2-2-2-3 Water Transmission and Distribution Facilities

(1) Service Areas

In addition to the existing Saateni service area and Welezo service area, a new reservoir will be constructed in Dole at 100 m elevation in order to supply water to the north area, which includes Bububu area which is to be a new site for the government offices and experiences rapid population growth. This area will be called Dole Service area.

For south and east parts of the study area, in order to facilitate water supply to Urban Extension area whose population is growing rapidly, a new reservoir is proposed. The location of the reservoir is Kinuni area at the east of Urban area near the proposed new wells to be constructed in the central area, avoiding possible salinization of wells mainly observed in south area. This Kinuni Service area also includes area served by the existing Mbweni and Magogoni wells and the Dimani spring. Those service areas are shown in Figure 2-4.

Daily maximum demand and population for the above service areas in year 2010 are shown in Table 2-21. Those service areas are further divided into the 19 zones according to the land uses in order to analyze water demand in details.

Table 2-21 Daily Maximum Demand and Population for Service Area

Zone No.	Total Demand (Daily Max.) m^3/day	SAATENI Service Area m^3/day	WELEZO Service Area m^3/day	DOLE Service Area m^3/day	KINUNI Service Area m^3/day
Urban					
1	1,894	1,894			
2	3,343	3,343			
3	4,324	4,324			
4	2,507	1,504	1,003		
5	4,197	1,049	3,148		
6	6,344		6,344		
7	8,004		8,004		
8	6,537		6,537		
Urban Ext.					
9	3,950		1,707	2,243	
10	3,030		2,730		300
11	6,399				6,399
12	521				521
Peri-Urban					
13	369			369	
14	583			583	
15	234			234	
16	793		793		
17	474				474
18	461				461
19	117				117
Total	**54,080**	**12,115**	**30,265**	**3,428**	**8,272**
Service Population	**457,330**	**74,781**	**256,675**	**18,213**	**107,661**

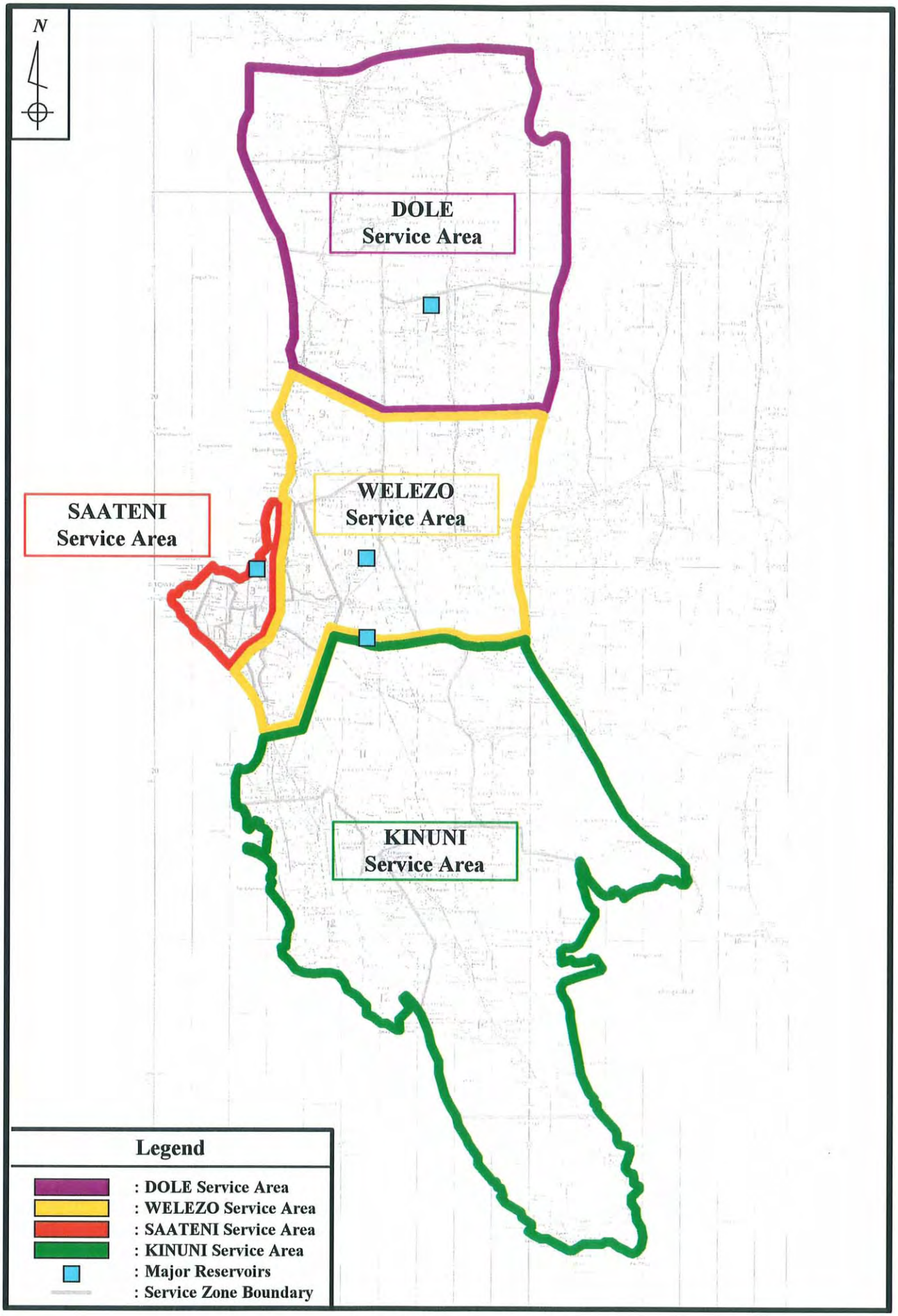

Figure 2-4 Service Areas

(2) Transmission Pipeline Plan

1) Development Strategy for Transmission Pipeline

Transmission pipes will be laid mainly in the existing roads to facilitate maintenance works. Diameters of the pipelines are designed to maintain flow velocity around 1 m/s in order to prevent excessive head losses. Badly damaged existing transmission pipeline from Chunga wells to Welezo reservoirs will be replaced to prevent water losses. The flow from those wells will be lead to the new Kinuni reservoirs. The part of this pipeline will also be used by the new wells.

2) Transmission Pipeline Plan

The proposed transmission pipelines from the proposed wells to the reservoirs are shown in Figure 2-5. Length of transmission pipelines is shown in Table 2-22 according to the service areas.

Table 2-22 Length and Diameter of Transmission Pipelines (m)

Service Area		SAATENI	WELEZO	KINUNI	DOLE	Total
Diameter	**Material**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**
150	DI	0	2,000	1,300	700	4,000
200	DI	0	1,900	500	3,800	6,200
250	DI	0	2,500	0	0	2,500
300	DI	0	2,300	2,700	0	5,000
400	DI	0	2,100	2,000	0	4,100
600	DI	0	2,200	0	0	2,200
Total Length		**0**	**13,000**	**6,500**	**4,500**	**24,000**

3) Additional Facilities for Transmission Pipelines

The following additional facilities for transmission pipelines will be constructed.

a) Intermediate Sluice Valve

For maintenance works of well pumps and transmission pipelines, emergency valve operation for cross-boundary water supply, sluice valves will be installed.

b) Air Valves

Transmission pipeline routes have some ups and downs. Air valves will be installed at summits of pipelines before and after invert crossing of underground structure such as culverts to release air automatically and prevent air binding and pressure build-up.

c) Drain Pipes

In order to remove debris left in pipelines after pipe and well pump maintenance works, drainpipes will be installed to the transmission pipelines. Drainpipes will be located at the near end of the pipelines and at the rivers and channels.

d) Appurtenances

Other fittings connect with the existing pipes.

