Ministry of Health, Labour and Welfare, Government of Japan

Fiscal Year 2013: Water Supply Project Formation Program

Study on Water Supply Project Formation in Karad, India

Final Report

March 2014

The Joint Venture of

Pacific Consultants Co., Ltd., Maezawa Industries, Inc., and Fuji Tecom Inc.

Table of Contents

Summary

Ⅰ. Background

With a population of approximately 1.2 billion, India kept a high GDP growth rate at 9% from 2005 to 2007. However, the GDP growth remained at 6.5% in 2011, due to the slowdown of development in recent years. Current government has focused on economic development through infrastructure investment as a bottleneck measurement of economic growth. In the 12th Five-Year Plan (2012-2016), infrastructure development became a mandatory issue.

As for water supply system at the national level, 12th Five-Year Plan or National Water Policy (drafted its revision in 2012) that indicates effective use of water resources and improvement of water supply services, state that the maintenance of supply side facilities will be promoted by the leverage from private investment. Currently, the Ministry of Urban Development has been formulating promotion system for infrastructure development on a local government basis, by establishment of service level benchmark for quantitative estimation of urban water supply service. These have been driven by the two urban infrastructure development schemes under central governments that are the Jawaharlal Nehru National Urban Renewal Mission, and the Urban Infrastructure Development Scheme for Small & Medium Towns (hereinafter referred to as “UIDSSMT”).

However, considering the prediction of urban population that increase from the current figure of 350 million, which takes 30% of the total population at present, to 590 million due to the inflow of population from rural area, the development pace of lifeline infrastructure such as electricity, water supply, transportation, etc. is far behind the increase speed of demand. In particular, it becomes a critical issue that water supply infrastructure development cannot meet the increasing demand in urban area. The coverage ratio of urban water supply system that use water treatment plant and piping network reached only 48%. Since the most of facilities were constructed in the days of UK’s ruleship, renewal of those facilities requires a vast investment cost. Therefore, many of cities provide an intermittent supply, which emerge a concern of health damage of users, as an intermittent water supply tends to allow an ingress of contaminant water from underground due to an adverse water pressure inside the pipe.

The State of Maharashtra, in which the project site “Karad City” situates, is the most dedicated state towards 24X7 in the 28 states of India. The state has set a policy aiming to promote and achieve 24X7, and prepared the infrastructure development promotion programs, namely; “Maharashtra Sujal Nirmal Abhiyan” that promotes the reform of urban water supply sector, and “Maharashtra Suvarna Jayanti Nagarotthan Maha-Abhiyan” that promotes urban renewal for small and medium towns in the state.

Under these circumstances, Indian side requested Japanese side through Indian Water Works Association for technical assistance for Karad city.

Ⅱ. Purpose of the Study

The purpose of this study is to conduct on-site survey and investigation on water supply in Karad City in Satara District of Maharashtra State and to provide guidance and advise to Indian counterpart organization, Karad Municipal Council (hereinafter referred to as KMC), in order to contribute to the maturity improvement of project request document, on the basis of information related to the potential needs and specific issues. At the same time, through the consideration process in examining actual measures to solve the issues together with Indian officials and staffs, it is expected to improve the ability of Indian central and local governments to make water supply project plan and water supply policy, as well as to improve water services management.

The prospective activity after the Study is to realize the project targeting on the pilot area in the part of Karad City. Accordingly, it is expected to expand such project activities, as a model project of Japanese technical assistance in water supply, to other small to medium cities in the state of Maharashtra and others.

Ⅲ. Study Result

1） Current condition and issues of waterworks in the project site

(1) Current Condition

Karad City is a small size local city with 74,830 population in 2011, locating on the roadside of Route 4, which is a main arterial road from east to west in southern India connecting the state capital Mumbai with other main cities such as Pune, Bangalore, Chennai, etc. The City attracts people as a bed town of the nearby big city Pune, and its population has been increasing. According to the national census, its population of 56,161 in 2001 has increased by approximately 30% in the past 10 years. It is estimated that it will increase to 150,000 by 2040.

Water supply system in Karad is managed by KMC, having an intake in Koyana River, 3 treatment plants with a total capacity of 24,000m^3/day (24 MLD;Million Litter per Day), and 4 ESRs (Elevated Service Reservoirs) distributing to the whole service area. The system has a coverage ratio of 63.4% and provide intermittent supply that is 3 to 8 hours per day.

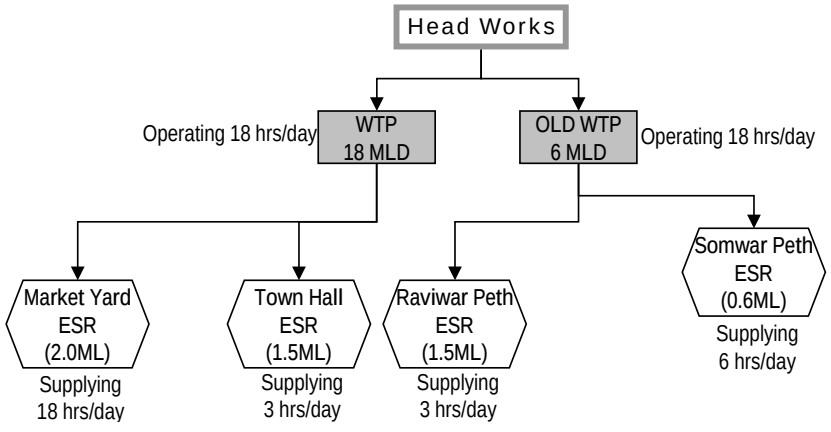


Figure. Water Supply Flow and Operating Hours of Existing Facilities

(2) Issues

High Leakage Ratio

According to the audit report "Water Audit/Detailed Project Report" commissioned by KMC in March 2013, percentages of NRW (Non-Revenue Water) and leakage reached to 47.95% and 40.67%, respectively. The high leakage rate is due to both a general issue such as a delay of renewal of decrepit pipes or inadequate maintenance, and a site-specific issue. KMC staff explained that a soft soil called "Black Cotton Soil" exists in some areas of Karad city, in where disconnection of water joint and pipe crack by increasing load weight of traffic might frequently happen. In addition, such soil damages causes more adverse effect on pipes around WTP and ESR when water hammer, which is a flow back phenomenon in the rising main at the time of electric power failure, happens.

Intermittent Supply

Currently, an implementation of the Water Supply System Improvement Plan for 2040 under UIDSSMT (Urban Infrastructure Development Scheme for Small & Medium Towns) Scheme, which will facilitate a new water intake, a WTP with 15,000m3/day capacity, a MBR (Mass Balancing Reservoir), four ESRs, and distribution pipes with a total length of 6.7km, is in progress.

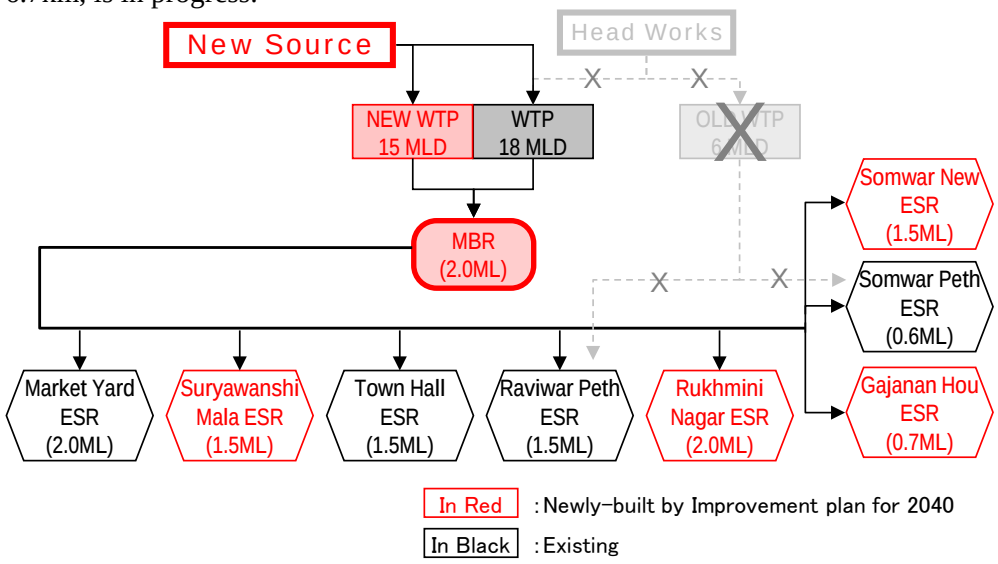


Figure. Changed Contents of Supply Flow by Improvement Plan for 2040

This Improvement Plan for 2040 is based on the on the assumption of specific water consumption as 135LPCD (Litter per capita per day) and NRW rate as 20%, which are Service Level Benchmarking values set by the Ministry of Urban Development in 2006. However, an actual countermeasure to reduce current specific water consumption of 195LPCD and NRW rate of about 48% does not exist. To make matters worse, KMC does not collect daily peak hour water consumption. Therefore, it is quite doubtful if an intermittent supply issue will be resolved even after a completion of the Improvement Plan.

For the situation of intermittent supply, inside of pipe will have a negative pressure, hence become susceptible to intrude wastewater or polluted water at physically damaged point of the underground pipe. As shown below, not a small number of waterborne diseases patients

is recorded in the city area of Karad where water supply system is developed. In this sense, an intermittent water supply is a serious issue from sanitation environment and public health points of view.

Table. Number of waterborne diseases patients in national hospital of Karad City

	2012.4 – 2012.9		2012. 10-2013. 3		Total
	Village (Malkapur, etc.)	Town (KMC)	Village (Malkapur, etc.)	Town (KMC)	
Cholera	0	0	0	0	0
Abdominal pain	13	13	394	141	561
Diarrhea	4	0	61	21	86
Dysentery	0	0	12	19	31
Viral hepatitis	0	0	0	0	0
Typhoid fever	0	0	178	90	268
Polio	0	0	0	0	0
Leptospirosis	0	0	0	0	0

2) A Need in the Study Target Area

KMC aims to achieve SLB values set by the Ministry of Urban Development. Current situation of KMC, however, is far behind from the SLB as shown below table, particularly, per capita supply of water, extent of metering of water connections, extent of NRW and continuity of water supply.

Table. National and Local (KMC's) SLB Indicators and Current Status in KMC

Indicator	National Benchmark	KMC Benchmark	Current values of KMC
Coverage of water supply connections	100%	100%	63.42%
Per capita supply of water	135LPCD	135LPCD	195LPCD
Extent of metering of water connections	100%	100%	0.10%
Extent of NRW	20%	20%	49.02%
Continuity of water supply	24X7	24X7	Intermittent (3 to 8 hours/day)
Efficiency in redressal of customer complaints	80%	80%	Data not available
Efficiency in collection of water supply-related charges	90%	90%	75.62%

Since a secure of water supply continuity, that is so called 24X7 in India, is a national and provincial goal, KMC also consider it as the most important issue, and the other indicators such as per capita supply of water, extent of metering of water connections and extent of NRW as necessary and complemental countermeasure to achieve 24X7.

Through numbers of discussion with KMC, a need and an expectation for Japanese assistance in the field of NRW rate improvement, particularly a reduction of physical leakage rate, has become apparent.

It is noted that, although measures such as tariff increase by shifting from fixed rate to metered rate or water-saving promotion to local users can be considered effective to reduce per capita supply of water, KMC think those are difficult to realize early. Because tariff change decision is a political matter and a cost for facilitating water meters at each connection is not affordable for KMC, which budget is limited.

3) Outline of Proposed Project

(1) Theme of Project

Proposed project aims at leak reduction to help achieving 24X7 in Karad under the theme of proper operation and maintenance of distribution network in Rukhmini Nagar DMA as a pilot area. The project composes of the following work items:

1. Installation of better quality and the latest technology valves for securing sustainable 24X7 water supply in the new water supply system being executed by KMC under the UIDSSMT scheme

- Installation of automatic operating valves according to water level at each ESR
- Change of air valves with better quality air valves at WTP and Super New WTP
- Change of defective check valves, air valves, gate valves with better quality valves with the latest technology in order to prevent water hammer effects at inlet pipelines at MBR and 8 ESRs
- Providing butterfly valves at some ESRs located closer to MBR to control water outflow so as to maintain required water level at any time in the ESR at the end of water distribution sequence

2. Leakage Reduction in Rukhmini Nagar DMA

- Measuring the minimum flow, by equipping flow meters or sensor devices and carrying the leak detection surveys during the night time
- Leakage detection by data logger system LNL-1 and leakage detective devices
- Installation of “multi-purpose T-shape pipe fitting”, which makes maintenance work, water quality monitoring, pipe flushing, pressure check, air check, monitoring by camera, and fire hydrant facilitation easier

3. Supplying and installation of consumer water meters in Rukhmini Nagar DMA and analyzing water distribution amount
4. Human resource development by on-site technology transfer through expert dispatch and training course in Japan

(2) Purpose

The short-term purpose is to achieve 24X7 in Rukhmini Nagar DMA by increase in water supply volume and secure water supply stability through a reduction of leakage.

The mid-tern purpose is to strengthen the entire water supply system through the application of experience and know-how of the model project in Rukhmini Nagar DMA, which contributes to improve the living environment and public health in the whole KMC coverage. Furthermore, the long-term purpose is to contribute to the implementation of 24X7 in small and medium cities from Maharashtra state to all over India.

(3) Extent of Assistance, Scheme and Schedule of Proposed Project

1) Extent of Assistance

Target area is Rukhmini Nagar DMA that is one of 8 DMAs in the KMC service area. Counterpart agency is KMC.

The objective of the technical assistance is a reduction of leakage rate by conducting actual water balance analysis and leak reduction measures, which are installation of water meters, analysis on water distribution amount, leak detection, prevention of water hammer effects by installing better quality valves, pipe maintenance by using multi-purpose T-shape pipe fitting. In addition, the assistance also aims at capacity development through on-site training and training course in Japan so that the technology and know-how gained through the model project in Rukhmini Nagar DMA will be spread to the whole KMC coverage.

2)Scheme of Assistance

The expecting implementation scheme of the model project is JICA Partnership Program, considering the size and extent of work items of the model project.

3)Schedule

The project shall start in Japanese Fiscal Year 2014, since the ongoing implementation works under Improvement Plan for 2040 will be completed in March 2014. The duration of the project will be 2 years, considering adequate technology transfer period and required duration for emerging effects of leak reduction.

