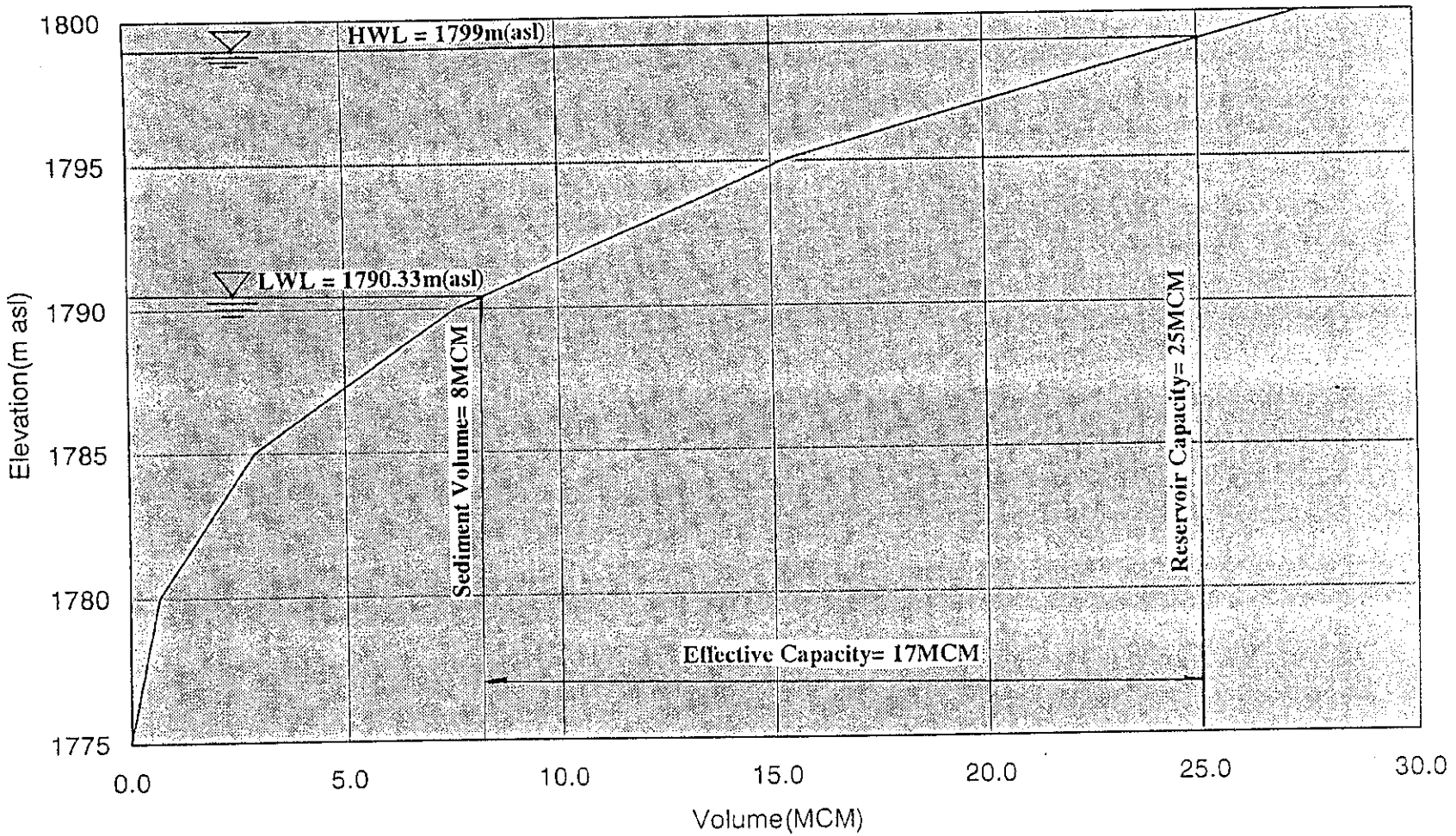
Figure 6.2.5 H-V Curve for Mereb-5 Dam Reservoir



(5) Preliminary design of the dam

According to the conditions of the damsite and availability of dam construction materials, a compacted rock-fill dam with concrete facing is recommendable (as also recommended in the Asmara Water Supply Feasibility Study, 1987). The required embankment volume may be calculated as 665,000 m^3. Using a unit cost per unit of filling volume (30.0 USD used in the above mentioned study with 8% of price escalation), the approximate cost including appurtenant facilities may be estimated as 21.0 million USD. The bases and the details on calculation of the dam parameters are presented in Appendix-B.