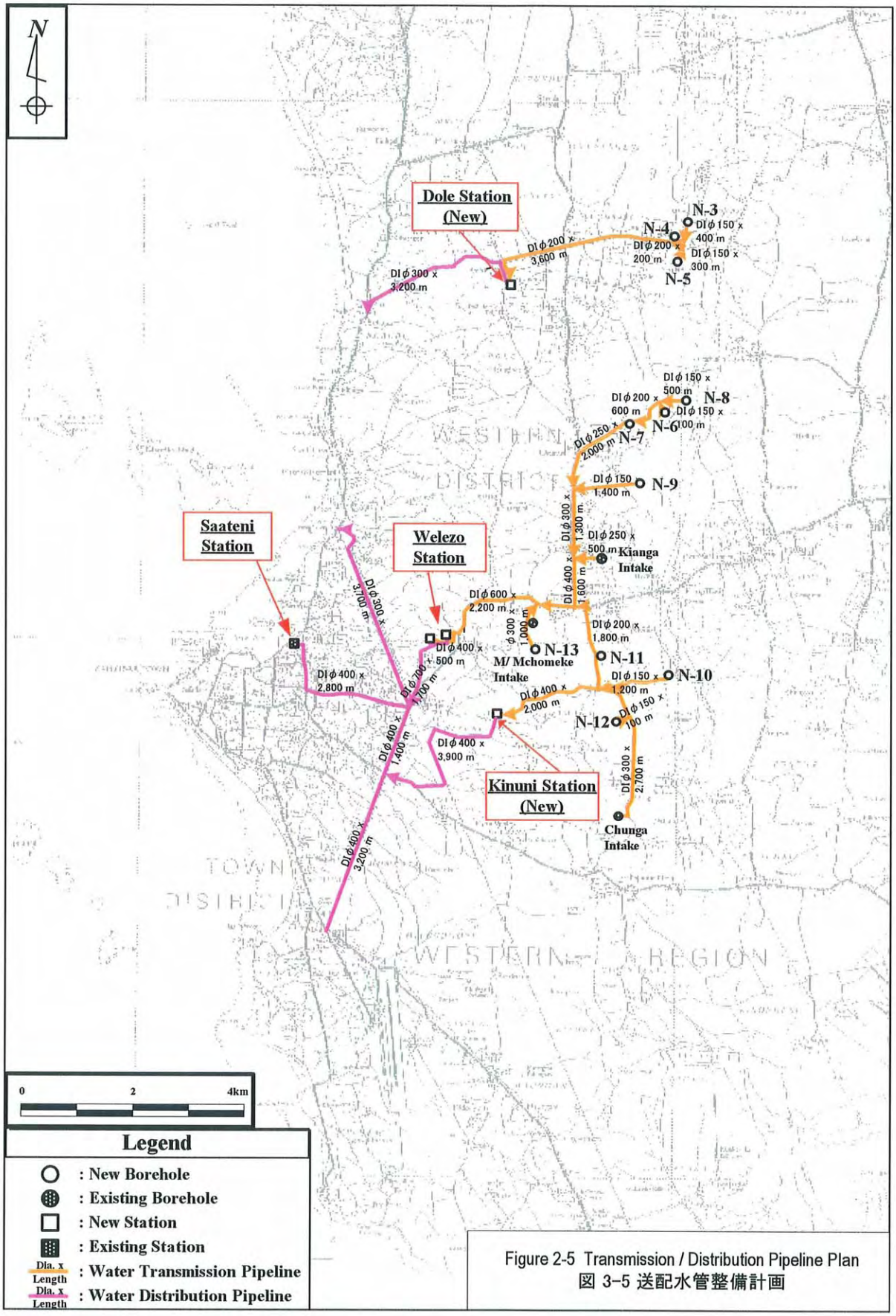

Figure 2-5 Transmission / Distribution Pipeline Plan
図 3-5 送配水管整備計画

(3) Water Reservoir Plan

1) Development Strategy for Reservoirs

Reservoir development plan is prepared based on the FINNIDA master plan (1991). The reservoirs are designed for the following purposes.

a) Attenuate Diurnal Fluctuation of Water Demand

Reservoir capacity required to attenuate diurnal fluctuation of water demands is 17.5% of daily water demand (FINNIDA Master Plan).

b) Uninterrupted Water Supply during Pump stops due to Power Failures

17.5% of daily water demand will be stored in the reservoirs in order to secure uninterrupted water supply during 3 hours pump stops during the peak hours (FINNIDA Master Plan).

c) Storage required for Fire Flow Demand

Reservoir capacity required for specifically fire fighting is 1% of daily demand (FINNIDA Master Plan).

The required reservoir capacity, the sum of the above 3 items, is 36%, equivalent to 8.6 hours of daily water demand.

2) Reservoir Plan

New reservoirs are proposed to secure 8.6 hours of daily demand in each service area. The proposed reservoirs are shown in Table 2-23.

Table 2-23 Proposed Reservoirs

Service Area		Dole	Welezo	Saateni	Kinuni	Remarks
Daily Maximum Flow	m^3/d	3,428	30,265	12,115	8,272	
Required Reservoir Volume (A)	m^3	1,228	10,845	4,341	2,964	=Qday.max.x8.6/24 (8.6hrs 分)
Existing Reservoirs (B)	m^3	(40x2)*	2,250x1 420x1 120x1(Begamoja)	2,250x1 1,000x2 90x1(Mbao)	250x1(Dimani)	
	Total		2,790	4,340	250	
Balance	m^3	1,228	8,055	1	2,714	=A-B
Proposed Reservoirs		**1,200m^3x1**	**4,000m^3x2**	**Not required**	**2,700m^3x1**	

Note) ＊: The existing reservoir is designed for the vocational school and hospitals.

3) Necessity of Elevated Tanks

After the implementation of the proposed project, Saateni service area will be served through two elevated reservoirs. In order to secure continuous water supply during power failures, elevated tanks shall store 2 - 3 hours of daily demand.

Daily Average Demand of SAATENI Service Area = Daily Maximum Demand x 1/1.35＝12,115/1.35＝8,974 m^3/d

Required elevated tank capacity = 8,974 x (2~3) hours / 24 = 748～1,121m^3

・Existing elevated tank = 450m^3 x 2 = 900m^3 ＞ 748m^3 (2 hours of daily average demand)

Thus, new-elevated tanks are not required.

4）Transmission Pump Plan (Saateni Service Area)

Deteriorated transmission pumps from the ground and underground tanks to the elevated tanks in Saateni Station will be renewed under this project. Pump capacity is calculated as follows.

・ Design Flow:

Hourly Maximum Flow = Daily Maximum Flow x 1.2 = 12,115m^3/d x 1.2 = 14,538m^3/d

・ Pump Configuration

Configuration will be same as the existing pumps.

Small pumps: 1 operation + 1 stand-by, Large pumps: 1 operation + 1 stand-by

・ Pump Sizing

200m^3/hr x 2 (include 1 stand-by)

400m^3/hr x 2 (include 1 stand-by)

5）Disinfection Facilities

Every reservoir will have disinfection facilities to disinfect drinking water.

・Disinfection type: Solution of powder disinfectant / drip dosing method

(The same method being used at the Saateni Station)

・Application: At the inlet of each reservoir

6）Additional Facilities for Reservoirs

The following facilities will be provided for the proposed reservoirs.

a) Water Level Meters

One water level meters will be installed to each reservoirs for efficient reservoir operation.

7) Proposed Reservoir Facilities

Table 2-24 Proposed Reservoir Facilities

Item	Specification	Number		Remarks
		Phase1	Phase2	
Saateni Station				
[Mechanical Equipment]				Renewal
Transmission Pumps	Horizontal Bidirectional Centrifugal Pump 400m3/hr x 40m x 75kW 200m3/hr x 40m x 45kW	 2 units 2 units		 Include 1 stand-by Include 1 stand-by
Pipes and Valves for Pumps	Discharge pipes, valves, flow meters, mechanical water level meter	1 set		
Disinfection Facility	Powder Disinfectant Solution Tank/Drip	1set		
[Electrical Equipment]				Renewal
Instrumentation Panel	Indoor Steel Wall-mounted Type (Arrestor preinstalled)	1 unit		
Low Voltage Panel	Indoor Steel Wall-mounted Type (Arrestor preinstalled)	1 unit		
Transmission Pump Control Panel 1	Indoor Steel Wall-mounted Type 75kW with auto-trans starter	2 units		
Transmission Pump Control Panel 2	Indoor Steel Wall-mounted Type 45kW Star-delta starter	2 units		
Level Sensor	Float type	5 sets		Reservoir, elevated tank level detection
Power and Instrumentation Cables		1 set		
[Civil and Architectural]				
Roof for Pump House		1 set		Renewal
Welezo Station				
[Civil and Architectural]				
Reservoir	Volume: 4,000m^3	2		New
Structure	Reinforced Concrete			
Dimensions	22.5 mW x 17.2 m L x 5 m H x 2 tanks			
High / Low Water Level	74.9m/69.9 m (elevation)			
[Mech. / Elect. Equipment]				
Disinfection Facility	Powder Disinfectant Solution Tank/Drip	1set		New
Kinuni Station				
[Civil and Architectural]				
Reservoir	Volume: 2,700m^3		1unit	New
Structure	Reinforced Concrete			
Dimensions	22.5 mW x 12.5 m L x 5 m H x 2 tanks			
High / Low Water Level	55.0m/50.0 m (elevation)			
[Mech. / Elect. Equipment]				
Disinfection Facility	Powder Disinfectant Solution Tank/Drip		1set	New
Dole Station				
[Civil and Architectural]				
Reservoir	Volume: 1,200m^3		1 unit	New
Structure	Reinforced Concrete			
Dimensions	14.6 mW x 8.9 m L x 5 m H x 2 tanks			
High / Low Water Level	103.7m/98.7 m			
[Mech. / Elect. Equipment]				
Disinfection Facility	Powder Disinfectant Solution Tank/Drip		1set	New

(4) Distribution Pipeline Plan

1) Development Strategy for Distribution Pipelines

Through the preliminary study and the site survey of this study, the areas that experience water supply disruptions are investigated and shown in Figure 2-6. While the most of the problem areas are within the Welezo service area, Saateni service area also has low-pressure area. Thus even in the Zanzibar Urban area, the existing pipes laid from 1950's to 1970's do not have sufficient capacities.

In order to solve the above problems, different strategies were developed for Urban area and Urban Extension/Peri-Urban area.

① Urban Area (SAATENI Service Area, A Part of WELEZO Service Area)

Urban area, which includes the Stone Town, is a built-up area with the fixed land use plan. Its future population growth is relatively small. Proposed distribution pipelines (main pipes) are designed to achieve the minimum water pressure of 5-meter water head.

② Urban Extension/Peri-Urban Area (WELEZO Service Area, DOLE Service Area, KINUNI Service Area)

Most of this area does not have fixed land use plan and future distribution of its population is not clear. Thus only minimum distribution pipelines (main pipes) enabling distribution of increased water production from the proposed wells are proposed for this area.

2) Distribution Pipeline Plan

Proposed distribution pipelines following the above strategy are shown in Figure 2-5. Lack of proper pipe replacement plan encouraged duplicated small diameter pipelines in the some routes in order to meet the increasing water demand. Those pipes are regarded as minor distribution pipes, which house connections are directly tapped into. The proposed distribution pipelines will form trunk distribution pipelines, whose role is to supply sufficient water as well as to maintain the minimum water pressure in Urban area. The proposed pipelines will be connected to the existing minor distribution pipelines at appropriate intervals. House connections will not be tapped directly into the proposed pipelines.

The proposed pipeline replaces the existing asbestos cement pipeline from Welezo station to Saateni Station. The most of the other existing pipelines will be used even after the completion of the proposed project since house connections are tapped into those pipes. The total length of the existing pipes to be abandoned after the project completion is estimated to be 3 km, 1.5% of the total length of the existing distribution pipelines.

