Potable Water Standards and it is not appropriate caused by excess degree of color of water to use chlorination facility without chlorine dosing flow rate control and iron removal treatment while the facility and Zagazig Markaz Branch shall continue the regular water quality monitoring in the network. Based on continual regular water quality analysis, when chlorine dosing rate should be controlled to a certain value, it turned out that water color of transmission water can be controlled below to a potable water standard value in Egypt.

2) Control of well pumps

Instead of twenty four hours well pump operation, on-off control of well pumps was examined by means of utilizing the existing elevated water tank.

Output-5: Application of Electrical SOPs through OJT

Electrical SOPs has been applicable through OJT which has held as site workshop. The OJT has been conducted at Zagazig WTP and Abbasa WTP. The list of OJT is reference in 4.2.4 sections.

(2) Evaluation of SOP application through OJT

In order to keep the O&M based on SOPs sustainable activity, it is quite important for the O&M members to recognize the effects, which are expected in improvement of equipment, O&M work-process, O&M cost and finally their own O&M capability.

A. Reduction in O&M cost

OJT for filter washing has conducted in five (5) water treatment plant where is Zagazig, Abbasa, Kafr Saqr, New Faqus, Huseinia. Though this OJT, the quantity of filter washing will decrease approximately ***25,000 m^3/day*** and O&M cost for filter washing will decrease approximately ***19,000LE/day*** in five (5) water treatment plant under following condition.

Table 4.2-6 Modification Example of run time for filter washing after applying OJT of filter refreshment in Zagazig Water Treatment Plant

		Before modification	After modification
Filter washing regime	Air acouring	3 min	5 min
	Air and backwash	5 min	5 min
	backwashing	8 min	5 min
	Dischaege volume of backwashing pump	475 l/sec	530 l/sec
Backwashing rate	Filtering area 69 m2	0.41 m3/m2/min	0.46 m3/m2/min
Water consumption	per one filter per once washing	370.5 m3	318.0 m3
Difference between before and after modification	per once washing per one filter	53 m3/filter/washing	
Filter run time	per one filter	24 hr	36 hr
Frequency of filter washing in a week	per one filter	7 times	5 times

Figure 4.2-11 Filter Before Refreshment

Figure 4.2-12 Filter After Refreshment

B. Growth in O&M capability

1) Objective member for the evaluation

Evaluation of H/Q counterparts' acquirement degree on O&M activity was carried out by the verification test as first step of evaluation. Objective members are three (3) SOP H/Q team members.

2) Evaluations and results Verification test consists of twenty (20) questions and all in question are not choice questions but description questions. Content of the questions is as follows

- Questions on common knowledge: 4 questions
- Questions on O&M activity: 16 questions

5 questions about chemical dosing
4 questions about operation and maintenance of filter
2 questions about iron and manganese removal process
2 questions about operation of main pump
3 questions about monitoring of water quality
Total 16 questions

All H/Q counterparts got the score of test more than eighty (80) percent, therefore the

judgment was acceptable.

Moreover, H/Q counterparts' achievements by SOP activities are summarized as following.

- Realization of importance of O&M records and data
- Realization of necessity of utilization by analysis of O&M records for improvement of activities
- Realization of achievement of reduction about operation cost regarding chemicals, power and water amount.
- Realization of possibility of improvement about reduction of O&M cost by experiences of successful approach in OJT activity
- Realization of capacity improvement on O&M activities of filter sand maintenance, filter washing operation and free residual chlorine control
- Acquisition of knowledge which is lacking for O&M staffs
- The intention to a suitable operating procedures

(3) Calculation of PI regarding O&M

Measurement of flow rate for intake water and transmission water in 6 water treatment plants in SHAPWASCO has become possible by installation or repair of flow meter. Records of these flow rates are informed to SOP H/Q team from managers of 6 water treatment plants and PIs are calculated by SOP H/Q team. Following PIs were calculated as one of the activities in this project:

1) Power consumption per unit production water volume
2) Chlorine consumption per unit production water volume
3) Alum consumption per unit production water volume
4) Ratio of production water volume to intake water volume
5) Production water volume per employee

Originally, PI should be calculated as performance indicator of management for the business unit. Therefore, the records for calculation of PI include whole records in the business unit. In this project, actual flow rate of intake and transmission water can be measured only at water treatment plants.

The following water treatment plants are in service from January, 2009 in SHAPEWASCO. Records in Hihiya WTP and Zagazig WTP have been taken since 2008, its in New Faqus, Kafr Saqr, Huseinia, and Abbasa WTP have been taken since January 2009.

1) Hihya WTP
2) Zagazig WTP
3) New Faqus WTP
4) Kafr Saqr WTP
5) Huseinia WTP
6) Abbasa WTP

The following water treatment plants are still under rehabilitation since 2008 and not in service. Therefore, PIs for those plants could not be calculated.

1) Old Zagazig WTP
2) Old Faqus WTP

PIs for the above mentioned plants were calculated in a period from January to September in 2009. Calculation results of PI for WTPs and target of PI is shown in Annex. These PI target will be finalized though internal workshop by SHAPWASCO.

(4) Issues to be addressed for the next step

Issue-1: Reduction in O&M cost

In phase-3, the run time of filter washing has changed and cost reduce is succeed in Zagazig Water Treatment Plant. Since OJT is carried out by H/Q counterpart, it will be possible to reduce the O&M cost by SHAPWASCO after this.

4.2.3.7 Action S7 (Development of SOPs for the Remaining Facilities)

In the course of Action S6, "Application of SOPs in the model facilities", it was found that there are many keen issues exist in the major equipment such as proper cleaning of filter basin in water treatment plant or free residual chlorine control in Fe Mn removal plant. In this SHAPWASCO decided to organize task force to tackle with these issues in other facilities and they prepare SOP documents limited to the particular issues and apply them prior to the development of overall SOPs for the facility concerned. Therefore activities of Action S7 in this reporting period were "Formation of Task Force" and "Instruction for the Remaining Facilities".

(1) Output from the action

Output-1: Instruction to SOP activities for the Remaining Facilities

For the first step of SOP activities in the remaining facilities other than the model facilities, two (2) kinds of instructions were conducted to the following water treatment facilities and Fe/Mn removal facilities by task force and SOP/HQ team. Modification of SOPs and forms to their facilities and application were instructed by task force and SOP/HQ team.

- Water treatment Plant (WTP) by task force and SOP/HQ team
  - Kafr Saqr WTP
- Fe/Mn Removal Plant (FMRP) by SOP/HQ team
  - Qenayat FMRP

Output-2: Capacity Development

Through the OJT implementation for SOP applying, C/P of SHAPWASCO H/Q team acquired the skills for OJT and skills for SOP applying. C/P of SHAPWASCO H/Q team can extend SOP activity to the remaining facilities by themselves.

(2) Issues to be addressed for the next step

Issue-1: Extending by the Continuous Activity

There are many facilities still waiting for the SOP activities and above experienced facilities need to develop comprehensive SOPs for the other equipment. Therefore continuous effort to extend the activity is requested to SOP/HQ team.

4.2.3.8 Action S8 (Preparation of O&M Plan)

Under the certain progress of the above Action S6 "SOP Application" to the Abbasa WTP, "Preparation of O&M Plan" was proposed from SOP/HQ team to SOP/MF team. For the SOP activity, the activity plan for a certain period is effective and important to develop the target areas sustainable in the form of O&M Plan. There was not any O&M Plan at Abbasa WTP and therefore expert and SOP/HQ team members started the explanation of purposes and the expected contents in the general O&M plans. But it was proposed to prepare a plan practical and easy for Abbasa by utilizing existing SOP documents.

Output from the action

Output-1: O&M Plan for Abbasa WTP

Preparation of the O&M Plan has been started and preliminary interview surveys in HQ and Abbasa WTP were done and collection of the existing rehabilitation and maintenance plans, such as "5-year Plan" and preparation of priority maintenance list were conducted for the first step.

Contents of the O&M Plan were discussed and considered at present as shown below "Contents of the O&M Plan". First draft of the O&M Plan is issued by H/Q team and SOP/MF team for Abbasa WTP. Preparation for the draft of the O&M Plan was started by H/Q team and SOP/MF team for Zagazig, New faqus and Kafr Saqr WTP. The made documents are under trial utilizing and contents will be improved while utilizing it.

"Operation & Maintenance Plan Contents for Abbasa WTP"

1. Description of the Facility
   - Overview
   - Regulations
   - O&M Targets of the Facility
   - Equipment List
2. Start-up and Normal Operating Procedures,
   Records and Reporting, and Quality Control
3. Emergency Plan
4. Planned Maintenance Program (first step version)
   Long term (Five-year) Plan
   - Annual Maintenance Plan
   - Equipment Data Base
     - ✧ Basic Equipment List
     - ✧ Individual Equipment List with a numbering system
     - ✧ Equipment Record Cards
5. Staffing and Training (first step version)
   Organization Chart and Staff Allocation
     - ✧ Task Classification
     - ✧ Job Descriptions
   - Training
     - ✧ SOP training
     - ✧ PC training

Note: SOP documents including Water Quality Control Program prepared in the Project will be referred to Chapters 2, 3 and 4.
"First step version" means collection of available information and compilation for improvement in the next O&M plan.

Output-2: Capacity Development: Understanding of O&M Plan

Expert and SOP/HQ teams explained necessities, purposes and the expected contents of the O&M Plan using the general O&M plans. Ideal O&M Plan should be a comprehensive plan for the safe and effective O&M based on the well organized system such as;

- Operation data management system
  - ➢ Operation records
  - ➢ Man power and Energy/chemical consumption records
  - ➢ Operation cost data
- Equipment inventory system
  - ➢ Equipment and parts list
  - ➢ Maintenance records
  - ➢ Maintenance requirements

However, it was understood among the SOP/MF team members that this can be achieved year by year or plan by plan and a plan practical and easy to conduct is important for Abbasa WTP.

(2) Issues to be addressed for the next step

Issue-1: Preparation of O&M Plan Guideline

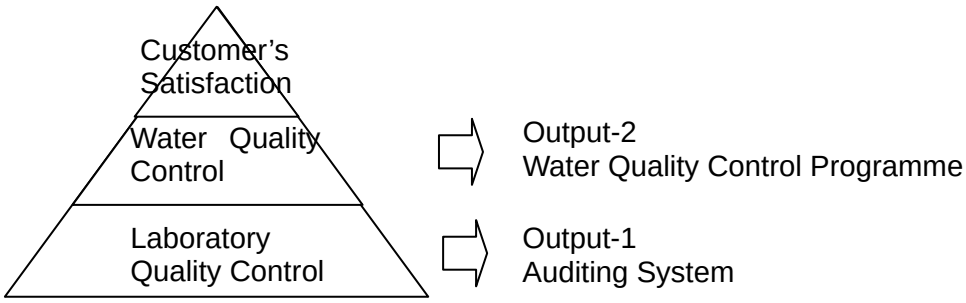
For extending the number of the facilities who can prepare O&M Plan, materials for OJT activity shall be prepared as "Guideline for the preparation of O&M Plan" by SOP/HQ teams.

Issue-2: Enhancement of O&M Plan for the next step

O&M plan will be a preliminary one and there are many parts to be enhanced to the standard level. Especially the plan shall be backed up with actual operation and maintenance records. It is necessary to concentrate on the accumulation of effective data/records for a few years.

4.2.3.9 Action S9: Developing water quality control programs

The ultimate objective of water quality control is to gain customer's satisfaction. For efficient management of water quality control, it is essential to establish such document as Water Quality Control Programme. Whereas, the foundation of water quality control attribute to accurate and efficient chemical analysis. Therefore, both laboratory quality control and water quality control were focused in this project and the following activities have been implemented.



(1) Output from the action

Output-1: Auditing System

Since the result of the analytical work is largely dependent upon the laboratory environment, establishment of desirable laboratory condition is an important aspect in quality control. Laboratory Auditing is a key activity to understand the present analytical condition by assessing the laboratory and to improve the weak points. Through the workshops held on the 31st of May and 27th of September, 2007, Auditing System for the quality control at laboratory was established. The auditing system for laboratory of SHAPWASCO is largely divided into two (2) phases.

(a) Self-Auditing:

Self-Auditing is an activity to check and assess the analytical and laboratory conditions by the laboratory chemists themselves based on the assessment checklist prepared by the Head Quarter. The checklist consists of daily, weekly and annual lists (See Annex-14). The main points assessed by the self-auditing include general laboratory conditions (such as cleanness of

the laboratory), waste control, chemicals, etc. This activity started from June 2007.

(b) Auditing

Auditing is an activity to assess the laboratory condition by a third person, who does not belong to the subject laboratory or the Head Quarter. The check points implemented in auditing overlaps as self-auditing. However, of significance is to assess the laboratory condition by the third person. Auditing includes assessment of the laboratory environment with checklist prepared by the Head Quarter (See Annex-14), interview with the laboratory manager and reporting. The result of auditing is assembled by the Head Quarter for establishment of integrated laboratory quality control system. This activity started from October 2007.

(c) Result of auditing

Self-auditing system and first water quality control programme were developed in phase-2. As a result of development for auditing, self check has been done at laboratory in Zagazig WTP and Abbasa WTP.

Output-2: Water Quality Control Program

The objectives of the water quality control program are summarized as the following 3 items:

- To establish SHAPWASCO's basic policy for analysis and water quality control
- To clarify the quality control system and its reliability to public
- To prepare for emergency case such as water pollution

To achieve the above mentioned objectives, the water quality control program consists of the following contents.

- Basic Policy of SHAPWASCO
  (Description of the objectives of the program)
- Abstraction of the subject Water Treatment Plant
  (Brief explanation of the subject water treatment plant)
- Water Quality Monitoring System and Facility
  (Description of water quality monitoring system in hard aspects)
- Summary of Water Quality Analysis System in the subject Water Treatment Plant
  (Description of water quality monitoring system in soft aspects)
- Current Water Quality Condition
  (Description of the past year's raw and treated water quality)
- Quality Assurance and Accuracy Control
  (Description of how the quality and accuracy of analysis is secured)

Under the circumstances in Japan, water quality control programme is usually prepared by such unit as city or prefectural offices. However, since preparation of the programme is not a common practice in Sharkia and Egypt and some water treatment plants in Sharkia are still under the control by other entity, the water quality control programme was prepared in a unit of each water treatment plant. As a first step, the programme was completed at Zagazig and Abbasa Water Treatment Plant by the end of October, 2007.

Output-3: Capacity Development

Current issues in water quality analysis works have been shaped through a series of the activities

formulation of scheme on audit, implementation of audit and evaluation of audit results, and utilizing of audit results to routine jobs.

In addition, activities of water quality analysis works have been systemized along of development of water quality control program.

(2) Issues to be addressed for the next step

Issue-1: Development of Water Quality Control Programme and expansion for other WTP

The prepared Water Quality Control Programme is a primary version of the document. The document shall be continuously developed through routine and periodical laboratory works including auditing activity, best knowledge of chemists' knowledge and experience and brand new chemical techniques.

The prepared Water Quality Control Programme shall be revised and, if necessary, modified at least annually. Also water quality control programme shall be expanded for other water treatment plant.

4.2.3.10 Action S10（Developing well inventory forms and monitoring wells）

For the management of the water sources of SHAPWACO, grasping the condition and production water volume of each well station and each well is quite important as very basic figures. In this activity, in order to grasp the condition and production water volume of each well and each well station, development of well inventory form and well monitoring has been implemented as Action-10 in Phase-2. First comprehensive and simultaneous well monitoring was conducted for 2007.

Under the financial support of HCWW, ninety one (91) wells were newly added for SHAPWASCO by June 2008 and the second monitoring including these new wells was conducted for 2008.

(1) Output from the action

In order to justify the Well Inventory Form, implementation method and organization, well monitoring has carried out in 2008. This well inventory Form, implementation method and organization was established in 2007 tentatively.

Output-1: Issue of Well list and Well inventory forms

Tentative well list was prepared in phase 1 of this program. In the phase 2 of this program, well list had checked and revised. The latest well list is shown in ANNEX of this report.

First draft well inventory forms were prepared by Expert team and SOP/HQ team in Zagazig in May 2007. First draft well inventory forms were modified and revised thorough a test operation on June 2007. The test operation was carried out about the all well stations of Diarb Nigm Markaz. During test operation, Expert team and SOP/HQ team discussed many times about the well inventory form. Based on these results, the latest version of the well inventory form was completed at the end of June 2007.

Composition of well inventory is shown in Figure 4.2-13 below.

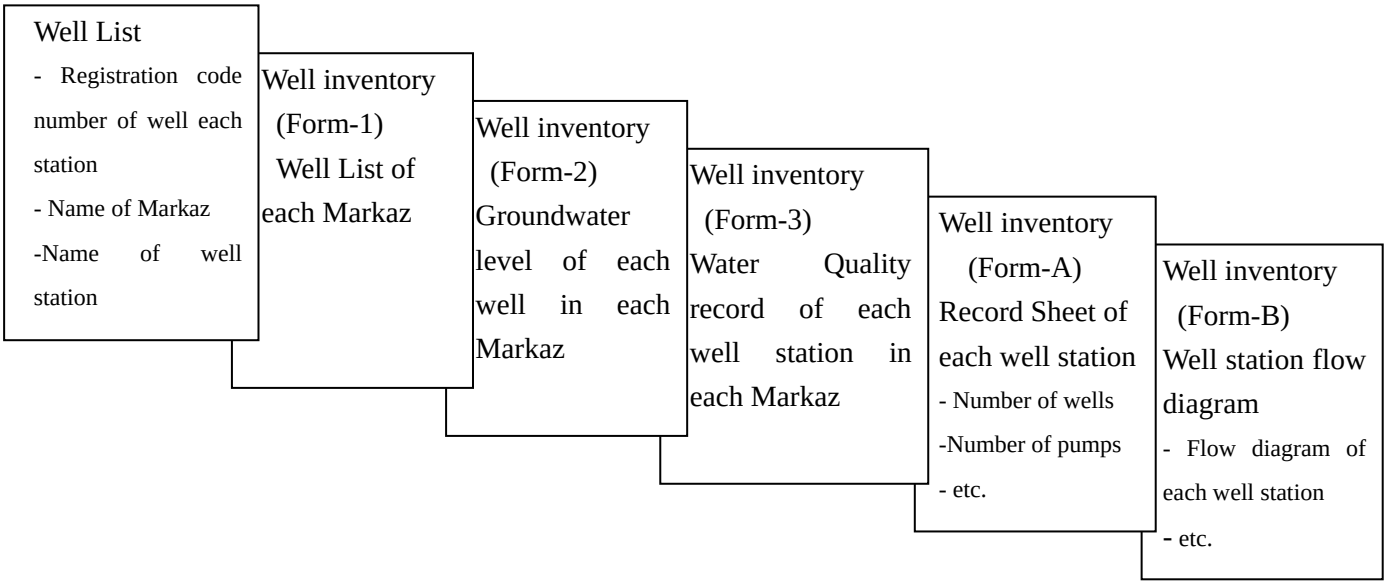


Figure 4.2-13 Typical Composition of Well Inventory and Well List

Output-2: First Activity of Monitoring of Whole Wells in SHAPWASCO

1) Periodical (Annual) Well Monitoring

Based on the well list which was made phase-2 in 2007, well list has been modified in 2008. Well monitoring for 180 wells in ten (10) Markazes and one (1) city has conducted by SOP members. According to the result of well monitoring 2008, total numbers of well station and total numbers of working well in the SHAPWASCO service area is as follows.