(6) Usage of reservoir water

The proposed dam shall have a 25.0 MCM of reservoir capacity, while, the shortage water volume for water supply in Mendefera by the year 2015 shall be 0.54 MCM/a, quite small compared with the capacity (around 2.2%).

The water taken from the dam shall be sent to Mendefera, through Dekemhare-Tera Emni road and along national road no.3 after Tera Emni. The total length of the pipeline from the dam to Mendefera is around 34 km, the deference of elevations is around 230m. Before delivering water, a treating of water quality shall be required.

6.3 Water Supply and Sanitary Facility Plan

6.3.1 Water Supply Facility Plan

(1) General

Outline of the center of Mendefera is divided into four areas by two main roads of Asmara - Adiquara (north - south direction) and Areza - Kudo Ferasi (east - west direction). Topographical feature of the center of the town undulates and the four areas have slightly higher positions than at the outskirts. Future town extension areas are located in the outskirts of the center of the town.

Water service area including future town extension area is almost 1965m to 1910m of elevation and inclines gently from west to east. Therefore, new reservoir will be planed at the higher location of the west.

Future population in the town will be drastically increased. Capacity of all the existing water supply facilities is not enough. In addition to this, the existing facilities except boreholes can not be used because of the following feature of the existing facilities.

- Existing water source around Kilowle dam is seemingly limited,
- Existing well pumps are obsolete and has breakdowns,
- Reservoir in the town is obsolete and difficult to repair,
- Pipelines is also obsolete with insufficient diameter to cover the future demand, unknown location and diameters, etc., and
- Communal water points are damaged.

(2) Facility plan

Water supply facilities of this project consist of intake facilities (borehole and well pump), transmission facilities (transmission pipeline, pump pit and booster pump), distribution facilities (reservoir and distribution pipeline), service facilities (individual connections and communal water points) and others (power supply and control house). These facilities are planed and summarized herein, and detailed calculations of each facility are shown in Appendix D.

a) Intake facility

As mentioned in "6.2.3. Water Resources Development Plan", total yield of the existing boreholes and test borehole of MEN-1 cannot cover the water demand in even 2005. Therefore, new boreholes shall be constructed one after another to meet the water demand in each target year, and the surface water from the new dam in Merab river shall also be planned for the water demand in target year 2015.

New wells and the existing wells along Mai Takhara are planned as main water sources under the project and the existing water source around Kilowle dam as used in reserve for emergency and during construction period.

Number of the boreholes and specifications of well pumps in each target year are as follows:

Target year 2005: Two existing boreholes of BH-4 and BH-5, test borehole of MEN-1 and two new boreholes of MEN-1 and nMEN-1.
Spec. of pump at BH-4: Q=0.288m^3/m, H=75.8m
Spec. of pump at BH-5: Q=0.096m^3/m, H=81.0m
Spec. of pump at MEN-1: Q=0.120m^3/m, H=87.7m
Spec. of pump at nMEN-1: Q=0.120m^3/m, H=18.2m
Spec. of pump at nMEN-2: Q=0.120m^3/m, H=68.4m

Target year 2010: Additional five new boreholes.
Spec. of pump at nMEN-3: Q=0.180m^3/m, H=32.8m
Spec. of pump at nMEN-4: Q=0.180m^3/m, H=30.7m
Spec. of pump at nMEN-5: Q=0.180m^3/m, H=45.2m
Spec. of pump at nMEN-6: Q=0.180m^3/m, H=65.6m
Spec. of pump at nMEN-7: Q=0.180m^3/m, H=90.0m

Target year in: New dam.

b) Transmission facility

Four new transmission pipelines are planned and extended to meet the water demand. Booster pumps shall be planned because of their long distances and difference of elevations. The transmission facility plan for each target year is as follows:

Target year 2005: A new pipeline from MEN-1, BH-4 and BH-5 to new reservoir 1 and another new pipeline from nMEN-1 and nMEN-2 to new reservoir 1.
Diameter and total length of the pipe:
D=125mm~60mm, L=9,647m
Spec. of new booster pump at BP1: Q=0.240m^3/m, H=99.8m
Spec. of new booster pump at BP2: Q=0.240m^3/m, H=101.1m