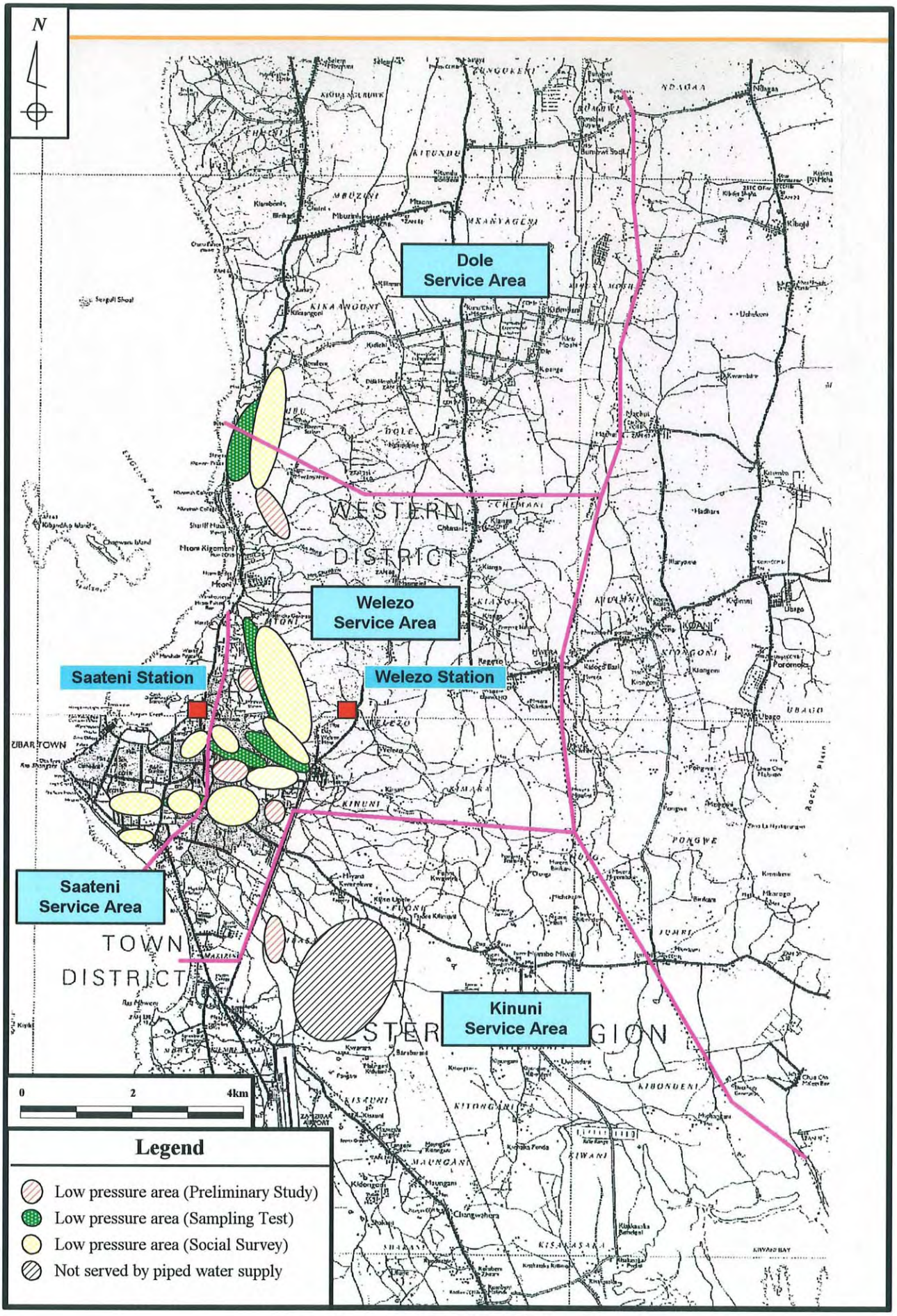

Figure 2-6 Areas with Service Disruptions

Length of the proposed distribution pipelines is shown in the Table 2-25.

Table 2-25 Length of Proposed Distribution Pipeline (m)

Service Area		SAATENI	WELEZO	KINUNI	DOLE	Total
Diameter	**Material**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**
200	PVC	0	0	0	0	0
250	PVC	0	0	0	0	0
300	DI	0	3,700	0	3,200	6,900
400	DI	0	4,200	7,100	0	11,300
700	DI	0	1,700	0	0	1,700
Total Length		**0**	**9,600**	**7,100**	**3,200**	**19,900**

3) Results of Water Supply System Simulation

In order to analyze problems of the existing water supply systems and to confirm the proposed pipelines rectify the problems in the most efficient manner, computer simulation of the existing and the future water supply systems are developed using EPANET as a simulation program. The results of the simulation of the existing system at the morning peak-demand hour are shown in Figure 2-7. Red nodes in the Figure show the points with no water pressure, thus experiencing supply disruption. Distribution of the red nodes overlaps that of service disruption area shown in Figure 2-6.

The simulation results of the future water supply system in 2010 are shown in Figure 2-8. Even at the peak-demand hour, the minimum water pressure (5m) is achieved in the Urban area. Most of the Urban Extension/Peri-Urban area will enjoy the improved water pressure during the peak-hours, thus service disruption will be minimized.

4) Additional Facility for Distribution Pipelines

a) Sluice Valve

Sluice valves will be installed at the pipe junctions, connection pipes to the existing pipelines, etc. to facilitate maintenance works of the distribution pipelines.

b) Flow Meters

In order to appropriate water distribution, flow meters will be installed mainly at the outlets of the reservoirs.

c) Pressure Reducing Valves

Pressure reducing valves will be introduced to control water pressure in the low elevation sections of Welezo and Dole service areas, which have reservoirs at the high elevations. The pressure reducing valves will be placed on the proposed distribution pipeline maintaining the water pressure less than 60 m.

d) Drain Pipes

In order to remove debris left in pipelines after pipe maintenance works, drainpipes will be installed to the distribution pipelines. Drainpipes will be located at the near end of the pipelines and at the rivers and channels.

e) Appurtenances

Other fittings connect with the existing pipes.

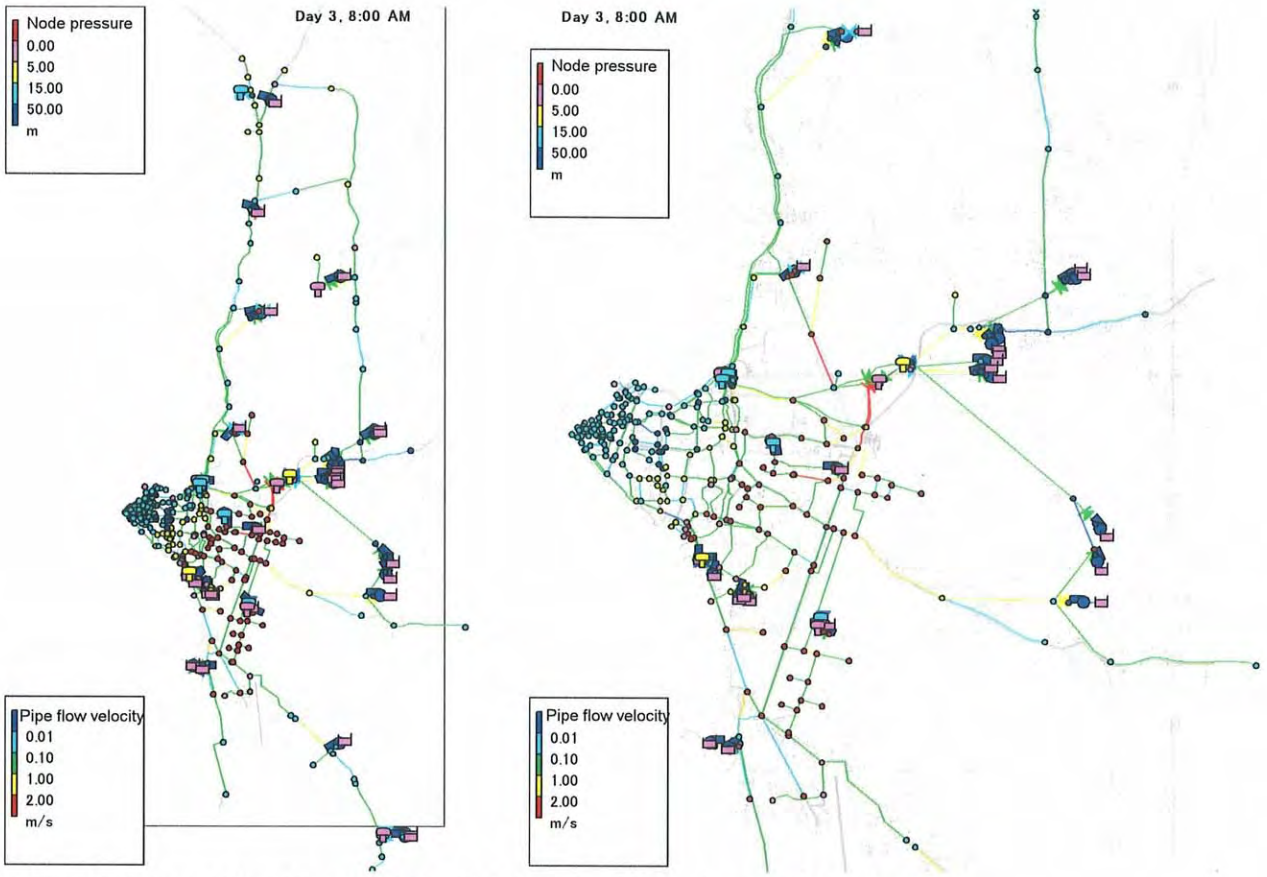

Figure 2-7 Simulation Results of the Existing Pipe Network (Peak Hour in 2004)