(4) Expected Outcomes

Expecting effects of the project are as follows at each administrative levels:

<u>At National and State</u>

- Formulation of a model for achieving 24X7 at small and medium cities
- Improvement of public health and sanitation in small and medium cities

<u>At Municipality</u>

- Increase in water supply amount
- Stabilization of water distribution
- Capacity development of C/P staffs in the operation and maintenance field
- Increase in coverage ratio
- Cost reduction in water supply operation

<u>At Local Users</u>

- Receiving water supply continuously
- Improvement of public health
- Reduction of number of waterborne diseases patients

Ⅳ. Conclusion and Points of Consider

1） Conclusion

1. The current service level of KMC is far behind the benchmark targets. KMC has been implementing Improvement Plan for 2040 under UIDSSMT Scheme so as to achieve 24X7 as national and state goal. However, it was came into focus that this plan is based on the assumption of the same SLB values set by the Ministry of Urban Development and there is no practical measures to reach to SLB values of, in particular, extent of NRW and per capita supply of water. Notably, it became clear that the highest need of KMC is leak reduction measure.
2. Study Team proposed a model project aiming at leak reduction through preventing water hammer effects and efficient pipe maintenance in Rukhmini Nagar DMA as a pilot case. This model project is expected to contribute to achieving 24X7 in the whole KMC coverage through an increase in water supply amount.
3. As to the proposed model project, the stated request for its implementation and willingness to cooperate were confirmed in the minutes of meeting between the KMC and Study Team
4. JICA Partnership Program is appropriate for implementing the model project, considering the size of target area and project components.
5. Expecting outcomes of the project are a formulation of assistance model of Japanese technology in water supply field, application of the model to other small and medium cities, and a contribution to achieve 24X7 in the wide range of the country.

2） Points of Consider

- This Study has its root in the meeting with Japan Water Works Association and in 2010, in which Indian Water Works Association recommended Karad Municipality as one of the candidate target city. Therefore, it is expected that a realization and an achievement of the project considerably contribute to building closer relationship between water works relating organizations of both countries in the future.
- Success of a model project and its diffusion to other small and medium cities would benefit considerably, since there are numbers of similar towns to Karad in terms of size and conventional water supply system in the country.
- KMC is a local municipality categorized into C-class, and an involvement of MJP, a governing agency in the water supply field in Maharashtra State, in the water supply operation by KMC is limited to technical experts dispatch. Therefore, gaining further understanding and cooperation from superagencies such as the Ministry of Urban Development and MJP Headquarter in Mumbai is effective to diffuse Karad model to the other towns in the country. In order to develop such relationship, building a close cooperation with Indian Water Works Association is of great importance.

Basic Indexes of India

Basic indexes	Value	Reference year
Total population (the whole country)	1,220,800,359 [1)]	July, 2013
Total population of Karad City	74,830	2011
GDP per capita (US $)	3,900[1)]	Estimated value in 2012
Annual growth rate of GDP per capita (%)	6.5[1)]	Estimated value in 2012
Annual population increase rate (%)	1.28[1)]	Estimated value in 2013
Under-5 years old child mortality rate (per 1,000 people)	76[2)]	Estimated value in 2006
Infant mortality rate (under 1 year old) (%)	4.46[1)]	
Life expectancy at birth (year)	67.48[1)]	Estimated value in 2013
Adult literacy rate (%)	62.8[1)]	2006
Urban population rate (%)	31.3[1)]	
Annual average growth rate of urban population (%)	2.47[1)]	
Access to improved drinking water (%) (National /urban/rural)	(92/97/90) [3)]	
Access rate to sanitation facility (%) (National/urban/rural)	(34/58/23) [3)]	
Land area (thousand km^2)	3,287[1)]	
Dry land area (thousand km^2)	2,973[1)]	
Water area (rivers and lakes) (thousand km^2)	314[1)]	

Reference: 1) PCIA World Fact Book 2013, CIA
2) The Little green data book 2013, The World Bank

Study Area

Source: Presentation document from Karad Municipal Council

Photo Collection

Kick-off meeting with KMC. Mayor of Karad at left, and higher officials at right

Working level meeting on the day 2nd

MBR under construction, to be completed in March 2013

Concrete placement work inside MBR

Market ESR

Low water pressure around Market ESR as reservoir is not filled with water

Eye-sight gauge for water level at Town Hall ESR

Flow meter

	
Office of MJP experts in Raviwar ESR site	Flow logger financed from Sujal Nirmal Program in MJP office
	
Pressure valve at Raviwar ESR	Air valve beside Raviwar ESR
	
Office in the old WTP, to be demolished after construction of Super New WTP	Intake source Koyana river
	
Lifted raw water at old WTP, with 150NTU	Coagulation tank in old WTP

	
Air backwash of filter sand in old WTP	Treated water in old WTP
	
Somwar ESR	New ESR construction site beside Somwar ESR
	
Rukhmini Nagar ESR	Pressure check in operating time in Rukhmini Nagar ESR
	
New WPT	Super New WTP under construction at existing New WTP site

	
Intake （Jackwell） beside New WPT	Intake point at Koyana river
	
Qater quality check kit at New WTP, checking pH, residual chlorine and NTU only	Flow meter for pump at New WPT
	
Serge tank at New WPT leaking by water hammer damage due to black cotton soil around	Cloth-based repair material to grind gap space of valve
	
Presentation of flow control valve, Jet Port @ Maezawa Industry Inc.	KMC staffs and MJP experts listening to presentation by Maezawa Industry Inc.

	
Courtesy call to Karad Mayor	Meeting with Karad Committee members
	
Residential area beside Malkapur WTP, and old air valve at right	Water meter at house connection in Malkapur
	
Connection pipe and remote rediowave detective device for water meter used in Malkapur	Automated meter reading used in Malkapur
	
Hearing survey to Malkapur residents	Hearing survey in Malkapur resident's house

	
ESR in Malkapur	Water meter in Malkapur ESR, transmitting signal through exposed wire
	
MM signing by Mayor	MM signing by Japanese side

Acronyms

KMC	Karad Municipal Council
MJP	Maharashtra Jeevan Pradhikaran
MOUD	Ministry of Urban Development
UIDSSMT	Urban Infrastructure Development Scheme for Small & Medium Towns
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
ESR	Elevated Service Reservoir
MBR	Mass Balanced Reservoir
MLD	Million Litter per Day
SLB	Service Level Benchmarking

Currency Exchange Rate

1 INR (Indian Rupee) ＝ 1.650 JPY (Japanese Yen)

Source : JICA rate in JFY2013

CHAPTER 1. INTRODUCTION

1.1 Purpose

The purpose of this Study is to make an advice and a guidance on the maturity improvement of request document or project plan to Indian counterpart organization, Karad Municipal Council (hereinafter referred to as KMC). The Study conducts on-site survey from professional and technical view on formulation of water supply project on the basis of information on the potential needs and specific issues in relation to water supply management, facilities improvement and their operation and maintenance in Karad City, Satara District, Maharashtra State, India. At the same time, through the consideration for detailed measurement to solve the issues together with Indian water supply officials and staffs, the Study contributes to improve the ability of Indian central and local governments to make water supply project plan and water supply policy, as well as to improve water services management.

1.2 Study Process and Method

1.2.1 Perspective of the Study

The below shows a perspective of the Study within an overall framework including the prior contacts with relating parties in India and the development scenario in the future:

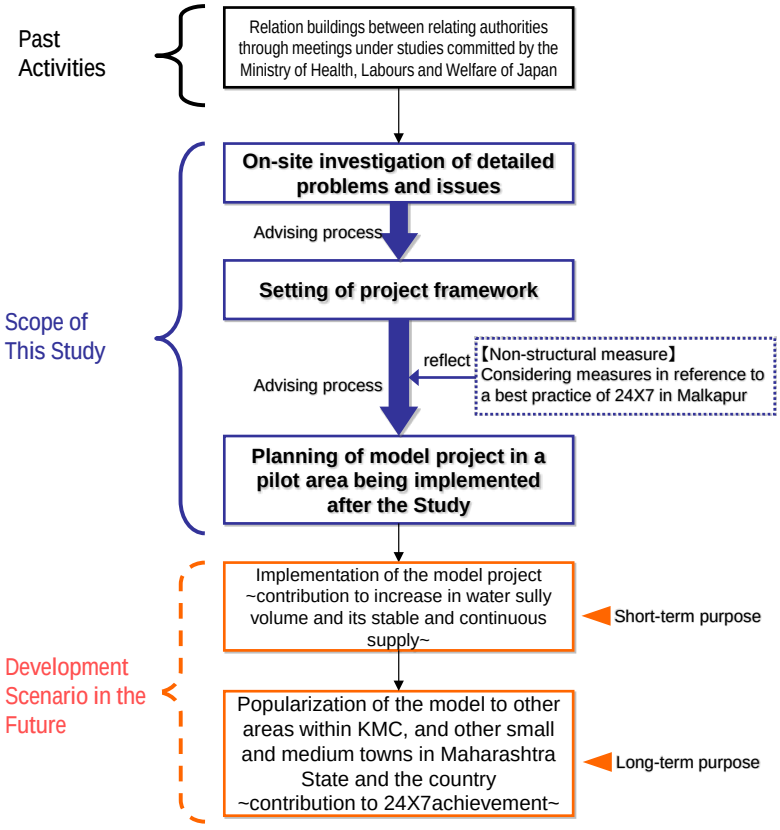


Figure 1.1 Perspective of the Study

1.2.2 Study Flow

The below shows a flow of the work items of the Study.

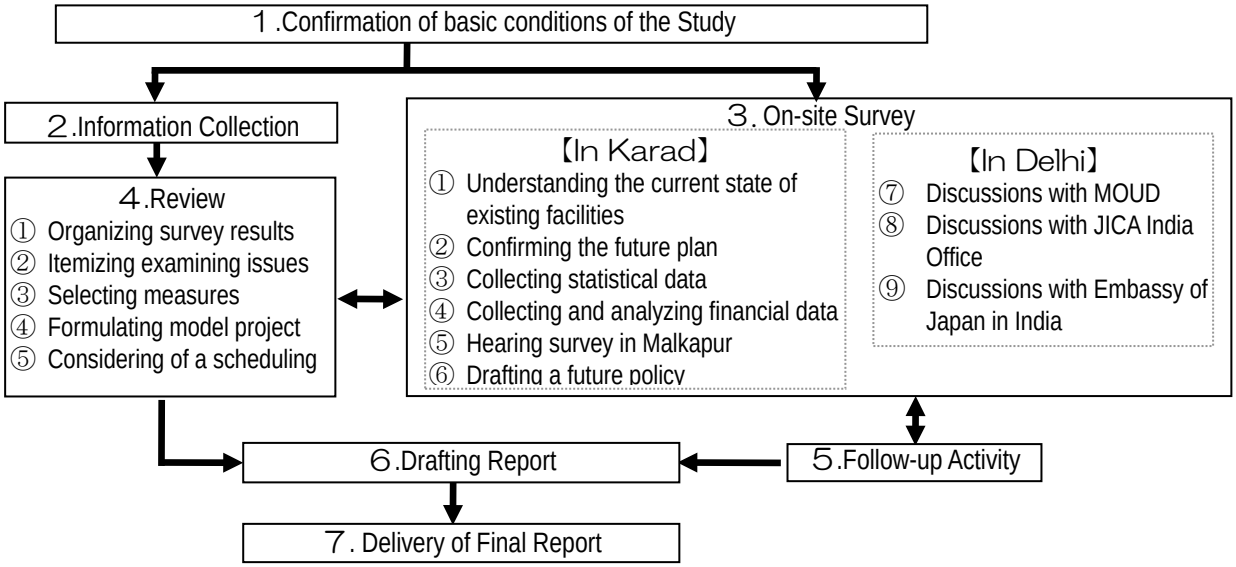


Figure 1.2 Study Flow

1.2.3 Outline of On-Site Survey in Karad City

1) **Survey Term**

From July, 28 to August, 10, 2013 (14 days)

2) **Work Items**

(1) Analysis and understanding of current status and issues

- To understand the current state of existing KMC water supply infrastructure (including GIS data, water quality data, etc.)
- To check the future water supply plan of KMC
- To collect statistical information such as population, waterborne disease prevalence, etc.
- To collect and analyze financial data of KMC

(2) Hearing with related organizations such as KMC, MOUD

- To understand the method, current situation and issues on how to change to metering system for tarrif collection in Malkapur through hearing survey
- To consult for a future policy with KMC
- To exchange opinions on water supply development policy in future with MOUD
- To exchange opinions on future development of the proposed project with Embassy of Japan in India and JICA India Office

1.3 Study Team

Name	Belonging	Role	Tasks
Tatsuo Morimoto	Pacific consultants Co. Ltd.	Project management	- Overall organizing and management
Kazushige Mizui	Pacific consultants Co. Ltd.	Planning	- Project coordination - Site survey / data collection and analysis
Hiroki Ariyoshi	Fuji Tecom Inc.	Advice and guidance	- Water distribution management / leakage control analysis - Field survey
Kenichi Mitsuma	Maezawa Industries, Inc.	Advice and guidance	- Water treatment / distribution facility analysis - Field survey
Yoshikane Takahashi	Maezawa Industries, Inc.	Advice and guidance	- Water treatment / distribution facility analysis - Field survey
Ikuo Mitake (Independent expert)	Japan Water Works Association	Supervise	- Guidance - Negotiation and guidance with related organizations

CHAPTER 2. Current Situation of the Study Objectives

2.1 Water Supply System and Its Problems of India

2.1.1 Current Situation of Water Supply at National Level

With a population near 1.2 billion, India kept a high GDP growth rate at 9% from 2005 to 2007; but a slowdown development has been seen in recent years that put a GDP growth remained at 6.5% in 2011. Current government, established in 2009, has focused on economic development through infrastructure investment as a bottleneck measurement of economic growth. In the 12th Five-Year Plan (2012-2016), infrastructure maintenance has become a mandatory issue.

As to water supply system, the national level policy is in the 12th Five-Year Plan and National Water Policy (revised draft 2012) that indicate to improve effective use and services of water resources; the maintenance of supply side facilities by the leverage form private investment. Particularly in the last decade, the spread of PPP projects in water sector has been progressing. The driving force of such a progress were the two urban infrastructure development programs funded by MOUD; namely, Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT). JNNURM was formulated in 2005 in order for the purpose to improve the necessary investment environment to induce private investment, and UIDSSMT was the infrastructure development scheme applied to small and middle towns in particular. Additionally, MOUD also established service level benchmarks for quantitative estimation of urban water supply service in 2006.