- Total number of well station: 212 well stations
- Total number of working wells: 315 wells

Following items has been checked and the results have arranged on the well inventory form that was established in 2007.

- Groundwater level
- Water quality: These data source is the water quality analysis results which were carried out by SHAPWASCO.

2) Continuous groundwater level measurement at 4 wells by self-recording groundwater level measurement system.

4 self-recording groundwater level measurement system has been installed at 4 wells in 2008, Phase-2. Data collection and data arrangement have been carried out by SOP members.

- Installed well name

Well name and monitoring period of each well is shown in Table 4.2-7. Location map of these wells are shown in annex of this report.

Table 4.2-7 Specification of 4 Monitoring Wells

Well station name	Markaz Name	Monitoring Period
Al Sanya	Diarb Nigm	6th March 2008 to 24th January 2009
Mogamaa EL Zeraa	Zagazig City	26th February 2008 to 19th January 2009
Kafr Farag	Menia Alqamah	11th March 2008 to 13th January 2009
El Bar El Gharbi	Bilbais	1st March 2008 to 26h January 2009

Output-3: Analysis of Well Monitoring Results

1) Result of Periodical (Annual) Well Monitoring

Result of periodical (annual) well monitoring is shown as a table in annex of this report. That table also shows the monitoring result of 2007. Based on the periodical well monitoring result, change of the groundwater level and water quality from 2007 to 2008 is described as follows.

(a) Groundwater level

Remarkable change of the groundwater level between 2007 and 2008 of each well is not identified. Therefore, the tendency of groundwater level down is not identified based on these monitoring results. According to the groundwater level measurement result of 2007, comparatively remarkable groundwater level decline was identified around southern portion of the Zagazig Markaz. And it was assumed that groundwater distribution around Sharkia Governorate was dominated by the groundwater level declination around southern portion of the Zagazig Markaz. Monitoring results of 2008 also indicate same trend.

(b) Water Quality

In this clause, water quality change of Fe (iron) content, Manganese (Mn) content and TDS content between 2007 and 2008 are described. These 3 items pose a problem in terms of water quality.

- Fe (iron) content

Before commencement of this project, it is identified that Iron (Fe) content in groundwater is high in the northern part and western part of SHAPWASCO service area, especially Bilbais Markaz and Mania Alqamah Markaz. Fe content contour map, which was made by expert and SOP members in 2007, indicates this trend obviously. According to the water quality analysis results 2008, high Fe content in groundwater is identified in above mentioned two (2) Markaz. Regarding 32 wells in Mania Alqamah Markaz where can compare Fe content 2007 with 2008, water quality analysis result 2008 indicates that thirty-four (34) % of the whole wells have increased in Fe content compare to 2007. Furthermore, it is identified that Two (2) wells, which could not obtain water quality analysis result in 2007, has high Fe content. On the other hand, regarding 23 wells in BilBais Markaz which can compare Fe content 2007 with 2008, water quality analysis result 2008 indicate that thirteen (13) % of the whole wells have increased in Fe Content compare to 2007. Furthermore, it is identified that Two (2) wells, which could not obtain water quality analysis result in 2007, has high Fe content. Comparison result of Fe content between 2007 and 2008 indicates that the number of wells, where Fe content is increasing, has been increasing. It is thought that high Fe content in groundwater area has been expanding in

above mentioned two Markaz.

- Mn (Manganese) content

Before commencement of this project, it is identified that Manganese (Mn) content in groundwater is high in the Mania Alquamah Markaz located in western part of SHAPWASCO service area. Mn content contour map, which was made by expert and SOP members in 2007, indicates this trend obviously. According to the water quality analysis results 2008, high Mn content in groundwater is identified in Mani Alquamah Markaz. Regarding 31 wells in Mania Alqamah Markaz where can compare Mn content 2007 with 2008, water quality analysis result 2008 indicate that Forty-five (45) % of the whole wells have increased in Mn content compare to 2007 result. Furthermore, it is identified that Two (2) wells, which could not obtain water quality result in 2007, has high Mn content. Comparison result of Mn content 2007 and 2008 indicate that the number of wells, where Mn content is increasing, has been increasing. It is thought that high Mn content in groundwater area has been expanding in Mania Alquamah Markaz.

- TDS content

Before commencement of this project, it is identified that TDS content in groundwater is high in the northern part of SHAPWASCO service area. TDS content contour map, which was made by expert and SOP members in 2007, indicates this trend obviously. And also TDS contour map indicates that high TDS content area spread along Hihiya, Mania Alquamah, Bilbais, Mashtool El Sooq and Zagazig Markaz. High content of TDS is thought to be caused by sea water intrusion into groundwater. Comparison result of TDS content 2007 and 2008 indicates following trend. Increasing in TDS content can be identified in many wells in Zagazig Markaz and Zagazig City. Regarding 22 wells in Zagazig Markaz where can compare TDS content 2007 with 2008, Sixty-eight (68) % of the whole wells have increased in TDS content 2008 compare to 2007 result. In Zagazig city, sixty-six (66) % of the whole wells have increased in TDS content as well. It is assumed that in Zagazig Markaz and Zagazig city is concentrated many wells and overabundance groundwater yield from each well may trigger the increase in TDS content. Regarding 30 wells in Mania Alqamah Markaz where can compare TDS content in 2007 with in 2008, Forty (40) % of the whole wells have increased in TDS content compare to 2007 result. Remarkable change of TDS content could not be identified the other Markaz. The wells, where TDS content has decreased in 2008 compare to 2007, are also identified.

2) Results of the continuous groundwater level measurement at 4 wells

The result of the continuous groundwater level measurement at 4 wells is shown in annex of this report. Static groundwater level and dynamic groundwater level could measure at 3 well stations except Mogamaa El Zerrar well station.

Outline of result of the continuous groundwater level measurement at 4 wells

- Except well of El Bar El Gharbi, Groundwater level is down from June to August in 2008. It is assumed that groundwater level is affected by groundwater yield caused by

groundwater use for irrigation. Moreover, there is variation in the groundwater level declining period of each well.

- After the period of groundwater use for irrigation, static groundwater level is stable.
- Dynamic groundwater level of El Bar El Gharbi well station is high during the period of groundwater use for irrigation. High dynamic groundwater level at El Bar El Gharbi in this period indicates that groundwater yield (product) volume from the well station is controlled for the groundwater use for irrigation.
- Groundwater level is slightly down from the middle of Mach to the middle of April in 2008. The reason of this phenomenon is not clear, however, it is assumed that water level of all the canals, which flow in Sharkia Governorate is low from the end of January to the end of February every year. It may correlate to cause of this phenomenon.
- Remarkable static groundwater level change between February or March 2008 and January 2009 is not identified at 4 wells. This tendency is same as the groundwater level measurement result by the periodical well monitoring.

Output-4: Maps

Based on the result of monitoring wells in 2007, maps below have been made by Expert Team, in order to clarify present groundwater condition. These maps are positioned as initial data.

- Groundwater distribution (contour) map
- Fe content distribution (contour) map
- Mn content distribution (contour) map
- TDS content distribution (contour)map

Expert team has transferred the technology of creation method of these maps to SOP/HQ team of SHAPWASCO.

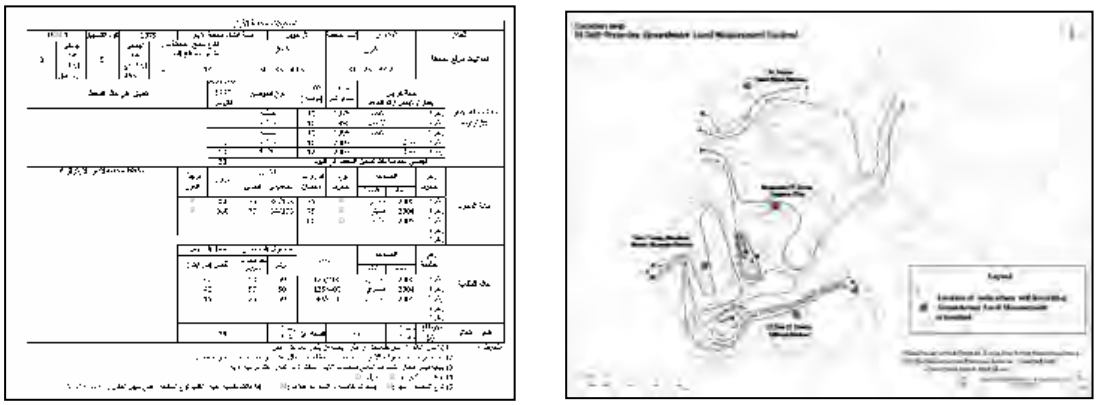


Figure 4.2-14 Well Inventory and Contour Map for Groundwater Level

(2) Issues to be addressed for next step

The aim of well monitoring is to establish a systematic data collection that comprises all performance-related data as a function of time. For that purpose, it is important to evaluate the monitoring system through the monitoring period.

Issue-1: Manpower Planning

There is no problem about the well monitoring form until now. However, it takes long time to input data, which was obtained by field monitoring work, into data based caused by shortage of staff so far.

Issue-2: Examination of Implementation organization and method for Periodical (annual) monitoring

(1) Implementation organization

The well monitoring work has been carried out by SOP member. All of the monitoring works especially groundwater level measurement and actual situation survey of each well station was carried out by the well sector manager of SHAPWASCO by himself in 2007 and 2008. Data input work was carried out by the SOP member who is not in charge of data input not only well monitoring data. Therefore it is thought that all of the monitoring works, which is consist of field work, data input and analysis, has done insufficient implementation organization.

Regarding well monitoring implementation organization, SOP group and SHAPWASCO has had a plan for establishment of a new sector for the well monitoring works in order to conduct monitoring works systematically.

Detailed plan and organization for monitoring works has been under consideration.

(2) Implementation time of the periodical well monitoring

According to the result of the continuous groundwater level measurement by self-recording groundwater level measurement system that is installed at 4 wells, static groundwater level from March to September in 2008 was fluctuated caused by groundwater use for irrigation and the other reason. On the other hand, static groundwater level from October 2008 to January 2009 is almost stable. Therefore, implementation time of periodical well monitoring, groundwater level measurement, should be carried out from October to January every year.

(3) Regular interval of the periodical well monitoring

The aim of well monitoring works is thought to be as follows. The data can be used for well operation, maintenance, and also groundwater environment forecast in the future.

- To check and to analyze groundwater level and water quality of each well station periodically.
- Based on these results, to obtain the basic policy and plan for usage of well (for example cancellation of well use) and construction of new well.
- To check the situation of operation and maintenance of each well and each well station periodically

For this purpose, well monitoring works should be conducted periodically and regular interval of the well monitoring should be once a year.

According to the comparison result of water quality analysis between 2007 and 2008, it was revealed that high content area of Fe and Mn has been expanding. And also TDS content has been increasing in the Zagazig Markaz. In order to forecast future groundwater quality change, it is very important to check the water quality of each well once a year.

Periodical groundwater quality analysis has been carried out by the laboratory of SHAPWASCO, the result of groundwater quality analysis should be added on the well monitoring form once a year.

(4) Implementation wells for well monitoring

For the purpose of well monitoring that was described in above clause, periodical well monitoring should be carried out at all well stations.

However, the groundwater level and the water quality of the same well station are though to be practically equal. Therefore, groundwater level measurement and groundwater quality analysis should be carried out selected well at each well station.

(5) Continuous groundwater level measurement at 4 wells

Continuous groundwater level measurement at 4 wells by self-recording groundwater level measurement system should go on at the present measured wells from now on.

Periodical data collection from the data logger, maintenance of the measurement equipments and data arrangement are required. Annual data analysis of arranged data is required. These analysis results should be examined.

(6) Effective utilization of well monitoring data

Effective utilization of well monitoring enhances the value. It is expected that well monitoring is utilized for future planning, which is mainly for water resource plan such as disuse or new well planning.

4.2.4 Internal Workshop for SOP Activities

Under the SOP activity in the Project, following internal workshops were held to accomplish the activity and to confirm the achievements during the project.

Table 4.2-8 Internal Workshop for SOP Activities

No.	Date	Subject of Workshop
1	Feb. 24-Mar. 1, 2007	Formulation of SOP Action Plan
2	Apr. 15, 2007	Explaining the SOPs
3	May 23-24, 2007	Actions S1, S2 and S10 for Model Facilities
4	May 31, 2007	Laboratory Control
5	Jun. 25, 2007	Site Workshop for Chemists and Plant operators
6	Jun. 26, 2007	Action S10 – Well monitoring
7	Aug. 20-21, 2007	Actions S2 & S4
8	Sep. 2, 2007	Action S5-1 Distribution Control in Small Areas
9	Sep. 27, 2007	Auditing in Action S9 – Water Quality Control
10	Oct. 27, 2007	Water Quality Control and Process Control
11	Feb. 09.2008	S-6: Applying SOPs
12	June 11, 2008	Workshop for Chemists and Plant operators of Aslougi WPS
13	July 22, 2008	Preliminary Results of Applying SOPs in Water Treatment Plants
14	Nov.29.2008	Introduce proposed operation records & general discussion about how to apply uniform records for well and booster pump operation.
15	Dec. 2.2008	The results of Appling uniform records for well and booster pump operation.
16	Feb.7.2009	Types of well pumps, control valves, priming of well pumps and well pollution.
17	Feb.10.2009	Water reservoirs, operation and control of chlorine system and proper Chlorine dose and proper booster and wells pump operation.
For Electrical		
18	Jan.15.2009	Applying electrical OJT for L.V switchgear at (Abbasa -WTP)
	Jan.17.2009	Applying electrical OJT for L.V switchgear at (Abbasa-WTP)
19	Jan.24.2009	Applying electrical OJT for M.V switchgear at (Zagazig - WTP)
	Jan.29.2009	Applying electrical OJT for M.V switch gear at (Abbasa -WTP)
	Jan.31.2009	Applying electrical OJT for M.V switch gear at (Hihya- WTP)

(1) Feb. 24-Mar. 1, 2007: Workshop for Formulation of SOP Action Plan

Objectives:

- to understand the targets and outputs of the project
- to clarify the current issues on O&M of the water supply facilities of SHAPWASCO
- to formulate SOP Action Plan for the project period

Attendants:

Twelve (12) persons attended as SHAPWASCO task force and these Attendants were selected from various types of facilities and the needs of formulating of the action plan. They were WTP managers, a FMRP manager, a BPS manager, a well stations manager, a chemist and a geologist from head quarter.

Material:

- A brief explanation about the current situation and the current issues to be dressed in the operation and maintenance of the facilities (Experts' opinion).
- Draft Copy from the suggested Action Plan.
  1. Selection Bases of the Model Facilities for SOP Activities

2. Materials for Formulation of SOP Action Plan with "Preliminary List of SOPs for WTP, Fe/Mn, BPS and Wells"
3. Measurement/Records of Intake and Production Water volume at the Seven WTPs
4. Proposed Implementation Schedule
5. Water Supply Facilities of SHAPWASCO

Main Topics of discussion:

- Organization of SOP activities and selecting model facilities by their SOP teams
- Explaining the ten actions included for the SOP activity
- Proposal on Measurement / Records of Intake and Production Water Volume from the Seven WTPs .
- Proposal for flow meters that will be installed for the WTPs
- Schedule for the SOP activity.

(2) Apr. 15, 2007: Workshop for explaining the SOPs

Objectives:

- To expand the knowledge of SHAPWASCO staff

Attendants:

- SHAPWASCO Chairman
- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Managers , Water Facilities Managers)

Material:

- The handouts explaining the ten actions included in the SOP activity

Main Topics of discussion:

- The Chairman explained and confirmed the background, importance and necessity, activities done by SHAPWASCO staff under the assistance of the Project's Experts.
- Mr. Khalaf and Dr. Sobhy explained the detailed programs of the Project

(3) May 23-24, 2007: Workshop for Actions S1, S2 and S10 for Model Facilities

Objectives:

- to determine the extent of basic system drawings to be prepared
- to discuss the method, task force and schedule of S1
- to discuss the extent of unified recording and reporting system in O&M
- to discuss the method, task force and schedule of S2

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Managers , Water Facilities Managers)

Material:

- Proposed Steps and Schedule for SOP Action S1 and S2
- Basic drawings of the model facilities with mechanical and electric equipment lists
- Example forms for O & M records
- Present issues of well monitoring

Main Topics of discussion:

- Unification of O&M records and reports and extent of unification
- Proposal of development stages for O&M forms unification
- Alternative improvements on raw water intake and production volume estimate
- Structure of well inventory

(4) May 31, 2007: Workshop for Laboratory Control

Objectives:

To discuss about following items with SHAPWASCO Chemists

- What is Water Quality Control?
- Why do we need to apply Water Quality Control?
- How do we apply Water Quality Control?

Attendants:

- Head Quarter team (Mr. Osama Al Masrey)
- One chemist from each laboratory

Material:

- Handouts for the workshop
- Daily, weekly, monthly and annually check lists

Main Topics of discussion:

- Concept of Water Quality Control System
- Project objectives and schedule
- Quality Assurance System for Analysis and Laboratory
- Treatment of Hazardous Chemical Waste

(5) Jun. 25, 2007: Site Workshop for Communication between Chemists and Plant operators

Objectives:

- Improving the communication between chemists and operators to get excellent performance of process control inside the plant

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Managers , Water Facilities Managers)
- Abassa WTP chemists and operators

Material:

- Proposed unified records :
  - Consumables
  - Raw water pump operation records
  - Treated water pump operation records
  - Sludge water pump operation records
  - Monthly records
  - Filter backwashing records

Main Topics of discussion:

- Expressing the importance of communication between chemists and operators
- How to utilize the records

(6) Jun. 26, 2007: Workshop for Action S10 – Well monitoring

Objectives:

- Creation of a well inventory (All wells of SHAPWASCO service area)
- Establishment of the well monitoring system

Attendants:

- SHAPWASCO Head Quarter team (Mr. Gamal Abd El Hameed)
- SHAPWASCO Staff (Representatives from Wells stations)

Material:

- Handouts of the presentation
- Outline for the presentation
- Tentative detailed program for Action S10

Main Topics of discussion:

- What is the well inventory?
- What is the well monitoring?
- Necessity of well inventory and well monitoring
- Implementation work for the well inventory Creation and the well monitoring

(7) Aug. 20-21, 2007: Workshop for Actions S2 & S4

Objectives:

- to understand and discuss the coming SOPs activities in water treatment facilities by "Headlines of SOPs for Abassa WTP" and common procedures
- to discuss the necessary steps for the implementation of unified forms of O&M records.
- to understand and discuss the existing and proposed electrical systems of the model facilities.
- to discuss electrical SOPs with the examples

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Managers , Water Facilities Managers , Chemists)

Material:

- Proposed Forms for O&M Records for WTP
- Headlines of SOP for Abassa WTP
- Common Procedures for "Filtration" and "Pump Operation"
- Steps and Schedule for SOP Development for Abassa WTP
- Electric System Coding and Single Line Diagrams for Model Facilities
- Examples of Electrical SOP

Main Topics of discussion:

- Discussing the headlines for the facilities included in WTP
- Trouble shootings in coagulation , sedimentation , filtration and pumps facilities
- Method of chlorides detection
- Steps for development of SOP for O&M of water treatment in Abassa WTP
- Electric system coding and examples of Electrical SOP.