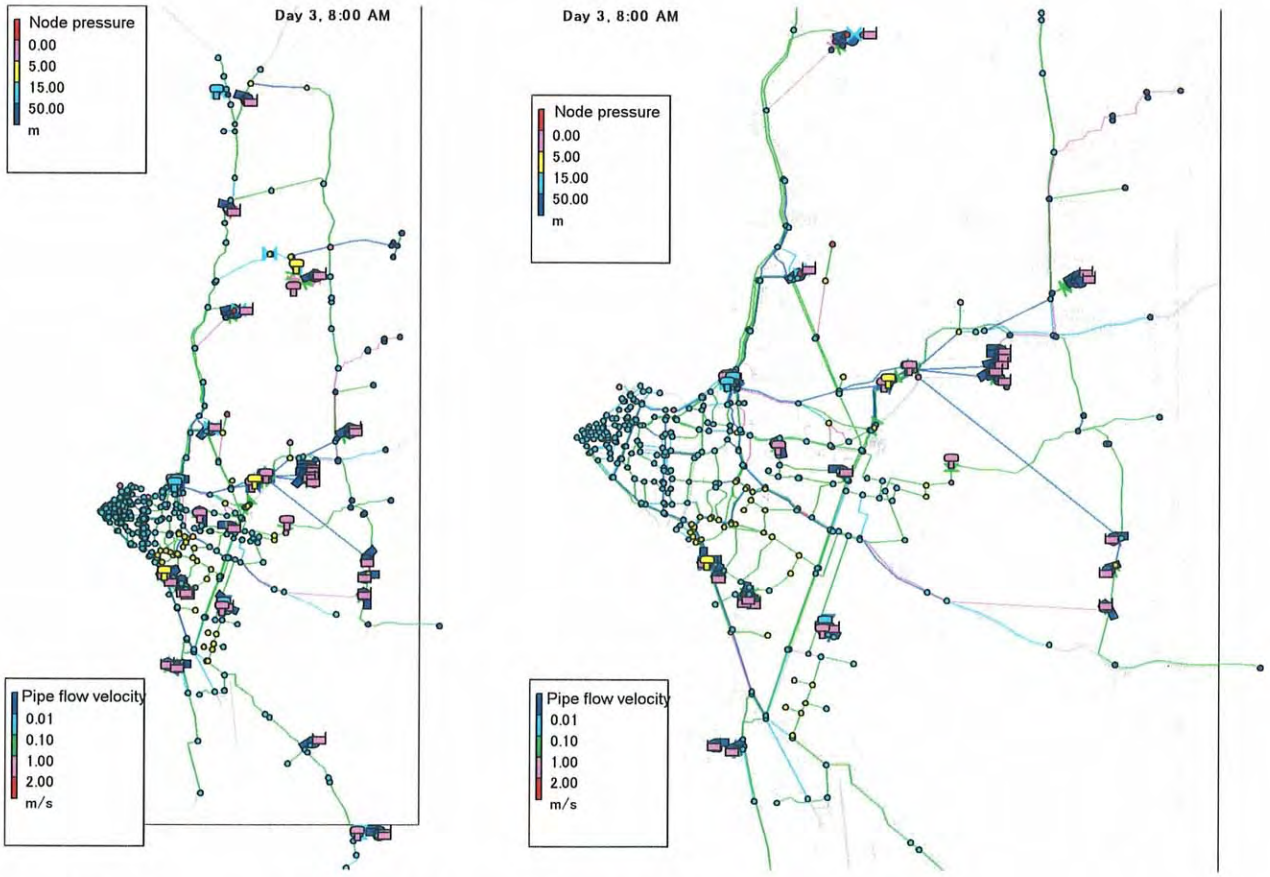

Figure 2-8 Simulation Results of the Future Pipe Network (Peak Hour in 2010)

5) Proposed Facilities for Distribution Pipelines

Table 2-26 Proposed Facilities for Distribution Pipelines

Item	Specification	Number		Remarks
		Phase1	Phase2	
[Civil Facilities]				
Flow Meters	Axial-flow Propeller Type			New
	Dole Service Area: ϕ 300	-	1 set	
	Welezo Service Area: ϕ 300	1 set	-	
	Welezo Service Area: ϕ 400	3 sets	-	1 set to be installed at connection pipe to Saateni elevated tanks.
	Saateni Service Area: ϕ 300	2sets	-	
	Kinuni Service Area: ϕ 400	-	1set	
Pressure Reducing Valves	Automatic Water-Pressure Driven Type			New
	Dole Service Area: ϕ 200	-	1 set	
	Welezo Service Area: ϕ 500	1 set	-	

2-2-2-4 Equipment Procurement Plan

Among the requested water quality laboratory equipment and maintenance equipment, DWD emphasized that urgent need for four pickup trucks. The study team evaluated this need and found out that DWD needs 3.5 – 4.8 trucks for routine operation and maintenance works, 1 truck for non-routine works. Thus, procurement of four trucks is regarded as a high priority. But these vehicles are excluded from this project because of the Japanese Government's ODA Policy.

	Purpose	Department	Work load/Manpower	Required trucks
1	Pump Maintenance	Plant and Mechanics	The existing well pumps - 27: After completion of this project - 38 Manpower: 250, Manpower working in the study area is 41.	*1) 38 trucks x 1/6 = 6.2 /month 6.3 trucks/month/21.4 = 0.3 trucks Required trucks: 0.3
2	Chemical Transportation, Water Quality Sampling	Water resources	The existing reservoirs: 2, After completion of the project - 4 Manpower: 77, Manpower working in the study area is 5.	*2) Chemical Transportation: 2 days/week Sampling: 1 day/week Required trucks: 0.6
3	Pipeline Maintenance	Water Supply	Length of the existing pipelines: 230km 126 pipe repair works in 9 month (2004): 14 repairs/month Manpower: 88, Manpower working in the study area is 26.	*3) 14 repairs/month x 2 x (2 - 3) /21.4 = 2.6 - 3.9 Required trucks: 2.6 - 3.9
4	Facility Maintenance	Planning & Design / Administration	Planning/Design: 7 + Administration: 37	*4) No routine works (Required trucks: 1)
Total				3.5～4.8 + (1)

*1) Pump requires maintenance works once in 6 months.
38 x 1/6 ＝ 6.3 pumps/month
Pump maintenance works consist of taking-out (1 hour), re-installation (1 hour), and transportation (1 hour). Within the working hours (8 hours/day), actual operation hours for truck is 4 hours/day, thus using one truck, DWD maintain one pump in a day. Saturday and Sunday are off for the government agencies; working days are 30 day/month x 5/7 = 21.4 days.
6.3 trucks/month/ 21.4 = 0.3 trucks are required.

*2) Chemical Transportation is required once per every week for each reservoir.
Within one day, one truck loads, unloads and transports disinfection chemical for 2 reservoirs. It will take 2 days per week for 4 reservoirs.)
Drinking water sampling at the reservoirs could be done at the time of chemical loading and unloading. Sampling at wells and springs in the region could be done in one day per week.
Thus 0.6 trucks are required. (3 days per week (5days))

*3) Pipeline repairs were done at average 14 locations/month in 2004. Repair of one pipe damage will take 2 – 3 days in average. (source: DWD workshop) It does take 2 trucks for 2 - 3 days for transportation of engineers, labours, materials and tools in order to repair one pipe break, the required trucks are 14 x 2 x (2 - 3)/21.4 = 2.6 - 3.9 trucks.

*4) Although facility maintenance works does not have clear routine works, design of pipeline extension, regional water resource management, and customer service (attending complains) do require one truck.

2-3 Obligation of Recipient Country

The Tanzania Government and DWD will undertake the works described in Section 2-4-3 for the completion of the project. Those works are listed below in details.

a.	Land Acquisition	Reservoirs	4
		New Wells	11
		Transmission/Distribution Pipelines	
b.	Fencing	Reservoirs	4
		New Wells	11
c.	Power Lines for	New Wells	11
		Reservoirs (Welezo, Kinuni, Dole)	4
d.	Disposal of replaced existing pumps		4 sets

2-4 Project Operation Plan

The Government of Zanzibar has plans to establish ZAWA as an autonomous body for executing water policy and acts that were past in the House of Representatives. Regardless whether ZAWA is established or not, the following O&M staff increases are necessary for this projects operation and maintenance of the newly constructed facilities. Proposed organization chart of Zanzibar Water Authority (ZAWA) by Zanzibar side is shown in Appendix 8.

2-4-1 Organization Strengthening Plan

Table 2-33shows a brief summary of support expected from donors including the strengthening capacity on revenue collection supported, soft components of this projects and other suggested support from donor agencies. Details shown in Table 2-34 focus on recommendations and suggestions for present organizational situation of DWD and expected function for ZAWA that is planned to be established in the near future.

The soft component of this project aims to support ZAWA's sound operation and management of the new water supply facilities by providing basic management, technical knowledge and skills as well as promoting the necessity of a safe water supply to people in Zanzibar. This could also contribute to ZAWA's financial stability by increasing income from water tariffs. This soft component does not replace any support from any other donor agencies.