Number and capacity of pump pit for booster pump:
15m³ 2sets

Target year 2010: Additional new pipeline from nMEN-7, nMEN-6, nMEN-5, nMEN-4 and nMEN-3 to new reservoir 1.
Diameter and total length of the pipe:
D=150mm~80mm, L=12,100m
Spec. of new booster pump at BP3: Q=0.720m³/m, H=95.8m
Spec. of 2 new booster pumps at BP4: Q=0.900m³/m, H=77.0m
Number and capacity of pump pit for booster pump:
25m³ 1 set and 30m³ 2sets

Target year 2015: Additional one new pipeline from new dam to new reservoir 2.
Diameter and total length of the pipe
D=150mm, L=43,000m
Spec. of 5 new booster pumps at BP5: Q=1.026m³/m, H=110.9m
Number and capacity of pump pit for booster pump:
35m³ 5sets

c) Distribution facilities

A new main reservoir (reservoir 1) is planned beside the existing reservoir in the town and its elevation can cover most of the service areas. However, another new reservoir (reservoir 2) for the future extension area shall be planned because the highest elevation in the north- western part in the future extension area can not be covered by the water pressure from reservoir 1. Also additional two new reservoirs shall be planned for two villages in the target year 2015. The reservoirs will be expanded to meet the water demand for each target year.

The distribution pipeline is also newly laid and extended to meet the water demand for each target year. The distribution facility plan of each target year is as follows:

Target year 2005: Capacity and type of new reservoir 1
V=340m³, ground type
Diameter and total length of the pipe
D=200mm to 50mm, L=28,066m

Target year 2010: Capacity and type of additional reservoir 1
V=430m³, ground type
Diameter and total length of the expansile pipe
D=125mm to 50mm, L=35,809m

Target year 2015: Capacity and type of one additional reservoir 1 and three new reservoirs
V=240m³, ground type for Additional
V=180m³, ground type of new reservoir 2 for future town extension area
V=50m³, ground type for Adi Wegri
V=40m³, ground type for Adi Hare
Diameter and total length of the expansile pipe
D=150mm to 50mm, L=37,742m

Table 6.3.1 Number of Facilities

Item		Unit	Year		
Facility	Description		2005	2010	2015
Intake Facility	New borehole	sets	2	5	
	Existing borehole	sets	2		
	Observation borehole	sets	1		
	Dam	sets			1
	(Sub-total)	sets	5	5	1
Well Pump Facility	Submersible pump		BH-5, 0.096m3/min 81.0m, 1set	nMEN-7, 0.180m3/min 90.0m, 1set	
			MEN-1, 0.120m3/min 87.7m, 1set	nMEN-6, 0.180m3/min 65.6m, 1set	
			nMEN-2, 0.120m3/min 68.4m, 1set	nMEN-5, 0.180m3/min 45.2m, 1set	
			nMEN-1, 0.120m3/min 18.2m, 1set	nMEN-4, 0.180m3/min 30.7m, 1set	
			BH-4, 0.288m3/min 75.8m, 1set	nMEN-3, 0.180m3/min 32.8m, 1set	
	(Sub-total)	sets	5	5	0
Transmission Pipeline	DCIP 200mm	m			
	ditto 150mm	m		2,900.0	43,000.0
	ditto 125mm	m	1,779.0	3,800.0	
	ditto 100mm	m	624.0	1,600.0	
	ditto 80mm	m	4,577.0	3,800.0	
	ditto 60mm	m	2,667.0		
	(Sub-total)	m	9,647.0	12,100.0	43,000.0
Booster Pump Facility	Centrifugal pump		BP.1, 0.240m3/min 99.8m, 1set	BP.3, 0.720m3/min 95.8m, 1set	BP.5, 1.026m3/min 110.9m, 5set
			BP.2, 0.240m3/min 101.1m, 1set	BP.4, 0.900m3/min 77.0m, 2set	
	(Sub-total)	sets	2	3	5
Pump Pit	Made of RC		15m3, 2set	25m3 30m3, 2set	35m3, 5set
	(Sub-total)	sets	2	3	5
Reservoir	Made of RC		340m3	430m3	240m3 180m3 50m3 40m3
	Made of F R P				
	Existing				
	(Sub-total)	sets	1	1	4
Distrbution Pipeline	P V C 300mm	m			
	ditto 250mm	m			
	ditto 200mm	m	980.0		
	ditto 150mm	m	832.0		883.0
	ditto 125mm	m	1,970.0	210.0	513.0
	ditto 100mm	m	454.0	1,484.0	1,877.0
	ditto 75mm	m	1,114.0	2,228.0	3,329.0
	ditto 50mm	m	22,716.0	31,887.0	31,140.0
	(Sub-total)	m	28,066.0	35,809.0	37,742.0
Control House		sets	7	8	5
Communal Water Point		sets	13	13	19
Individual Connection		sets	2,593	1,307	1,77
Tempolaty Road	Width 3.0m	m	5,500	8,000	3,50