(8) Sep.2, 2007: Workshop for Action S5-1 Distribution Control in Small Areas

Objectives:

- To improve the management capacity of Sector and HQ for distribution control in small areas through actual measurements and analysis of water distribution inside Markaz

Attendants:

- Network staff in Hihya branch

Material:

- Handouts of the presentation
- Outline of the proposed pilot project

Main Topics of discussion:

- Why in Hihya?
- Plan of Pilot Area
- Collaboration with Action S5-2 Hydraulic Analysis

(9) Sep. 27, 2007: Workshop for Auditing in Action S9 – Water Quality Control

Objectives:

- to understand aims of Quality Control System, Auditing, Auditing system in SHAPWASCO and Auditing Procedures

Attendants:

- Headquarter team (Mr. Osama Al Masrey)
- One chemist from each laboratory

Material:

- Handouts for the workshop
- Blank Auditing Report

Main Topics of discussion:

- How to make Auditing
- Revision of Auditing

(10) Oct. 27, 2007: Workshop for Water Quality Control and Process Control

Objectives:

- To acknowledge the result of Auditing and to set the coming year's auditing strategy.
- To understand the content of Water Quality Control Programme and to set the strategy.
- To share the experience of process control from good practice

Attendants:

- SHAPWASCO Head Quarter team (Mr. Osama Al Masrey)
- One chemist from each laboratory

Material:

- Handouts for the presentation

Main Topics of discussion:

- Main feature of Water Quality Control Process
- Future Application Plan
- The experiments achieved in Hihya WTP to improve the process and the results of it.

(11) Feb.9, 2008: Workshop for introduction to SOP applying for water treatment plant

Objectives:

- to understand current condition of O&M activity performance
- to realize reason of insufficient current condition
- to recognize required improvement for O&M activity in current condition
- the improvements of O&M activity by SOP applying
- the improvement of O&M activity by other activities excluding SOP applying
- introduction of the recording sheet to realize a change trend of records

Attendants:

- SHAPWASCO Head Quarter team
- Abbasa WTP
  Branch manager Mr.Farouk Basha
  Station manager Mr.Samir Gharieb
  Chemist Mr.Mansour Nasar
  Mechanical supervisor 3, electrical supervisor 2, technician 2
- Zagazig WTP
  Station manager Mr. Mohamed Faried
  Chemist Mr. Ahmed Abd El Mohsen
  Mechanical supervisor Mr. Abd Allah Mohamed Youseif
  Electrical supervisor Mr. Hani Zaki

Material

- Analysis sheets of O&M activity performance in current condition
  Description regarding following;
  Current condition, insufficient result of O&M activity and reason for current condition
- Recording sheet to recognize a change trend of records as following:
  Transmission water quantity, raw water quantity and water pressure in the network
  Solution level in aluminum sulfate solution tank and dosing flow rate

Main topics of discussion

- Insufficient collection of records and utilizing as data for O&M activities
- Difference with “record” and “data”, and utilizing of data for O&M activities
- Judgment regarding operating water treatment condition
- Control of the process and system
- Recognition of operating condition in current condition and in the past
- Communication with working team each other, and station manager and supervisor
- Responsibility and authority of station manager and supervisor
- Parameters for evaluation of O&M activity

(12) June 11, 2008: Workshop for Chemists and Plant Operators of Aslougi WPS

Objectives:

- to understand the SOPs prepared for the Aslougi WPS
- to clarify the situation on the existing chlorination facility of Aslougi WPS

Attendances:

EL Aslougi WSP:	Mr. Salah Al Dien
Zagazig Markaz Branch:	Mr. Abdl El Aleem, Mr. Attia and Mr. Ahmed Henry
SOP/HQ team:	Mr. Shafi, Mr. Gamal, Mr. Usma and Ms Heba

Material:

- Current well water quality analysis, especially focusing on "Fe" concentration
- SHAPWASCO regulation for "Free residual chlorine Residual in the Network"
- Proposal of trial operation and measurement
- Study on detention time of supplied water in the network pipe from well station to hospital

Main Topics of discussion:

- Present water quality of source well water
- Problems caused by the chlorine injection to the pipeline for Al Ahrar Hospital area
- Problems caused by no free residual chlorine in the network

(13) Jul. 22, 2008: Preliminary Results of Applying SOPs in Water Treatment Plants

Objectives:

- To expand the knowledge of SHAPWASCO staff
- To applying SOPs in SHAPWASCO for the WTPs
- To explaining preliminary results of applying SOPs

Attendants:

- SHAPWASCO Chairman
- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Plant Managers , Supervisor)

Material:

- The handouts explaining the result of applying SOP

Main Topics of discussion:

- The Chairman explained and confirmed the background, importance and necessity, activities done by SHAPWASCO staff under the assistance of the Project's Experts.
- Mr. Khalaf explained the detailed programs of the Project.
- Mr. Shafi explained Preliminary results of applying SOPs.

(14) Nov.29, 2008: On site workshop for applying uniform records for well and booster pump operation.

Objectives:

- Discussion and confirmation on operation records for well pumps and booster pump operation.

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Manager, Plant Manager, operators).

Material

- Form of records

Main topics of discussion

- Current records for pump operation used in the facility. The available records were not clear

and not sufficient for operation.

- Introduce the proposed records sheets and explanation of these forms
- Proposal of trial to use these forms and the staff comments on applying these records.

(15) Dec.2, 2008: On site workshop for the results of Appling uniform records for well and booster pump operation

Objectives:

- Submit revised operation records.
- Explain and discussions about the revised records.
- Explain the importance of control pump operation with regard to proper out let pressure to cover the actual demand of water consumption at network during the day hours.

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Manager, Plant Manager, operators).

Material

- Revised operation records

Main topics of discussion

- Explain the changes occur of water demand along the day hours.
- Control of the pump operation to have proper out let pressure to cover the actual required consumption along the day hours.
- Explain about saves of electric power consumption through the control of pump operation.
- Necessity to have working pressures gauges at the out let of the BPS and well pumps for monitoring the proper working pressure.

(16) Feb.07, 2009: Types of well pumps, control valves, and priming of well pumps.

Objectives:

- Horizontal and vertical well pumps and its component and control valves.
- Importance of pressure gauges for suction and outlet pipes of pumps.
- Explain about setting of pumps (series and parallel).
- Priming of pumps.

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Manager, Plant Manager, operators).

Main topics of discussion

- Explain the main component of horizontal and vertical pumps.
- Control valves of pump suction and delivery.
- Importance of pressure gauges for pump suction and outlet.
- Priming pumps for operation and cooling of pumps.
- Types of pumps connection setting (series and parallel).

(17) Feb.10, 2009: onsite workshop for Water reservoirs, operation and control of chlorine system and proper Chlorine dose and proper booster and wells pump operation.

Objectives:

- Details of ground water reservoirs.
- Protection of reservoir from pollution.
- Chlorine system and injection of chlorine dose, if necessary.
- How to avoid chlorine gas leakage.
- Proper operation of booster and well pumps according to actual demand of water supply.

Attendants:

- SHAPWASCO Head Quarter team
- SHAPWASCO Staff (Branch Manager, Plant Manager, operators).

Main topics of discussion

- Explain the detail component of water reservoir such as inlet pipe, outlet pipe, drain pipe and level meter device.
- Importance of level meter device for pump operation. Using marked stick to measure the water level in the reservoir in case that level meter is not available.
- Protection of the reservoir of contamination due to outside actions by animas and human. Keeping the inside and outside of reservoir clean.
- Explanation of the existing chlorination system, how to operate and control the required chlorine flow rate.
- Actions to avoid chlorine gas leakage, actions to be taken in case of leakage and how to protect the staff from such accidents.
- Control of pump operation to provide the required pressure and quantity along the day. Explain how to prepare operation pump schedule.

(18) Jan.15 & 17, 2009: Applying electrical OJT for L.V switchgear at Abbasa WTP.

Objectives:

- Training for IEC& NEMA symbols & control for L.V switchgear.

Attendants:

- SHAPWASCO staff.

Material

- Handouts for the workshop

Main topics of discussion

- Applying reading of wire diagram in accordance to IEC& NEMA symbols.
- Explain about main component for L.V switchgear.
- Using wiring diagram for follow up troubles of L.V switchgear.
- How to avoid the troubles in L.V switch gear and to repair troubles.
- Field practice to Know how we can design control circuit according to needs (Contactors, Timers, Aux contact Act)

(19) Jan.24& 29 and 31, 2009: Applying electrical OJT for M.V switch gear at (Zagazig, Abbasa and Hihya WTP)

Objectives:

- Training for M.V switchgear.

Attendants:

- SHAPWASCO staff.

Material

- Handouts for the workshop

Main topics of discussion

- Explain M.V switchgear main component (circuit breakers, metal clad switchgear).
- How to find out the troubles in the M.V switchgear.
- How to apply protective maintenance for different kinds of M.V switchgear at Zagazig, Abbasa and Hihya WTP.

4.3 Other Activities

4.3.1 Water Conservation Campaign

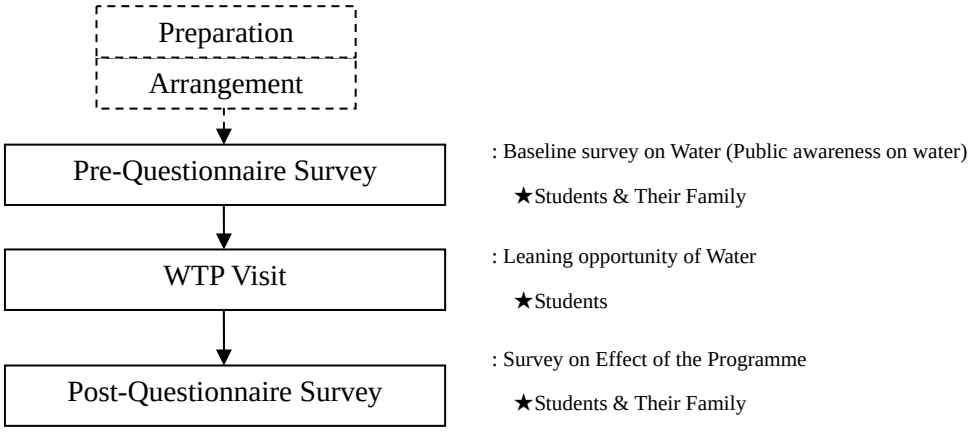
4.3.1.1 Methodology

Water conservation campaign will be conducted in the following two (2) fields. Field-1 mainly has been conducted on this project.

Table 4.3-1 Methodology of Water Saving Campaign

Field	Event Name	Target	Method
Field-1	School Programme (School Students' Visit to WTP)	Primary: Students (10 to 16 years old) Secondary: Their family	◆ Pre-Questionnaire Survey ◆ School Visit/Tour to WTP ◆ Invite TV Programme for the tour ◆ Post-Questionnaire Survey
Field-2	Workshop (Public Consultation)	Primary: NGOs Secondary: House Wife	◆ Workshop for NGOs ◆ Open-air Workshop for House Wife ◆ Workshop for mid-high income citizens

(1) Event Name: School Students' Visit to Water Treatment Plant



(2) Objectives

Objectives of the school visit are as follows:

- ◆ The programme is supposed to be one of the school education programme.
- ◆ To educate the students on the importance of water.
- ◆ To educate the students on the importance of water production
- ◆ To expand the idea of water saving to families through their children.

(3) Target

Targets of the campaign are as follows:

- ◆ The primary target is school students (aged 10 ~ 16 years old).
- ◆ It is expected that students will talk to their experience in WTPs to their family (only in the case if the school trip is enjoyable). Therefore, our secondary target is the family of the

students.

- Ideally, it is desirable to select the school that employee's son/daughter attends for encouraging and raising morale of the employees.

(4) Preparation

1) Selection of the candidate schools

Candidate schools have been selected in the following manner:

- It is understood that there may be no vehicles available for their transportation from the school to the WTP.
- Therefore, at the very first stage, the selection of the schools should be limited from the area of walking distance (i.e. approximately 3 km around the WTPs) unless otherwise, any sponsors (i.e. Ministry of Education, Directorate of Education from City, etc.) prepare the transportation.
- For the selection of the school, SHAPWASCO conducted interview with the employees to seek their sons/daughters school.

2) Arrangement

Arrangement of the campaign has been done by C/P as follows:

- SHAPWASCO contacted the selected schools and visited for explanation of the programme.
- SHAPWASCO and the schools arranged for the date of visiting to the WTPs.

3) Materials

Materials prepared for the campaign are as follows:

- Pamphlet (should be for students)
- Miniature (Traditional and Water purification process)
- Quiz for water
- Preparation of Pre- & Post- Questionnaires
- Invitation Letter
- (Sponsorship from Min. Education, etc)

4) Training

Training for the staff in charge of the campaign has been done in the following manner:

- At least, one of the employees from each WTP shall bear the role of tutor/demonstrator/tour guide for the school trip.
- Since children are not so patient, the tour guide is required to deliver interesting and enjoyable explanation.
- It is Head Quarter's responsibility to train the employees as a tutor.

(5) Procedure

1) Pre-Questionnaire Survey

Pre-questionnaire survey has been done in the following manner:

- In advance to the WTP visit, SHAPWASCO sent a questionnaire to the school (refer to Table

4.3-2).

- The questionnaire was filled at school or home.
- The purpose of the pre-questionnaire survey is to find out the baseline of children's or citizen's awareness on water and water saving.
- The result of the survey was digitalized.

Table 4.3-2 Questionnaire to Students in Pre-questionnaire Survey

Question		Answer of yours	Answer of your parents
Q1	Did you enjoy the visit to the Water Treatment Plant?	a. Yes	
		b. No	
Q2	Did you understand the water treatment process?	a. Yes	
		b. No	
Q3	What did you think about the process of water purification?	a. It is very simple & easy to purify	
		b. It is very complicated	
Q4	Is it necessary to protect water source?	a. Yes, because water is limited & valuable	a. Yes, because water is limited & valuable
		b. No, because I don't care	b. No, because I don't care
Q5	Do you want to start water saving in your house?	a. Yes.	a. Yes.
		b. No.	b. No.
Q5-1	(if you say "yes") Why do you think water saving is important?	a. Water is limited	a. Water is limited
		b. Water is expensive	b. Water is expensive
		c. Saving water protect the environment	c. Saving water protect the environment
Q5-2	(if you say "no") Why do you think water saving is not important?	a. Water is cheap	a. Water is cheap
		b. Water is abundant	b. Water is abundant
		c. I prefare to use much water	c. I prefare to use much water
Q6	Do you think "close your tap frequently while washing" is a water saving way?	a. Yes	a. Yes
		b. No	b. No
Q7	Do you think "close your tap frequently while taking shower" is a water saving way?	a. Yes	a. Yes
		b. No	b. No
Q8	Do you think washing many clothes at once save water rather than washing few closes frequently?	a. Yes	a. Yes
		b. No	b. No
Q9	Do you think washing your dishes with a pail saves water rather than flushing tap water during your washing?	a. Yes	a. Yes
		b. No	b. No

2) WTP Visit

WTP visit has been done in the following manner:

- WTP observation tour navigated by a SHAPWASCO's tour guide for approximately 1 hour.
- Followed by a brief lecture on water purification process with miniature in the main building.
- If the students think the visit is very much enjoyable, they will tell their family after returning their home.
- Quiz time was conducted after WTP observation tour and they learned water saving.

3) Media

Media has been utilized in the following purposes:

- Media, such as TV, newspaper or magazine, are invited simultaneously with students visit.
- When they broadcast or report as a local article, it is a good example of advertisement.

4.3.1.2 Schedule for the Campaign

Water conservation campaign has been conducted according to the schedule mentioned in Table 4.3-3. Public Awareness Section of SHAPWASCO is in charge of this activity.

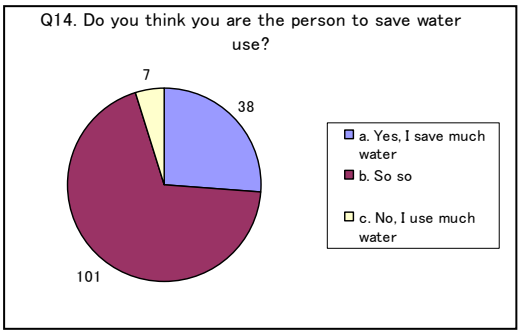
Table 4.3-3 Schedule of the Campaign

(As of the end of October 2009)

Location(Markaz)	School Category/Paricipants	Date of School Visit	Date of WTP Visit	Detail Location
Hihya Markaz	El Shaheed Nabil Abass-Abu Hatab Primary School	24th October 2007	28th October 2007	Hihya WTP
Ibrahimiya Markaz	El Seds Junior High School for Boys	14th November 2007	19th November 2007	Hihya WTP
Diarb Nigm Markaz	El Mahad El Azhary for Girls in Diarb Nigm	26th February 2008	27th February 2008	Hihya WTP
Zagazig City	El Mahad El Azhary for Girls & Boys in Zagazig	9th March 2008	12th March 2008	Zagazig WTP
Kafr Saqr Markaz	El Mahad El Azhary for Girls & Boys in Kafr Saqr	25th March 2008	27th March 2008	Hihya WTP
Abu Hamad Markaz	El Mahad El Azhary for Girls & Boys in Abu Hamad	10th April 2008	13th April 2008	Abbasa WTP
Bilbais Markaz	Bilbais Youth Club	2nd February 2009	3rd February 2009	Abbasa WTP
Diarb Nigm Markaz	Diarb Nigm Youth Club	4th February 2009	5th February 2009	Hihya WTP
Abu Hamad Markaz	Abu Hamad Youth Club	7th February 2009	8th February 2009	Abbasa WTP
Menia Alqamaha Markaz	El Mahad El Azhary for Girls in Menia Alqamaha	24th February 2009	25th February 2009	Hihya WTP
Abu Kabier Markaz	El Mahad El Azhary for Girls in Abu Kabier	1st March2009	2nd March 2009	Abbasa WTP
Faqus Markaz	El Mahad El Azhary for Girls in Faqus	4th March 2009	5th March2009	Abbasa WTP
Hihya Markaz	El Mahad El Azhary for Girls in Hihya	11th March 2009	12th March 2009	Hihya WTP
Ibrahimiya Markaz	El Mahad El Azhary for Girls in Ibrahimiya	15th March 2009	16th March 2009	Hihya WTP
Zagazig Markaz	Kafr Alashraf Junior High School for boys and Girls	25th March 2009	26th March 2009	Hihya WTP
Abu Hamad Markaz	El Mahad El Azhary for Girls in Abu Hamad	31st March 2009	1st April 2009	Abassa WTP
Suzan Mobark Library	Suzan Mobark Library members and SHAPWASCO staff Children.	16th June 2009	17th June 2009	Hihya WTP
People's Representatives	Hihya and Ibrahimya Cities and Markaz. People's Representative (Local People Committee and People's Assembly Representatives)	From July 18 to August 15, 2009		Hihya WTP
Plumping Training Program	Hihya and Ibrahimya Cities and Markaz Schools, Mosques Guradmen.	From July 19 to July 29, 2009		Hihya WTP
Open Workshop on Water Conservation Campaign	Governor, Holding Company Chairman and People's Representatives	August 18, 2009.		Culture Center in Zagazig City

4.3.1.3 Result of Questionnaire

Questionnaire has conducted on before and after visiting for water treatment plant and these questionnaires were counted. Following figures are part of result. The student who kept saving water in mind was approximately 25% before visiting water treatment plant. There was consciousness improvement trend that approximately 100% students wanted to keep saving water in mind after visiting water treatment plant. At same time, there was repercussion effect to family.