Table 2-33 Summary of Organization Strengthening

	Soft Component	**Required Future Strengthening**
(1) Organization Design and establishment of the organization for water supply		
Autonomy		YES
Organizational set up		
Development of operation manual and operation manual based staff training		YES
Transfer of HR to ZAWA and recruitment of staff		
Capacity development	YES	YES
Transfer to ZAWA		
Operation and Management of ZAWA		
(2) Strengthening of Management Capability		
Management information system		YES
Management capability	Transfer basic knowledge	YES
Human Resources Planning	Transfer basic knowledge	YES
Internal Training	Provide training material	
OJT from other water supply system in Tanzania		
(3) Strengthening of Accounting and Financial Management Capability		
ue increase		
Cost reduction		
Strengthening accounting capability	Transfer basic knowledge	YES
(4) Strengthening of Customer Services capability		
Water charge rate structure		YES
Strengthening revenue collection capability		YES
Water meter		YES
Develop branch office and customer services unit		
Promotion of public hygiene and water supply system	Transfer basic knowledge	YES

Table 2-34 Present Situation and Recommendations of Organization Strengthening for DWD and ZAWA

Item	Present situation	Future	Recommendation	Support from this Project
(1) Organization Design and establishment of the organization for water supply				
Autonomy	DWD is one department in the Ministry of Water, Construction, Energy and Land. Therefore, DWD does not have much empowerment.	ZAWA, autonomous body for executing water supply policy has been established and manages the water supply system with cost recovery policy.	Establishment of ZAWA by an Act to Provide for the Establishment of Water Management Authority in Zanzibar and Other Matters Connected Therewith.	n.a.
Organizational set up	Present executing organization structure of DWD is engineering oriented for focus on operation and maintenance of water supply system. However, ZAWA is required to manage with cost recovery policy. It may need to strengthen function of customer services as well as business administration.	Established executing organizational structure for executing all necessary activities within the organization. Strengthening customer services function is very important in order to earn enough income to cover all necessary expenditures to keep operation and maintenance of water supply system.	The Government of Zanzibar should maintain establishment of ZAWA and hire necessary staff. However, it is recommendable to provide some advisory service support by senior consultant in the preparation of the operation manual, rules and regulation for staff and other organizational strengthening.	n.a.
Development of operation manual and operation manual based staff training	Presently operation manual are not prepared and also not conduced manual based internal training for standardize the quality of operation	Operational manual are developed and conduct internal training based with operation manual for standardize the quality of work	The soft component of this project will provide operation manual on new facility. It is recommendable to get support from other donors for developing other operation manual and conduct training based on that operation manual.	Partly Yes
Transfer of HR to ZAWA and recruitment of staff	Staff is working as government staff	It could be different salary and wages structure as staff of ZAWA	n.a.	n.a.
Capacity development	DWD does not conduct much staff training because of limited budget. Mainly they use external training sponsored by foreign donor agencies.	Conduct more internal training or OJT cooperation with other water supply authority in Tanzania.	The soft component of this project will conduct training for engineers and management regarding improving total efficiency of facility system operations, and basic knowledge and skill for senior management officer for managing their organization more effectively. However, it is recommended to dispatch senior advisor and transfer knowledge and technology for managing water supply system including inventory of necessary skills and knowledge.	Partly YES
Transform from DWD to ZAWA		ZAWA will select necessary staff from	The Government of Zanzibar should	n.a.

Item	Present situation	Future	Recommendation	Support from this Project
		present DWD staff and hire other staff. After establishment of executing organization and transfer of facilities, ZAWA start managing water supply.	maintain establishment of ZAWA and hire necessary staff or transfer staff from DWD to ZAWA. However, it is recommended to dispatch senior advisor and provide advises for administration area including evaluation of fixed assets and necessary qualification for staff.	
Operation and Management of ZAWA			It is recommended to dispatch senior advisor and provide skill and technology transfer of water supply system management.	n.a.
(2) Business administration				
Management information system	Senior and middle management are not required integrated management information presently for they can only manage activities as rules and regulation in the ministry.	Senior and middle management required to maintain all necessary activity within revenue and will be required to make total decision-making based on integrated management information.	The soft component of this project will provide technique of decision making based on MIS: Management Information System in the senior management-training course.	Partly YES
Management capability	Senior and middle management are not required professional management skills and knowledge presently. They only requested to manage activities within the budget.	Both senior and middle manager will require professional skills and knowledge.	The soft component of this project will provide basic skills and knowledge in the senior management-training course.	Partly YES
Human Resources Planning	DWD does not have or required human resources management plan based on the business plan.	ZAWA will need to formulate human resources management plan based on the business plan.	The soft component of this project will provide basic human resources management knowledge in the senior management-training course.	Partly YES
Internal Training	DWD do not conduct training because of budget constraints. They mostly use external training when donors offer training courses.	Recommend conducting internal training program, OJT and job rotation based on the human resources management plan.	This soft component program will provide training material for internal training	n.a.
OJT from other water supply system in Tanzania	In this kind of training and support is not much done	Cooperation between water supply systems in mainland and Zanzibar, including staff of ZAWA have OJT at water supply authority in Tanzania, or visa versa.	It is recommendable to build cooperative relation to have workshop or seminar and then exchange staff for OJT and other cooperation.	n.a.
(3) Accounting and Financial				
Revenue increase	Present revenue from	ZAWA must collect	It is recommended to	n.a.

Item	Present situation	Future	Recommendation	Support from this Project
	water sales covers less than 15% of necessary expenditure because DWD does not collect water tariff from household users.	water tariff from sufficient number of household users. Also, they may consider increasing the water tariff rate to recover costs in the future.	dispatch senior experts in the future to advise about change in water tariff structure to make cost recovery.	
Cost reduction	DWD does not have a cost reduction plan. They only care to manage within the budget as a governmental organization.	ZAWA must maintain operation within revenue. It may require cost reduction for less necessary activities as well as keeping the necessary budget for all necessary activities.	The soft component of this project will provide basic knowledge about cost analysis. However, it is recommended to dispatch senior advisor for technical transfer of cost analysis and financial management.	Partly YES
Strengthening of accounting capability	DWD do not require many skills on accounting and financial management presently.	ZAWA required doing all activities of accounting and financial management including bookkeeping, financial reporting, cost analysis and financial planning.	The soft component of this project will provide basic knowledge about accounting and financial management. However, it is recommended to provide accounting software package and computers.	Partly YES
(4) Water Tariff Structure and customer services				
Water charge structure	It is insufficient not to collect water tariff from household users.	It is recommended that ZAWA decide water tariff level and structure to cost recovery of water supply.	It is recommended to dispatch senior experts to advise about changing water tariff structure to ensure cost recovery.	n.a
Strengthening revenue collection capability	DWD does not collect water tariff from household users.	ZAWA should collect water tariff from household users.	This soft component program does not cover this issue directly. Project for strengthening the revenue collection capability of ZAWA is recommended.	n.a
Water meter	Very few water meters are attached presently.	Attaching water meters to every customer is recommended to establish accountability and equality.	This project does not have a plan to provide water meters. However, attaching water meters is recommended. Projects providing water meter to ZAWA is recommended.	n.a
Develop branch office and customer services unit	DWD does not have a sufficient number of staff for revenue collection from household users, presently.	ZAWA should prepare a stronger revenue collection structure including regional offices, increase the customer services staff, and establish a revenue collection unit from household users.	This soft component program does not cover this issue.	n.a
Promotion of public hygiene and water supply system	DWD does not conduct either public education for hygiene or the promotion of clean water supply.	ZAWA should conduct public education and promotion of water supply in cooperation of the Ministry of health and related government organizations.	The soft component of this project will offer workshops on public education and promotion of a clean water supply through the introduction of cases and experiences of another countries.	Partly YES

n.a.: Not Applicable

(1) Recommendations on institutional issues

Explained necessary improvement activity and recommendable supports from donors for operate ZAWA as autonomous body of water supply system after success from DWD.

1) Organization (organizational structure, roles and responsibility)

New organization of ZAWA has three departments namely, engineering, customer service and finance. Customer service department has important roles and responsibility on this new organization. Therefore, it should be determined more clearly about required skills, roles and responsibilities of customer services on job description, rules and regulation, and job manual. It is recommendable to get technical transfer from donor for development of job description to determine required skills, to determine roles and responsibility on rules and regulation, and to determine what to do and how to do on job manual.

2) Development of job manual and training based on job manual for standardization of job quality

It is necessary to develop job manuals and conduct staff training based on the job manual for standardizing and keep consistency of jobs. ZAWA should develop several rules and regulations including:

- Rules and Regulation of ZAWA Staff (job description, award and punishment, etc.)
- Manual of Human Resources Management (recruiting, promotion, performance evaluation, and training)
- Accounting and Financial Management Manual (budgeting guideline, budget control guideline, accounting policy, accounting manual, etc.)
- Procurement guideline (procurement guideline, stock control manual, bidding guideline, etc.)
- Facility Operation and Maintenance Manual
- Customer Service Manual (Meter Reading, Billing, Collection, Connection, Management of Customer Complains, etc.)
- Promotion Hygiene to Public Guideline

ZAWA should build branch offices for collect water charges from household customer widely on Zanzibar. Keep consistency of quality and activity among branch offices and head quarter is important and this is why training based on the job manual is necessary. It is recommendable to get technical transfer from donor for development of manuals and conduction of job manual based training to standardize quality and manage consistency of activities.

3) Strengthening capacity after establishment of ZAWA

It may obvious as management and staff must face with so many new issues and problems after establishment of ZAWA and manage as autonomous body with full cost recovery policy. It is recommendable to get management advisory support from donor to strengthening management capability after establishing ZAWA and start operation of water supply system.

(2) Recommendations on management and business administration

1) Management Information

It is recommendable to make monthly MIS report using micro computer and deliver report to stakeholder to make understand, and get their cooperation and support. Generally, this MIS report including basic management information such as target population, number of customer, new customer, intake volume, purification volume,

distribution volume, billing amount, collection amount, expenditure, number of staff, progress of project, events and news.

2) Strengthening of business administration capability

It is strongly recommendable to strengthening capability of business-administration. Specially, conduct training focus to strengthening management skills and knowledge of middle management is recommended. Several donors have been providing in such training opportunities.

3) Cooperation between water supply systems in Tanzania

It is not much active on cooperation between water supply systems in Tanzania, including water supply system in Zanzibar and institutions in mainland. However, several water supply systems in mainland already start collection of water charges from household customer, such as Dar Es Salaam Water Supply Authority. It is recommendable to get OJT: On the Job Training under such institutes in mainland, or request to dispatch experts to ZAWA and get OJT under Tanzanian experts, or having workshop and seminar among water supply systems in Tanzania and establish cooperative relation between institutes.