However, it is predicted that a current urban population of 350 million, which counts for 30% of total population, will increase to 590 million, because of the influx of people from rural area to urban area. The development speed of lifeline infrastructure such as electricity, water supply and transportation, etc. has not caught the population increase speed.

2.1.2 Issues in Waterworks at National Level

The most important issue of water supply in India is a delay of water supply infrastructure development for water demand associated with the surges of urban activity and population growth, especially significant in urban areas. The reason of water demand increase is not only the population growth, but also the ambition of industry development announced in 2011 that aimed to increase manufacturing ratio to GDP contribution from 16% to 25% in the following 10 years. In addition, the Ministry of Water Resources forecasted the annual available water resources amount would exceed the demand in 2050. From the viewpoint of the supply side, because the water supply infrastructure developed in the United Kingdom rulership period has been turning deteriorated, a great deal of investment cost is required for facility renewal. Therefore, a new infrastructure development is sluggish, hence arising an imbalance between supply and demand.

This is the same situation when looking at state level. The Maharashtra State, where the Study

target Karad City situates, recorded 15.99% of population increase from 2001 to 2011. Even local cities has experienced a rapid growth of population surge due to the influx from neighboring rural areas that results in the surge of water demand. In a normal case it takes several years for completing a physical facilitation of larger scale development planning after its formulation. Because the speed of the recent population increase is far beyond the anticipated speed in the plan formulated several years ago, the planned capacity is less than the actually demanding volume. At the same time, replacement of deteriorated pipes has not overtaking its demand. According to the report by the World Bank, the average NRW rate is between 35% and 40% in Maharashtra State. That is why most of local water utilities has been preoccupied with supportive measures such as an excessive operation of water treatment facilities or only a few hours of an intermitted supply.

2.1.3 Issues Relating with Sanitation and Waterborne Disease at National Level

1) Access Rate to Safe Drinking Water

According to UNICEF, the access rate to safe drinking water in urban area is 97% and 90% in rural area in 2010. However, as in the details, the water supply rate through modern facilities such as water treatment plant and distribution facilities is only 48% in urban area and 12% in rural area; and the rest is through underground water, i.e. untreated wells, springs and rainwater. Moreover, the access rate in 1990 was 49% in urban area and 7% in rural area; which implies that the rate in urban area has been slightly decreased in 20 years. This represents the actual situation that water supply infrastructure cannot keep up against rapid population growth as described above.

2) Waterborne Disease

Surface water pollution is a serious problem in India. The reasons include increasing oxygen demand caused by untreated discharge of waste water from urban area, dilution of domestic wastewater, lack of river and lake water quantity, and expansion of bacterial contamination, etc[1]. According to the annual report of Ministry of Environment and Forests, in Maharashtra State, the wastewater treatment capacity of 4.2 billion litter/day is not enough to the sewage outflow quantity of 6.0 billion litter/day. The Water Quality Statistics Yearbooks reported that almost all of the water is contaminated with coliform bacteria as obvious organic matter contamination in the major rivers.

The World Bank reports that about 20% of the infectious diseases in India is caused by water; and number of diarrhea deaths caused by intake of unsanitary water reaches to around 600,000 people a year.

[1] Study Report under the Ministry of Economy, Trade and Industry of Japan in 2011 JFY

2.1.4 Current Situation of Water Works in Target Area

1) Current Situation in Maharashtra State

In federal-type governance system of India, state governments have relatively large authority. State government takes charge of water supply infrastructure development plan and project, and water supply operation and maintenance tends to be managed by local municipality or state government, community organizations, depending on the size of water supply system.

Maharashtra State has already upheld the vision to change to 24-hours continuous water supply (24X7). As the first 24X7 project in India, Nagpur City contracted the 24X7 water supply PPP agreement with Orange City Water Limited, a joint venture of Veolia Water (France) and Vishwaraj Infrastructure (local company) in 2011. In accordance with aforementioned infrastructure development program at national level under MOUD, Maharashtra state sets 2 individual programs that defines the distribution ratio of infrastructure development budget for state and local governments, as shown below.

Table 2-1 Infrastructure Development Program of Maharashtra State Government

Name	Purpose	Features	Regulation of Subsidy
Maharashtra Sujal Nirmal Abhiyan	To promote standard system for water supply index collection to check SLB set by MOUD	・ Providing a continuous water metering, GIS, house connection meters, improvement of tariff collection ・ Development schemes of MOUD such as UIDSSMT will be available when above provision is done	・ Regulates distribution ratio among grant, loan and income from tariff, depending on the size of city
Maharashtra Suvarna Jayanti Nagarotthan Maha-Abhiyan	To promote urban regeneration of mid-medium size town in the fields of water supply, transportation, waste management, housing development and environmental improvement	・ Applicable by the city that does not apply Sujal Nirmal Abhiyan program ・ Grant or loan will be provided for the project which bankability is too low even viability gap funding is provided	・ Regulates distribution ratio between grant and loan, depending on the size of city ・ Income from tariff is not applied to this scheme ・ In case for Class C such as Karad, 50% from grant, and 50% from loan

In 2000, Maharashtra state government reviewed and changed the regulation of above-mentioned Maharashtra Sujal Nirmal Abhiyan that income from tariff could be allocated to the distribution of subsidy, for promoting self-reliant effort of local government.

In conclusion, the situation of water supply development in Maharashtra state is in the process of promoting development of fundamental water supply system in the small and middle size cities.

2) Current Situation in Karad

(1) Population Increase

Population and categories of cities in Maharashtra in February 2011 are as follows. Karad City has 74,830 of population and categorized as C-class city.

Table 2-2 Population and Categories of Cities in Maharashtra

City categories	Population	Number of municipalities
Municipal Corporation	> 1 million	6
Municipal Corporation	0.3-1 million	16
'A' class Municipal Council	0.1-0.3 million	18
'B' Class Municipal Council	40,000-100,000	62
'C' Class Municipal Council	20,000-40,000	63
'C' Class Municipal Council	<20,000	79
Nagar Panchayats / Nagar Panchayats	-	3
Total		247

Karad City locates on the roadside of Route 4, a main artery connects the main cities from the state capital Mumbai to Pune, Bangalore, Chennai, etc., in southern India from east to west. It is famous for the production place of sugar, and it has the largest market in Satara District for its main industry as commerce and productive industry. Moreover, focusing on medical services and education, it is also attractive as the bed town of the nearby big city Pune. Therefore, it recorded 30% of population increase in the past 10 years from 2001 to 2011, and forecasted to increase by up to 150,000 by 2040.

(2) Existing Water Supply Infrastructure

Below shows the existing water distribution system in Karad. Having raw water intake from Koyana River, it provides water to 4 ESRs (Elevated Service Reservoir) through water treatment plant of 18 MLD（Million Litter per Day） and 6MLD. Water supply hours from ESR varies from 3 to 8 hours per day as shown below.

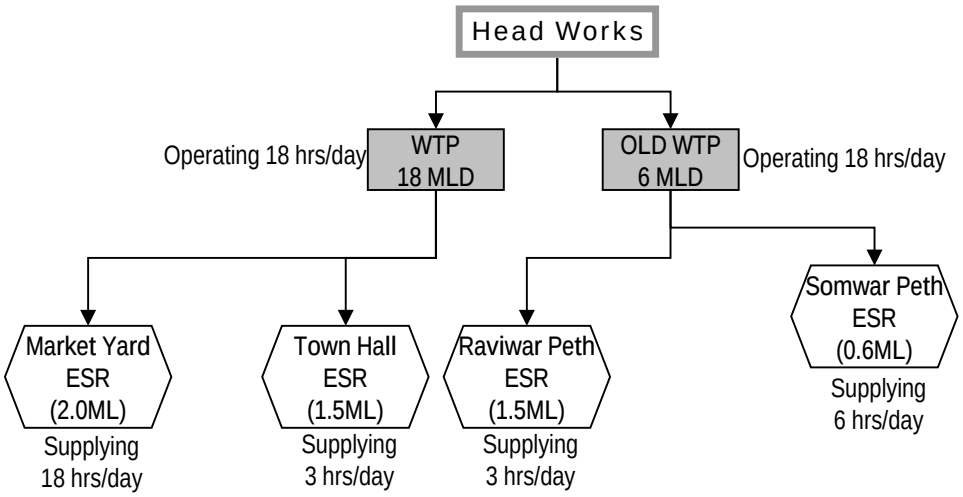


Figure 2-1 Existing Water Supply Flow

Location of each facilities are as follows.

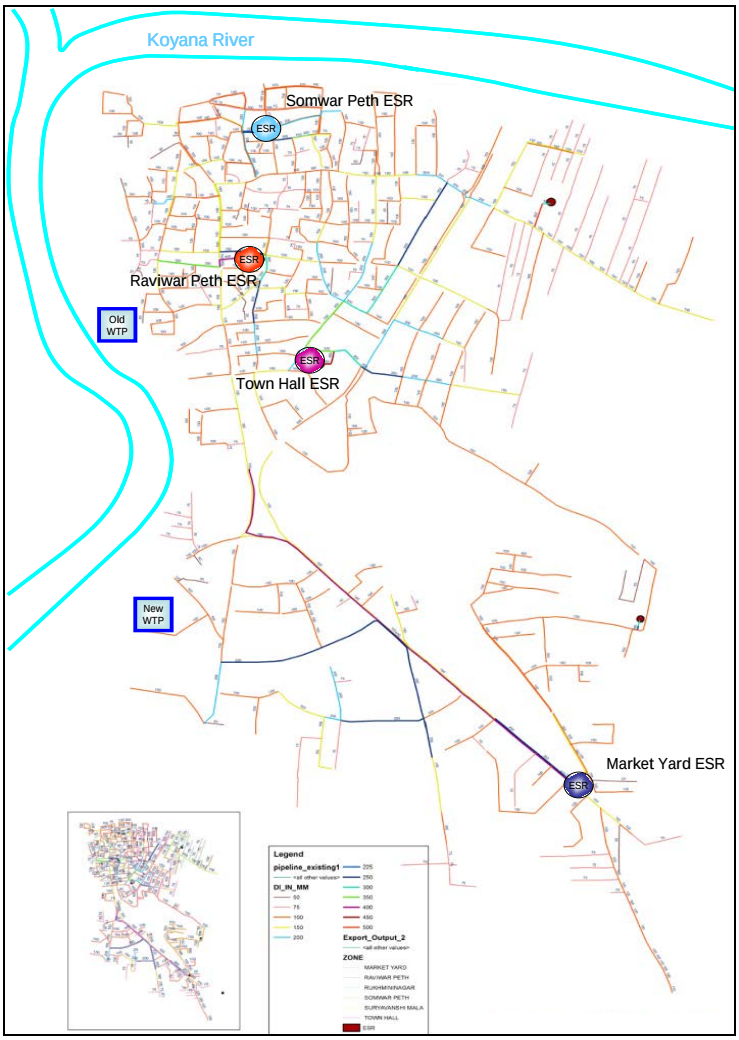


Figure 2-2 Water Supply Facility Location Map

Service connection has been increasing recently as shown below.

Table 2-3 Number of Connections

	2010	2011	2012
Domestic	9006	9457	9638
Commercial	199	203	387
Industrial	-	-	-
Public	8	4	4
Other	177	182	182

Table below shows the system of water tariff which adopts a fixed rate corresponding to the diameter of water meter. The tariff was increased slightly by the revision in April 2012, most users set up 0.5 inch diameter water meter which leads to a low rate of 2,040 yen/year.

Table 2-4 Water Tariff (Yearly)

Diameter of Meter		2011						2012					
		Domestic		Public		Commercial		Domestic		Public		Commercial	
inch	mm	INR	(JPY)	INR	(JPY)	INR	(JPY)	INR	(JPY)	INR	(JPY)	INR	(JPY)
0.5	12.7	1,140	(1,938)	2,280	(3,876)	5,700	(9,690)	1,200	(2,040)	2,400	(4,080)	6,000	(10,200)
0.75	19.1	2,565	(4,361)	5,130	(8,721)	12,825	(21,803)	2,700	(4,590)	5,400	(9,180)	13,500	(22,950)
1	25.4	5,235	(8,900)	10,470	(17,799)	26,175	(44,498)	5,508	(9,364)	11,016	(18,727)	27,540	(46,818)
1.5	38.1	10,260	(17,442)	20,520	(34,884)	51,300	(87,210)	10,800	(18,360)	21,600	(36,720)	54,000	(91,800)
2	50.8	18,240	(31,008)	36,480	(62,016)	91,200	(155,040)	19,200	(32,640)	38,400	(65,280)	96,000	(163,200)

The trends of treated water volume, supply volume, unit cost of supply, unit cost for production in the past 5 years are shown as follows that was provided by KMC. The treated water volume was almost constant, while the supply volume was increasing. In addition, in contrast to the moderate increase in unit cost of supply, increase rate unit cost for production was high, especially about 40% of increase in 2012. According to KMC, the main reasons are increase of the civil service salary due to the decision of National Payments Council of India and a recent increase of electricity cost and chemicals cost.

Table 2-5 Changes of Water Volume at each Facility

	2008	2009	2010	2011	2012
Treatment Volume (million L)	5172.74	5216.82	5219.10	5253.37	5288.04
Supply Volume (million L)	4415.64	4744.74	4889.56	5072.68	5262.90
－Domestic Use	4415.53	4744.62	4889.44	5072.55	5262.77
－Commercial Use	0.11	0.12	0.12	0.13	0.13
－Industrial Use	-	-	-	-	
Unit cost for water supply (INR/kilo L)	2.66	2.83	3.00	3.16	3.16
Unit cost for production (INR/kilo L)	3.60	3.67	5.27	5.30	7.52

2.1.5 Problems of Water Supply (Study Area)

1) High Leakage Rate

According to the audit report “Water Audit/Detailed Project Report” commissioned to local company ADCC Infocad Pvt Ltd. by KMC in March 2013, NRW rate reached to 47.95% and Leakage rate reached to 40.67%. It should be noted, however, that those figures are estimation as KMC does not equip water meter, and that possibility of water steal should be considered as one of the cause of such high NRW rate. Accuracy and strictness are in doubt as the estimation method of water loss in this report is calculated as a simple average of proportion of water loss in only 3 sample areas. Having said that, these values are referred as there is no other reliable data.