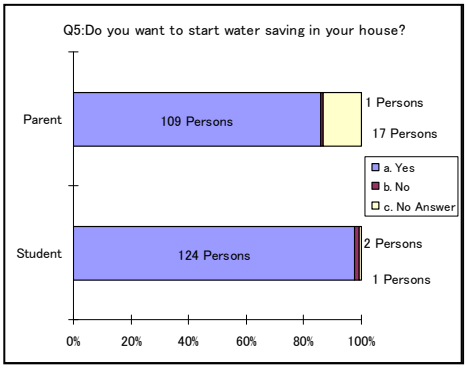


Figure 4.3-1 Result of Pre-Questionnaire **Figure 4.3-2 Result of Post-Questionnaire**

4.3.2 Public Relation Activities

(1) Publication of Newsletter

Counterpart team and expert team had made up a newsletter which has general and detail information of UFW reduction activities and SOP activities. This newsletter distributed to staff of SHAPWASCO and other water companies at 2nd open workshop which was held in Zagazig in December 2008.

Figure 4.3-3
Opening part of Newsletter

(2) Creation of Activity Information Video for UFW

Since UFW team finished water balance analysis, expert team created information video for UFW reduction activity. C/P team has used this video to public relations in the project.

Figure 4.3-4
Public Information Video CD

(3) Web Page of SHAPWASCO

Expert Team had recommended releasing Web Site for Public Relation Activity. Through this recommendation, IT section of SHAPWASCO was established on August, 2008. Then, they have released Web Site of SHPWASCO Since April, 2009.

Web address is "http://www.shapwasco.com.eg/ar/index.aspx".

4.3.3 Coordination with Other Donor and Organizations

The following meetings with other donor and organizations were made in Phase-1 (from December 2006 to March 2007).

Table 4.3-4 Meeting with Other Donor and Organizations

Organizations	Meeting Date	Information/Data obtained
USAID	11th Dec. 2006	Expert team visited the office of CH2MHill the consultant of USAID and obtained the following information. - The contract of the USAID consultant (CH2MHill) with HCWW for WWSPR project has been extended until March 2009. - Permanent licenses for the GIS softwares (ArcEditor and ArcView) have already been given to HCWW. Therefore, SHAPWASCO can request HCWW to transfer it to them. - A plotter for SHAPWASCO has already been placed an order so that SHAPWASCO will be able to receive it by around January next year.
Holding Company for Water and Wastewater (HCWW)	24th Dec. 2006	Expert team met with the chairman of HCWW on 24th December and obtained the following information: - Permission from the Minister of Communication is not required when international telephone line is installed in SHAPWASCO and the chairman will issue a supporting letter to SHAPWASCO. - UFW data for 12 water companies from HCWW on 26th December. - Information on the leakage detection project in Nasr City which will be done under the assistance from Italian Government including staff training and leakage equipment procurement. - Information on the master plan study project for water supply and sewerage system for HCWW.
Greater Cairo Water Company (CWC)	24th Dec. 2006	UFW/HQ team and the expert team visit Greater Cairo Water Company and obtained the following: - Outline of UFW reduction project to be executed under the Italian assistance, titled as "Italian-Egyptian Capacity Building in the Optimization of Water Networks". - Criteria for selecting pilot area
Sharkia Branch of National Organization for Potable Water and Sanitary Drainage (NOPWASD)	8th Jan. 2007	Existing distribution pipeline drawings for the whole of Sharkia Governorate were obtained from Sharkia branch of NOPWASD.
Dakahlia Potable Water and Sanitation Company (DAPWASCO)	4th Jan. 2007	SOP team, MIS/GIS members of SHAPWASCO (total nine engineers) and the expert team visited DAPWASCO in Mansoura and got useful information and suggestions for the future SOP activities and MIS establishment.
Survey Department of Sharkia Governorate	8th Jan. 2007	Topographic maps for all the Markazes of Sharkia Governorate were obtained.
Fayoum Drinking Water and Sanitation Company (FDWSC)	22nd Jan. 2007	Expert team visited FDWSC and obtained the experiences of Netherlands projects which have been executed from 1992 to now as follows: - Budget, finance and periods of UFW reduction activity - Water balance analysis - Criteria on selecting pilot area for UFW reduction activity - Numbers of personnel in team for UFW reduction activity - Latest information of UFW ratio - Main cause of leakage - GIS drawings - Other advisory information to do UFW reduction activity
Main Center for Calibrating Water Meters of HCWW (Amiria Water Treatment Plant)	8th Mar. 2007	UFW/HQ team and the expert team visit Main Center for Calibrating Water Meters of HCWW and obtained the following: - Calibrating method using sophisticated equipment - Mechanism of metering errors in water meters

Source : Prepared by C/P team and JICA expert team

CHAPTER 5 ACTUAL IMPLEMENTATION SCHEDULE

5.1 Actual Implementation Schedule for UFW Reduction Activity

Actual implementation schedule for UFW reduction activity which is compared with Plan of Operation (PO) is shown in Figure 5-1.

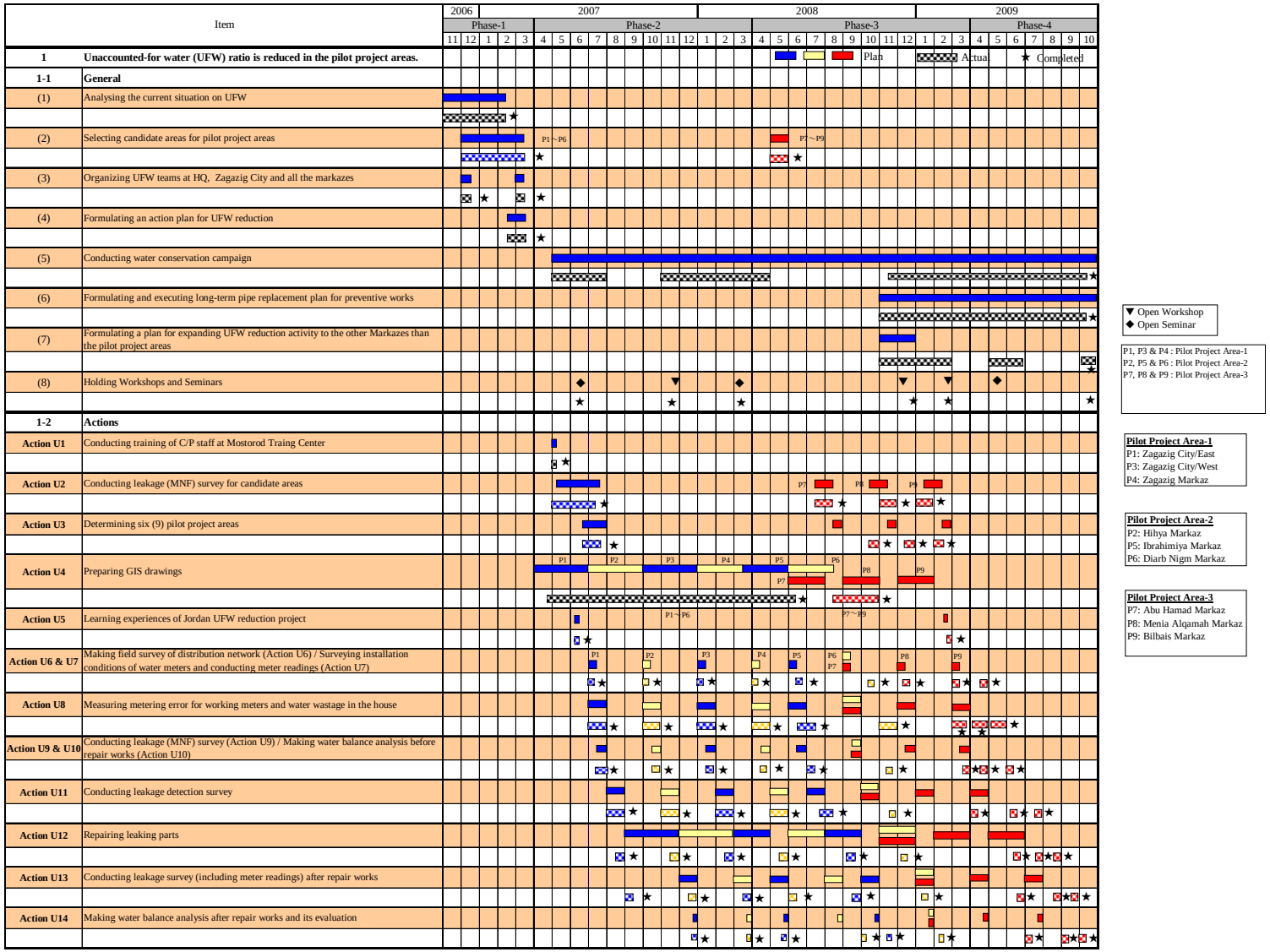


Figure 5-1 Actual Implementation Schedule for UFW Reduction Activities

5.2 Actual Implementation Schedule for SOP Activity

Actual implementation schedule for SOP activity which is compared with Plan of Operation (PO) is shown in Figure 5-2.

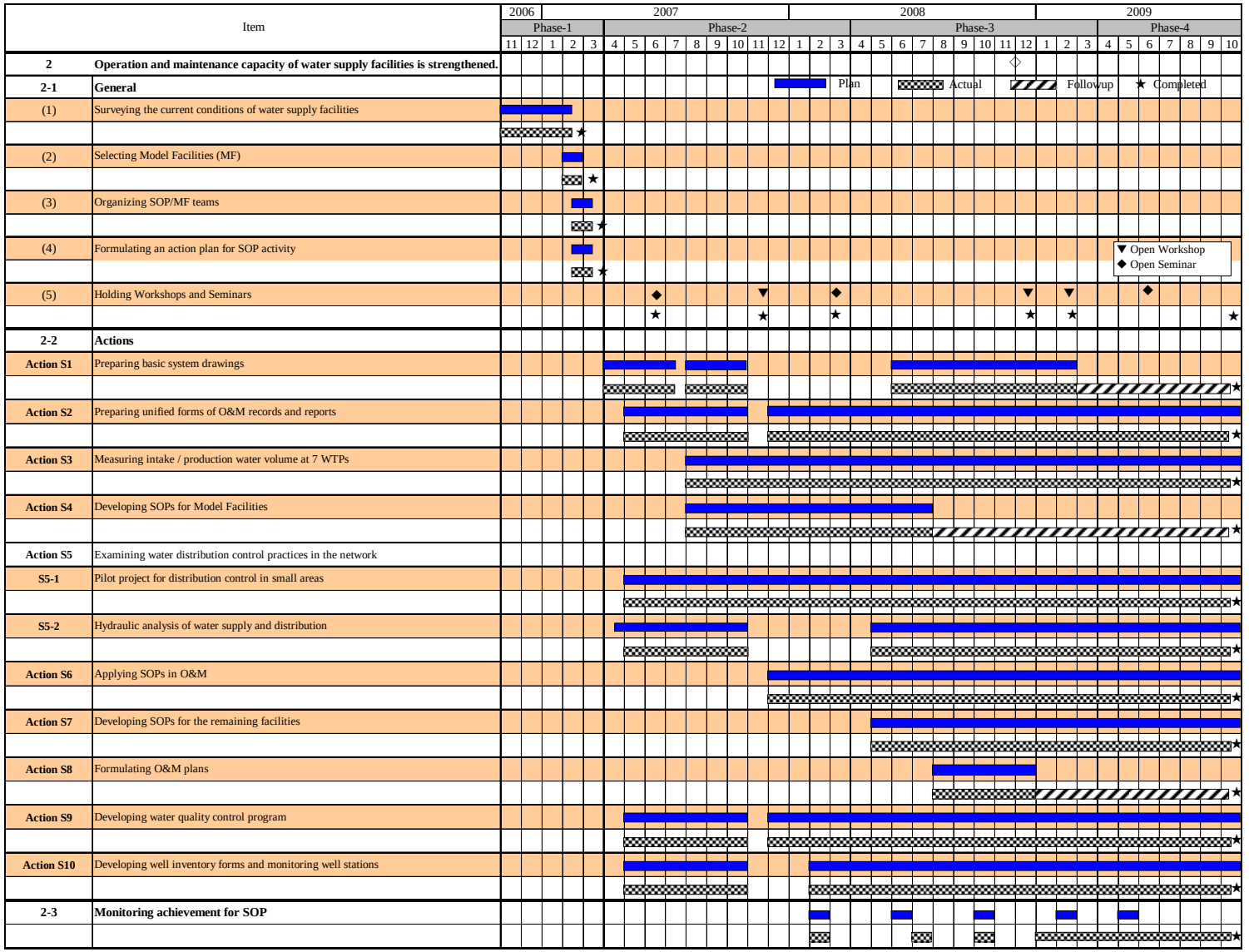


Figure 5-2 Actual Implementation Schedule for SOP Activities

CHAPTER 6 ACTUAL OUTPUTS

6.1 Input by Japanese Side

6.1.1 JICA Expert Team

Dispatch of experts is shown in Table 6-1 to 6-4.

Table 6-1 Dispatch of experts (Phase-1)

	Field	Name	Company	Phase-1					(Man Month)	
				2006		2007			Egypt	Japan
				11	12	1	2	3		
◎	Team Leader	Mr.Takeuchi	YEC	28 45		11	15 30	16	2.50	0.10
◎	Sub Leader Unaccounted-for Water	Mr.Seno	YEC		2 55	25	25	20 16	2.50	0.10
◎	Water Supply& Maintenance 1	Mr.Saeki	YEC	28 45		11	15 30	16	2.50	0.10
◎	Water Supply& Maintenance 2	Mr.Kimura	YEC	28 45		11	15 30	16	2.50	0.10
	Coordinator	Mr.Omori	YEC		2 30 31		15 30	16	2.00	0.00
								Except Coodinator	10.00	0.40
									10.40	

Table 6-2 Dispatch of experts (Phase-2)

	Field	Name	Company	2007									2008			(Man Month)	
				Phase-2													
				year2007												Egypt	Japan
				4	5	6	7	8	9	10	11	12	1	2	3		
◎	Team Leader	Mr.Takeuchi	YEC	20	60	18				16	45 29			8 30	8	4.50	0.00
◎	Subleader Unaccounted-for Water	Mr.Seno	YEC	20	60	18		1 30		1 60	29			8 30	8	6.00	0.00
	Leackage Detection	Mr.Okazaki	YEC (FGC)	1 45	14		20	60	17		5 45	19				5.00	0.00
◎	Water Supply& Maintenance 1	Mr.Saeki	YEC	1 45	14			1 45	14		15 30	14				4.00	0.00
◎	Water Supply& Maintenance 2	Mr.Kimura	YEC		16 60	14		17 75		30			9 60	8		6.50	0.00
	Network Hydlaulic Analisys	Mr.Omori	YEC		20 150					16						5.00	0.00
	Electric	Ashraf A. Ahmed	YEC (Personal)					1 60	29					8 30	8	3.00	0.00
	Hydlogyology	Mr.Iijima	YEC		1 60	29								8 30	8	3.00	0.00
	Water quality	Mr.Hara	YEC		16 60	29			17	30 31						3.00	0.00
	Coodinator	Mr.Omori	YEC	20 30	19									15 30	15	2.00	0.00
															Except Coodinator	35.00	0.00
																35.00	

Table 6-3 Dispatch of experts(Phase-3)

	Field	Name	Company	2008 Phase-3 year2008 4	5	6	7	8	9	10	11	12	2009 1	2	3	(Man Month) Egypt	Japan
◎	Team Leader	Mr.Takeuchi	YEC		16	60 14						34 19 22		21 3 23	5 8 12	4.00	0.00
◎	Sub Leader Unaccounted-for Water	Mr.Seno	YEC		16	30 14	4 7	30 13 7		45 10	23		11	45 24		5.00	0.00
	Leackage Detection	Mr.Okazaki	YEC (FGC)			6	75	19								2.50	0.00
◎	Water Supply& Maintenance 1	Mr.Saeki	YEC		16	30 14		2	30 31							2.00	0.00
◎	Water Supply& Maintenance 2	Mr.Kimura	YEC		30	48	16			10	45 23					3.10	0.00
	Network Hydlaulic Analisys	Mr.Omori	YEC													0.00	0.00
	Electric	Ashraf A. Ahmed	YEC (Personal)				15	30 13								1.00	0.00
	Hydlogyology	Mr.Iijima	YEC													0.00	0.00
	Water quality	Mr.Hara	YEC													0.00	0.00
	Coodinator	Mr.Omori	YEC		16	30 14							(11) 19	30 28		2.00	0.00
													Except Coodinator			17.60	0.00
																17.60	

Table 6-4 Dispatch of experts (Phase-4)

	Field	Name	Company	2009 Phase-4 year2009 4	5	6	7	8	9	10	11	(Man Month) Egypt	Japan
◎	Team Leader	Mr.Takeuchi	YEC		18	30 16				20	15 3	1.50	0.10
◎	Sub Leader/Unaccounted-for Water	Mr.Seno	YEC	25	30 24			30	20 18			1.67	0.00
◎	Water Supply& Maintenance	Mr.Kimura	YEC	25	30 24					5	30 3	2.00	0.00
	Coodinator	Mr.Omori	YEC	29	30 28					5	30 3	2.00	0.00
											Except Coodinator	5.17	0.10
												5.27	

6.1.2 Counterpart Training in Japan

(1) Summary of Counterpart Training

The summary of counterpart training is as shown in Table 6-5.

Table 6-5 Summary of Counterpart Training in Japan

Name	Field	Period	Training Course Title	Hosting Institution	Position when accepted
Mr. Alae El-Din Mohaamed	UFW	2007/2/5-2007/2/20	Improved Management of entity for Water	To learn the technology for UFW reduction activities in Japan / Waterworks Bureau, Yokohama City and Saitama City, FUJI TECOM INC.	Head of UFW/HQ Team
Mr. Abd El Shafi	SOP	2007/2/6-2007/2/20	Improved Management of entity for Water	To learn the technology for UFW reduction activities in Japan / Waterworks Bureau, Yokohama City and Saitama City	Head of SOP/HQ Team
Dr. Salah Bayoumi	Project Leader	2008/1/18 - 2008/1/25	Improved Management of entity for Water	To learn the technology for UFW reduction activities in Japan / Waterworks Bureau, Kitakyushu City	Chairman of SHAPWASCO
Mr. Salah Abd El Hak	UFW	2009/1/20 - 2009/2/3	Improved Management of entity for Water	To learn the technology for UFW reduction activities in Japan / Waterworks Bureau, Yokohama City and Saitama City, FUJI TECOM INC.	Water Department manager for Huseinia Sector
Mr. Samir Mohamed Ghareib	SOP	2009/1/20 - 2009/2/3	Improved Management of entity for Water	To learn the technology for UFW reduction activities in Japan / Waterworks Bureau, Yokohama City and Saitama City	Plant Manager for Abbasa water treatment plant

(2) Counterpart Training in Japan in Phase-1

1) Purpose

Counterpart Training in Japan had been planned as a part of the Project for capacity development of operation and maintenance for SHAPWASCO staff.

Training programs in Japan had been designed as part of measures for SHAPWASCO staff to learn the technology for unaccounted-for water reduction, O&M skills and knowledge of the water supply facilities. Thus, the topics included in the training and inspections will be matters essential for the Sharkia Governorate to improve its capability in operating, maintaining and managing the facilities, that is, reduction in the UFW amount; detection of water leakage; operation and maintenance of the water supply facilities and so on.