(3) Recommendations on accounting and financial management

1) Strengthening capability of accounting and financial management

Accounting and financial management staff required more skills and knowledge of accounting and financial management for operate ZAWA as cost recovery principles. It is recommendable to get support on technology and skills transfer of accounting and financial management including financial reporting, budget control and cost management.

In accounting and financial management, improvement of accuracy, speed up, quality standardization and keeping consistency of accounting activities among offices are required. For this purpose, it is recommendable to get support from donor on technical and skills transfer from accounting and financial management experts and implementation of computer system using accounting package software.

(4) Recommendations on activities of customer services

1) Water charge

Sufficient level of water charge should be settled regarding sustain necessary expenditure on operation of facility and organization, realize full cost recovery on expansion and rehabilitation, and yet reasonable and payable for customer. Charges to poor people should be carefully considered as safe water is basic human needs. It is recommendable to get advisory support and technical transfer for settling sufficient water charge from experts dispatched by donor.

2) Water charge collection system

It is necessary to developing institutional system for collect water charges from household customer widely in Zanzibar including billing and collection system, and customer ledger customer ledger management system. Following issues must be prepared:

- Customer ledger and census survey: Develop customer ledger and conduct census survey for customer information of ledger such as name, address, type of usage, family member, etc.
- Development of Customer Services Manual: Develop manual for customer services including billing and

collection, customer complain management, etc.

- Implementing billing system: It is recommendable to implementing computer system for billing and customer management.
- Strategy: It is recommendable to establish business strategy for determine from where, when and how to start collection of water charges from household customer as part of business plan.

It is recommendable to get support from donors on development of customer services manual, customer services manual based training, development of billing system and technical transfer on formulation of strategy.

3) Institution of water charge collection

It is necessary to build branch office, prepare office furniture, vehicles and telecommunication equipment, recruiting and training of staff for customer services activity before start to collect water charges from household customer. Following is the list of necessary items for prepare before start to collect water charges from household customers:

Table 2-35 Items for Strengthening Revenue Collection Capability

items	Notes	Prepare by Government of Zanzibar	Required support from donors
(A) Capital investment items			
(1) Computer system			
1) Billing system	- For there may not sufficient package software, it is recommendable to develop own billing system - It is recommendable to get support from donor for system development - This system development should including determination of user requirements, system design, interface design, system development, system test, development of system documents, **development of operation manual** and **conducting training to operator on billing system based on operation manual.** - System should be manage input of customer information, inquiry from customer, billing, collection, consumption analysis and monthly reporting on billing amount, collection amount, outstanding amount, new connection and disconnection, revenue from water charges and connection fee, etc.		○
2) Hardware	- Consistency of harmonization with software must be important. Very careful as hardware vendor and software developer both easy try to refuse their responsibility. Control by consultant is highly recommendable. - This hardware including server, client PC, printer, **UPS**: unit power supply, LAN: local area network, cable network construction, development of hardware maintenance and operation manual, etc. - This also including **training to operator on hardware operation and management based on operation and maintenance manual**		○
(2) Vehicles	- Vehicles for transporting cash from branch office to head quarter or visa versa is necessary. However, no necessary to be 4WD. - Motor bicycles are also necessary for delivery of bill and collection of water charges	○	
(3) Telecommunication	- Telephone - FAX - mobile phone	○	
(4) Office building and furniture	- Office building - Office furniture including desk, chair, bookshelf, safety box, etc. - Copy machine, FAX, etc	○	
(5) Development of Operation Manual and manual based training	- Billing and Collection Manual - Customer Complain Management Manual - Training on customer services - Accounting Guideline - etc.		○
(B) Recurrent cost item	- Operation and maintenance cost for computer system, vehicles, office building - Fuel for vehicles, telecommunication and training cost - Salaries and wages - Administration cost	○	

4) Water meter

Presently no meter is attached for water supply to household customer and no choice but would collect with flat rate. However, it is recommendable to attach water meter to all users for improve efficiency of water distribution in the future. It may suggest to collect deposit for water meter from customer or including cost of water meter to water charges. Water meter system may increase cost for meter reading and billing. However, water meter provides more reasonable water charges for customer and also gives more accuracy on planning of water intake and water distribution by demand for ZAWA. Therefore, it is recommendable to get water meters with grant from donor to set water meter to household customer in pilot project as starting point.

5) Promotion of hygiene to public

To increasing water collection from household customers, and to promote conservation of secured water resources as well as promote hygiene as objectives or mission of water supply system, it is recommendable to conduct promotion activity to users more actively.

(5) Supporting schemes

1) Support for strengthening management capability of ZAWA

It is recommended to dispatches senior volunteers or management consultants who have experience in establishing branch offices or factories abroad, have business administration skills, which includes human resource management and accounting, as well as self-improvement activity so called Kaizen or quality control, and provide skills transfer on strengthening management capability.

It is also recommendable to dispatch senior experts on engineering field to develop operation and maintenance manual and conduct manual based OJT.

a) Accounting and financial management

Providing an accounting package system and advising them on how to use this software is also recommended.

By using this accounting software package, senior adviser can provide technical transfer for financial management including budget control, cost analysis and other financial managements based on financial statements.

b) Human resources management

DWD did not conduct a great deal of human resource management to include recruiting, OJT and rotation based on a long term human resource management plan because it wasn't necessarily required in the present governmental organization. However, ZAWA may be required to introduce in such concept on human resources management.

Due to an insufficient budget, DWD did not conduct internal training and relied on international donor agencies to perform training seminars. Under the new authority, establishing a human resource development system to include OJT, internal training, and job rotation is vital in building staff capabilities. To improve human resources management transferring and sharing knowledge by senior advisors is recommended.

Secondly, DWD staff is unwilling to initiate self-improvement activities and would rather rely on external assistance. The introduction of Kaizen or QC activities to identify and improve areas of need is recommended. FINNIDA proposed a new organizational structure in their master plan nearly 10 years ago. The basic concept mentioned in this master plan is still effective today; though it needs to be adjusted to newly emerged areas such as computer and revenue collection. Senior advisors or senior volunteers are focus on strengthening the capability of

routine work with knowledge and skills transfer to staff of the Authority.

In the soft component program of this project, we will provide simple EXCEL based MIS: Management Information System and senior management training for transfer management knowledge and skills of:

- Business administration including accounting and finance, and human resources management
- Leadership skills including motivating staff, communication and risk management

However, this training is conducted in a classroom type setting and skills transferred by senior advisor by way of field training and OJT is recommendable.

2) Strengthening revenue collection capability by other donors

Strengthening revenue collection capability was proposed in 2003, however, this proposal was not realized with political reasons. However, concept and idea of strengthening revenue collection including needs of billing system, vehicles and telecommunication equipment are basically still true. It is recommendable to get support from donors on this matter. However, with or without support from donors, those are necessary to start collection of water charges from household customer to maintain cost for operation and maintenance of water supply system. If the Government of Zanzibar could not get sufficient support from donors, the Government of Zanzibar must prepare by them. There is difficulty in covering the assistance needed under the soft components of this project for size and necessary cost. If the Government of Japan considers support of this item, provide support with technical assistant project and dispatch experts with long term is recommendable. First step is starting water charge collection from household customer. Then manage revenue (from sales of water, connection fee, sales to ship, etc.) and expenditure (for salaries and wages, electricity, chemical, maintenance, etc.). In future, implementing water meter system and also consider to developing revolving fund for poor people. Technical transfer on settlement of sufficient water charge system and structure, increases to sufficient number of customer, and efficient management are required.

3) Training on non computer system in customer services

It is strongly recommendable to computerized customer services works, however, if the Government of Zanzibar could not get sufficient support from donors, and also if difficult to develop by them, it is suggested to conduct training on non computer system including following items. The soft component of this program may possible to do as part of these items:

a) Design of customer ledger

- Design of customer ledger
- Design of invoice and other formats uses in billing works

b) Development of Operation Manual on Customer Services

- Development of billing and collection manual
- Development of customer complain management guideline

c) Training and technical transfer based on manual and guideline above

d) Training and technical transfer on census survey

- Design of survey format
- Technical transfer on census survey

2-4-2 Project Operation and Maintenence Plan

The proposed water supply facilities will be divided into water intake facilities (wells) and water transmission/distribution facilities. Operation and maintenance for facilities are described below. New staff will belongs to the proposed new technical department. O&M works will be performed under supervision of the DWD supervisors.

(1) Water Intake Facilities

Water intake facilities consist of wells and well pump equipment. Well flow and water quality will be recorded. Water flow will be measured by flow meters. Water samples will be taken and analyzed by staff of the DWD laboratory.

Ten new intake facilities are newly constructed and 40 additional staff (10 teams with 4 staff per team) for monitoring and controlling this new facility is necessary.

Table 2-36 Additional Staff for Intake Facility

Facility	New/Renew	Current Staff	Additional Staff
New Intake 10 Wells	New	0	40 (4 staff x 10 teams)
Total Additional Staff			40

(2) Transmission/Distribution Facilities

The proposed facilities include new reservoirs, renewed pumping station, new transmission pipelines and new distribution pipelines. The transmission and distribution facilities will be extended and renewed in the future according to a long-term maintenance plan. Replacement schedule of the existing pipes shall be developed according to pipe material, construction year, leakage records and actual observation of the pipes.

DWD has now dispatch 6 staff for existing facility in Welezo. New reservoir and pumping station will be constructed; add 2 additional staff for the operation and maintenance of this new facility.