d) Service facilities

Number of individual connections is estimated from the percentage of consumers in each target year. Communal water points are planned close to the area of low income houses and the vicinity. Communal water points are arranged to cover up the area by approx. 150m-radius circles. Service facility plan for each target year is as follows:

Target year 2005:	Number of individual connection	2,593 sets
	Number of communal water points	13 sets
Target year 2010:	Number of additional individual connection	1,307 sets
	Number of additional communal water points	13 sets
Target year 2015:	Number of additional individual connection	1,777 sets
	Number of additional communal water points	19 sets

e) Others

Power supply for pumps is planed to use the network from diesel power plant in the region. Control houses are planed for the panel for pump, booster pump, generator for future plan, etc. Type A and B of the control house are for well pump, and type C and D are for booster pump. There is a generator room in the Type B and D. Number of the control house is as follows:

Target year 2005:	Number and type of control house Type A: 3sets, Type B: 2sets, Type C: 2sets
Target year 2010:	Number and type of additional control house Type A: 4sets, Type B: 1set, Type C: 2sets, Type D: 1set
Target year 2015:	Number and type of additional control house Type A: 4sets, Type B: 1set,

6.3.2 Sanitary Facility Plan

(1) School sanitation facilities

In Mendefera the sanitation condition in general is very poor condition. For most of the schools do not have proper sanitation facilities. In order to come up with a radical change in sanitation practices within the society one approach of sanitation promotion should be through schools.

Therefore, the main target group in this sanitation improvement program study are students. By targeting students the advantages are both in economic aspect and effectiveness in behavioral change. The economic advantages are achieved by using existing institution, teachers, organized students by age and level of understanding. The effectiveness of the program in schools is proved in some other town in Eritrea. Students learn easily and accordingly change their hygienic behaviors. Follow up to their hygiene/sanitation practice in school is an easy task. On the other hand students` changed perception is believed to influence in particular their family and will also have a compounded effect result in the society.

In this study school sanitation facilities development program along with hygiene education program is envisaged to bring about an improved sanitation facility, hygienic behavioral changes and environmental conditions.

The type of latrine recommended is taking into consideration the cultural, economic, operation and maintenance aspects. The constraints pointed out by the schools for having poor condition latrines and latrines which are out of use are also addressed in this latrine promotion program.

(2) Public sanitation facilities

Provision of public facilities for solid waste, wastewater and storm water drainage, sludge removal and latrines are crucial for environmental sanitation and community public health promotion. Mendefera at present is lacking appropriate public facilities. Required improvement of public facilities are discussed below. For phased programs and budget requirement refer `Financial Plan` of this section.

a) Wastewater and storm water drainage

It is well understood that water supply coverage without parallel improvement of sanitation increases environmental pollution and causes public health problem. Trying to correct the imbalance between the water supply and sanitation on the other hand will create a financial burden to the town. In Mendefera the economic or development level of the people for instance does not allow for a conventional sewerage system provision. Moreover, from the technical point of view the wastewater flow in a sewerage system shall be too low due to anticipated low consumption rate. A very low flow rate results in poor self cleansing of the sewerage system. However, Mendefera having a sewerage system from the time of Italian colony it is proposed to rehabilitate and expand the system in stages. In the first target year it is recommended that the sewerage system to cover 1/3rd of the area and in year 2005-2010 to cover 2/3rd of the area and in 2010-2015 a complete coverage. Mendefera's projected water consumption rate and wastewater generation rate is shown below.

Mendefera's estimated quantity of wastewater is:

- house connection users - 90% of the water demand
- yard connection users - 70% of the water demand
- community water point users - 60% of the water demand

Table 6.3.2 Water Demand and Wastewater Generation Projection

	Consumers (% of hld)			Water demand (l/c/d)			Wastewater generation (l/c/d)		
Mode of supply	2005	2010	2015	2005	2010	2015	2005	2010	2015
HC	29	34	39	35	40	47	31.5	36	42.3
YC	33	66	61	22	24	27	15.4	16.8	18.9
CWP	38	0	0	15	15	15	9	9	9

To areas where the Sewerage system does not cover an on-site drainage system is proposed for Mendefera.