In conducting training programs in Japan, the selection of trainees and the contents of the programs had been examined and coordinated between C/P and JICA expert team. Then, the following two trainees, who are the responsible persons for UFW/HQ team and SOP/HQ team, were nominated.

- For UFW activity : Mr. Alae El Din Mohamed, Head of UFW/HQ team
- For SOP activity : Mr. Abd El Shafi Abdel Aziz, Head of SOP/HQ team

2) Training Schedule in Japan

Training had been conducted in Japan from 5th February to 20th, 2007 in Japan and the training schedule is as shown in Table 6-6.

Table 6-6 Training Schedule in Japan for Phase-1

Date		Programs			Place to stay
Feb. 4	Sun	Arrival in Japan			JICA Tokyo
5	Mon	Briefing Session		JICA Tokyo	
		Mr.Alae El-Din Mohaamed	Mr. Abd El-Shafi		
6	Tue	Technical Training at Fuji Tecom Inc (for detection of leakage)	Technical Training (Purification Plant)	Fuji Tecom Inc.	JICA Tokyo
7	Wed	Technical Training at Fuji Tecom Inc	Technical Training (Booster Pump Station)	Fuji Tecom Inc.	JICA Tokyo
8	Thu	Technical Training at Fuji Tecom Inc	Technical Training (Distribution Plant)	Fuji Tecom Inc.	JICA Tokyo
9	Fri	Technical Training at Yokohama City		Yokohama City	JICA Yokohama
10	Sat	Day-off			
11	Sun	Social survey in Tokyo			
12	Mon	Internal meeting with JICA expert			
13	Tue	Technical Training at Yokohama City (for corrosion of pipes) and visiting WTP		Yokohama City	JICA Yokohama
14	Wed	Technical Training at Yokohama City(for mapping system)		Yokohama City	JICA Yokohama
15	Thu	Technical Training at Yokohama City(for reading a meter)		Yokohama City	JICA Yokohama
16	Fri	Technical Training at Yokohama City(surveying water leakage)		Yokohama City	JICA Yokohama
17	Sat	Day-off			JICA Tokyo
18	Sun	Internal meeting with JICA expert			JICA Tokyo
19	Mon	Report writing		Yachiyo Engineering	JICA Tokyo
20	Tue	Evaluation Meeting		JICA Tokyo	JICA Tokyo
21	Wed	Departure from Japan			

Source : Prepared by C/P team and JICA expert team

3) Outcomes of the Training

Although the training periods were short as shown in the training schedule mentioned above, the both trainees have acquired the following technology related to UFW reduction and SPO activities for the water supply facilities at Waterworks Bureau of Yokohama City and Saitama City, major municipality in Japan, and also the leakage detection techniques and the procedure at Fuji Tecom Inc.

- Summary of waterworks and maintenance procedure on water supply networks in Japan
- Summary of waterworks of Yokohama City, Saitama Prefecture and Saitama City
- Procedure of the maintenance on water supply equipment
- Mapping system on water facilities
- Collecting system of water bill and organization regarding maintenance on water supply equipment
- Operation and maintenance on water treatment plant
- Appropriate management on customer (customer service and meter reading)
- Detection of leakage, block system in pipelines and repairing procedures
- Measurement for corrosion in pipelines
- Maintenance on distribution pipelines and visiting the construction site of distribution pipelines
- Quality control on pipe installation works
- Identifying for leakage by using water quality test during the pipe installation works
- Quality control on the pipe installation works
- Mechanism and practical training on the leakage detecting equipment
- Mechanism and practical training on the ultrasonic flow meter and pipe locator

Two trainees utilized their experiences in Japan for the Project and transferred their knowledge and technology obtained in Japan to other staff of SHAPWASCO to arouse the importance of the operation and maintenance, the detection of water leakage and the decrease of UFW in SHAPWASCO.

(3) Counterpart Training in Japan in Phase-2

1) Purpose

The purpose of the training in Japan is to learn the experience for UFW reduction activities and water supply service management in Japan and utilize it in the water supply service management of SHAPWASCO.

2) Training Schedule in Japan

C/P training had been conducted in Japan from 18th January to 25th 2008. The project manager of this project (chairman of SHAPWASCO) attended the course.

Table 6-7 Training Schedule in Japan for Phase-2

Date			Contents	Section-in-charge	Place of Training	Type of Training		
						Lecture	Exercise	Others
Jan. 17	Thu		Arrival in Japan					
Jan. 18	Fri	AM	Briefing by KIC		TIC			
		PM	Courtesy call on JICA Headquarters, Meeting with YEC		JICA/YEC			
Jan. 19	Sat		Holiday					
Jan. 20	Sun		Travel (Tokyo - Kitakyushu)					
Jan. 21	Mon	AM	Opening ceremony/**Job Report***1/Outline of Kitakyushu City Waterworks Bureau	General Affairs Sec.	Waterworks Bureau, Kitakyushu City	1	0	2
		PM	Countermeasures for UFW reduction (Overall Policy)	Water Supply Management Sec.		3	0	0
Jan. 22	Tue	AM	1. Plan for District Metering Zone (incl. site observation)	Water Supply Management Sec.	Waterworks Bureau, Kitakyushu City	2	1	0
		PM	2. Outline of SCADA System (incl. observation of the related facilities)	Water Supply Management Sec.		2	1	0
Jan. 23	Wed	AM	3. Leakage survey plan (incl. experience of Kitakyushu City)	Water Supply Management Sec.	Waterworks Bureau, Kitakyushu City	2	1	0
		PM	4. Billing and water tariff collection system	Service Sec.		3	0	0
Jan. 24	Thu	AM	5. Actual situation of leakage repair (incl. visit to working center)	Water Supply Management Sec.	Waterworks Bureau, Kitakyushu City	2	1	0
		PM	6. Management for UFW reduction (incl. organization and system)	Construction Office		3	0	0
Jan. 25	Fri	AM	7. Plan for distribution pipe renewal (incl. site observation)	Construction Office	Waterworks Bureau, Kitakyushu City	1	2	0
		PM	Presentation of **Action Plan***2/closing session	General Affairs Sec.		0	0	3
Jan. 26	Sat		Departure from Japan					
					Total	19	6	5
						30		

Notes:

1. Job Report means the report about the activities of the trainee in his company.
2. Action Plan means the plan about what actions the trainee will take after the training based on the outcomes of the above training.

3) Outcomes of the Training

C/P training has been conducted intensively for 30 hours in five (5) days from 21st to 25th January 2008. The trainee acquired following knowledge about the water supply service management in Japan through the course:

- Technology on unaccounted-for water (UFW) reduction (leakage survey, leakage detection, leakage repair works, etc.)
- Institutional framework for UFW countermeasures
- Water distribution control system

- Water tariff and water charge collecting system

(4) Counterpart Training in Japan in Phase-3

1) Purpose

Counterpart Training in Japan had been planned as a part of the Project for capacity development of operation and maintenance for SHAPWASCO staff.

Training programs in Japan had been designed as part of measures for SHAPWASCO staff to learn the technology for unaccounted-for water reduction, O&M skills and knowledge of the water supply facilities. Thus, the topics included in the training and inspections will be matters essential for the Sharkia Governorate to improve its capability in operating, maintaining and managing the facilities, that is, reduction in the UFW amount; detection of water leakage; operation and maintenance of the water supply facilities and so on.

In conducting training programs in Japan, the selection of trainees and the contents of the programs had been examined and coordinated between C/P and JICA expert team. Then, the following two trainees, who are the responsible persons for UFW/HQ team and SOP/HQ team, were nominated.

- For UFW activity : Mr. Salah Abd El Hak, Head of UFW/El Husainia team
- For SOP activity : Mr. Samir Mohamed Ghareib, Head of Abbasa WTP

2) Training Schedule and Program in Japan

Training had been conducted in Japan from 20th January to 3rd February, 2009 in Japan and the training schedule and program is as shown in Table 6-8 for UFW and Table 6-9 for SOP.

Table 6-8 Training Schedule and Program in Japan for UFW for Phase-3

Date				lecturer	Location
01/19/08	Mon		Arrival in Japan		
01/20/08	Tue		Orientation Lecture		JICA Osaka
01/21/08	Wed	AM	Lecture；General Description of Water System in Osaka City	Planning Management Person	OSAKA City Waterworks Bureau (World Tread Centore Building)
		PM	Lecture；Business Management of Water System in Osaka City	Planning Management Person	
01/22/08	Thu	AM	Lecture；Briefing for Water Treatment Plant	Kunijima Water Treatment Plant	Kunijima Water Treatment Plant in OSAKA City Waterworks Bureau
		PM	Lecture；General Description for W.T.P Facility（Sedimentation/Filter）and Treatment Management		
			Practical Work；Tour of Inspection for Water Treatment Plant Facility		
01/23/08	Fri	AM	Practical Work；Pipe Maintenance （accessory equipment of pipe, junctions）	TOBU Water Construction Center	Water Technology Center in OSAKA City Waterworks Bureau
		PM			
01/24/08	Sat				
01/25/08	Sun				
01/26/08	Mon	AM	Lecture；Water Distribution Management System（Pressure Control/District metering Zone/Plan and practice on Unaccounted-for Water）	Person for water distribution	OSAKA City Waterworks Bureau (World Tread Centre Building)
		PM	Practical Work；Tour of Inspection (Cast Iron Pipe Factory)	Person for Personnel/Human Resource	KUBOTA Corporation
01/27/08	Tue	AM	Operation management for Water Distribution Facility(Tour of Inspection)	Person in NIWAKUBO W.T.P	NAGAI Distribution Plant in OSAKA City Waterworks Bureau
		PM	Movement（Osaka－Tokyo）		
01/28/08	Wed		Practical Work in Manufacturing Corporations（Equipment Technology、Practical Work)	FUJI TECOM Corporation	FUJI TECOM Corporation
01/29/08	Thu		Practical Work in Manufacturing Corporations（Equipment Technology、Practical Work)	FUJI TECOM Corporation	FUJI TECOM Corporation
01/30/08	Fri		Practical Work in Manufacturing Corporations（Equipment Technology、Practical Work)	FUJI TECOM Corporation	FUJI TECOM Corporation
01/31/08	Sat				
02/01/08	Sun				
02/02/08	Mon		Tour of Inspection (Yokohama water Memorial Hall), Preparing Report	Yachiyo Engineering Corporation	Yokohama Water Memorial Hall、Yachiyo Engineering Corporation
02/03/08	Tue		Evaluation Mission	JICA Tokyo International Center	JICA Tokyo International Center
02/04/08	Wed		Departure from Japan		

Source : Prepared by JICA expert team

Table 6-9 Training Schedule and Program in Japan for SOP for Phase-3

Date				lecturer	Location
01/19/08	Mon		Arrival in Japan		
01/20/08	Tue		Orientation Lecture		JICA Osaka
01/21/08	Wed	AM	Lecture；General Description of Water System in Osaka City	Planning Management Person	OSAKA City Waterworks Bureau (World Tread Centre Building)
		PM	Lecture；Business Management of Water System in Osaka City	Planning Management Person	
01/22/08	Thu	AM	Lecture；Briefing for Water Treatment Plant	Kunijima Water Treatment Plant	Kunijima Water Treatment Plant in OSAKA City Waterworks Bureau
		PM	Lecture；General Description for W.T.P Facility（Sedimentation/Filter）and Treatment Management		
			Practical Work；Tour of Inspection for Water Treatment Plant Facility		
01/23/08	Fri	AM	Lecture；Water Quality Control (Basic matter, Water quality control method)	Water Quality Laboratory	Kunijima Water Treatment Plant in OSAKA City Waterworks Bureau
		PM	Lecture, Practical Work；Maintenance for Electrical/Mechanical Facility (Including field trip)	Facility Conservation Center	
01/24/08	Sat				
01/25/08	Sun				
01/26/08	Mon	AM	Lecture；Water Distribution Management System（Pressure Control/District metering Zone/Plan and practice on Unaccounted-for Water）	Person for water distribution	OSAKA City Waterworks Bureau (World Tread Centre Building)
		PM	Practical Work；Tour of Inspection (Cast Iron Pipe Factory)	Person for Personnel/Human Resource	KUBOTA Corporation
01/27/08	Tue	AM	Operation management for Water Distribution Facility(Tour of Inspection)	Person in NIWAKUBO W.T.P	NAGAI Distribution Plant in OSAKA City Waterworks Bureau
		PM	Movement（Osaka－Tokyo）		
01/28/08	Wed	AM	Lecture / tour；Method of Water Tariff Collection		YOKOHAMA City Waterworks Bureau
		PM	Lecture/tour；Customer Management（Customer Service, Meter Reading）		
01/29/08	Thu	AM	General Description in SAITAMA CITY Waterworks Bureau and General Statement		Water Distribution Office in SAITAMA City Waterworks Bureau
		PM	Practical Work；Tour of Inspection (TOBU Distribution Plant etc)	Person in TOBU Distribution Plant	
01/30/08	Fri	AM	General Description for Project Operation in SAITAMA Prefecture	Person in OKUBO Water Treat Plant	OKUBO Water Treat Plant in SAITAMA City Waterworks Bureau
		PM	Tour of Inspection for Plant and Question and Answer	Person in OKUBO Water Treat Plant	
01/31/08	Sat				
02/01/08	Sun				
02/02/08	Mon		Tour of Inspection (Yokohama water Memorial Hall), Preparing Report	Yachiyo Engineering Corporation	Yokohama Water Memorial Hall、Yachiyo Engineering Corporation
02/03/08	Tue		Evaluation Mission	JICA Tokyo International Center	JICA Tokyo International Center
02/04/08	Wed		Departure form Japan		

Source : Prepared by JICA expert team

3) Outcomes of the Training

Although the training periods were short as shown in the training schedule mentioned above, the both trainees have acquired the following technology related to UFW reduction and SPO activities for the water supply facilities at Waterworks Bureau of Osaka City, Yokohama City and Saitama City, major municipalities in Japan, and also the leakage detection techniques and the procedure at Fuji Tecom Inc.

- Summary of waterworks and maintenance procedure on water supply networks in Japan
- Summary of waterworks of Osaka City, Yokohama City, Saitama Prefecture and Saitama City
- Procedure of the maintenance on water supply equipment
- Mapping system on water facilities

- Collecting system of water bill and organization regarding maintenance on water supply equipment
- Operation and maintenance on water treatment plant
- Appropriate management on customer (customer service and meter reading)
- Detection of leakage, block system in pipelines and repairing procedures
- Measurement for corrosion in pipelines
- Maintenance on distribution pipelines and visiting the construction site of distribution pipelines
- Quality control on pipe installation works
- Identifying for leakage by using water quality test during the pipe installation works
- Quality control on the pipe installation works
- Mechanism and practical training on the leakage detecting equipment
- Mechanism and practical training on the ultrasonic flow meter and pipe locator

Two trainees utilized their experiences in Japan for the Project and transferred their knowledge and technology obtained in Japan to other staff of SHAPWASCO to arouse the importance of the operation and maintenance, the detection of water leakage and the decrease of UFW in SHAPWASCO.

6.1.3 Provision of Equipment

(1) Equipment Item

For reducing UFW ratio in the water supply system, it is important to clarify the contents of UFW consisting of commercial loss (or apparent loss) and physical loss (or real loss). The physical loss means the water loss by leakage in the water supply system and, for the most cases, is the main part of UFW ratio.

In order to detect the leakage in the water supply system, leakage survey equipment shall be introduced in the Project. In Phase-2, since there were two (2) pilots project areas, UFW reduction activities were carried out by two teams (Zagazig team and Hihya team). Therefore, two (2) sets of equipment were procured (one set for each team). In Phase-3, since one (1) pilot project area was added, UFW reduction activities were carry out by Abu Hamad team. Therefore, one (1) set of equipment was procured for phase-3.

For SOP activity, some equipment such as district flow meters was required.

The equipment procured in Phase-1, 2 and 3, and the purposes of the equipment are mentioned in Table 6-10.

Table 6-10 Equipment for UFW and SOP Activities procured

No.	Name of Equipment	Phase-1 (Set)	Phase-2 (Set)	Phase-3 (Set)
1	Water leak detector	4		2
2	Digital sound detector	2		1
3	Hammer drill	2		1
4	Drill bid	10		5
5	Boring bar（1m）	2		1
6	Acoustic rod (1.5m)	4		2
7	Ultrasonic flow meter (For large diameters)	5		
8	Generator	2		1
9	Pickup	2		
10	Portable ultrasonic flow meter (ϕ 200- ϕ 6000)		4	2
11	Portable ultrasonic flow meter (ϕ 50- ϕ 400)		4	2
12	Water pressure recorder		4	2
13	Pipe and cable locator		2	1
14	Metal locator		2	1
15	Leak sound detector		2	1
16	Ultrasonic flow meter (For large diameters)		21	
17	Non metallic pipe vibrator		2	1
18	Water level indicator		4	
19	Data logger		16	
20	Data transfer device		5	
21	Software (Auto Cad)		1	
22	Software (Water Cad)		1	

Source : Prepared by C/P team and JICA expert team

1) Water leak detector

Water leak detector is used for the leaking point detection. Two (2) sets will be used for each UFW team.

2) Digital sound detector and acoustic rod

Digital sound detector and acoustic rod is used for detecting leaking sound spread through valves, hydrants, etc.

3) Hammer drill, drill bid, and boring bar

Hammer drill is used for checking the leak point detected by water leak detector, digital sound detector and acoustic rod. Holes are drilled by a hammer drill with drill bit, and boring bar is inserted to the hole. By doing this, the actual leak point is found by acoustic rod.

4) Ultrasonic flow meter (For large diameters)

Ultrasonic flow meters are needed for monitoring water treatment volume and water distribution volume at twenty one (21) water treatment plants. In addition, ultrasonic flow meters are needed for monitoring water distribution of the specific distribution district. At present, there were no district flow meters in the whole Governorate. Therefore, it was not possible to measure the water distribution volume in the distribution district. In this project, district flow meter is newly installed in the district defined as the pilot area “Hihya Markaz”.

5) Generator

Generators are required for electricity source of hammer drill.

6) Pickup

Pickup trucks are used as transportation means for the field work by UFW teams and SOP teams.

7) Portable ultrasonic flow meter(ϕ 200～ ϕ 6000, ϕ 50～ ϕ 400)

Portable ultrasonic flow meters are needed for flow measurement which shall be done by setting single inflow point in the pilot area and under the condition that the area can be totally closed. Each two (2) sets are used for each UFW team.

8) Water pressure recorder

Water pressure recorders are used for the measurement of pressure during the flow measurement by using the portable ultrasonic flow meter. Two (2) sets will be used for each UFW team.

9) Pipe and cable locator

Pipe and cable locators are used for search of piping location and depth.

10) Metal Locator

Metal locators are used for search of valve location.

11) Leak sound detector

Leak sound detectors are used for the leaking point detection. These equipments can search the leaking area automatically by inputting piping data. After using leak sound detection, water leak detector is used for the leaking point detection at this area.

12) Non metallic pipe vibrator

Non metallic pipe vibrators are used for the leaking point detection of non metallic pipe by vibration of water hammer.

13) Water level indicator

Water level indicators are needed for well monitoring at four wells which is considered the monitoring is necessary.

14) Data logger

Data loggers are needed for record of the flow volume measurement at the point of ultrasonic flow meters which is far from operation point.

15) Data transfer device

Data transfer device are needed for transfer from data logger to personal computer.