Table 2-37 Additional Staff for Transmission/Distribution Facilities

Facility	New/Renew	Current Staff	Additional Staff
Welezo Station and Pipelines	New reservoirs/new disinfection facilities	6	2 additional staff Total 8
Saateni Station and Pipelines	Renew transmission pumps/ disinfection facilities	26	-
Kinuni Station and Pipelines	New reservoir/new disinfection facility	-	2 additional staff
Dole Station and Pipelines	New reservoir/new disinfection facility	-	2 additional staff
Total Additional Staff			6 additional staff

(3) Financial Plan

3-1) Water tariff

Detail of new water charge system is not yet determined by the Government of Zanzibar. However, main concept would follows “Bill for an Act of Water Supply Rules and Procedures” prepared in 2004. Table 2-38 and Table 2-39 shows some idea of water tariff and deposit. However, the draft basic design report point out as 1,035 Tsh per month

as flat rate is not sufficient to maintain operation and maintenance activity sustainable way with full cost recovery policy. Rewarding our findings, the Government of Zanzibar consider for increasing the tariff to 3,000 Tsh per month as flat rate. In this report, show simulation results as 1,035 Tsh for flat rate of household customer as Case-1, and 3,000 Tsh as Case-2. Also set assumptions as same income level from business customer and may not change rapidly.

Table 2-38 Water Charges suggested in "Bill for an Act of Water Supply Rules and Procedures" in 2004

Unit: Tsh

Category	Present Water Tariff	New Water Tariff
A. Water Charges		
House connection		
(1) No meter		
Flat monthly charge	0	1,035 -> increase to 3,000
Flat monthly charge of pubic standpipe	0	1,035
(2) With meter	N/A	
～5m3		200/m3
6m3～10m3		206/m3
11m3～		215/m3
(3) Others		200/m3
Business use		
(1) Without meter	Depends on pipe caliber	Depends on pipe caliber
(2) With meter	2,000/m3	500/m3
Government and Public		300/m3
B. Connection Fee	Depends on pipe caliber and cost of civil work	10,000
C. Disconnection due to violence against water law	0	5,000
D. Disconnection with application	0	5,000

Table 2-39 Deposit Amount for Water Supply

Pipe calibre	Urban	Rural
0.5" – 1.5"	20,000	10,000
2" - 6"	25,000	20,000
8" - 12"	30,000	20,000

2-2) Number of customer

The Government of Zanzibar developed road map and this road map mentioned to collect water charges gradually from household customer after April 2008, however do not yet developed action plan. In this simulation, assumed ZAWA star to collect water charges from 34 thousand customers they have records presently and increasing 9,000 customers per year to 2010/2011. Also assumed collection ratio is 80% during that period.

2-3) Expenditure

This project may increases expenditure of operation and maintenance that shows detail in "3-5 Project Cost". Also simulation including payment of electricity for pump presently exempted. And inflation ratio assumed as 8%. However this simulation do not including expenditure and investment for new branch offices and increasing activity for customer services comes from star to collect water charges from household customer.

2-4) Profitability analysis

As the simulation results shows, impossible to sustain operation and maintenance in full cost recovery policy in Case-1 (monthly flat rate of 1,035 Tsh per household). However, increasing tariff to 3,000 Tsh makes improving situation and could profitable after 2012 as Case-2 shows.

Though flat rate system does not encourage water saving, and user does not care leakage from water supply equipments, it is recommended to shifting to volume charges system, and to attach water meter to every household customer in the future.

Table 2-40 Trial income statement of Case-1 and Case-2

Case-1 Water Charge Rate 1,035 per Household per Mont (Unit: 1,000 Tsh)

	Actual	Projected	Projected	Projected	Projected	Projected	Projected
	2003/2004	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014
(Revenue)	70,341	512,248	601,672	691,096	780,520	869,944	959,368
Sales of Water	70,341	512,248	601,672	691,096	780,520	869,944	959,368
(Expenditure)	1,082,260	1,682,031	1,816,594	1,961,921	2,118,875	2,288,385	2,471,456
(Direct Cost)	689,900	1,107,192	1,195,768	1,291,429	1,394,744	1,506,323	1,626,829
- Electricity	655,699	1,046,792	1,130,536	1,220,979	1,318,657	1,424,149	1,538,081
- Chemical	0	35,084	37,891	40,922	44,195	47,731	51,550
- Fuel and Oil	16,100	14,724	15,901	17,174	18,547	20,031	21,634
- other O&M cost	18,101	10,593	11,440	12,356	13,344	14,411	15,564
(Salary and Administration)	392,360	574,839	620,826	670,492	724,131	782,062	844,627
- Salary and allowances	376,371	554,185	598,519	646,401	698,113	753,962	814,279
- Administration cost	15,989	20,654	22,307	24,091	26,018	28,100	30,348
(Profit/Loss)	-1,011,919	-1,169,783	-1,214,922	-1,270,825	-1,338,355	-1,418,441	-1,512,088

Case-2 Water Charge Rate 3,000 per Household per Month

	Actual	Projected	Projected	Projected	Projected	Projected	Projected
	2003/2004	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014
(Revenue)	70,341	1,323,400	1,582,600	1,841,800	2,101,000	2,360,200	2,619,400
Sales of Water	70,341	1,323,400	1,582,600	1,841,800	2,101,000	2,360,200	2,619,400
(Expenditure)	1,082,260	1,682,031	1,816,594	1,961,921	2,118,875	2,288,385	2,471,456
(Direct Cost)	689,900	1,107,192	1,195,768	1,291,429	1,394,744	1,506,323	1,626,829
- Electricity	655,699	1,046,792	1,130,536	1,220,979	1,318,657	1,424,149	1,538,081
- Chemical	0	35,084	37,891	40,922	44,195	47,731	51,550
- Fuel and Oil	16,100	14,724	15,901	17,174	18,547	20,031	21,634
- other O&M cost	18,101	10,593	11,440	12,356	13,344	14,411	15,564
(Salary and Administration)	392,360	574,839	620,826	670,492	724,131	782,062	844,627
- Salary and allowances	376,371	554,185	598,519	646,401	698,113	753,962	814,279
- Administration cost	15,989	20,654	22,307	24,091	26,018	28,100	30,348
(Profit/Loss)	-1,011,919	-358,631	-233,994	-120,121	-17,875	71,815	147,944

Although deficits of DWD have been filled by Zanzibar government, ZAWA is expected to be financially independent. It may take sometime to increase customer base for tariff collection and to improve tariff collection efficiency, in order to achieve financial independence. This issue is well recognised by the Zanzibar government. The Zanzibar government has proposed to set up a special joint account to cover the deficiency of operation and maintenance costs.

2-5 Project Cost Estimate

2-5-1 Project Costs

The total project costs of the project to be implemented under Japanese Grant Aid Scheme amount to 2,095 million Yen. The contributions from the Japanese and Tanzania Governments, following the scope of works in Section 2-4-2, are shown below. The cost estimates were made based on the condition shown in (3) below. This estimate does not guarantee the amount to be agreed in the Exchange of Notes

(1) The Project Costs borne by the Japanese Government

The Total Estimated Cost

Saateni/Welezo Service Area	Approximately 1,231 million Yen
Kinuni/Dole Service Area	Approximately 859 million Yen
Total	Approximately 2,090 million Yen

Table 2-41 Project Costs borne by the Japanese Government

Item		Cost (Million Yen)		
		First phase	Second phase	Total
Facility	Borehole Construction Reservoir Construction Pipeline Construction	1,132	763	1,895
Detailed design, Construction Supervision and Soft Component		99	96	195

(2) The Project Cost borne by the Tanzania Government

1) Fencing	21,780 thousand Tsh	(Approx. 2.18 million Yen)
2) Power Line	1,800 thousand Tsh	(Approx. 0.18 million Yen)
3) Bank Arrangement	21,600 thousand Tsh	(Approx. 2.16 million Yen)
Total	45,180 thousand Tsh	(Approx. 4.52 million Yen)

(3) Estimate Conditions

Costing Date: March 2006

Exchange Rate

Yen/US$	1 US$ = 116.85 Yen
Yen/Local Currency	1 Tsh = 0.100 Yen

Implementation Period: Phasing plan is shown in Figure 2-29.

Others: The project implemented will follow strictly the rules of Japanese Grant Aid.

2-5-2 Operation and Maintenance Costs

(1) Operation and Maintenance Costs

The increment of operation and maintenance costs by the implementation of the project is calculated for labour, electricity, disinfection chemical and repair costs. The electricity costs for well pumps are calculated for the increment of flow by this project (Daily average 14,000 m^3/d x 1/1.35 = 10,370 m^3/d). The disinfection chemicals are calculated for daily average flow.

Table 2-42 Increment of Operation and Maintenance Costs by the Project

Item	**Calculation**	**O&M Costs (thousand Tsh/year)**	**Remarks**
Labour costs (Increment)	O&M staff for wells and transmission/distribution pipes: 46 46 x 1,800,000 Tsh/year/person = 82,800 thousand Tsh/year/person	82,800	
Electricity costs (Increment)	Unit cost: 130 Tsh/kWH Well pumps (increment: 10 wells) Operation hours: 10,370 m^3/d x 1/(60 x 24 x 10) x 24 (daily average) =17.2 hrs/d Electricity costs: (37 kW x 6 + 30kW x 2 + 22 kW x 2) x 0.75 (loading rate) x 17.3 hrs/d x 365d/yr x 130 Tsh/kWH = 199,546 thousand Tsh/year	199,546	
Disinfection Chemical (Increment)	Unit cost: 1,000 Tsh/kg (Powder Chlorine) Chlorine dosing rate: 2 mg/l Chemical consumption (daily average) Kinuni: 6,128 m^3/d x 2 mg/l x 1/0.7 x 10^{-3}= 17.5 kg/d Dole: 2,540 m^3/d x 2 mg/l x 1/0.7 x 10^{-3}= 7.3 kg/d Welezo: 22,453 m^3/d x 2 mg/l x 1/0.7 x 10^{-3}= 64.2 kg/d Total: 89 kg/d = 32,485 kg/yr Disinfection Chemical Costs: 32,485 kg/yr x 1,000 Tsh/kg = 32,485 thousand Tsh/yr	32,485	Exclude Saateni Station where disinfection chemical is injected now.
Equipment Repair (Increment)	Mechanical / Electrical Equipment x 0.3% /yr 987,000,000 Tsh x 0.3%/yr = 2,961 thousand Tsh/yr	2,961	
Total (Increment)		317,792	

Table 2-43 shows the actual cost of DWD operation and maintenance in fiscal year 2003.