The type of drainage techniques recommended are soak-away pit and drainage field channels for sludge removal and road side and cross road trenches for storm water drainage.

b) Public latrine

In Mendefera lack of public latrines is one area which contribute to the environmental degradation and poor public health. In this study public facilities under direct responsibility of the town administration are areas under consideration. Hence, from the public health point of view public areas such as market places, bus terminals, stadium etc. are proposed to be provided with public toilets.

c) Refuse disposal

The town administration of Mendefera never had refuse truck. As part of sanitation safe refuse collection and disposal is essential to improved public health. The present situation of Mendefera does not provide these basic services. In this study it is anticipated that Mendefera during the target year 2000-2005 need to have at least two refuse trucks with compaction to go round and collect garbage and dispose at environmentally safe place outside the town at a reasonable distant place. During the three target years provision of refuse containers for all areas of the town is proposed.

(3) Private sanitation facilities

The awareness for an improved public health condition should basically be created within the family. Therefore, efforts made to promote private sanitation facilities has great effect to improve environmental sanitation conditions. For small towns such as Mendefera where coverage of conventional sewerage system is limited the inhabitants are advised to have appropriate household latrine and on-site wastewater disposal systems.

Mendefera having very low coverage of household latrine, open field defecation is a major factor to the present poor sanitation condition of the town. Having unhygienic latrine in a house also causes health problem. If actions are not taken in due time the pollution and health problems due to lack of household latrines and unhygienic latrine usage will be aggravated with increase in population.

The action taken by the town administration by introducing rules and regulations for the new house builders with regard to provision of family latrine in their house is highly appreciated and its impact on sanitation improvement is inevitable. However, economic constraint of the owners (builders) is still an obstacle to implement the town administration's new regulations. In socio-economic survey the residents expressed their awareness to the need for private latrine but some of them due to money constraint said they can afford only community latrine only. Hence this study proposes latrines for various groups of the society including those with very low income status.

The kind of latrines recommended are in line with the type of water supply facilities provision. The coverage anticipated is proportional to the water supply facilities coverage. The type of latrines already in use are flush latrine and dry pit latrine only. Therefore, in this project it is recommended to enhance the quality of the toilets in use taking into consideration the economic, social and cultural aspects of the

society.

Basically three types of toilet for three modes of water services are recommended as tabulated below. In this study communal latrines are not recommended for the very reason of anticipated difficulty in its management. It is rather recommended shared latrines for up to four families.

Table 6.3.3 Recommended Household Latrines

Mode of water service	Recommended household latrine
House connection users	Cistern flush latrine (CFL)
Yard connection users	Pour flush latrine (PFL)
Communal water point users	Ventilated improved pit latrine (VIP)

Table 6.3.4 Anticipated Coverage of Latrines in Mendefera

Target year	CFL	PFL	VIP
2000-2005	17%	15.4%	24.4%
2005-2010	19%	19.2%	33.6%
2010-2015	22%	21.6%	40.8%

Pit latrines are designed in double pits considering the none availability of vacuum trucks in the town and the inconvenience and unaffordable rates of the truck borrowed from Asmara. The pits are 4 cubic meter capacity each. Assuming 0.5 liters per day excreta per person for an average household size of five, 915 liters of excreta is disposed annually. Hence a single pit may serve for four years for a family. When one pit is full the family shift the vent pipe and squatting hole to the second pit and put lid on both squatting and vent holes. The height and the area of the latrines are sized just for economic purpose.

The double pit VIP latrine if used by three or four families it will be affordable for even very low income group. Hence the town administration should encourage the low income group families to built common VIP latrine. For four families of 20 members a single pit will last for a year and the decomposed matter shall be removed every two years.

The flush latrines are recommended to have a septic tank with dry masonry wall for soak-away purpose in order to solve the problem of frequent vacuum truck requirement to some degree. If soak-away is not possible due to impermeable ground formation, the town shall rely on Asmara vacuum truck during the 1st phase of the project up to year 2005.