16) Software (Auto Cad)

Auto Cad software is used for preparing of the basic drawing.

17) Software (Water Cad)

Water Cad is used for pipe network calculation. An appropriate pipe diameter and pressure is grasped by analysis of the pipe network.

18) Equipment for common activities

In Phase-1&2 of this Project, in order to analyze the collected data, establish a database and prepare the required documents, following equipment have been procured.

Table 6-11 Equipment for Common Activities procured

No.	Name of Equipment	Quantity	Phase-1	Phase-2
1	Copy and Fax machine	1	○	
2	Personal computer (Notebook)	2	○	
3	Personal computer (Notebook)	1		○
4	Personal computer (Desktop)	2		○

Source : Prepared by C/P team and JICA expert team

(2) Equipment Status

These equipments status is as shown in Table 6-12.

Table 6-12 Equipment Status

Date of Buying	Fiscal Year	Equipment (Specification)		Installation Place	Usage of the Equipment
3/3/2007	2006	Water Leak detector	HUJI TECOM HG-10A Ⅱ	Store Room in SHAPWASCO	in use Counterpart
3/3/2007	2006	Digital sound detector	HUJI TECOM FSB-8D	Store Room in SHAPWASCO	ditto
3/3/2007	2006	Hammer drill	Hitachi PR-25B	Store Room in SHAPWASCO	ditto
3/3/2007	2006	Drill bid		Store Room in SHAPWASCO	ditto
3/3/2007	2006	Boring bar	L=1m	Store Room in SHAPWASCO	ditto
3/3/2007	2006	Acoustic rod	LS-1.5	Store Room in SHAPWASCO	ditto
3/3/2007	2006	Ultrasonic flow meter	Fuji Electric FLV	Site	ditto
3/12/2007	2006	Generator	Cobota	Store Room in SHAPWASCO	ditto
3/14/2007	2006	Pickup	Mitsubishi 2500CC/4WD	Zagazig Water Treatment Plant	ditto
12/14/2006	2006	Copy and Fax machine	WorkCentre Pro128	JICA Expert Office	ditto
12/13/2006	2006	Personal computer (Notebook)	DELL D620	JICA Expert Office	ditto
5/13/2007	2007	Portable ultrasonic flow meter	Fuji Electric Potaflow-X（φ200-φ6000)	Store Room in SHAPWASCO	ditto
5/13/2007	2007	Portable ultrasonic flow meter	Fuji Electric Potaflow-X（φ50-φ400)	Store Room in SHAPWASCO	ditto
5/13/2007	2007	Water pressure recorder	HUJI TECOM FJN501	Store Room in SHAPWASCO	ditto
5/30/2007	2007	Pipe and cable locator	HUJI TECOM PL-960	Store Room in SHAPWASCO	ditto
5/30/2007	2007	Metal locator	HUJI TECOM F-90M	Store Room in SHAPWASCO	ditto
5/30/2007	2007	Leak sound detector	HUJI TECOM LC-2500	Store Room in SHAPWASCO	ditto
5/18/2008	2007	Ultrasonic flow meter	GE AT868	Site	ditto
5/30/2007	2007	Non metallic pipe vibrator	TOKIO RHYTHM	Store Room in SHAPWASCO	ditto
1/12/2008	2007	Water level indicator	CTI science RT510-W	Site	ditto
1/12/2008	2007	Data logger	Hioki 3639 Pulse Rogger	Site	ditto
1/12/2008	2007	Data transfer device	Hioki 3912 Communication Base	Site	ditto
5/6/2007	2007	Personal computer(Notebook)	DELL D520	JICA Expert Office	ditto
5/6/2007	2007	Personal computer (Desktop)	HP Compaq DX7800	JICA Expert Office	ditto

Date of Buying	Fiscal Year	Equipment (Specification)		Installation Place	Usage of the Equipment
4/19/2007	2007	Software	Water Cad	JICA Expert Office	ditto
5/6/2007	2007	Software	AutoCAD 2007	JICA Expert Office	ditto
7/1/2008	2008	Digital sound detector	HUJI TECOM FSB-8D	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Water Leak detector	HUJI TECOM HG-10A Ⅱ	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Leak sound detector	HUJI TECOM LC-2500	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Pipe and cable locator	HUJI TECOM PL-960	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Metal locator	HUJI TECOM F-90M	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Acoustic rod	LS-1.5	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Boring bar	L=1m	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Hammer drill	Hitachi PR-25B	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Drill bid		Store Room in SHAPWASCO	ditto
7/1/2008	2008	Non metallic pipe vibrator	TOKIO RHYTHM	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Portable ultrasonic flow meter	Fuji Electric Potaflow-X（φ200-φ6000)	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Portable ultrasonic flow meter	Fuji Electric Potaflow-X（φ50-φ400)	Store Room in SHAPWASCO	ditto
7/1/2008	2008	Water pressure recorder	HUJI TECOM FJN501	Store Room in SHAPWASCO	ditto
6/16/2008	2008	Generator	Cobota	Store Room in SHAPWASCO	ditto

6.1.4 Expense of Project Implementation

Expense of project implementation is shown in Table 6-13.

Table 6-13 Expense of Project Implementation

(Unit: Yen)

Items	FY2006 (1)	FY2007 (2)	FY2008 (3)	FY2009 (4)	Total (1)+(2)+(3)+(4)	Remarks
1) General Cost	3,756,000	16,484,000	9,700,000	3,651,000	33,591,000	
Staff Cost	2,142,662	8,122,936	5,026,678	1,566,200	16,858,476	
Consumable Cost	84,554	188,551	236,273	123,890	633,268	
Travel Expense	0	274,834	37,466	0	312,300	
Document Preparation Cost	0	163,789	148,375	35,350	347,514	
Rental Cost	1,702,124	7,263,221	4,204,019	1,925,772	15,095,136	
Miscellaneous Cost	0	472,057	47,666	0	519,723	
2) Equipment Cost (JICA Expert's Equipment)	7,066,000	14,341,000	8,573,000	0	29,980,000	
3) Equipment Shipping Cost (Other Equipment)	61,000	0	0	0	61,000	
4) Report Preparation Cost (Printing and Binding)	75,000	12,000	46,000	0	133,000	
Total	10,958,000	30,837,000	18,319,000	3,651,000	63,765,000	

Note: in FY2009 is contract amount

6.2 Input by Egyptian Side

6.2.1 Counterpart Team

Transition of counterpart team is shown in Table 6-14.

Table 6-14 Transition of Counterpart Team

C/P Name	Title	Field	Working Period	Note
Salah Bayoumi	Chairman/Headquarters	Management	2006.11～up to now	
<UFW Team>				
Alae El Din Mohamed	Head of UFW Team/Headquarters	Management	2006.11～up to now	
Wala Mohamed Ali	Assistant for head of UFW team/Headquarters	Engineer	2007.10～up to now	
Wala Hamdi	Assistant for head of UFW team/Headquarters	Engineer	2007.10～up to now	
Tamer Kamel	Assistant for head of UFW team/Headquarters	Engineer	2008.4～2009.5	To I.T. May 2009
Mohamed Saad	Assistant for head of UFW team/Headquarters	Engineer	2008.4～2008.12	turnover
Alaa Abd El Raheem Ali	Technician	Assistant Engineer	2009.5～up to now	
Salama Mahmoud Abd El Aal	Supervisor/ Head of Zagazig UFW Team/Zagazig City(East)	Distribution management	2006.11～up to now	
Mohamed Mohamed Bakr	Supervisor/Zagazig City(East)	Distribution management	2006.11～up to now	
Medhat Moneir Mahhmoud	Supervisor/Zagazig City(East)	Distribution management	2006.11～up to now	
Mohamed Hafez Lotfy	Supervisor/Zagazig City(East)	Distribution management	2006.11～up to now	
Emad Ahmed Abd El Kader	Engineer/Awlad Saqr	Distribution management	2006.11～up to now	
Bendary Hassan Bendarhy	Engineer/Awlad Saqr	Distribution management	2006.11～up to now	
Hegazy El Sayed Ali	Engineer/Awlad Saqr	Distribution management	2006.11～up to now	
Saeed Abd El Salam Ahmed	Engineer/Awlad Saqr	Distribution management	2006.11～up to now	
Sebaey Mohamed Rabee	Engineer/Faqus	Distribution management	2006.11～up to now	
Mostafa Mohamed Mosabah	Supervisor/Faqus	Distribution management	2006.11～up to now	
El Sayed Abd El Aziz Soliman	Supervisor/Faqus	Distribution management	2006.11～up to now	
Salah El Dien Abbas	Supervisor/Faqus	Distribution management	2006.11～up to now	
Samir Mahmoud Abd El Hameed	Engineer/Zagazig City(West)	Distribution management	2006.11～up to now	
Mahmoud Mohamed El Hariry	Supervisor/Zagazig City(West)	Distribution management	2006.11～up to now	
Nabil Fathy El Sayed	Supervisor/Zagazig City(West)	Distribution management	2006.11～up to now	
Gorge Abd El Maseeh	Supervisor/Zagazig City(West)	Distribution management	2006.11～up to now	
Fahmy Mohamed Khalf Allah	Engineer/Kafr Saqr	Distribution management	2006.11～up to now	
Mohamed Ibrahim Mohamed	Supervisor/Kafr Saqr	Distribution management	2006.11～up to now	
Mahmoud Awad Abd Allah	Supervisor/Kafr Saqr	Distribution management	2006.11～up to now	
Osman Mansour Mohamed	Supervisor/Kafr Saqr	Distribution management	2006.11～up to now	
El Sayed Abd El Reheem	Engineer/Abu Kabier	Distribution management	2006.11～up to now	

C/P Name	Title	Field	Working Period	Note
Abd El Wahab Mohamed Ali	Supervisor/Abu Kabier	Distribution management	2006.11～up to now	
Mahrous Gergis Romees	Supervisor/Abu Kabier	Distribution management	2006.11～up to now	
Mahmoud Mohamed Gebaly	Supervisor/Abu Kabier	Distribution management	2006.11～up to now	
Asma'a Mohamed Farag	Engineer/Zagazig Markaz	Distribution management	2006.11～2009.3	To Water Department March 2009
Mohamed Mohamed Sabry	Supervisor/Zagazig Markaz	Distribution management	2006.11～up to now	
El Sayed Farag Ahmed	Supervisor/Zagazig Markaz	Distribution management	2006.11～2009.4	To Water Department April 2009
Ibrahim Bayoumi Mohamed	Supervisor/Zagazig Markaz	Distribution management	2006.11～up to now	
Ahmed Younis Metwaly	Supervisor/Zagazig Markaz	Distribution management	2009.4～up to now	
Esam Afifi	Supervisor/Zagazig Markaz	Distribution management	2009.4～up to now	
Mohamed Mohamed Nour	Engineer/Minia Al Qamah	Distribution management	2006.11～2009.1	turnover
Mohamed Abd El Wahab	Engineer/Minia Al Qamah	Distribution management	2009.1～up to now	
Adel Mahmoud Saleh	Supervisor/Minia Al Qamah	Distribution management	2006.11～up to now	
Ibrahim Fathy El Sadany	Supervisor/Minia Al Qamah	Distribution management	2006.11～up to now	
Sayed Hashem El Emary	Supervisor/Minia Al Qamah	Distribution management	2006.11～up to now	
Mostafa Abd Allah Ghanaiem	Supervisor/ Head of Abu Hamad UFW Team	Distribution management	2006.11～2009.1	To Salehia Sector
Taher Mansour Metwaly	Supervisor/Abu Hamad	Distribution management	2006.11～up to now	
Mohamed Mahmoud Radwan	Supervisor/Abu Hamad	Distribution management	2006.11～up to now	
Youssry Abd El Monem Hassan	Supervisor/Abu Hamad	Distribution management	2006.11～up to now	
Sayed Nasser	Supervisor/Abu Hamad	Distribution management	2009.1～up to now	
Mahdy Fathy ahmed	Supervisor/ Head of Hihya UFW Team	Distribution management	2006.11～up to now	
Gamal Mohamed Hussein	Supervisor/Hihya	Distribution management	2006.11～up to now	
El Hady Ahmed El Taher	Supervisor/Hihya	Distribution management	2006.11～up to now	
Saeed Abd El Rahman Hefny	Engineer/Mashtool El Sooq	Distribution management	2006.11～up to now	
Mohamed Ahmed Ali Hozayen	Supervisor/Mashtool El Sooq	Distribution management	2006.11～up to now	
Abd El Baset Mostafa Mohamed	Supervisor/Mashtool El Sooq	Distribution management	2006.11～up to now	
Soliman Hassan Soliman	Supervisor/Mashtool El Sooq	Distribution management	2006.11～up to now	
Salah Abd El Haq	Engineer/El Husainia	Distribution management	2006.11～up to now	
Mohamed Abd El Moneam Hashem	Supervisor/El Husainia	Distribution management	2006.11～up to now	
El Sayed Ibrahim Ali	Supervisor/El Husainia	Distribution management	2006.11～up to now	
Mohamed Abd El Aal Mohamed	Supervisor/El Husainia	Distribution management	2006.11～up to now	
Abd Allah Abd El Mgeed	Supervisor/Ibrahimyia	Distribution management	2006.11～2009.4	retired
Samir Mohamed Ahmed Farag	Supervisor/Ibrahimyia	Distribution management	2006.11～2009.4	To Water Department April 2009

C/P Name	Title	Field	Working Period	Note
Ramadan Abd Allah	Supervisor/Ibrahimyia	Distribution management	2006.11～up to now	
Mohamed Ragab	Supervisor/Ibrahimyia	Distribution management	2006.11～2009.4	To Water Department April 2009
Khairi Abd El Rahman	Supervisor/Ibrahimyia	Distribution management	2009.4～up to now	
Abdu Fatehy Mohamed	Supervisor/Ibrahimyia	Distribution management	2009.4～up to now	
Mostafa Ali El Sayed Khalil	Engineer/Bilbais	Distribution management	2006.11～up to now	
Reda Abd El Hameed Abd Allah	Supervisor/Bilbais	Distribution management	2006.11～up to now	
Salah Mohamed Kamel	Supervisor/Bilbais	Distribution management	2006.11～up to now	
Mahmoud El Sayed El Killany	Supervisor/Bilbais	Distribution management	2006.11～up to now	
Hamdi El Sayed Abd El Fatah Sharaf	Engineer/Diarb Nigm	Distribution management	2006.11～up to now	
Khairy Abd El Motelb Mohamed	Supervisor/Diarb Nigm	Distribution management	2006.11～up to now	
Mohamed El Sayed El Killany	Supervisor/Diarb Nigm	Distribution management	2006.11～up to now	
Mahmoud Megahed Abd El Aziz	Supervisor/Diarb Nigm	Distribution management	2006.11～up to now	
Mohamed Saleem Abd El Salam	Engineer/Salehia (New Sector)	Distribution management	2009.6～up to now	
Mohamed Mohamed Gomaa	Supervisor/Salehia (New Sector)	Distribution management	2009.6～up to now	
Ibrahim Ali Attia	Supervisor/Salehia (New Sector)	Distribution management	2009.6～up to now	
Abd El Aziz Khalil Mahmoud	Supervisor/Salehia (New Sector)	Distribution management	2009.6～up to now	
Abd El Halim Mahdy	Advisor for GIS Department	GIS	2008.4～up to now	
Tarek Yousef	Head of GIS Team	GIS	2006.11～up to now	
Mohamed El Badawi	GIS Engineer	GIS	2006.11～2009.5	turnover
Mohamed Mosbah	GIS Engineer	GIS	2006.11～2009.2	turnover
Aliaa El Saeed	GIS Engineer	GIS	2008.5～up to now	
Doaa Zaki	GIS Engineer	GIS	2007.10～2009.5	turnover
Hend Ali	GIS Engineer	GIS	2008.5～up to now	
Maha Abd Allah	GIS Engineer	GIS	2007.10～2009.5	turnover
Mohamed Saeed	GIS Engineer	GIS	2008.5～up to now	
Nour Abbas	GIS Engineer	GIS	2008.10～up to now	
Marwa Ahmed	GIS Engineer	GIS	2008.5～up to now	
Basma Ibrahim	GIS Engineer	GIS	2009.4～up to now	
Samar Samir	GIS Engineer	GIS	2009.4～up to now	
Aliaa El Honsainy	Public Awareness Campaign	Commercial	2006.11～2007.9	turnover
Ahmed El Feki	Public Awareness Campaign	Commercial	2006.11～2009.4	turnover
Mohamed Hamouda	Public Awareness Campaign	Commercial	2006.11～2009.5	turnover
Mariam Wageih	Public Awareness Campaign	Public Awareness	2008.8～up to now	
<SOP Team>				
Abdel Shafi Abdel Aziz	Head of SOP/HQ Team	Engineer	2006.11～up to now	
Ibrahim Shaheen	Electrical Engineer	Electrical Engineer	2006.11～up to now	
Gamal Abd El Hameed	Well Depart/Head Quarter	Geologist	2006.11～up to now	
Osama El Masry	Head Quarter	Chemist	2006.11～2009.2	turnover
Mohamed Ali	Head Quarter	Chemist	2009.2～up to now	
Heba Mahmoud Mohamed	Head Quarter	Engineer	2007.10～up to now	
Abd Allah Sayed	Head Quarter	Engineer	2006.11～up to now	
Nagi Labib Abd El Sayed	Hihya WTP manager	Engineer	2006.11～up to now	

C/P Name	Title	Field	Working Period	Note
Mohamed El Sayed Abd El Kader	Kafr Saqr WTP manager	Engineer	2006.11～2009.1	To Head of Kafr Saqr Sector
Bahaa Abd Allah Badran	Kafr Saqr WTP manager	Engineer	2009.1～2009.8	To sewage Department
Samir Gharieb	Abbasa WTP manager	Engineer	2006.11～up to now	
Ibrahim Noufal	El Husainia WTP manager	Engineer	2006.11～2009.5	turnover
Aly El Mosalemy	Water Department Manger	Engineer	2006.11～up to now	
Emam Abd El Mawgoud	Menia Al Qamah FMR plant	Engineer	2006.11～up to now	
Mohamed El Sayed Abd El Hameed	Bilbais BPs	Engineer	2006.11～up to now	
Mohamed Mesbah	Head Quarter	Data Base Engineer	2006.11～2009.2	turnover
Naglaa Ftehy	Head Quarter	Data Base Engineer	2009.4～up to now	
Haesham Gamal	Head Quarter	Auto Cad Operator	2007.5～2007.11	turnover

6.2.2 Budget Allocation in Egyptian Side

Budget allocation in Egyptian side is shown in Table 6-15.