Table 2-6 Breakdown of NRW Cited in “Water Audit/Detailed Project Report”

System Input Volume 17.09 MLD	Authorized Consumption	52.10%	Billed Authorized Consumption	52.05%	Billed Metered Consumption	1.13%	Revenue Water	52.05%
					Billed Un Metered Consumption	50.92%		
			Unbilled Authorized Consumption	0.05%	Unbilled Metered Consumption	0%	Non Revenue Water	47.95%
					Unbilled Unmetered Consumption	0.05%		
	Water Losses	47.90%	Apparent Losses	0.16%	Unauthorized Consumption	0.16%		
					Customer Billing inaccuracies	0%		
			Real Losses	47.74%	Leakages in Raw Water Transmission	1.11%		
					WTP Losses	3.38%		
					Leakages in pure Water Transmission	2.49%		
					Leakages & Overflows at Storage Reservoirs	0%		
					Distribution Losses & Leakages on Service Connections up to Point of customer Meter	40.76%		

The high leakage rate as of 40.67% seems to be caused by a site-specific issue, as well as a general issue such as a delay of renewal of decrepit pipes or inadequate maintenance. KMC staff explained that a soft soil called “Black Cotton Soil” exists in some areas of Karad city, in where disconnection of water joint and pipe crack by increasing load weight of traffic might

frequently happen. In addition, such soil damages causes more adverse effect on pipes around WTP and ESR when water hammer, which is a flow back phenomenon in the rising main at the time of electric power failure, happens.

Considering a forecast of a sharp increase in population as 150,000 in 2040, which is a double figure of the present, the most important measure should be a reduction of NRW, and in particular, a reduction of leakage that counts more than 40%.

2) Defect of On-Going Development Plan

(1) Gap between Prerequisites of Plan and Reality

Currently, the water supply system improvement plan approved the UIDSSMT program of MOUD in 2008 is in progress. This improvement plan, setting a target year as 2040, composed of the establishment of new Intake, WTP with 15,000m^3/day, MBR and several ESRs, and the expansion of transmission pipe of 6.7km. A total cost reaches to approximately 48 million JPY, and an implementation will be completed in March 2014.

By this improvement plan, total treated water volume will increase from 24MLD to 33MLD. The main change is that the distribution will be in-line to each ESR through MBR, as shown below.

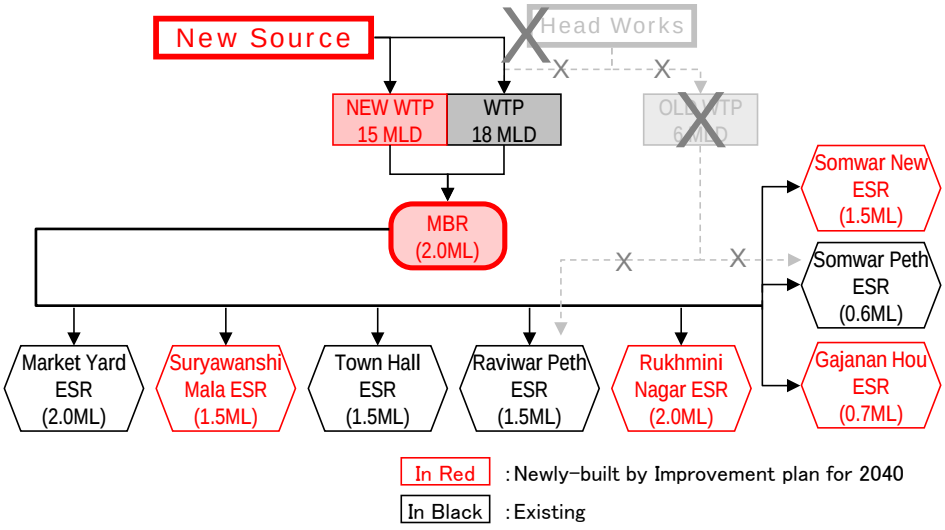


Figure 2-3 Change in Distribution Flow by the Improvement Plan

The target population of the improvement plan is 148,487 by 2040, and KMC expects to achieve all of SLB values set by MOUD. However, there exists a huge gap between the current values and SLB, particularly in NRW, continuity of water supply and metering of water connections.

Table 2-7 National and Local (KMC's) SLB Indicators and Current Status in KMC

Indicator	National Benchmark	KMC Benchmark	Current values of KMC
Coverage of water supply connections	100%	100%	63.42%
Per capita supply of water	135LPCD	135LPCD	195LPCD
Extent of metering of water connections	100%	100%	0.10%
Extent of NRW	20%	20%	49.02%
Continuity of water supply	24X7	24X7	Intermittent (3 to 8 hours/day)
Efficiency in redressal of customer complaints	80%	80%	Data not available
Efficiency in collection of water supply-related charges	90%	90%	75.62%

Using 195 LPCD and leakage rate of 40.67% under the current status, the planned treatment volume of 33MLD is calculated as 100,405 of supply population, which is only 68% of the target population of 148,487. Therefore, reductions of per capita supply of water and leakage rate are required conditions.

One of the reason for the high per capita supply of water as 195 LPCD is a portable tank at most of each house. It is presumed that the cock of the tank is always open for the purpose of securing daily use water under intermittent water supply circumstances and fixed rate of tariff. The transition of tariff system to metered rate seems to be effective to reduce per capita supply of water.

KMC also has a willingness to reduce per capita supply of water to the SLB as 135 LPCD. One of the reason is that KMC wishes to reduce the operation and maintenance cost of sewage system that is also managed by KMC. Its cost is covered by tariff from drinking water. The less people use water, as load of sewage system will be reduced, the less KMC spends cost for sewage operation and maintenance. However, KMC officials said introduction of metered is difficult because the concept of tariff as a compensation for the water supply service is not common to citizens and the decision making is a political matter.

Therefore, reduction of leakage rate is only a practical option to achieve 24X7. Although, neither an accurate data collection of volumes of leaked water and NRW nor a concrete countermeasure to reduce leakage rate does exist.

(2) Uncertainty of 24X7 at each Connection

The improvement plan adopts a gravity in-line distribution system through MBR as shown in the next page.

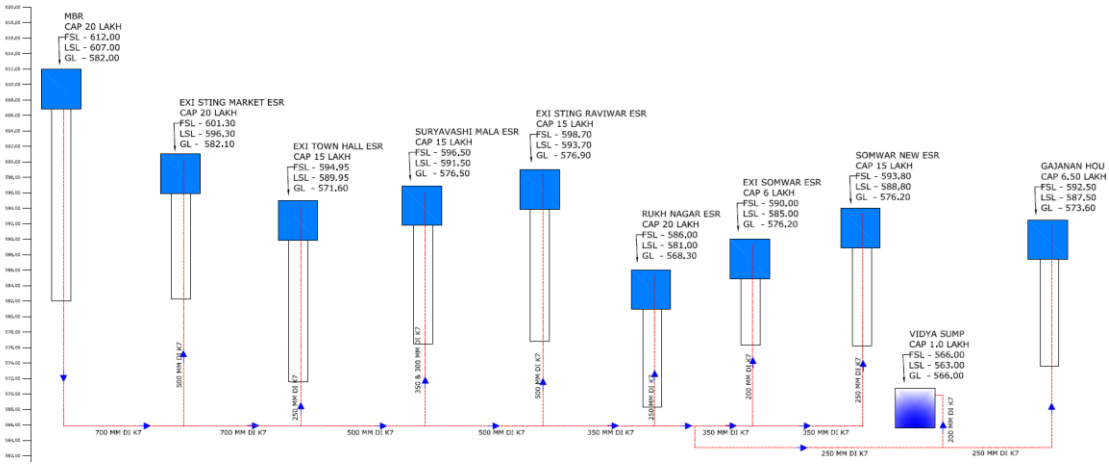


Figure 2-4 Gravity Distribution Model of Improvement Plan

KMC said an intermittent duration will be solved in a step-by-step manner by controlling distribution volume by a manual valve handling at each ESR, as the same way of the current system. However, it should be noted that a recognition of KMC to 24X7 is critical. The definition of 24X7 is a condition that water can flow out from the tap in each house at any time, though KMC recognize that 24X7 will be achieved by filling water at any time in the portable tank at each house. Because most of houses does not have water meter in Karad city, data of diel and seasonal variation of water use volume is absent. This implies that there is an anxiety that shortage of water in each ESR would happen sometimes.

Therefore, based on the data of diel and seasonal variation of water use volume, enough volume of water should be kept in not only ESR but also portable tank at each house all the time.

2.1.6 Problems Relating to Sanitation and Water Borne Disease (Target Area)

1) Water Quality

In early August that fit the rainy season, Study team collected raw and treated water from WTP and tap water at hotel in Karad City. The result of water quality analysis indicates there is no problem from sanitation point of view, even though Fe and Al from tap water are slightly over than values of Japanese water quality standards due to a small amount of turbidity, as shown below.

Table 2-8 Water Quality of Raw and Treated water at WTP and Tap Water in Karad

Items	Unit	Raw water	Treated water from WTP	Tap water
pH	--	6.9	6.6	7.3
Turbidity	degree	5.4	1.4	0.6
Chromaticity	degree	5.9	<0.5	0.5
Type of odor	--	Nothing abnormal	Nothing abnormal	Nothing abnormal
Residue on evaporation	mg/L	121	77	91.0
Alkalinity	mg/L	30	18	23
Calcium hardness	mg/L	19	20	24
Fluorine and fluorine compounds	mg/L	< 0.08	<0.08	<0.08
Electric conductivity	mS/m	7.9	8.7	9.1
Langelier index	--	-2.2	-2.7	-1.9
Ultraviolet absorbance (260nm)※measured by 50mm cell	--	0.056	0.021	0.021
Total organic carbon (TOC)	mg/L	0.7	0.5	0.5
Dissolved organic carbon (DOC)	mg/L	0.5	0.5	0.5
Trihalomethane formation potential				
Chloroform	mg/L	0.015	--	--
Dibromochloromethane	mg/L	<0.001	--	--
Bromodichloromethane	mg/L	0.004	--	--
Bromoform	mg/L	<0.001	--	--
Total trihalomethane	mg/L	0.019	--	--
Trihalomethane				
Chloroform	mg/L	<0.001	0.013	0.014
Dibromochloromethane	mg/L	<0.001	<0.001	0.001
Bromodichloromethane	mg/L	<0.001	0.004	0.004
Bromoform	mg/L	<0.001	<0.001	<0.001
Total trihalomethane	mg/L	<0.001	0.017	0.019
Residual chlorine in the sample upon arrival	mg/L	<0.1	0.9	0.7
Manganese and its compounds	mg/L	0.069	0.008	0.006
Dissolved manganese and its compounds	mg/L	<0.001	<0.001	<0.001
Iron and its compounds	mg/L	2.6	0.29	0.22
Dissolved iron and its compounds	mg/L	<0.01	<0.01	<0.01
Aluminum and its compounds	mg/L	1.7	0.24	0.14
Dissolved aluminum and its compounds	mg/L	0.02	<0.02	0.03
Arsenic and its compounds	mg/L	<0.0003	<0.0003	<0.0003
Dissolved arsenic and its compounds	mg/L	<0.0003	<0.0003	<0.0003
Cadmium and its compounds	mg/L	<0.001	<0.001	<0.001
Dissolved cadmium and its compounds	mg/L	<0.001	<0.001	<0.001

2) Water Borne Disease

The number of waterborne diseases patients in recent two years is collected from Mrs. VYChavan Sub-District Hospital, the only national hospital in Karad City, as shown below.

Table 2-9 Number of Waterborne Diseases Patients in Karad National Hospital (2012.4-2013.3)

	2012.4 – 2012.9		2012. 10-2013. 3		Total
	Village (Malkapur, etc.)	Town (KMC)	Village (Malkapur, etc.)	Town (KMC)	
Cholera	0	0	0	0	0
Abdominal pain	13	13	394	141	561
Diarrhea	4	0	61	21	86
Dysentery	0	0	12	19	31
Viral hepatitis	0	0	0	0	0
Typhoid fever	0	0	178	90	268
Polio	0	0	0	0	0
Leptospirosis	0	0	0	0	0

There are many patients suffering from abdominal pain and typhoid in the whole Karad area, particularly in dry season from October. The reason is that amount of coliform bacteria is

diluted due to an abundant volume of water in river in rainy season, but larger amount of contaminants are stored in water source and using frequency of that water source become higher during the dry season.

It is also noted that, although the disease rate in rural areas is particularly high, there exist some extent of patients inside Karad City where water supply system is developed. It is assumed that an intermittent water supply allow an ingress of contaminant water from underground due to an adverse water pressure inside the pipe. Therefore, achievement of 24X7 is strongly required from sanitation point of view.

2.2 Relevant Plans

2.2.1 Outline of Improvement Plan

As mentioned earlier, currently an improvement plan of water supply system in Karad, which was approved under UIDSSMT by MOUD in 2008, is in progress. The outline of the plan is shown below.

Table 2-10 Outline of Water Supply Improvement Plan under UIDSSMT

Item	Value	Item	Value
Target year	2040	Intake pump	335 horse power
Target population covered	148,487	New WTP	15MLD (15,000m³/day)
Coverage	100%	Transmission pipe	Total length of 6.65km (diameter 600mm)
Per capita per day	135 LPCD	New MBR	2ML (2,000m³)
Leakage rate	15%	Additional ESR	4（2ML, 1.5ML, 1.5ML, 0.6ML）
NRW	20%	Cost	29,104,100 INR（48,021,765JPY）

Distribution area in accordance with new ESR location and distribution network is shown in the following figure. Newly developing facilities by the improvement plan are in red, and the ESR and corresponding distribution area appears in the same color.