(4) Number of facilities

The facility plan is derived on the basis of development program. Accordingly the following assumption are considered in the facility plan:

- All existing schools with out proper latrine provision need to have latrine by the target year 2000-2005.
- At least one new school establishment is assumed in five years period for financial projection.
- All existing public places under the town administration such as market places, bus terminal and stadium to be provided public latrine by target year 2000-2005.
- The household latrine provision is based on demand, coverage and mode of water service development program for the three target years.
- Every five years replacement of vacuum and refuse truck is assumed.

Table 6.3.5 Number of Latrines

	Year 2005	Year 2010	Year 2015
School Latrine - PFL	5	1	1
Public Latrine - CFL	5	1	1
Household Latrine - CFL	1,882	946	1,297
Household Latrine - PFL	1,285	2,562	1,314
Household Latrine - VIP	986	933	457

Table 6.3.6 Number of Public Facilities

	Year 2005	Year 2010	Year 2015
Refuse truck (compactor)	2	1	2
Vacuum truck (3,000 liters)	1	2	1
Refuse collecting bins	150	100	100
Refuse collecting container (8 m^3)	20	25	10

6.4 Institutional Strengthening Plan

6.4.1 Existing Situation

Water and sanitation typically require multisectoral intervention and collaboration in their planning, implementation and management stages. At the central level, the main focal ministries for water and sanitation related affairs are: the Ministry of Land, Water and Environment, the Ministry of Local Government and the Ministry of Health. In Mendefera, the town administrations, the former WSS or new WSA and the Communal Water Point committees and sanitation committees are directly involved.

In this chapter, the national level institutional set-up of the above institutions will be described and recommendations forwarded for strengthening them. This will be followed by the description and recommendation for strengthening water related institutions in Mendefera. This is important because institutional building starts from the top and goes down to the bottom rather than the other way round.

6.4.2 The Ministry of Land, Water and Environment

The Government's decision behind the establishment of the Ministry of Land, Water and Environment (MoLWE) lies in its desire to ensure that its strategic resources of land, water and environment are managed and utilized through appropriate study, documentation and proper upkeep. The MoLWE has three Departments, one each for water, land and environment.

The former Water Resource Department (WRD) has been reorganized within the new MoLWE. It is now called Water Department (WD) and has two divisions under it: the Water Use Management Division (WUMD) and the Water Resource Assessment Division (WRAD) (Appendix A, Chart 6.1).

(1) Staffing pattern of the WD

Presently, there are 13 experts assigned for the WD and it has not been decided yet in which. one of the Units of the WD they will be assigned.

(2) Functions of Water Use Management Division (WUMD)

This Division is responsible for drawing up policies and guidelines and for drafting water laws and regulations for the development and management of the country's water resources. There are two Units under this Division: the Water Law Unit (WLU) and the Water Resources Development Unit (WRDU). The former is responsible for drafting laws and regulatory guidelines on water resource utilization. It also issues permits for water related works and renders legal and advisory service to the other Units. The WRDU is responsible for the provision of policy and implementation guidelines for those involved in water resource development and management activities, studies new water basins and catchment areas and supervises national projects that cut across regions or that serve more than one region.

(3) Functions of Water Resource Assessment Division (WRAD)

The responsibilities of this Division are to collect, process and store data on the quality and quantity of available water resources for the efficient planning and implementation of the sector's program. There are three units under this Division, namely the Hydrometeorological Information Service Unit (HMSU), the Water Quality and Pollution Unit (WQPU) and the Water Resource Information Unit (WRIU). As the name suggests, the first Unit is responsible to undertake hydrometeorological works related to both ground and surface water resources, supervises and monitors the conservation of protection of these resources, and submits collected data and information to the data base center. The investigation of the quality of water collected by the HMSU is the responsibility of the WQPU, and additionally, it measures and monitors pollution levels in collaboration with the Department of Environment and passes on water pollution information to concerned bodies. The responsibilities of the WRIU is to enter, process and analyze data and information secured from the two units, and in collaboration with the Department of Land and Environment and concerned sectors, prepares written materials and maps concerning the quality and quantity of water resources.

(4) Establishment of the Water and Sanitation Authority (WSA)

It is mentioned in Chapter 2 that the draft Water and Sanitation Law, envisages the establishment of Water and Sanitation Authority (WSA) whose mandate will be to manage water and sanitation facilities and thus ensure the provision of water supply and sanitation services to both urban and rural areas of the

country. One of the most important task or program of the WD will be to see the quick establishment of the WSA.