Table 6-15 Budget Allocation in Egyptian Side

(Unit: LE)

Items	FY2006/2007 Expenditure (1)	FY2007/2008 Expenditure (2)	FY2008/2009 Expenditure (3)	FY2009/2010 Expenditure (4)	Total (1) +(2)+(3)+(4)	Remarks
(Personnel Expense)						
Personnel Services						Including employment cost
(Implementation Cost)						
Civil works of flow meter chambers for UFW	0	96,000	64,000		160,000	
Replacement water meter	0	114,300	72,900		187,200	
GIS maps	0	363,600	849,320		1,212,920	
Training yard for leakage reduction	0	0	162,500		162,500	
Civil works of flow meter chambers in including steel fences at aqueduct	0	154,800	310,135		464,935	
Electrical works and installation for flow meter	0	22,000	241,000		263,000	
Rehabilitation for Zagazig WTP	0	0	1,050,000		1,050,000	
Level measure equipment for alum dosing tank and water reservoir.	0	0	150,000		150,000	
Rehabilitation of Abbasa WTP			1,100,000	9,700,000	10,800,000	
Rehabilitation of New Faqus WTP				4,000,000	4,000,000	
Rehabilitation of Kafr Saqr WTP				4,000,000	4,000,000	
Rehabilitation of Huseinia WTP				3,500,000	3,500,000	
Pipe Replacement and renovation				2,350,900	2,350,900	
Central laboratory	0	0	11,000,000		11,000,000	
Total					39,301,455	

CHAPTER 7 DEVICE AND LESSON ON PROJECT MANAGEMENT AND IMPLEMENTATION

Devices and lessons on the Project management and implementation are as follows:

(1) Learning Experience of Similar Project and Technical Exchange with Other Country

During the Project, the project called "Capacity Development Project Non Revenue Water Reduction in Jordan" much similar to this Project was being implemented in Jordan. In June 2007, at Phase-1 of the Project, six (6) members representing UFW reduction team headed by SHAPWASCO chairman was dispatched to Jordan and had technical exchange with Water Authority of Jordan (WAJ).

Through the exchange tour, the following useful results were obtained:

- Through the observation of UFW reduction activities in other country, SHAPWASCO UFW reduction team could deepen their knowledge on UFW reduction activities.
- UFW team confirmed importance of UFW reduction activities and what they should do from now on by learning outputs from UFW reduction activities in Jordan.
- UFW team learned the appropriate methods obtained through experiences in Jordan for leakage survey method.
- UFW team learned evaluation method for UFW.
- SHAPWASCO received valuable experiences, advices, data, etc. from WAJ for establishing UFW department. By the advice from the Jordanian side, issues to be solved for establishment of the department were clarified.
- The Egyptian side and Jordanian side agreed that technical exchange should be done in UFW related workshop in both countries.
- Network in Middle East of the staff concerned for UFW reduction activities was expanded by the technical exchange of both authorities.

After the technical exchange, the following were realized during the implementation of the Project.

- In Phase 3 of the Project, director of UFW department of WAJ participated in open seminar held by SHAPWASCO and JICA expert team in Cairo. Technical exchange was made between the Egyptian side and the Jordanian side through the presentation about current situation and outputs by UFW reduction activities in Jordan.
- In October 2009, board of directors of SHAPWASCO made decision for establishment of UFW department and SHAPWASCO is now preparing the establishment.

(2) Construction of Leakage Survey Training Yard

SHAPWASCO learned that WAJ operates his own leakage survey training yard and obtains good results for training leakage detection team members. It inspired SHAPWASCO to construct his own leakage survey yard for expanding UFW reduction activities to the whole governorate, although the construction of the yard is not included in the Project.

Design and construction supervision were done by UFW/HQ team under the assistance of JICA expert team. The training yard was opened in January 2009. Currently, UFW/HQ team is conducting training

for leakage survey technique to UFW team members of the entire governorate.

(3) Importance of Detailed Survey of O&M Conditions for Existing Facilities

Understanding of the current situation is most important. Especially, in addition to the survey of conditions for facilities and keeping conditions of records, drawings and manuals, it is important to make survey of the contents of and awareness for routine activities of a staff member. This survey is important process to bring evaluation and grasp of management capacity of staff members based on the contents of activities by operating staff. Management capacity is to implement a cycle of formulating plan, doing it, checking the results and acting. It is important to evaluate which process in the management capacity is the weakest point and formulate an action plan by analyzing the causes.

(4) Suggestion for Improvement Activity taking into account the Current Situation

After the current condition survey of SHAPWASCO's water supply facilities, it was confirmed that O&M is generally not in good condition. Regarding the O&M of SHAPWASCO, although it is not wrong in principle, there are many cases that something to be done is not actually done. Things that should be done in O&M vary from one country to another.

They are categorized into three cases: "must be done" or better to be done" or "not important whether it is done or not". It is necessary to sort them out and select carefully the subjects for improvement activity explaining in detail for cases in Japan. In this case, it is more effective to respect the good point in their current activities and do improvement activities related to their activities.

(5) Setting Visible Achievement for Improvement

It is difficult to convince O&M staff working at facilities of improvement method and expected outputs for improvement pointing out because they consider it causing increase of working load in the end.

Motivation for starting improvement activities by O&M staff is to realize the poor level at present and to show visible improved outputs and effects. In order to prepare those outputs and effects, it is necessary to grasp and analyze the current situation through detailed field survey.

(6) Importance of Training Counterpart Trainer for Efficient OJT

Method and selection of subjects for OJT will have much affect to the result of OJT. In general, OJT is defined as a process for trainees to acquire management skill through their working closely with trainers in routine work. However, in OJT for the Project, all the subjects in the routine work can not be selected because implementation period for OJT is relatively short. Therefore, it is needed to select limited subjects with high priority for improvement, reliable output/effect and visible aspect.

Lessons from the Project are as follows:

- Prior to OJT, scenario of OJT shall be prepared. Explanation procedure, demonstration by trainer on the spot, demonstration by trainee on the spot, necessary equipment, staff and time shall be prepared.
- OJT shall be done for the selected subjects. It is more effective that frequent follow-up of the

OJT for one subject is done and after that OJT for the next subject is done.

- OJT is implemented for the counterpart staff by JICA expert team at the 1st stage. However, at the next stage, counterpart staff members will do OJT to O&M staff. Therefore, for enhancing an effect of OJT in the routine work, it is important for JICA expert to do a technology transfer to the counterpart for implementing skill of OJT.

(7) Simplification of OJT Manual

Most of the works applied in OJT is the routine work, not the work relying on the manual. In the routine work, every staff understands the job contents and learns the operational procedures. Manual for the routine work is not required for the operating staff. Main purpose of the routine work manual is to teach or train new staff for implementation procedures and standard when they are revised or to store the current work procedures by document.

It is important to note that the contents of materials to be used in OJT should be easy to understand as much as possible. They should be prepared utilizing figures, illustrations, tables, graphs, chart, etc. for easy reference.

(8) Constraints in Implementation of OJT

When OJT is done at the existing facilities in operation, it should be conducted on condition that the existing facilities are not damaged or the operation is not interrupted.

Responsibility of the experts in the project for improvement of management capacity of O&M does not include maintenance of equipments and facilities. Therefore, in the OJT for the Project, the item with less frequency of emergency case should be selected as the OJT item to mitigate the risk.

(9) Holding Project Team Meeting by the Lead of Counterpart Staff

During the Project, project team meeting called PTM has been held every week or every other week. It is chaired by SHAPWASCO chairman and consists of counterpart team (UFW/HQ team and SOP/HQ team) and JICA expert team.

In PTM, activities in the previous week(s) and in the following week(s), issues in each activity, etc. were discussed by the lead of C/P team members. JICA expert team supported C/P team. By this, awareness of ownership by C/P team members for implementing the Project was enhanced. As a result, C/P conducted each activity more independently and positively.

(10) Holding Open Seminar and Workshop by the Lead of Counterpart Staff

During the Project, open seminar and open workshop were held three times each to advertise the Project activities to other water companies, foreign aid organizations, university professors, etc. Management of these seminars and workshops were conducted by the lead of C/P team members. As a result, awareness of ownership by C/P team members was enhanced and also presentation skill of each member was much upgraded.

CHAPTER 8 EVALUATION OF THE PROJECT

8.1 Mid-term Monitoring Study

8.1.1 Objective of Mid-term Monitoring Study

The objective of Mid-term Monitoring Study is to confirm the progress of activities and the achievement of project purpose of the Project. Mid-term Monitoring Study was done from 27th February to 6th March 2008.

8.1.2 Comments by Mid-term Monitoring Study Team

The comments made by the Mid-term Monitoring Study Team (the Team) are as shown in Table 8-1.

Table 8-1 Comments made by Mid-term Monitoring Study Team

No.	Item	Comments
1	Staff allocation	➢ Necessary staff for proper operation of water treatments plants should be posted. ➢ Additional UFW team members and AutoCAD operator for SOP activities should be allocated.
2	Supervision of construction worker	Small contractors/plumbers should be trained in order to improve installation skills for house connection which was found as the main leaking part in UFW reduction activities.
3	Objectively verifiable indicators for project purpose	Indicators for project purpose should be specified and modified indicators should be proposed.
4	UFW pilot project site	Upon the request by SHAPWASCO for addition of three (3) pilot project sites, JICA will examine the request and inform SHAPWASCO of the result.
5	Planning of UFW reduction activities	Formulating a plan of disseminating UFW reduction activities should be added as one of the Project activities.
6	Revision of PDM1	PDM1 and PO1 were revised for the following items: (1) Objectively verifiable indicators for "Project Purpose" (2) Objectively verifiable indicators for Output-1 (UFW ratio is reduced in the pilot project sites) (3) Following activity was added in "1-1 General": ➢ Formulating a plan for expanding UFW reduction activity to other Markazes than the pilot project sites (4) The terms of "pilot project area" and "pilot project site" were defined as follows: ➢ Pilot project area: Zagazig city or Markazes where a pilot project is conducted. ➢ Pilot project site: the site where a pilot project is conducted. According to the above definition, the related wordings in PDM1 and PO1 were revised into PDM2 and PO2.

8.1.3 Feedback of Comments made by Mid-term Monitoring Study Team

Feedback of recommendations made by the Mid-term Monitoring Study Team has been conducted by the completion of the Project as shown in Table 8-2.

Table 8-2 Feedback of Comments made by Mid-term Monitoring Study Team

No.	Item	Feedback
1	Staff allocation	➢ New operators and works were allocated at water treatment plants. ➢ Two (2) staff members were allocated for UFW reduction activities and one (1) staff member was allocated as AutoCAD operator.
2	Supervision of construction worker	Plan for training small contractors/plumbers was included in the distribution pipe replacement plan.
3	Objectively verifiable indicators for project purpose	Refer to PDM2
4	UFW pilot project site	Addition of three (3) pilot project sites was approved by JICA at the beginning of Phase-3 of the Project.
5	Planning of UFW reduction activities	Formulating a plan of disseminating UFW reduction activities was added in PDM2 and PO2. The plan was formulated in Phase-4 and SHAPWASCO started to work in accordance with the plan.
6	Revision of PDM1	Refer to PDM2 and PO2.

8.2 Terminal Evaluation

8.2.1 Objectives of Terminal Evaluation

Terminal evaluation of the Project has been done from 8th to 23rd February 2009 for the following purpose:

- To assess, 6~8 months prior to the termination of the Project, whether the Project is on track in achieving intended objectives.
- To decide between termination or continuation (follow-up activities) of the Project
- To draw recommendations for the project concerned and lessons learnt for similar projects.

8.2.2 Results of Terminal Evaluation

(1) Evaluation for Outputs, Project Purpose and Overall Goal

Output 1: Mostly Achieved

- Water balance analysis could be now conducted properly
- UFW ratio reduced by average of 14.5% points in 6 pilot project areas.
- Leakage ratio reduced by average of 15.1% points for the initial 6 pilot project areas.
- 12 staff members have acquired sufficient level of skills on detection survey technique and could train others.

Output 2: Mostly Achieved

- Basic system drawings of the facilities were prepared and updated at 5 model facilities.
- 34 SOP packages were developed for WTPs; 20 for iron and manganese removal plants; 9 for booster pump stations and 8 for well stations.
- On-the-Job training on SOP have been conducted at 6 facilities.
- SOP for Water quality control management was developed.
- Database of 315 well stations developed and the level of groundwater being monitored.

- Capacities to conduct Hydraulic analysis developed.

Project Purpose: Mostly Achieved

Indicator 1: All 7 WTPs have been equipped with sufficient skills to measure and monitor water production.

Indicator 2: Indicators for optimum electricity and chemical consumption and manpower standard working hours have been set.

Indicator 3: Activities on UFW and SOPs are being incorporated into the routine work and are being expanded beyond the pilot project areas to the remaining target areas.

Therefore, it can be said that the project purpose has been achieved.

- Management capacity of operation and maintenance of water supply facilities is improved in target areas.

Estimated Achievement Level of Overall Goal

- Difficult to judge at the time of Terminal Evaluation if 'Management capacity of operation and maintenance of water supply facilities is improved in Sharkia Governorate' could be achieved within the coming several years due to absence of specific objectively verifiable indicators.

(2) Evaluation based on JICA's Five Evaluation Criteria

The Project has been evaluated according to JICA's five (5) evaluation criteria as follows:

- Relevance
- Effectiveness
- Efficiency
- Impact
- Sustainability

Results and conclusion of the evaluation are summarized in Table 8-3.

Table 8-3 Results and Conclusion of Evaluation according to JICA's Five Evaluation Criteria

Evaluation Item	Question	Result	Comment
Relevance	Are the Project Purpose and the Overall Goal relevant to: water sector's development policy in Egypt, the needs of Egypt and the target groups (SHAPWASCO); and, to the JICA's country assistance policy?	Excellent (A)	
Effectiveness	Will the Project produce expected achievements? Is the Project effective?	Excellent (A)	The Project Purpose "Management capacity of operation and maintenance of water supply facilities is improved in target areas" has been achieved to an Excellent (A) extent verified with high levels of achievements in two Outputs.

Evaluation Item	Question	Result	Comment
Efficiency	How were Japanese/Egyptian inputs utilized and managed to attain outputs?	Good (B)	● Concerns regarding the timing, length of Japanese experts ● Limited availability of senior level Egyptian counterparts due to their already heavy workloads ● Turn-over of key Egyptian counterparts who have already been trained.
Impact (1)	Will the Overall Goal be achieved within 3-5 years after the end of the Project based on the result of inputs, outputs and activities, and achievement of the Project Purposes?	No Rating	With no specified indicator previously set, it was not possible to measure the level of achievements of Overall.
Impact (2)	Are there any positive effects brought about by the Project which were not intended/ designed in the Project?	Excellent (A)	● Increased visibility of SHAPWASCO ● Proliferation of knowledge (i.e. SOP to other companies) ● Construction of Hihya training yard water leakage detection ● Strengthened relationships with communities.
Sustainability (1)	Would the impact induced by the Project be sustained after the Project finishes? Is there any possibility that impacts be sustained?	Good (B)	
Sustainability (2)	Political aspect at the level of the national government and the HCWW	Excellent (A)	
	Institutional and Financial aspects	Fair (C)	Satisfactory but have many challenges
	Technical aspects	Excellent (A)	For continuation of activities
		Fair (C)	There would be difficulties for expansion of activities to cover the whole governorate.
CONCLUSION	**As the Project has achieved the Purpose to a great extent (A) therefore will be completed in October 2009 as planned.**		

(3) Recommendations and Lessons Learned by Terminal Evaluation Team

Towards the end of the Project in October 2009, the Project is recommended to:

- Finalize an action plan for UFW activities both within target areas and the whole Governorate
- Link distribution pipe replacement plan and the master plan
- Benchmark a target UFW ratio as a indicator to measure achievement of Overall Goal

- Follow-up on incident in Ibrahimiya Markaz
- Complete installation and operationalization of flow-meters at the remaining 5 locations

SHAPWASCO is recommended to:

- Secure budget and execute distribution pipe replacement plan
- Implement UFW Action Plan
- Share its expertise on UFW and SOP

Lessons Learned for the Project are:

- Provide learning opportunity in the countries that face similar constraints and challenges but has a longer history to demonstrate what possible measures could be undertaken.
- Consider measures to tackle reduction of leakages not only at distribution networks but at household connections.

8.2.3 Feedback of Recommendations made by Terminal Evaluation Team

Feedback of recommendations made by the Terminal Evaluation Team has been conducted by the completion of the Project as shown in Table 8-4.

Table 8-4 Feedback of Recommendations made by Terminal Evaluation Team

No.	Recommendation	Feedback
1	Finalize an action plan for UFW activities both within target areas and the whole Governorate	All the UFW reduction activities have been conducted at nine (9) pilot project sites as required in the Project scope and two (2) expanded pilot project sites by SHAPWASCO's own effort.
2	Link distribution pipe replacement plan and the master plan	Pipe replacement plan has been formulated. However, the plan could not be linked because the master plan does not deal with the pipe replacement.
3	Benchmark a target UFW ratio as a indicator to measure achievement of Overall Goal	Long-term target for UFW ratio has been set for the years of 2015, 2020, 2025 and 2030.
4	Follow-up on incident in Ibrahimiya Markaz	Non-working meters have been replaced and the results of meter readings were reflected in the water balance analysis.
5	Complete installation and operationalization of flow-meters at the remaining 5 locations	Installation and operationalization of flow meters has been completed at the remaining 5 locations.

8.3 Cost-Benefit Analysis for UFW Reduction Activity

(1) Cost Incurred in UFW Reduction Activities

Cost incurred in the UFW reduction activities includes the following:

- Personnel cost for staff
- Repairing cost for leakage points
- Preparation of GIS maps
- Construction cost of chambers

- Depreciation of leakage survey equipment

The breakdown of the cost incurred in three (3) years as the project period is as shown in Table 8-5.

Table 8-5 Cost Breakdown of Cost Incurred in 3 Yeas for UFW Reduction Activities

No.	Item	Cost (LE)
1	Personnel cost	243,825
2	Leakage repair cost	24,800
3	GIS preparation cost	20,700
4	Construction cost for flow meter chambers	160,000
5	Depreciation cost for leakage survey equipment	187,500
	Total Cost	636,825

The depreciation cost was calculated using 3-year amount for depreciation period of 20 years based on the price of equipment donated from Japan in the Project.

(2) Result of Cost-Benefit Analysis

In the Project, UFW reduction activity has been done at 11 pilot project sites for three (3) years. Three teams have participated in the activity as the core team and the period for the activity at one site was three (3) months in average. Therefore, number of activity site which one branch or UFW team can conduct activity is set as 4 districts annually.

Cost-benefit analysis was done on condition that each branch conducts UFW reduction activity at 4 districts annually for reference of the activity by SHAPWASCO's own effort. In the analysis, results of 11 pilot projects were converted into 4 districts.

Leakage will increase again by the recurrence of leakage expected after reduction activities. It is recommended that UFW survey should be re-conducted every 5 years and if much increase is found, countermeasure will be taken. In this analysis, it is assumed that increase of leakage for 5 years after UFW reduction activity is negligibly small compared with leakage reduction volume for 5 years.

As a result of cost-benefit analysis based on the above-mentioned assumptions, cost reduction will be LE743,396 or revenue increase will be LE534,058 through the leakage reduction for 5 years. These will much exceed the cost incurred for UFW reduction activity. Therefore, it can be said that UFW reduction activity is beneficial to the management of SHAPWASCO.

Table 8-6 Cost-Benefit Analysis for UFW Reduction Activities (For 1 Year in Each Branch)

Parameters	Unit	Quantity (For 11 Pilot Projects)	Quantity (For each branch: 4 districts in 1 year)
Water saving	m^3/day	1,705	620
	m^3/year	622,325	226,300
Money saving			
● At production cost (@0.657LE/m^3)	LE/year	---	148,679
● At selling price (@0.472LE/m^3)	LE/year	---	106,814
Cost incurred	LE	636,825	231,573
Benefit for 5 years after activity			
● Cost reduction (at production cost)*[1]	LE	---	743,396
● Revenue increase (at selling price)*[2]	LE	---	534,068
Cost recovery period			
● At production cost (@0.657LE/m^3)	Year	---	1.6
● At selling price (@0.472LE/m^3)	Year	---	2.2

Notes:
1. Cost reduction when distribution volume is deducted by the saved water amount.
2. Revenue increase when the saved water is sold to the customers.