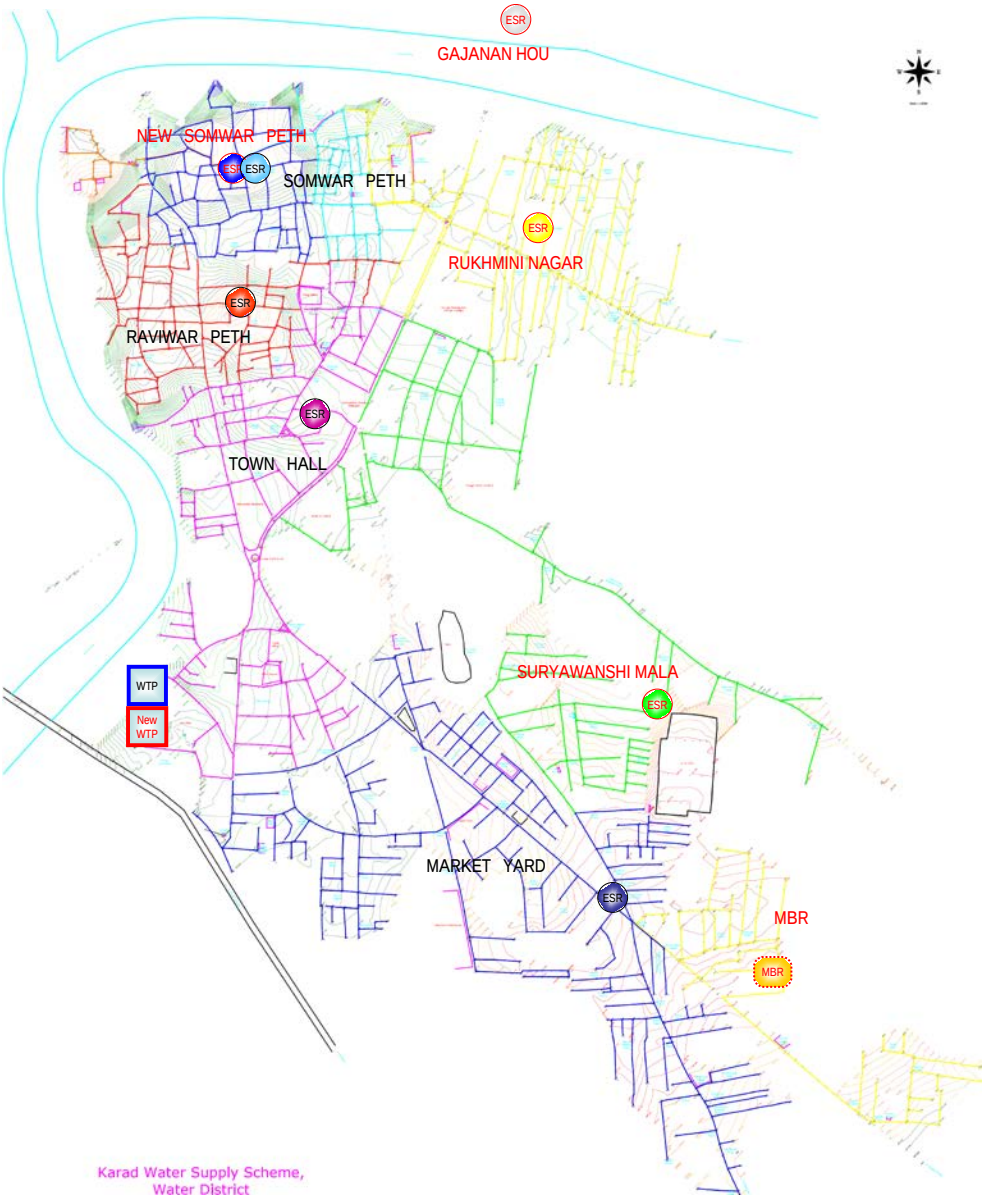


Figure 2-5 Distribution Area and Network by Improvement Plan

2.2.2 Upper Level Plans to the Proposed Project

1) UIDSSMT

The top plan at national level relevant to the proposed project is Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT) set by MOUD in 2005, targeting to promote private investment by developing urban infrastructure. The on-going improvement plan has been receiving subsidy from central government after an approval of UIDSSMT in 2008.

2) Maharashtra Sujal Nirmal Abhiyan

"Maharashtra Suvarna Jayanti Nagarotthan Maha-Abhiyan" is a state level upper plan that aims at promoting urban renewal for small and medium towns in Maharashtra, which sets a political goal of 24X7 achievement earlier than other states. This is an incentive program of Maharashtra state,

in accordance with UIDSSMT, setting a goal of SLB satisfaction by 2017 and obligating local government to develop below works if local government expects to receive subsidy from the State.

- ◇ Development of GIS mapping
- ◇ Customer survey
- ◇ Set up the model of water resource usage
- ◇ Audit of electricity consumption and water reuse amount
- ◇ Set up the water reuse meter
- ◇ Install the water tariff collection system (software)

KMC has completed the first 4 work items by up to present, after receiving UIDSSMT approval.

2.2.3 Urgency and Priority of Counterpart Country Towards Proposed Project

1) Urgency and Priority for National and State Governments

The basic water supply system development is of great importance to the small cities in India, where records rapid increase in population. Urgency and priority is quite high for Maharashtra state as it set an achievement of 24X7 as a political goral, earlier than the other states.

In addition, in the country assistance programs to India set by Japanese Government, support on water supply described as an example of one of the 3 priority goals, “improvement of poverty and environmental problems”. As for the water sector support by JICA, a proactive utilization of the advanced Japanese technology corresponding to water supply facilities in small and medium cities are set as a policy. Considering those Japanese Government standpoints, the proposed project has a priority from the viewpoint of international assistance.

2) Urgency and Priority for KMC

It was confirmed through site survey that KMC has a great deal of interest in Japanese leak technology and maintenance technique of pipes, considering the highest priority to the leak reduction.

KMC is expecting to achieve 24X7 gradually in a step-by-step manner from the distribution area nearest to MBR to the next after completion of improvement plan by 2014. However, it is doubtful to achieve this if the current high leakage rate and per capita supply of water are not improved. Therefore, leakage reduction measure and water use control by facilitating water meter are the top priority.

2.3 Responsible Authorities and Implementing Agencies

2.3.1 Responsible Authorities

1) Central Government

MOUD is a responsible ministry for water supply in urban area, and will play a coordinating role

to disseminate proposed project to the other small and medium cities in other area.

Besides, the Ministry of Water Resources is in charge of regulation, policy and development plan related to water resources, it collects water charge from entities that intake water from first-class river and dam, etc. Ministry of Drinking Water and Sanitation is in charge of water supply in rural areas, this is an upgraded organization from a subordinate organization from the Department of Drinking Water Supply of the Ministry of Rural Development. Since KMC belongs to the category of C-class city council, it does not have a direct relationship.

2) **State Government**

The relationship of water supply related organizations in Maharashtra State is shown as below. Water Supply and Sanitation Department of state government manages the policy regulation and project implementation for cities. Among those cities in Maharashtra, other than metropolitans such as Mumbai, 23 small and medium cities are under a direct management of MJP (Maharashtra Jeevan Pradhikaran), which is a department of Maharashtra state government, in the field of planning, implementation, operation and maintenance of water supply system. Other smaller cities manage water supply by their own with having a technical supervision from MJP.

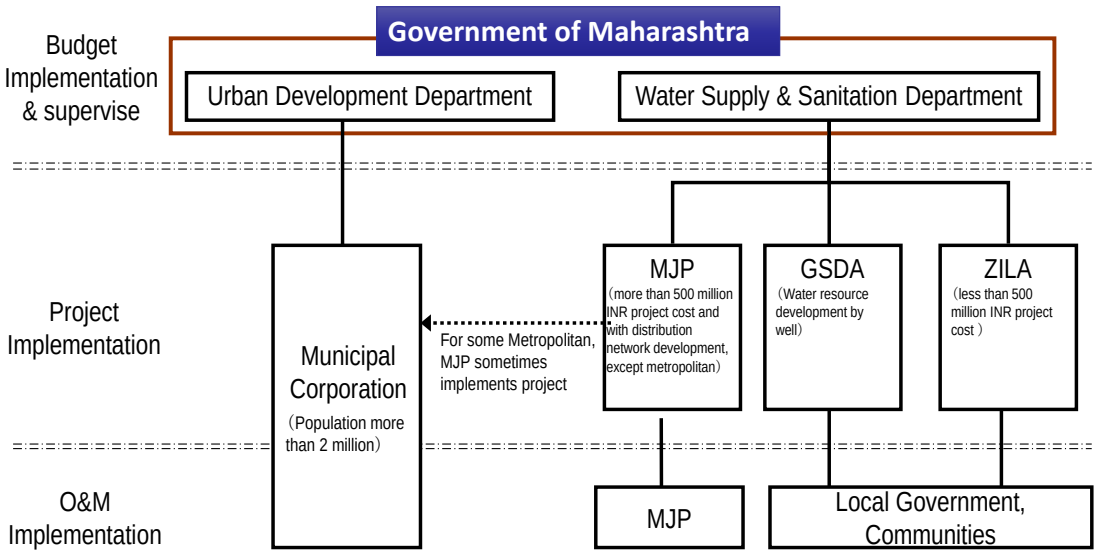


Figure 2-6 Relationship among Relevant authorities and Agencies

KMC has own water management department within city government, and MJP does not have a responsibility of direct management. However, there is an strong connection with KMC and state government since MJP dispatches technical staffs in KMC

2.3.2 Organization of Implementation Body

Below shows organization chart of water supply department of KMC. The counterpart will be Technical Section that composes of 3 units. Total numbers of technical staffs are more than 40.

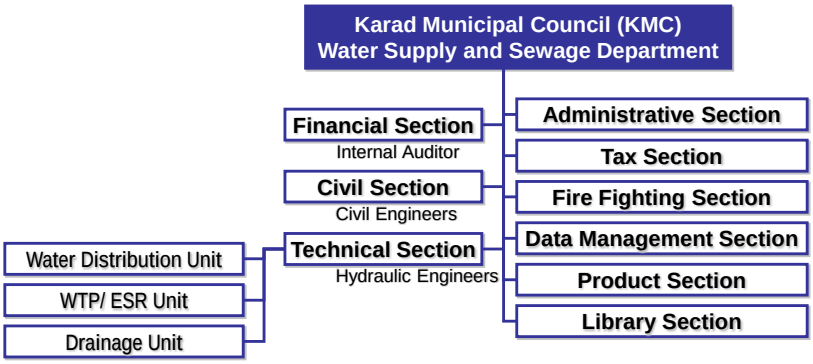


Figure 2-7 Organization Chart of Water Supply and Sewage Department of KMC

2.3.3 Responsibility of Counterpart

KMC is responsible for planning, operation and maintenance of water supply, with a technical advice from dispatched MJP staffs.

2.4 Cooperation History between India and Japan

2.4.1 Financial Assistance

After India became the largest ODA recipient country in 2003, Japan has been one of the two main donors of India together with UK. India continues the steady economic growth; the regulation to foreign investment is loosened and the liberalization of domestic economy is actively progressing. For the 300 million population of middle layer, there are still potential of expected investment destination and market, the necessity to increase the closeness of bilateral relationship is still high. The loan-based assistance of Japan is expected to continue by placing the emphasis to promote economic growth, contribute to poverty reduction, and to solve environmental issues in the future.

Table 2-11 Experience of Japanese ODA to India

Unit: 100 million yen

	Yen Loan	Grant Aid	Technology cooperation
2005	1,554.58	21.09	17.84 (8.36)
2006	1,848.93	5.96	25.35 (13.17)
2007	2,251.30	3.97	21.60 (12.31)
2008	2,360.47	4.28 (0.05)	24.51 (11.79)
2009	2,182.17	4.66 (0.77)	18.55
total	34,004.00	885.81 (0.82)	293.51

Source: Ministry of Foreign Affairs official development assistance (ODA) Country Data Book 2008

2.4.2 Technical Cooperation

1) Assistance Record to India in Water Supply

The list of ODA assistance for water supply infrastructure maintenance is shown as below. The

maintenance has been implemented in water supply infrastructure of big cities and local cities. Especially in recent years, assistance focuses on operation and management of sustainable water supply has been conducted; after replaced the pilot water pipe network and water meters in some area in cities. The implementation of NRW measurement, which is scaled up by utilization of Loan Aid, has become characteristic.

Table 2-12 Experience of Japanese ODA Related to Water Supply

ODA scheme	Name of proposal	Type	Time period/year of signing
Loan Aid	Bangalore Water Supply and Sewerage Project(I) Bangalore Water Supply and Sewerage Project(II)	Urban water supply	1996 2005
Loan Aid	Kerala Water Supply Project	Urban water supply	1997/08～2010/12
Loan Aid	Jaipur Water Supply Project	Water source development and urban water supply	2004
Loan Aid	Agra Water Supply Project	Rural Water Supply	2006
Development Study	Goa Water Supply and Sewerage Strengthen Program	Urban water supply	2005/02～2006/12
Loan Aid	Goa Water Supply and Sewerage Project	Urban water supply	2007
Loan aid attaching technical assistance	Capacity Development Project for Non Revenue Water Reduction in Goa	Urban water supply	2011/01～2014/03
Loan Aid	Hogenakkal Water Supply and Fluorosis Mitigation Project (Phase 2)	Rural Water Supply	2008/03～2013/07
Loan Aid	Guwahati Water Supply Project	Rural Water Supply	2009/03～2017/01
Loan Aid	Delhi Water Supply Improvement Project	Urban water supply	2012/11～2022/12

Source: Edited from JICA knowledge site and other internet information

2) Cooperation by Japanese Local Government

Up to present, the assistance of water supply to India is implemented by taking advantage of the NRW measurements as well as know-how about organization and management that Japanese utilities possess. Recently, the Bureau of Waterworks, Tokyo Metropolitan Government dispatched urban water supply experts to the preliminary survey of technical assistance attaching to Delhi Water Supply Improvement Project. Yokohama Waterworks Bureau dispatched experts of organization system and training to join the preliminary survey for Capacity Development Project for Non-Revenue Water Reduction in Jaipur, which is the capital of Rajasthan state in northwest India.

2.4.3 Opinions from Counterpart

From the hearing with CPHEEO (Central Public Health and Environmental Engineering Organization of MOUD), the opinions of the cooperation with Japan are as follows;

- UIDSSMT is not a scheme developed originally for the 24X7 maintenance. To achieve the continuous 24-hour water supply in major big cities India, awareness of residents and t the monitoring system of water balance are important elements.
- Now UIDSSMT is in the preparation stage for the next phase, up to present the review of phase 1 was conducted. For the support of Japan, it’s expected to introduce the most advanced technology of leakage control, as well as to widespread the conceptual proposals, such as smart city, etc., to other cities.

- We expect a dissemination of pilot study with new technology introduction to other area. MOUD is waiting for the report from KMC and we are willing to give necessary assistance as much as we can.

2.5 Cooperation with the Third Country / International Organization

2.5.1 Past Record of Cooperation and its Scheme Relating to the Proposed Project

There is no record of relating cooperation by other countries in Karad.

2.5.2 Request from India

It was confirmed by the minutes of meeting on 5th of August 2013 that towards the creation of object proposal, both Japan and India sides are making efforts to exchange information towards the necessary financial and technology cooperation by holding consultations with KMC. It was also confirmed that KMC has a willingness to conduct the specific action such as preparing request of the project to Japanese Government.