6.4.3 The Ministry of Local Government

The Proclamation to decentralize regional administrations was out in 1996. However, the process of complete empowering and building the capacities of these regional administrations should be seen as a long term goal. Accordingly, the primary mandate of the Ministry of Local Government (MoLG) is to act as the main coordinating and facilitating body for the regions in their dealings and relationships with the ministries at central level.

MoLG has four Departments: Regional Departments Affairs Department, Administration Department, Council, Municipal and Cooperatives Affairs Department and the Research Department.

(1) Regional affairs department

The Department which is entrusted with water projects implementations is the Regional Affairs Department (RAD/MoLG). Its functions include coordinating and assisting in the preparation and implementation of social and infrastructure development of the region. RAD's tasks would be to facilitate the implementation of regional projects that involve high level expertise at the central level. Examples of such activities include: procurement, bidding/contracting, project implementation, evaluation and follow-up. In the structural organization of RAD, therefore, similar structure exists as of the Departments in the regions, viz., Economic Development, Social Services and Infrastructure Services Divisions

The Units under these three divisions and the staffing pattern is as indicated in Appendix A, Chart 6.2. The Infrastructure Services Division and the Engineering and Project Management Unit under it are responsible for the planning, implementation and follow-up of water projects on behalf of the regions. There are six experts composed of engineers and economists in this Unit.

(2) Establishment of the project management unit (PMU)

When there is a major water project to be implemented the RAD/MoLG establishes a project management unit (PMU) which would assume direct responsibility for the implementation of the project. There are five of such PMUs at present for water projects financed by the World Bank, EU, GTZ, KFW and SDR.

For the implementation of the project under study, a Project Management Unit (PMU) will be established under RAD in the MoLG. It is proposed that the PMU be headed by an expatriate technical expert, one national counter part and three national experts: two engineers in charge of supervision works and one for community organization.

6.4.4 The Ministry of Health

The MoH has three main Departments under it: the health Service Department, the Pharmacy Department and the Research and Human Resources Department. Environmental Health and Sanitation Unit is one of the Units under the Health Service Department (Appendix A, Chart 6.3). It is responsible for

developing and revising legislation, policies, standards and guidelines concerning environmental health and sanitation. Additionally it is involved in training of personnel, research and evaluation and rendering technical advise to regions. There are five experts under the Environmental Health and Sanitation Unit each responsible for environmental health, environmental sanitation, quarantine of food, drinks and beverages at airports, environmental pollution and work hazards. The first three experts in particular are responsible for ensuring the safety and adequacy of water, personal, food and environmental hygiene and environmental sanitation concerned with latrines and dry and liquid waste disposal.

6.4.5 Proposal for Institutional Strengthening Plan

(1) The WD in MoLWE will need additional manpower during the periods under considerations if it is to dispense its mandate properly. On the assumption that its staff number will increase by 10 percent every five years, the number will be 14, 15 and 17 by the years 2005, 2010 and 2015 respectively. Additionally, in order to enhance the level of skills of the experts, training for a second degree will be needed at least for five experts, and short term overseas for all the 17 experts within the period of the development program. Possible areas of training could be information collection and analysis, supervision/monitoring and evaluation in underground and surface water resources.

(2) A Project Management Unit (PMU) in MoLG could be established to see the implementation of the water and sanitation projects for the seven towns under study. The PMU will be under RAD/Infrastructure Service Division. There should be one expatriate staff who will head the PMU assisted by one counterpart staff and three experts under them. He and his staff will all be paid by the project. Additionally, it is suggested that training, in procurement, water facility design, design evaluation, etc. will be needed for the staff of the Engineering and Project Management Unit under the Infrastructure Service Division under RAD.

(3) To facilitate the task of the head of the PMU, the three suggested experts to be employed will be: two assistant engineers and one expert on people's participation and community organization/ management. While the latter will be responsible for the software aspect of the project, the two engineers will help to supervise the construction work of the water supply and sanitation facilities in the seven towns.