Table 2-43 Actual Cost of DWD Operation (2003)

Item	Actual 2003	%
Salary and administration	321,510,984	32
Electricity	659,898,960	66
Chemical	0	0
Fuel and others	800,000	0
Maintenance	16,050,000	2
Total	998,259,944	100

Unit: Tsh
Electricity including electric charges indirectly paid by DWD

After the project implementation, additional 32 million Yen, which is required for operation and maintenance, could be recovered by water tariff in the future. It will take sometime to generate sufficient revenue from water tariff to cover increased operation and maintenance costs, until then, the deficits will be filled by a special joint account to be set up by the Zanzibar government. In year 2004/2005, the Zanzibar government have special joint accounts, whose budgets amount to 51,657 million Tsh (approximately 5,166 million Yen), which could cover the above deficit.

2-6 Other Relevant Issues

2-6-1 Water Source preservation

The water source of this project consists of boreholes and springs. According to the geotechnical feature of Unguja island, the surface water infiltrates easily to the underground water level. So the groundwater may easily contaminated if the surface water is polluted.

To prevent the water sources from the contamination by livestock, fencing is necessary for the intake from boreholes and/or springs. And more, to restrict the garbage disposal not only the borehole /spring but also wide spread of the catchment of water sources.

2-6-2 Operation of water source facilities

１）Continuous operation of borehole pumps

Borehole pump should be operated continuously. An intermittent operation may cause filler disarrangement and it may cause screen blockage.

２）Prevention from salt water pumping

The new borehole sites are located out of the salt water detected areas, however, the risk of salt water pumping is still remain when extremely dry season/year.

Not to draw salt water, the borehole pumps should be stopped when the pumping water level is below averaged sea water level. The water level meter will be installed in the boreholes and the borehole pumps can be stopped as the signal from the meter. The pump stop level should not be set below averaged sea water level.

2-6-3 Disinfection

To provide safe water is essential for water works. The chlorine dosing equipment will be installed by this project for each station, disinfection of supply water should be conducted everyday. To estimate the proper dosing rate, water quality should be examined periodically.

2-6-4 Distribution Pressure Adjustment

Pressure reducing valves are installed at Welezo and Dole distribution area to prevent the pipe breakage and water leakage causing from the high pressure. Water leakage increases as the inner pressure increase, the lower pressure operation is desirable while the distribution is performed.

The recommended pressure for Welezo area is ranged 5 m to 10 m as the ground level of valve is about 40 m. For Dole area, recommended pressure is not larger than 5 m as the ground level of valve is about 45 m.

2-6-5 Water Management Considerations

2-6-5-1 Transmission from Welezo to Saateni

The main water source of Saateni is spring of Mtoni and Bububu, the intake from these two springs are reduced in dry season. Saateni area needs water from Welezo reservoir in dry season, conduit pipe from Welezo station to

Saateni station is planned in this project and it flows by gravity up to the overhead water tank. Flow control vales and flow meter are installed for proper operation.

2-6-5-2 Welezo and Kinuni

To supply water to the southern areas, two distribution tanks, Welezo and Kinuni, and one transmission line is planned in this project. The distribution pressure of these area is varied depend on the setting of the pressure reduce valve and/or the water demand fluctuation. Gate valves and pressure reduction valve should be operated properly monitoring the flow meter.

Chapter 3 Project Evaluation and Recommendation

Chapter 3 Project Evaluation and Recommendation

3-1 Project Effect

The expected project effects are shown in Table 3-1.

Table 3-1 Expected Project Effects

Present Condition	Measures	Project Effects
A: Direct Effects		
The water supply capacity is much smaller than the water demand increasing by population growth.	・Develop 14,000 m^3/day of raw water by construction of new 11 boreholes.	・The water supply capacity will be equal to the water demand of 2010 as much as 54,100 m^3/day including existing water source of approx. 40,100 m^3/day.
Distributed water has problem in quality because of low pipe pressure and an intermittent distribution.	・Review the water distribution networks, construction/renewal of water distribution stations and pipelines. ・Construct disinfection facilities for each distribution stations.	・The minimum distribution pressure will be assured and stable water supply will be realised. ・The water supply quality will be improved.
The existing water supply facilities are aged. The pump equipment of Saateni Station looks difficult to operation and the leakage from the network pipes are estimated as 30 % as distributed.	・Renewal of four (4) sets of transmission pump. ・Renewal of 6.5 % of pipeline.	・The transmission capacity will be equipped. ・The leakage rate will be reduced.
Operation and maintenance, business management are not evaluated as sufficient level.	・Soft Component for these items.	・Water business management and the operation and maintenance will be improved.
B: Indirect Effects		
High morbidity of water caused disease because of the poor water supply system.	―	・Morbidity of water caused disease will be reduced by the water supply system improvement.
Tourism is not well developed because of the poor water supply system.	―	・Tourism will be promoted by the water supply system improvement.

3-2 Recommendations

For further effective display and sustain of project effects, the DWD, the execution agency, shall undertake the following items to improve the water supply system management.

a. To establish the new water authority and build the organization for tariff collection, operation and maintenance. Then collect enough money to maintain the water supply system and manage the water works properly.

b. To repair/replace the existing facilities including borehole pumps, roof of Saateni Station, pipelines made of asbestos. Especially to conduct a non revenue water reduction measures.

c. To expand the distribution network to meet the population growth and urban expansion.

d. To make necessary measures to protect the water sources, such as the prohibition of building construction and garbage disposal near the water source.

e. To treat or discharge the wastewater increased by this project in accordance with the Ministry of States, Regional Administration and local Government and/or Zanzibar Municipal Council.

f. Items related to this project;

- To prepare the budget for the cost undertaken by Tanzanian side. They shall be disbursed based on the implementation schedule.
- To obtain/issue necessary permission/licence for the implementation of the works for the project.
- To organize the implementation team for the project from the beginning of the detailed design to understand the project components and to master technology.

g. Secure budget for providing new house connections to new users.

Appendices

Appendix 1

Member List of the Study Team

Appendix 2

Study Schedule

Appendices

Appendix 1 Member List of the Study Team

Name	Assignment	Position
Mr. Toshihiro OBATA	Team Leader	JICA
Ms. Keiko YAMAMOTO	Senior Advisor	
Mr. Yoichi INOUE	Planning Management	
Mr. Daigo KOGA	Project Coordination	
Mr. Hiroki FUJIWARA	Chief Consultant/O&M Planning	NJS Consultants Co., Ltd.
Mr. Toru SUETAKE	Waterworks Management	
Mr. Shusaku UENO	Cost estimation/Procurement Planning	

Appendix 2 Study Schedule

No.	Month/Date		Activities
1	3/18	Sat	Move（Japan－Dubai）
2	3/19	Sun	Move（Dubai－Dar es Salaam）
3	3/20	Mon	Discussion with JICA, EOJ, MOF, UNDP Dar es Salaam, Move（Dar es Salaam - Zanzibar）
4	3/21	Tue	Ecplanation on Inception Report / Field Survey, etc.
5	3/22	Wed	M/D Duscussion / Field Survey, etc.
6	3/23	Thu	M/D Duscussion / Field Survey, etc.
7	3/24	Fri	M/D Signing /Field survey, etc
8	3/25	Sat	Work shop for revenue collection / Field survey, etc
9	3/26	Sun	Field survey, etc Move (Zanzibar- Dar es Salaam)
10	3/27	Mon	Discussion with UNDP Dar es Salaam
11	3/28	Tue	Discussion with EOJ Move（Dar es Salaam －Dubai)
12	3/29	Wed	Move（Dubai－Japan）

Appendix 3

Lists of Parties Concerned in the Recipient Country

Appendix 3 List of Parties Concerned in the Recipient Country

Organization	Name	Position	Notes
Ministry of Water, Construction, Energy and lands (MWCEL)	Mr. Mansour Y. Himid	Minister	
	Mr. Tafana	Deputy Minister	
	Mr. Yasser De Costa	Principal Secretary	
	Mr. Silima M. Khamis	Deputy Principal Secretary	
Ministry of Finance	Mrs. Malisa	Assistant Commissioner-Aid Coordination	
	Mr. Dulle Moses	Finance Management Officer	
Ministry of Finance & Economic Affairs (MFEA)	Mr. Hussein S. Khatib	Commissioner External Finance	
	Ms. Zeniab H. Pandu	Senior Officer, External Finance Department	
Department of Water Development (DWD)	Mr. Salim Hemed Salim	Director of DWD	
	Mr. Ilyasa	Executive Engineer	
	Mr. Mohamed Salim Msabah	Administrative Officer	
	Mr. Mzec Mpatan Ali	Executive Engineer	
	Mr. Juma Zubeir	Executive Engineer	
	Mr. Said Saleh Sureiman	Executive Engineer	
	Mr. Hafidh S. Makame	Executive Engineer (Revenue)	
	Ms. Mariyam Hassan	Senior Hydrogeologist	
	Mr. Maulid Haji Kinange	Revenue Officer	
	Mr. Ali Mkali	Accountant	
UNDP Dar es Salaam Office	Ms.G. Lyatuu	Assistant Resident Representative Energy and Environment	
	Mr. N. K. Murusuri	National Coordinator GEF Small Grants Programme	
UNDP Zanzibar Office	Mr. K. S. Mohamed	Programme Analysist	
	Mr. Ali J. Shaib	Financial Officer	