After that, agreement was made between both sides on 27th of January 2014 in relation to implementation items and procurement of water meter by KMC side, when Japanese ODA would be implemented.

2.5.3 Consistency of Assistance Policy of Japan towards Proposed Project

1) Policy to Assistance to India

The “Country Assistance Program for India”, proposed in May 2006, set the key aims as followings: (1) promotion of economic growth through electric power, transport and increasing added value through infrastructure development assistance, etc.; (2) improvement of the poverty and environment issues through assistance for health and sanitation, assistance for local development, assistance for water supply and sewage systems and assistance for the forestry, etc.; (3) expansion of human resources development and human exchange. Based on this program, the Japan-India high-level economic cooperation policy council is conducted each year since 2007 to make the consultation about development policy and priority proposals from the mid-term viewpoint. This council makes agreement on promoting the development of public and private industrial infrastructure by the framework of Delhi · Mumbai Industrial Corridor etc., towards further strengthening of “Japan-India Strategic and Global Partnership”.

As to water supply, ODA has supported a wide range of assistance issues such as urban water supply, rural water supply, water quality improvement, water resources development, etc. The “Japan-India Global Partnership Summit 2011” also proposed the cooperation between Japan and India on water project, assistance on water supply would be significantly considered in the future. Through the water sector assistance policy of JICA listed as below, towards urban water supply improvement that calls for private investment hereafter, we are aiming to strengthen the water

supply project operation and maintenance capacity of by actively utilizing the knowledge and technology of Japan.

2) **Assistance Policy of JICA in Water Sector in the Future**

JICA India Office sets up the following three points as the basic policy of the assistance policy of water sector for India in the future. Among them, the below 2 points accord with proposed project.

Policy 2: Application of knowledge, experience and advanced technology of Japan

The high-effective Japanese technology of advanced treatment to non-revenue water measurements and reclaimed water is actively considered for the limited surface flow in India. In addition, as a part of this effort, assistance is also conducted to contribute to strengthen the cooperation of Japanese companies, local governments, Indian companies and water entities.

Policy ③: To strengthen sustainability

The aim is to ensure the strengthening of operating and managing ability as well as financial soundness of water supply entities, through water leakage detection training, introduction of SCADA • GIS and meter-based water charge, and educational activities to the residents.

3) **Water and Sanitation Broad Partnership Initiative**

In “Water and Sanitation Broad Partnership Initiative” presented at the 4th World Water Forum held in Mexico in 2006, “To support capacity improvement of local society such as to support the residents including women to manage and operate facilities self-reliantly. Furthermore, to assistant the maintenance of system aims to dissemination of knowledge related to water and sanitation, for the improvement of residents’ consciousness related to water safety” was expressed as the detail effort of the basic policy #2 in the countryside.

The intended case of this time can contribute to (1) and (3) of the above policy. In the “pursuit of sustainable water use” in policy (1), through the introduction of household water meter, Japanese technology of leakage control and monitoring technology, aiming to the water balance management plan for entire system based on leakage rate reduction, it is expected to ensure the sustainability on the level of project. About the “emphasis on capacity development” in (3), be considered for the "emphasis on capacity development", since the spread of water leakage diagnostic monitoring technology and pipeline repair the leakage point is expected by the transfer of technology leakage control, improvement of management skills and technical capabilities of KMC would be achieved.

2.5.4 Necessity of Cooperation Linkage with Third Country / International Organization

The World Bank and the Asian Development Bank are working on assistance of water supply and

sewerage sector as a part of poverty reduction policy, the priority issues includes 1)organizational re-form of the relevant organizations, 2)promotion of competition among local governments for water supply and sewerage service improvement, 3)optimization of water charge level, 4)introduction of private sector activities, 5)consideration of poverty, etc. However, there is still few project for water supply system improvement. As for project on the survey stage, the World Bank is supporting the development of water supply in Delhi Territory to some extent.

This subject project transfers to Japanese water supply technology, which focuses to proper management of water balance in which leakage control measurements take the center position. Therefore, it is not necessary for linkage of cooperation with the third country/international organization on this project.

2.5.5 Reason of Distance from International Assistance in Karad

Karad City is a regional city of Maharashtra State and it has the access to large city Pune about 300km. As a small and medium city, it is not an assistance target of the third country and international organization yet. Therefore, is not particularly envisaged to coordinate with other donor at present.

CHAPTER 3. Proposed Project

3.1 Background

As described in Chapter 2, KMC faces issues of intermittent supply with 3 to 8 hours a day, together with high leakage rate and financial difficulties. In corresponding to this issue, KMC has been implementing an improvement plan, which set prerequisites as 135 LPCD and 20% of leakage rate that are same as SLB set by MOUD.

However, in reality, per capita water supply is 195 LPCD and leakage rate is over 40%. This leads to an anticipation that achievement of 24X7 is difficult even if completed facility development by the improvement plan. At the same time, sanitation problem lies with a big concern since intermittent supply tends to allow an ingress of contaminant water from underground due to an adverse water pressure inside the pipe.

Reductions of per capita water supply and leakage rate are required for achievement of 24X7. Because KMC thinks it difficult to introduce metering tariff system, reduction of leakage rate become only effective countermeasure. That is why the proposed project set the theme of leakage reduction, composed of water hammer measures by introducing valve control and effective O&M measures in Rukhmini Nagar area, which is one of 8 ESR areas in Karad City.

It is noted that public enlightenment for water saving to public will also be effective to reduce per capita water supply. However, in India, political service on particular to the poor is of great importance, and public enlightenment is a political action of KMC. Therefore, proposed project focuses on technical leakage reduction.

3.2 Approach towards Countermeasure Implementation

3.2.1 Relationship between Issues at National Level and Proposed Project

The notable gap between SLB set by MOUD and current service level of KMC are per capita supply of water, extent of metering of water connections, continuity of water supply and extent of NRW.

Table 3-1 National and Local (KMC's) SLB Indicators and Current Status in KMC

Indicator	National Benchmark	KMC Benchmark	Current values of KMC
Coverage of water supply connections	100%	100%	63.42%
Per capita supply of water	135LPCD	135LPCD	195LPCD
Extent of metering of water connections	100%	100%	0.10%
Extent of NRW	20%	20%	49.02%
Continuity of water supply	24X7	24X7	Intermittent (3 to 8 hours/day)
Efficiency in redressal of customer complaints	80%	80%	Data not available
Efficiency in collection of water supply-related charges	90%	90%	75.62%

Among them, the highest priority is on the continuity of water supply by KMC, as state

government also set as a political goal. To achieve this reductions of per capita water supply or leakage rate is far effective than developing new facilities. Also, the proposed measure of reduction of leakage rate accords with the concern of national government, since it requires accurate data of water volume by equipping water meter to reduce leakage rate, which is a main cause of high NRW.

3.2.2 Relationship between Sanitation Issues of Current System and Proposed Project

Failure of achieving 24X7 will cause a continuous defect of intermittent supply, which results in sanitation problem to the public due to negative pressure inside pipe taking contaminants from underground.

Reduction of leakage also contributes to the improvement of coverage rate, hence improvement of financial condition of KMC. Therefore, the proposed project seems to be appropriate to solve the issues.

3.2.3 Range, Scheme and Schedule of Project

1) **Range of Cooperation**

Target area is Rukhmini Nagar area, and counterpart agency is KMC.

Theme of technical cooperation is a reduction of leakage, by understandings of current water volume and leakage reduction by conducting introduction of water meters, water volume analysis, leakage detection, water hammer countermeasure by valve control and effective O&M by introduction of multi-purpose T shape. In addition, technology transfer through OJT and training course in Japan contributes to human resource development in KMC.

2) **Scheme**

Considering the size of target area, the expecting scheme as a first step of project is JICA Partnership Program. As a second step, Technical Cooperation is appropriate to disseminate the project to the other area in the state and country.

3) **Schedule**

The implementation period is 3 years at least in the case of JICA Partnership Program. Because the currently undergoing infrastructure maintenance by KMC is scheduled to finish in March 2014, the implementation period is assumed as 3 years starting from 2014.

3.3 Purpose of the Project

3.3.1 Short Term Purpose

The short-term purpose is the contribution to achieve 24X7 within Rukhmini Nagar area by expression of water supply quantity increase and stabilization effect in the area.

3.3.2 Mid to Long Term Purpose

The mid-tern purpose is to contribute to living environment and sanitation improvement to the whole city of Karad, by developing project to the other 7 ESR areas. And the long term purpose is to contribute to achieve 24X7 in other cities in Maharashtra State.

3.4 Component of Project

3.4.1 Outline of Plan

The proposed project includes four components as below, with the theme of leakage reduction in order to realize 24X7.

1. Installation of better quality and the latest technology valves for securing sustainable 24X7 water supply in the new water supply system being executed by KMC under the UIDSSMT scheme

・ Installation of automatic operating valves according to water level at each ESR

・ Change of air valves with better quality air valves at WTP and Super New WTP

・ Change of defective check valves, air valves, gate valves with better quality valves with the latest technology in order to prevent water hammer effects at inlet pipelines at MBR and 8 ESRs

・ Providing butterfly valves at some ESRs located closer to MBR to control water outflow so as to maintain required water level at any time in the ESR at the end of water distribution sequence

2. Leakage Reduction in Rukhmini Nagar DMA

・ Measuring the minimum flow, by equipping flow meters or sensor devices and carrying the leak detection surveys during the night time

・ Leakage detection by data logger system LNL-1 and leakage detective devices

・ Installation of “multi-purpose T-shape pipe fitting”, which makes maintenance work, water quality monitoring, pipe flushing, pressure check, air check, monitoring by camera, and fire hydrant facilitation easier

3. Supplying and installation of consumer water meters in Rukhmini Nagar DMA and analyzing water distribution amount

4. Human resource development by on-site technology transfer through expert dispatch and training course in Japan

As the target scope of 1, at the existing water purification plant and elevated water tank or the

ones will be maintained before March 2014, technical guidance is conducted on how to change the valves that also include water level and interlocking automated control, as well as related operation and maintenance.

For the target scope of 2 and 3, in the Rukhmini Nagar area where is one of the water distribution area separated by 8 existing ESRs, technical guidance is conducted for setting up water meters in 750 exiting water connected households, water leakage detection and measurement, as well as effective maintenance of water tubes.

Human resource development in 4 is assumed to include technology transfer and separate of OJT method in the implementation of component mentioned above, leakage measurement and valve control for KMC water supply staffs, and training in Japan for Japanese advanced technology of water operation and management.

3.4.2 Scope, Size and Time Period of Project

Content and scale quantity of four components of the project is assumed as below:

Table 3-2 Content and Size of Project Components

Components	Items	Quantity
Improvement of valve control for water supply and distribution system	Improvement of control by water level geared valve (on-site technical guidance)	2 sites (BMR, Rukhmini Nagar ESR)
	Valves for ESR	1 electric valve to control raw water flow 1 electric valve to adjust water delivery quantity
Leakage improvement of Rukhmini Nagar	Leakage control measurements a)Minimum flow investigation b)Leakage detection c)Planning measurements	3 Experts (total 3.5MM)
	Set up the multi-purpose T-tube	8 sites
	Introduction of leakage detection, equipment, leakage detector and local technical guidance	1 data logging sensor 60 data loggers 2 Water Leak Detectors
Water meter installation in Rukhmini Nagar	Water meter procurement	123 sites
	Water meter installation	123 sites
Human resource development (Training in Japan)	Leakage control	3 days
	Valve control	3 days
	Water supply control and management (water conveyance, water distribution, water supply) and water planning	3 days

Scheduling is as follows;

Planning stage: from 4th quarter in 2014 till 2nd quarter in 2015
Implementation stage: from 2nd quarter in 2015 till 1st quarter in 2016
Round-Up stage: from 2nd quarter in 2016 till 3rd quarter in 2016

3.4.3 Contents, Scale and Amount of Dispatch of Experts and Facility Provided

Area of expertise and man/month to be dispatched are as follows;

Table 3-3 Specializing Area and Man/month of Experts

Area of Expertise	Number of Expert	Total Months
Valve control	1	6 months
Leakage control	2	6 months

Contents and amount of facilities to be provided are as follows;

Table 3-4 Contents and Amount of Facilities

Facilities	Amount
Manual flow control valves for raw water	1
Electric valve to adjust water delivery quantity	1
Water meter	123
Data logging sensor	1
Leak detector	2
Flow meter	1

3.4.4 Project Cost

The estimated total project cost is around 60 million JPY, including procurement and delivery costs of facilities, installation work, training expenses in Japan and expenses for consulting service.

3.4.5 Others

Reduction of per capita supply of water is another effective measure than leakage reduction in order to achieve 24X7. JICA Partnership Program, which enable mixing facility provision and training with targeting local residents of the target country, allows it possible to implement enlightenment activities for residents to water works. Although, since KMC recognize that an introduction of tariff increase by shifting from fixed rate to metered rate is difficult to realize, a reduction of per capita supply of water is out of scope in the proposed project.

However, it depends on a willingness of KMC to introduce metered rate tariff system.

This study conducted a site survey in Malkapur, a neighboring city of Karad where the 24X7 effort has been made since 2009. In Malkapur, by setting up water meter in 5,500 households, repairing water supply pipe and introduction of the monitoring system, the infrastructure maintenance of 24X7 project due to total 140 million IDR (about 220 million JPY) results to approximately 12% NRW rate and achievement of profitable operating water supply project nowadays. The reasons of this successful effort are that state government covers 90% of the project cost, and the strong demand for 24-hour continuous water supply from local residents who complained intermittent watering before 24X7; it was also approved by the city congress.

In Karad City, the situation is not so similar to Malkapur, although an enlightenment activities is effective to reduce per capita supply of water. It is important to confirm the perception of KMC on an effectiveness of enlightenment for an introduction of metered rate tariff system.

3.5 Situation of Target Site

3.5.1 Location

Karad City is a rural city surrounded by Koyana River as water source.

Figure 3-1 Karad City Satellite Image (Google Map)

The facilities and distribution area are shown as below. In Rukhmini Nagar area as the target area of pilot project, there are new-built residential areas and many middle-income households live.