Production cost and selling price are calculated using the record of revenue water volume, O&M cost and water revenue in the fiscal year of 2007 (July 2007 to June 2008) for SHAPWASCO as shown in Table 8.7 and 8.8.

Table 8-7 Production Cost of SHAPWASCO（FY2007）

Item	Unit	Figure
Revenue Water Volume [A]	m^3/year	182,914,538
O&M Cost [B]	LE/year	120,094,932
Production Cost [C] = [B]/[A]	LE/m^3	**0.657**

Table 8-8 Selling Price of SHAPWASCO (FY2007）

Item	Unit	Figure
Revenue Water Volume [A]	m^3/year	182,914,538
Water Revenue [B]	LE/year	86,314,772
Selling price [C] = [B]/[A]	LE/m^3	**0.472**

CHAPTER 9 HOLDING OF VARIOUS MEETINGS

9.1 Joint Coordinating Committee (JCC) Meeting

JCC meetings had been held as follows:

Table 9-1 List of Joint Coordinating Committee

No.	Date	Contents
1st JCC	3rd December 2006	IC/R was explained and approved by JCC
2nd JCC	10th June 2007	PDM1 and PO1 were discussed and approved by JCC
3rd JCC	4th March 2008	PDM2 and PO2 were discussed and approved by JCC
4th JCC	10th July 2008	PDM3 and PO3 were discussed and approved by JCC
5th JCC	23rd February 2009	Minutes on terminal evaluation report for the Project were explained and signed at JCC
6th JCC	27th October2009	Minutes on completion of the project

9.2 Technical Committee (TC) Meeting

The 1st TC meeting was held on 14th March 2007 to confirm the progress of the activities done in Phase-1 of the Project, and to discuss action plans for UFW reduction activity and SOP activity. Both action plans were approved in the meeting. The action plan for UFW reduction activity is attached as ANNEX and the action plan for SOP activity is attached as ANNEX.

9.3 Project Team Meeting (PTM)

The Project Team Meeting (PTM) had been held on a weekly basis to confirm the progress and discuss the problems to be solved for the Project (UFW reduction activity and SOP activity). The minutes of meeting are attached in Attachment.

9.4 Open Seminar

9.4.1 1st Open Seminar (Phase-2)

1st Open seminar was held on 10th June 2007 in the following manner:

(1) Time : 11:00 to 15:00

(2) Place : Grand Hyatt Hotel in Cairo

(3) Objectives and Attendance of Seminar

Objectives

Objectives of the seminar are as follows:

- To introduce the contents of the Project
- To announce the outcomes at the initial stage of the Project to the related authorities,

institutions, other foreign aid organizations, etc.

- To introduce the formation procedures of WHO drinking water quality guidelines by an Expert in this field.

Attendance

Attendants were as follows:

- Water companies under HCWW
- Authorities related to water supply services in Egypt
- Institutions such as universities in Egypt
- Foreign aid organizations involved in water sectors in Egypt
- Related organizations in Japan

(4) Program of Seminar

- **[Part-1]** Introduction of the Project by JICA Expert Team
- **[Part-2]** Presentation of Action Plan for UFW reduction activity and the Achievement (leakage survey result of Zagazig City) by SHAPWASCO
- **[Part-3]** Presentation of Action Plan for SOP activity and the Achievement (development of database for water supply facilities in Sharkia Governorate) by SHAPWASCO
- **[Part-4]** Presentation of "Formulation procedures of WHO drinking water quality guidelines with emphasis on some pollutants and risk consequences" by Expert in this field

9.4.2 2nd Open Seminar (Phase-2)

2nd Open seminar was held on 4th March 2008 in the following manner:

(1) Time : 10:30 to 14:30

(2) Place : Grand Hyatt Hotel in Cairo

(3) Objectives and Attendance of Seminar

Objectives

Objectives are as follows:

- To explain the outline of the Project
- To announce the outcomes at the second stage of the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To introduce the experiences of UFW reduction activities in Osaka City of Japan

Attendance

Attendants were as follows:

- Water companies under HCWW
- Authorities related to water supply services in Egypt
- Institutions such as universities in Egypt
- Foreign aid organizations involved in water sectors in Egypt
- Related organizations in Japan

(4) Program of Seminar

- **[Part-1]** Brief explanation of the Project by JICA Expert Team
- **[Part-2]** Presentation of the second stage achievement for UFW reduction activity by SHAPWASCO
- **[Part-3]** Presentation of the second stage achievement for SOP activity by SHAPWASCO
- **[Part-4]** Presentation of the current situation of UFW reduction activities in Osaka City in Japan by Osaka Waterworks Bureau

9.4.3 3rd Open Seminar (Phase-4)

3ed Open seminar was held on 27th October 2009 in the following manner:

(1) Time : 10:30 to 14:00

(2) Place : Al Masah Hotel in Cairo

(3) Objectives and Attendance of Seminar

Objectives

Objectives are as follows:

- To explain the result and evaluation of the project
- To announce the recommendation though the project

Attendance

Attendants were as follows:

- Water companies under HCWW
- Authorities related to water supply services in Egypt
- Institutions such as universities in Egypt
- Foreign aid organizations involved in water sectors in Egypt
- JICA expert team
- Related organizations in Japan

(4) Program of Seminar

- **[Part-1]** UFW Results, evaluation and recommendations
- **[Part-2]** SOP Results, evaluation and recommendations
- **[Part-3]** Public Awareness Results, evaluation and recommendations

9.5 Open Workshop

9.5.1 1st Open Workshop (Phase-2)

9.5.1.1 Open Workshop for UFW Reduction Activity

1st Open workshop for UFW reduction activity was held on 25th November 2007 in the following manner:

(1) Time : 11:00 to 14:30

(2) Place : Police Club in Zagazig

(3) Objectives and Attendance

Objectives

Objectives of the workshop are as follows:

- To announce the outcomes at the intermediate stage of the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To discuss with engineers and operators of the other water companies and utilize the results of the discussions in the further activities.

Attendance

Attendants of the workshop were as follows:

- Engineers and operators in SHAPWASCO
- Engineers and operators of water supply facilities of water companies under HCWW
- Related organizations in Egypt and Japan

(4) Program of Open Workshop

- **[Part-1]** Latest achievement of UFW reduction activity by UFW/HQ Team of SHAPWASCO
- **[Part-2]** Results of Pilot Project in Zagazig City and Hihya Markaz by UFW Team of Zagazig City and Hihya Markaz of SHAPWASCO
- **[Part-3]** Current situation of UFW reduction activities in Greater Cairo Water Company
- **[Part-4]** Open discussion

9.5.1.2 Open Workshop for SOP Activity

1st Open workshop for SOP activity was held on 26th November 2007 in the following manner:

(1) Time : 11:00 to 14:30

(2) Place : Police Club in Zagazig

(3) Objectives and Attendance

Objectives

Objectives of the workshop are as follows:

- To announce the outcomes at the intermediate stage of the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To discuss with engineers and operators of the other water companies and utilize the results of the discussions in the further activities.

Attendance

Attendants of the workshop were as follows:

- Engineers and operators in SHAPWASCO
- Engineers and operators of water supply facilities of water companies under HCWW
- Related organizations in Egypt and Japan

(4) Program of Open Workshop

- **[Part-1]** Latest achievement of SOP activity in general by SOP/HQ Team of SHAPWASCO
- **[Part-2]** Methodology of SOP documentation and an example of SOP package by SOP/HQ Team of SHAPWASCO
- **[Part-3]** Open discussion

9.5.2 2nd Open Workshop (Phase-3)

9.5.2.1 Open Workshop for UFW Reduction Activity

2nd Open workshop for UFW reduction activity was held on 16th December 2008 in the following manner:

(1) Time : 11:00 to 14:30

(2) Place : Wedding ceremony hall in Zagazig

(3) Objectives and Attendance

Objectives

Objectives of the workshop are as follows:

- To announce the outcomes at the intermediate stage of the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To discuss with engineers and operators of the other water companies and utilize the results of the discussions in the further activities.

Attendance

Attendants of the workshop were as follows:

- Engineers and operators in SHAPWASCO
- Engineers and operators of water supply facilities of water companies under HCWW
- Related organizations in Egypt and Japan

(4) Program of Open Workshop

- **[Part-1]** Latest achievement of UFW reduction activity by UFW/HQ Team of SHAPWASCO
- **[Part-2]** Latest achievement of water conservation campaign by public relation section of SHAPWASCO
- **[Part-3]** Open discussion

9.5.2.2 Open Workshop for SOP Activity

2nd Open workshop for SOP activity was held on 17th December 2008 in the following manner:

(1) Time : 11:00 to 14:30

(2) Place : Wedding ceremony hall in Zagazig

(3) Objectives and Attendance

Objectives

Objectives of the workshop are as follows:

- To announce the outcomes at the intermediate stage of the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To discuss with engineers and operators of the other water companies and utilize the results of the discussions in the further activities.

Attendance

Attendants of the workshop were as follows:

- Engineers and operators in SHAPWASCO
- Engineers and operators of water supply facilities of water companies under HCWW
- Related organizations in Egypt and Japan

(4) Program of Open Workshop

- **[Part-1]** Latest achievement of SOP activity in general by SOP/HQ Team of SHAPWASCO
- **[Part-2]** Methodology of SOP documentation and an example of SOP package by SOP/HQ Team of SHAPWASCO
- **[Part-3]** Open discussion

9.5.3 3rd Open Workshop (Phase-3)

3rd open workshop was held on 23rd February 2009 in the following manner:

(1) Time : 11:00 to 15:00

(2) Place : Grand Hyatt Hotel in Cairo

(3) Objectives and Attendance of Seminar

Objectives

Objectives of the seminar are as follows:

- To announce the outcomes of UFW reduction activity in the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To announce the outcomes of SOP activity in the Project to the related authorities, institutions, other foreign aid organizations, etc.
- To learn the experiences of UFW reduction activities by Water Authority of Jordan in the Hashemite Kingdom of Jordan

Attendance

Attendants were as follows:

- Water companies under HCWW
- Authorities related to water supply services in Egypt
- Institutions such as universities in Egypt
- Foreign aid organizations involved in water sectors in Egypt
- JICA final evaluation team

- Related organizations in Japan

(4) Program of Open Workshop

- **[Part-1]** Introduction of the Project by SHAPWASCO chairman
- **[Part-2]** Presentation of the achievements of UFW reduction activity by SHAPWASCO
- **[Part-3]** Presentation of the achievement of SOP activities by SHAPWASCO
- **[Part-4]** Presentation of the experiences for UFW reduction activity by Water Authority of Jordan (WAJ)

CHAPTER 10 TASK AND RECOMMNEDATION

10.1 Task

As mentioned in Chapter 8, project purpose for the Project has been achieved. However, in order for SHAPWASCO to conduct activities continuously, following tasks shall be tackled.

(1) Aging of Staff

SHAPWASCO staff is mostly between 45 to 55 years old which accounts for more than 70%. Staff of 20 to 30 years old is very small in number. After 10 years, many staff members will have retired and there is a great fear of degrading technical level. Since water supply and sewerage facilities in which proper O&M is required is increasing, younger staff members should be recruited as soon as possible.

(2) Expansion of DMA

In UFW reduction activities for the Project, chambers for installation of flow meter were constructed in the candidate sites for pilot project. From now on, UFW survey work at those sites will be able to be conducted easier by installation of portable flow meter or fix-type flow meter in the chambers. However, in order to conduct UFW survey in the future more efficiently, zones with high UFW ratio should be selected by measuring flow regularly at DMA zones where flow measurement can be done by district flow meters.

(3) Procurement of Leakage Survey Equipment

In the Project, three sets of leakage survey equipment were procured and transferred to SHAPWASCO. Therefore, three UFW reduction teams are ready to conduct UFW reduction activities from now on. SHAPWASCO is required to procure equipments for the remaining 12 UFW teams by his own budget within three (3) years in accordance with the plan for expanding UFW reduction activities to the whole governorate.

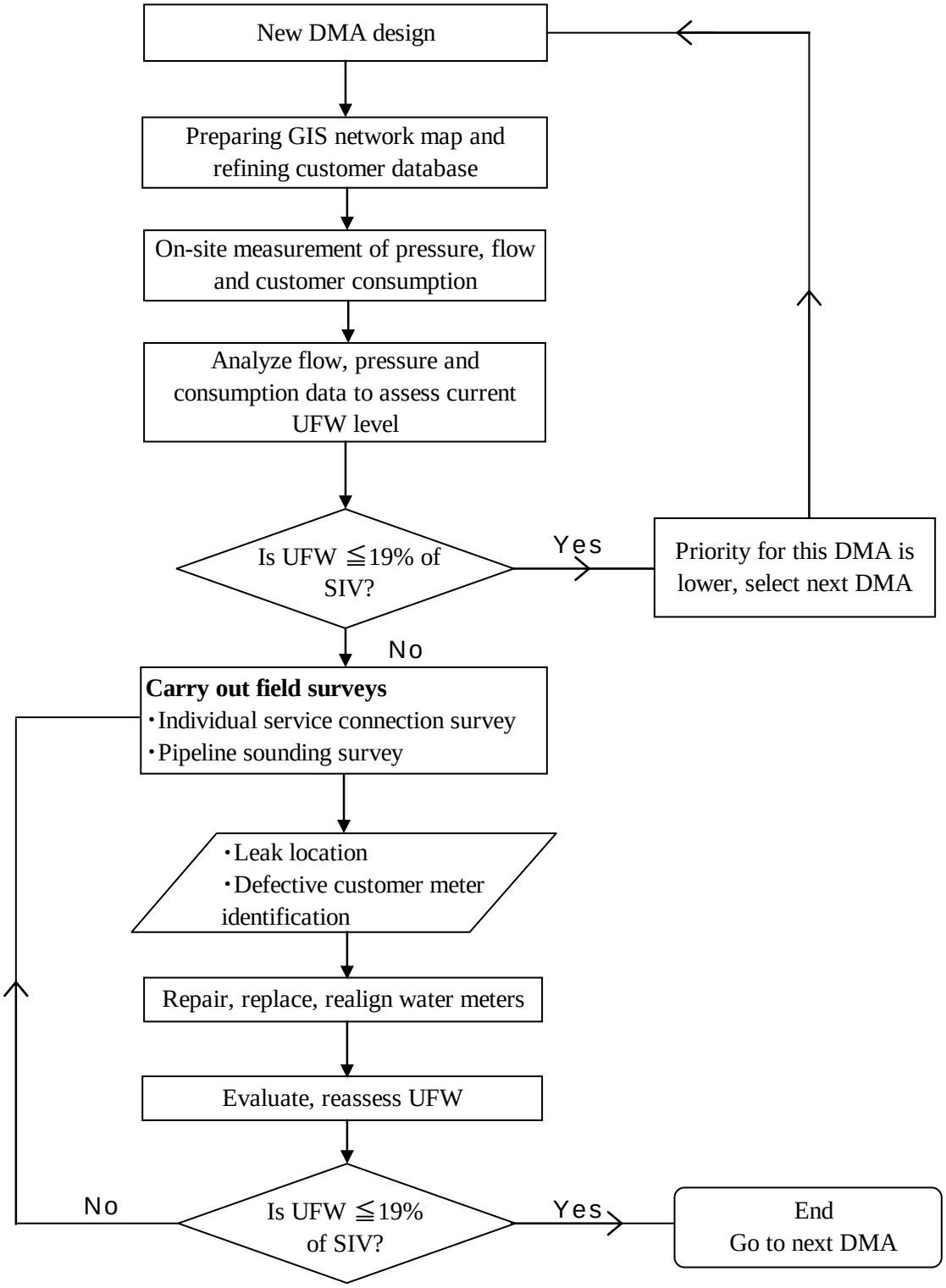
(4) Early Completion of Rehabilitation for Facilities

Among the water treatment plants of SHAPWASCO, two (2) plants are still under rehabilitation. For improving performance indicators by applying SOP to all the facilities, rehabilitation work should be completed as soon as possible.

10.2 Recommendation

10.2.1 UFW Reduction Activities

For achievement of long-term targets for UFW ratio, it is indispensable for each UFW team to conduct activities according to the flow chart shown in Figure 10-1 which is included in the plan for expanding UFW reduction activities to the whole governorate.



SIV = System Input Volume (or Distribution Volume)

Figure 10-1 Practicable Approach for UFW Reduction by Establishment of DMA

10.2.2 SOP Activities

The following are recommended in terms of PDCA (plan-do-check-act) cycle for conducting activities continuously by .SHAPWASCO.

(1) Securing Staff for Expanding SOP Activities to the Whole Governorate (P: Plan)

SHAPWASCO is required to expand SOP activities to all the water supply facilities except compact units after the completion of the Project. As the activity of the first priority, activities done in the Project should be continued for the coming three (3) years. As the activity of the second priority, activities developed from the outputs from the Project or planned by SHAPWASCO should be started.

The work assignment and the required number of staff for SOP activities are as shown in Table 10-1.

Table 10-1 Work Assignment and Number of Staff for SOP Activities

Work Assignment	Number of Staff (person)
Leader	1
Water treatment and mechanical equipment	3
Water treatment and electrical instrument	3
Water quality control	2
O&M for well station	3
Data compilation and documentation	2
Total	14

In order to incorporate SOP activities into the routine work, establishment of SOP department is required to organize SOP/HQ team and clarify the responsibility and authority of the team members.
During the Project, some C/P staff members trained in the Project left SHAPWASCO. This will hinder the expansion of the transferred skills to the whole governorate. Therefore, SHAPWASCO is required to take an action to keep such members in the company.

(2) Making Routine Work of Outputs in the Project for all the Facilities (D: Do)

Effects of staff training, work improvement, cost reduction for O&M will be expected through earlier implementation of activities at all the facilities. It is also expected to accelerate the work improvement by the competition between facilities.

It is important to incorporate the work improvement activities into the routine work. This will be realized smoothly when younger staff members succeeding to the senior staff start O&M work by improved methods.

(3) Evaluation of Improvement and Introduction of Incentive (C: Check)

It can be said that SOP activities for the Project depended much on the leadership of SHAPWASCO chairman. For continuation of SOP activities by self-help efforts of SHAPWASCO, staff members are required to do their work spontaneously and realize the outputs from the activities.

Especially, since improvement of O&M cost is directly connected to financial improvement, activities for improvement should be continuously conducted. It is necessary for Chairman or senior managers to inspect all the water supply facilities periodically and evaluate the situation of O&M with a support of SOP/HQ team.

SOP/HQ team members are requested to find out any subject for improvement activities in cooperation with field staff and achieve the improvement target.

It is recommended to adopt awarding system for giving organizational or individual award with monetary incentive and to make it public internally. It is also recommended to disclose information on SOP activities internally or in public monthly through utilization of Web page as one of the alternatives.

(4) Verification of Effectiveness for Activities and Review of their Priority and Method (A: Act)

For SOP activities, it is necessary to evaluate periodically the activities in the process of staff training, facility improvement and work improvement, and outputs achieved and the achievement method. In accordance with the evaluation results, effectiveness of the activities is verified. If necessary, contents and methods for activities will be reviewed. This is called as management review and it is recommended to adopt third party evaluation in addition to internal evaluation.

The evaluation mentioned above requires knowledge on management as well as technical knowledge. Since the evaluation requires fairness and transparency, evaluation criteria should be explained in advance to the person-in-charge for the subjects in the activities.