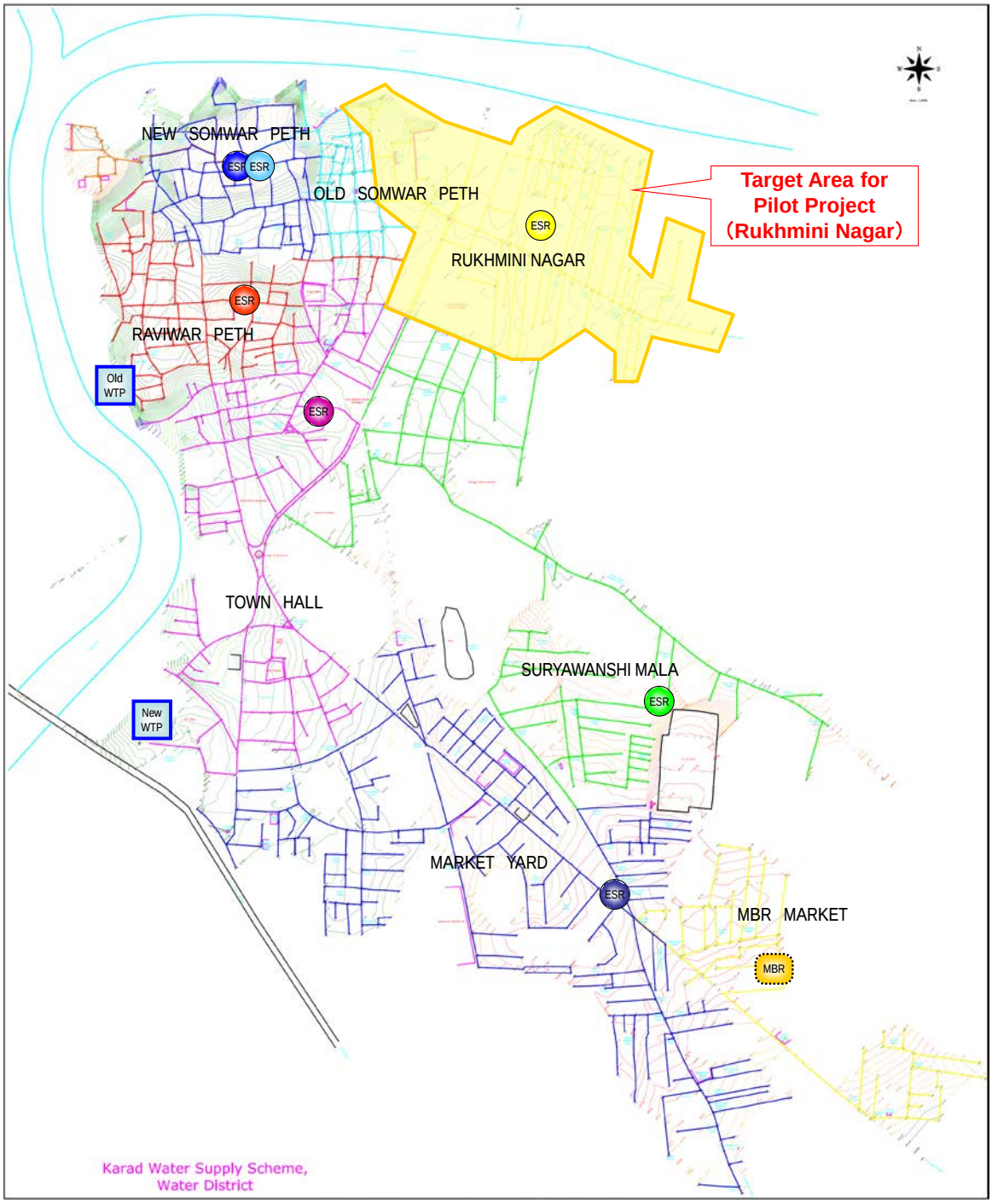
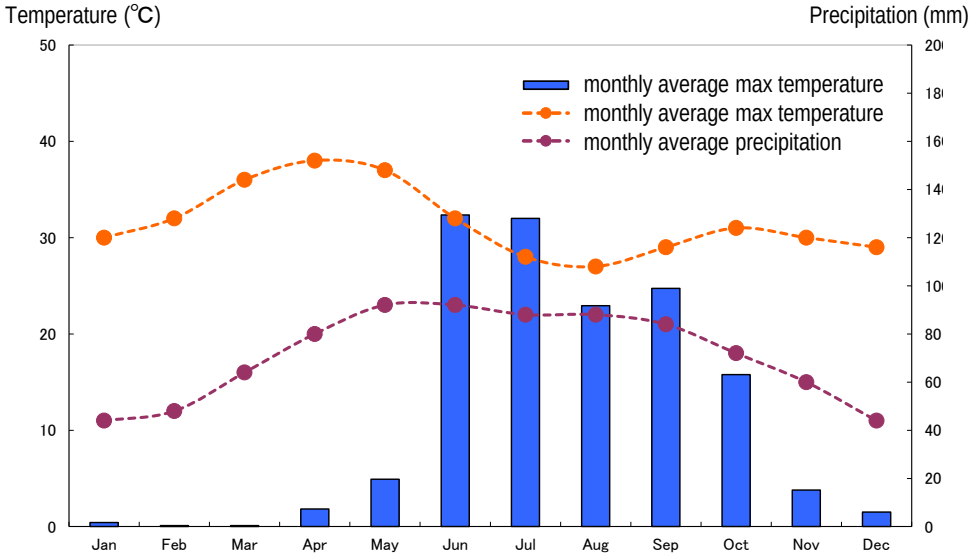


Figure 3-2 Location of Target Area of Pilot Project

3.5.2 Natural Conditions

The following shows monthly average maximum and minimum temperatures and precipitation of the past months in Pune, a neighboring city of Karad City. In rainy season from June to October, precipitation reaches to around 100mm; in dry season, temperature difference is large and rainfall is extremely low. From the viewpoint of water supply, measures on water turbidity in rainy season is critical.



Edited based on MSN Climate Data

Figure 3-3 Monthly Average of Temperature and Precipitation in Pune

3.5.3 Access

Karad City locates on the Route 4, a main artery that connects the main cities such like the state capital Mumbai, Pune, Bangalore, Chennai, etc., in southern India from east to west, therefore a traffic access condition is good. However, there is no airport; the nearest airport is in Pune, about 300km away.

3.5.4 Electricity and communication

Power supply is relatively stable in the whole area except some cases of power outage in heavy rain. Mobile communication is available but internet access is limited in many areas.

3.5.5 Safety

On the Ministry of Foreign Affairs Overseas Safety Homepage on 17 August 2012, the middle and east states (east area of Maharashtra State, plateau backland of Andhra Pradesh, Odisha, Chhattisgarh states, rural areas of Bihar and Jharkhand State) of India have become the area of "investigate the pros and cons of voyage". The target area where Karad City belongs is in southwest Maharashtra State, notice of danger which can cause problem for project implementation has not been announced.

CHAPTER 4. Effect and Impact of Proposed Project

4.1 Effect of Implementation

4.1.1 Expecting Outcome

The effects by proposed project at each administrative levels are as follows:

(1) National and State Levels

- Formulate the model of 24X7 achievement in small and medium cities as policy aim
- Improve the sanitary condition of small and medium cities

(2) Municipality Level

- Increase in water supply amount
- Stabilize of water distribution
- Capacity development of KMC staffs in operation and maintenance
- Increase in coverage
- Reduction of water work operation and management cost

(3) Residential Level

- Receive of stable water supply
- Improvement of sanitary environment
- Reduction of water borne disease

4.1.2 Extent of Resolution to the Current Condition of Water Supply

The current condition of water supply in India is that the speed of infrastructure development is not able to catch up the speed with rapid increase in demand. One of the main reason for that is a shortage of investment budget.

The proposed project aims at maximizing supply capacity by utilizing existing facilities, which is effective to maximize B/C of new facilities to be developed in the future. Because it is difficult to increase investment budget in future, such approach is quite effective.

4.1.3 Extent of Resolution to the Issues of Drinking Water Supply

The water utilities that do not have an effective know-how of water supply control and management such as KMC, is in such a situation that even after completion of infrastructure development, 24X7 would not soon be achieved. Moreover, if maintenance is not properly done, the service level will be back to the level before the infrastructure development.

The effective operation by valve control and leak reduction through the proposed project is expected to secure, as well as a contribution to 24X7 achievement, a sustainable water supply in the future.

4.1.4 Extent of Resolution to the Issues of Sanitation and Water Borne Disease

Current operation by KMC does not have a problem in treating water but does an intermittent supply in distribution. The influence in sanitation by intrusion of pollution through damaged pipe point caused by negative pressure of the pipe is problematic. It is expected that an achievement of 24X7 can improvement of sanitary condition through a resolution of negative pressure of the pipe.

4.1.5 Others

At present, approximately 50% reduction of NRW rate is expected to make great contribution to improve the management and financial aspect of KMC, hence to improve other public services in Karad City. In particular, if the management of water supply improves, maintenance cost of sewerage is possible to turn over, and contribution to public sanitation is also expected.

4.2 Impact of Proposed Project

Expected impacts of proposed project is summarized as follows:

Table 4-1 Impacts of Project Implementation

Items	Contents
Political Aspect	・ Could be a model case for small and medium cities in India ・ Expected to promote more close relationship between India and Japan
Technical Aspect	・ Proper operation and maintenance technology for facilities is transferred ・ Could be one of a guideline for systemic summary of technologies that was pointed out in 12th national 5 years development plan or water policy
Environmental Aspect	・ Utilize limited water resource effectively ・ Expected a reduction of energy consumption by effective supply and distribution
Social Aspect	・ Increase in a user satisfaction by stable supply service by proper control and management ・ Improve sanitary environment by reducing risk of waterborne disease ・ Anticipation of arising unfairness among resident in outside of Rukhmini Nagar as not being designated for a pilot project
Institutional Aspect	・ Healthier management for KMC ・ Deepen a relationship between Japanese and Indian water works associations
Economic Aspect	・ Reduce cost for operation by energy saving supply and distribution with little loss of water ・ Reduce man power cost by effective maintenance

CHAPTER 5. Appropriateness of Proposed Project

5.1 Appropriateness and Sustainability from Institutional Aspect

5.1.1 Management Ability of KMC

Qualitative assessment on management ability of KMC by study team is as follows:

Table 5-1 Qualitative Assessment on Management Ability of KMC

Item		Qualitative Value (Good＝3, Average＝2, Bad＝1)
Vibrancy	Doesn't give over to upper organizations and leaders	3
	Doesn't have the mood of resignation	2
Attitude of topsider	Recognize the issues precisely	1
	Has a vision for the future	1
	Considers for self-assistance	2
Ability of administration and supervisory	Authority over the cooperation request	3

About the ability of organization MJP that is involved in the implementation and management of water supply policy plan in the aspect of technology as KMC's advisor, the result of qualitative assessment by survey team is shown as below:

Table 5-2 Qualitative Assessment on Management Ability of MJP

Item		Qualitative Value (Good＝3, Average＝2, Bad＝1)
Vibrancy	Doesn't give over to upper organizations and leaders	3
	Doesn't have the mood of resignation	3
Attitude of topsider	Recognize the issues precisely	2
	Has a vision for the future	2
	Considers for self-assistance	1
Ability of administration and supervisory	Authority of administration and supervision towards KMC	1
	Authority over the cooperation request	2

As described above, KMC has problems in understanding current issues and ability to resolve the issues, it is expected to improve by human resource development by proposed project. KMC has a strong chain of command and sufficient staffs, and also has a willingness to improve the current situation. Therefore, there is no problem in appropriateness and sustainability of KMC.

5.1.2 Financial Management Ability of KMC

Qualitative assessment on financial management ability of KMC by study team is as follows:

Table 5-3 Qualitative Assessment on Financial Management Ability of KMC

Item		Qualitative Value (Good＝3, Average＝2, Bad＝1)
Authority to do individual management	Authority to organize the organization	3
	Authority of recruitment and staffing	3
	Authority to make contract	3
	Authority to determine the income and expenditure by independent accounting	3
Establishment of organization which manages the users of water supply	Management of users' information	2
	Management of water charge billing and collection	2
Establishment of organization that can make budget, balance sheet, and long-term prospect	Budget-balance sheet, long-term prospect	2
	Facility (material) management	1
	Properties (land, facilities, buildings)	2
	Establishment of human resource organization	2

There is no problem in authority and management. The only problem lies in facility management, which bring a budget planning anticipation. Facility management should start from data collection and this could be covered by technology transfer for pipe maintenance in the proposed project. Therefore, there is no problem in financial management.

5.1.3 Construction Execution Ability of KMC

Qualitative assessment on construction execution ability of KMC by study team is as follows:

Table 5-4 Qualitative Assessment on Construction Execution Ability of KMC

Item	Qualitative Value (Good＝3, Average＝2, Bad＝1)
Whether there is a department for general management of construction	3
Whether enough influential voice and authority is provided to the department	2
Whether it rely on donor countries during the construction	1
Whether there is a positive attitude to participate in the planning, design and construction	2
Whether it has experiences of similar projects that have been carried out so far	-

5.1.4 Maintenance Ability of KMC

Qualitative assessment on maintenance ability of KMC by study team is as follows:

Table 5-5 Qualitative Assessment on Maintenance Ability of KMC

Item	Qualitative Value (Good＝3, Average＝2, Bad＝1)
Whether there is a department for general direction of maintenance management	3
Whether enough influential voice and authority is provided to the department	2
Whether it has experiences of similar projects that have been carried out so far	-

Supplementary special notes are as follows:

- KMC has a GIS mapping system, in which facilities and equipments were found in civil engineering drawing, but not in facility design drawings.

- Materials lie neglected in the open yard at WTP and ESR.
- Repair work is under direct management of KMC.

There is no anxious on appropriateness and sustainability of KMC since organization structure of KMC is reliable and operational experience is adequate. However, technical staff with basic knowledge and skills are required since leak detective work, leakage repair and daily check, which are work items in the proposed project, are not common to KMC.

5.1.5 Relationship with Local Residents

The relationship between KMC and residents is good, as little complaints are raised. Although, this is due to a fixed rate tariff even in a intermittent condition.

It is noted that collection ratio of tariff is 75%, partly because KMC has not promoted enlightenment activities on water saving to the residents. If KMC would try to shift tariff system from current fixed rate to metered rate, the key to its implementation is how KMC persuade residents that tariff is a compensation for water supply service.

5.2 Financial Appropriateness and Sustainability in Implementation

5.2.1 Financial Source of Indian Side

1) Financial Share of Indian Side in JICA Partnership Program

Refurbishment works and staff allocation are the requirements to Indian side, as JICA Partnership Program covers procurements of facilities. In terms of financial appropriateness and sustainability, financial source in Indian side has no problem as those cost is relatively little.

2) Financial Share of Indian Side after JICA Partnership Program

After implementation of JICA Partnership Program, the pilot project is expected to disseminate to other areas of Karad and similar size towns in the other states and nationwide.

Equipment of water meters and T-shape multi-purpose pipe are required to KMC in disseminating to the other area in the city. When the cost benefit effectiveness is high in Rukhmini Nagar area, KMC would find their own financial source to implement to the other area.

On the other hand, for the other small and medium cities outside of Karad requires financial schemes of Maharashtra state such as Sujal Nirmal or Nagarotthan, or UIDSSMT of central government. Since leakage repair and appropriate maintenance contributes to maximization of water supply volume which merged by the development of facilities, it is expected for government to budget as one of the basic implementation items as a first step of infrastructure development.

5.2.2 Current Status of Water Work Indexes

Current water work indexes of KMC are as follows:

Table 5-6 KMC Water Works Index

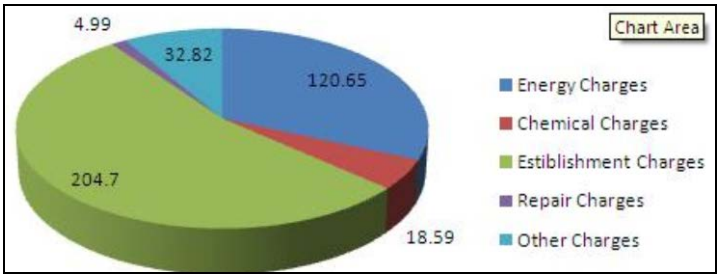
Item	Value
Load ratio	73%
Facility utilization ratio	27%
Maximum utilization ratio	27%
Ratio of revenued water to supplied water	65%
Supply cost	Domestic 1.2Rp/m^3, Commercial 1.8Rp/m^3, Industrial 1.55Rp/m^3, Public 1.3Rp/m^3
Production cost	2.68Rp/m^3
Numbers of users per KMC staff	2,778
Revenued water per KMC staff	187

5.2.3 Financial Balance of KMC

The financial situation of KMC in 2011 is following: The revenue underruns largely by expenditure and under deficit operation. The main reason is a raise of the labor cost according to a decision of the national pay revision committee of 2006, together with increasing purchase price of chemicals and electric power.

Table 5-7 Financial Situation of KMC in 2011

Items	Amount (Unit:JPY)
Revenue	31,094,183
Expenditure	59,321,005
a) Labour cost	*34,800,081*
b) Electricity	*20,512,105*
c) Chemicals	*3,160,368*
d) Repair works	*848,451*



Ref: KMC documents prepared in 2013

Figure 5-1 Proportion of Expenditures of KMC in 2011

5.2.4 Prospect for Financial Balance of KMC

Financial balance of KMC has been worsening over the past three years due to increase in expenditure and decrease in income. The main factor of the former is the increased labor and electricity costs. It is difficult to reduce expenditure in near future as nearly 10% of inflation is foreseen in India. Therefore, an increase in income is required by reduction of NRW and increase in connections since the shift to metered rate is difficult.

Proposed project might contribute to a financial improvement by increase supply ration that is currently 63.4%, as leakage ratio might be decreased.

5.3 Technical Appropriateness and Sustainability in Implementation

5.3.1 Conformity with Technical Level of India

Central government of India has prepared standards and guidelines as to water quality and facility development, and Maharashtra State Government also developed own standard for facility construction. Furthermore, those guidelines are followed even at local level. For example, national standard applies to water treatment plant construction. KMC staffs comprehend the technical points in an explanation made by Japanese experts in this study, and KMC has a technical advisory staff dispatched by MJP.

Therefore, there is no problem in a technical conformity of the proposed project.

Although, technical level in construction management are relatively low, judging from the fact that many pipes have long been left without physical connection at each house connections.

5.3.2 Solidarity of Staffs

KMC plays its role functionally by administrative wing for governmental services and congress wing topped by the Major for decision making. Technical appropriateness and sustainability is enough as mentioned above. Therefore, institutional solidarity of KMC is strong enough to receive technology transfer by the proposed project and its sustainable possession.

5.3.3 Maintenance of Facilities and Equipments

Daily check of existing facilities and data management are done without problem by local staffs. However, ledger of materials are not found in the survey and materials lie neglected in the open yard at WTP and ESR. Technology transfer in facility maintenance and management is required.

5.4 Environmental Concerns

5.4.1 Environmental Impact

Impacts of proposed project on environment are effective use of water source by appropriate leakage measure, and energy saving by effective pumping due to proper supply and distribution management.

5.4.2 Environmental Assessment

Negative impact of the proposed project is nil, since reduction of leakage contributes to maximizing water source hence new water source development is not required, and proposed work items does not require large scale of works.

CHAPTER 6. Conclusion

6.1 Noteworthy Points

The below points are noteworthy in implementation of the proposed project:

- This project has a beginning based on the memorandum of the Japan Water Works Association and Indian Water Works Association, and India Water Works Association recommended Karad City. The implementation and success of this project is expected to make great contribution to the maintenance and development of cooperation and friendship between the two countries in the field of water supply in the future.
- KMC is a local government classified as C class city council. Although MJP dispatched an engineer as an advisor to KMC in water supply management, there is not direct involvement of MJP. Strong involvement of the state and central governments is desirable by decent report and discussion during the course of JICA Partnership Program.

6.2 Points of Concern in Implementing Cooperation

The below points should keep in mind in implementation of the proposed project:

- The laws and regulations of import duty are frequently updated in India, and procedure of import restrictions and regulations from outside the country tends not so relatively smooth. It is necessary to prepare well in advance when exporting materials and equipments from Japan.
- For the training course in Japan, the approval of Department of Economic Affairs in charge of bilateral cooperation and state chief minister is required, which takes more time and effort for the case of India.

6.3 Conclusion

Karad has a big gap between current status and goals in terms of water supply service indexes. It was found that concrete countermeasures to achieve 24X7 as a political goal of both Maharashtra State and central government are absent and the prerequisites to achieve the goal were set as quite optimistic NRW ratio and per capita supply of water to be reduced to the national benchmarking values. In particular, leakage reduction measure is the most required need by KMC.

Study Team proposed to KMC the model project that sets the theme of leakage reduction by water hammer countermeasure and appropriate pipe maintenance for Rukhmini Nagar as a pilot area. This expects to contribute to the achievement of 24X7 in Karad city through increasing in

water supply amount. KMC, as a counterpart organization to the project, expressed its willingness to request an implementation to Japan and to cooperate when it is succeeded.

Considering the scale and contents of the proposed project, JICA Partnership Program is an appropriate scheme. It is expected to contribute to the achievement of 24X7, which is a political goal of both Maharashtra State and central government, in a wider range of the country through a dissemination of Karad model applying Japanese water work technology to small and medium size towns.

6.4 Prologue

The orientation of proposed project, which is to assist sustainable 24X7 even after a development of water work facilities through leakage reduction and valve control improvement, is the same direction with a current policy of JICA in a water sector. On the other hand, the target of the project, which is a small or medium size local city, is different from that of past Japanese ODAs in a water sector in India.

There exists numbers of small or medium cities similar to Karad in terms of size or water supply system in the whole country. Therefore, a great deal of benefit is expected if the proposed project is disseminated to the other local cities after a success of Karad model.

In order to disseminate the Karad model to the other cities, it is important to raise awareness and deepen an understanding of central and state government with the project, while being implemented. A further cooperation with Indian Water Works Association in the implementation is one of the effective approach to do so.

[References]

Ref-1 Minutes of Meeting with KMC dated on August 5, 2013

Ref-2 Minutes of internal meeting of KMC dated on January 27, 2014

〔Ref-1〕

Minutes of Meeting with KMC dated on August 5, 2013

Minutes of Meeting
held on Aug. 5, 2013 at Conference Room In Karad Municipal Council

The Japanese Expert Team composing of the Joint Venture of Pacific Consultants Co., Ltd., Fujitecom Inc., and Maezawa Industries, Inc., explained its suggestions based on a result of the site survey and number of discussions carried out by the Team with KMC officials from July 29, 2013 to August 2, 2013, indicating the below mentioned components required for improvement of overall Karad water supply system including 24X7 water supply to Rukhmini Nagar Area as a Pilot Project.

Mr. Daigo Takeda, assistant director of the Ministry of Health, Labour and Welfare, Government of Japan (MHLW), Mr. Ikuo Mitake, Senior International Director of Japan Water Works Association, and Mr. Anand Wachasundar from Indian Water Works Association, also participated in the meeting.

1. Installation of better quality and the latest technology valves for securing sustainable 24X7 water supply in the new water supply system being executed by KMC under the UIDSSMT scheme
   1) Installation of automatic operating valves according to water level at each 8 ESRs and 1 MBR
   2) Change of air valves with better quality air valves at New WTP and Super New WTP
   3) Change of defective check valves, air valves, gate valves with better quality valves with the latest technology in order to prevent water hammer effects at inlet pipelines at MBR and 8 ESRs
   4) Providing butterfly valves at some ESRs located closer to MBR to control water outflow so as to maintain required water level at any time in the ESR at the end of water distribution sequence

2. Supplying and installation of consumer water meters in the whole KMC area
   1) Procure and install 15,000 of consumer water meters of required sizes

3. Leakage Reduction in Rukhmini Nagar DMA to decrease the NRW ratio to the Indian National Service Level Benchmark or below 10%
   1) Measuring the minimum flow, by equipping flow meters or sensor devices and carrying the leak detection surveys during the night time
   2) Leakage detection by data logger system LNL-1 and leakage detective devices
   3) Installation of "multi-purpose T-shape pipe fitting", which makes maintenance work, water quality monitoring, pipe flushing, pressure check, air check, monitoring by camera, and fire hydrant facilitation easier

4) On-site technology transfer of leakage detection and water supply maintenance works

4. Technical Training Course in Japan
   1) The curriculum and training for leakage control
   2) The training for installation and operation of flow control equipments
   3) The curriculum for effective water distribution control activities

The Team explained that details of the proposal will be worked out based on the agreement in principle by KMC authorities.

The KMC authorities agreed in principle to above recommendations and suggested the Japanese Team to work out detailed proposal including cost implications. They also expressed the probable financial constraints from their side for implementation of the recommendation.

It was agreed that, in order to implement above mentioned suggestions of the Japanese Expert Team, both the Indian and Japanese sides should put their best efforts to seek the ways to ease technical and financial constraints through continuous communications between each other through Mr. Anand Wachasundar, being coordinating officer for this project. Both sides will confirm in this regard by January, 2014.

Mrs. Amita DAGDE
Chief Officer
Karad Municipal Council

Mrs. Uma Uday HINGMIRE
President
Karad Municipal Council

Mr. Tatsuo MORIMOTO
Pacific Consultants Co., Ltd.
Japanese Expert Team Leader

Mr. Anand WACHASUNDAR
Indian Water Works Association

Mr. Ikuo MITAKE
Senior International Director
Japan Water Works Association

In presence of

Mr. Subhash PATIL
Standing Committee Member
Ruling Party President
Karad Municipal Council

Mr. Daigo TAKEDA
Assistant Director
Ministry of Health, Labour and Welfare,
Government of Japan

〔Ref-2〕

Minutes of internal meeting of KMC dated on January 27, 2014

Minutes of Meeting held on 27th January 2014 at karad

Participants – 1) Hon. Mrs. Uma Hingmire - President KMC 2) Mr. Subhash Patil – Hon. Standing Committee Member, Ruling Party President 3) Mr. Prashant Rode – Chief Officer, KMC 4) Mr. Vijay Tevare 5) Mr. Suhas Inamdar 6) Mr. Sunil Basugade 7) Mr. Anand Wachasundar, IWWA, Co-Ordinating Officer

Reffrence - Minutes of Meeting dt. 5th Aug. 2013 held at Karad. and Minutes of Meeting dated 18th January 2014

As agreed in the Minutes of Meeting dt. 5th Aug. 2013, Mr. Anand Wachasundar, Member, IWWA Co-Ordinating Officer for the karad water supply project, explained the KMC authorities the developments from Japanese side subsequent to the meeting dt. 5th Aug. 2013 as informed to him by Mr. Ikuo Mitake, Senior International Director of Japan Water Works Association on 18th January 2014.

The KMC authorities expressed their gratitude for the efforts made by the Japanese team in conducting number of meetings with related organization for Grant AID from Ministry of Foreign Affaire, Japan. / JICA budget for the studies/pilot project etc. They also were thankful to Ministry of Health, Labour and Welfare of Japan for their strong commitment to the joint venture of Japanese experts to support Karad Project. KMC felt confident to improve the water supply service levels with the positive support from Japanese side to overcome their financial hurdles.

As already elaborated at point at sr. no. 3 of the Minutes of Meeting dt. 5th Aug. 2013, the KMC authorities confirmed the proposal of JICA side of taking up leak reduction measures in Rukmininagar DMA as pilot project to achieve 24×7 water supply in Rukmininagar DMA on completion of new water supply scheme taken up by KMC under UIDSSMT

The KMC authorities agreed in principal the technical details indicated by the Japanese team, as stated in minutes of meeting 18th January 2014. They however they inform that the numbers of consumer meters in Rukmininagar DMA is about 700 No. However they stated that target of **24 × 7** water supply to pilot area should be achieved as a end result.

The KMC authorities noted that the detailed cost estimation are being prepared by the Japanese team based on the indicated broad technical parameters and in case JICA assistance not found sufficient, KMC will have to supplement the same to complete the

pilot project. In response this KMC agreed to cater for supply & installation of domestic water meters. and carrying out all the leak repair work. They also agreed for providing workmen required for pilot area works. They desire the time frame for implementation of the project.

The KMC authority confirmed their collaboration willingness with Japanese team & commitment for project.

Mr..Sunil Basugade.
M.J.P. P.M.C. Karad.

Mr. Suhas Inamdar,
Mech. Engineer,
KMC, Karad.

Mr. Vijay Tevare
Sanitary Engineer,
KMC, Karad.

Mr. Prashant Rode,
Chief Officer,
KMC, Karad.

Mrs. Leena Thoravade
Chairman,
Water Supply & Sewrage Committee,
KMC, Karad.

Mrs. Uma Hingmire,
President,
KMC, Karad.

Mr. Anand Wachasundar,
IWWA, Co-Ordinating Officer

Mr. Subhash Patil,
Hon. Standing Committee Member,
Ruling Party President