(4) A Water and Sanitation Authority of Eritrea (WSA) should be established as an autonomous body charged with management of all water and sewerage/sanitation facilities in the country. The establishment of WSA is envisaged in the draft 'Water and Sanitation Law'. It is proposed that the national level WSA should be overseen by a Board whose members should be from the main focal ministries and other interest group in the country. The Board will report to the Minister of the MoLWE. The manager with his support staff will run the office efficiently and in a coast effective manner. It is important to have two main departments under the organizational set-up of WSA: one for urban and another for rural and it is proposed that these two main departments ought to have separate divisions for water supply and for sanitation. Under these two divisions, there will be six units one for each six regions of the country. Towards this end, WSA will have to be vested with ownership and control of all towns' water supply and sanitation assets including infrastructure facilities. It is proposed that each town's WSA management become an autonomous unit with its separate cost center, possibly retaining its won income for maintenance and repair works. In order to minimize costs, WSA should operate with minimum staff. The number of staff in town WSA will

be determined as per the requirement of the facilities and number of beneficiaries. The details of the management structure, including maintenance and tariff collection system will have to be worked out in the course of the project implementation.

(5) In the wake of the approval for the establishment of WSA, it would be appropriate that it assists central level and Debub Regions to dispense their respective responsibilities as per the spirit of the Water Law, Water Policy and the Proclamation which allows the establishment of regional administration. For example, it could coordinate all local training of accountants, plumbers and fitters, motor and water meter technicians, electricians, etc.

(6) In the MoH the Environmental Health and Sanitation Unit will be strengthened both at the national and region level, by training 6 sanitation specialists for first degree and 30 assistant sanitarians for diploma to be stationed at the regions and sub-regions.

(7) Most importantly, the functional relationship between regional administration and central level ministries need further refinement and strengthening.

In Table 6.4.1 at the next page is presented a tentative summary of the proposal for institutional strengthening plan for the entire period under study. The expected outcome of the management and strengthening plan as suggested here will be dealt in Chapter Seven.

Table 6.4.1 Summary of Proposals for Institutional Strengthening Plan (2005, 2010, 2015): A Summary

Institution	Recommendation
1. MoLWE (Water Department)	**1. Capacity Building** - Office equipment and supplies - Hydrological, hydrometeorological, survey, geological, and related equipment **2. Training** - Long Term Overseas (BA) for a second degree for 6 experts, including one in water sector planning - Short-term training for 17 experts
2. MoLG (RAD/PMU)	**1. Capacity building** - Technical Assistance for one expatriate - Technical Assistance for three engineers and one community organization experts – all nationals. - Office equipment and supplies - Vehicles **2. Training** - Long term training in facility design for 2 experts - Short terms training for three experts in the water infrastructure services?
3. MOH (Environmental Health and Sanitation Unit)	**1. Capacity building** - Office equipment and supplies for region sanitation offices **2. Training** - Long term training for 6 sanitatrians (BA) - Short term (6months)training for 30 assistant sanitarians
4. Water Supply and Sanitation Authority (WSA)	**1. Capacity Building** - Office equipment, supplies and facilities - Transport vehicles - Technical assistance for engineers and community organization experts - Mendefera WSA office building - HQ building, and stores - Seed money for Mendefera sanitation credit program **2. Training** - Short term training of plumbers, fitters, recorders (water meters and generators, pumps, etc.), in Mendefera at community level. - Short term training for bookkeepers of community level water and sanitation committees.
5. Other Public Institutions: Schools, health institutions, Churches, Mosques, public places, etc.	**1. Capacity Building:** - Establishment of water and sanitation groups in these public institutions and construct latrines and piped water sources by the end of the plan period. Its finance will be jointly from institutions themselves, parents, community, etc.

6.5 Project Cost

6.5.1 Project Cost for Water Supply

Project cost consists of the following main facilities and items.

a) Construction cost

-Intake facilities (borehole, well pump, etc.)

-Transmission facilities (booster pump, pump pit, transmission pipeline, etc.)

-Distribution facilities (reservoir, distribution pipeline, etc.),

-Service facilities (individual connection, communal water point, etc.)

-Electric facilities (control house, power supply, etc.), and

-Others (temporary road etc.)

b) Engineering fee,

c) Administration cost

d) Physical contingencies, and

e) Price contingencies

Project costs for local currency component consists of earth works, concrete works, pipe laying works, installation of mechanical and electrical facilities, temporary works, etc., while for foreign currency component consists of materials and equipment, such as pipes and its fittings, valves, pumps control panels, etc..

To the construction cost, percentages for engineering fee and administration cost are assumed as 10% and 2% respectively. Physical contingencies are assumed as 10% of the sum of the construction cost, engineering fee and administration cost. Finally, price contingencies also assume 6% per year. Project costs of each target year are estimated following tables.

Table 6.5.1 Project Cost in 2005

(Nakfa)

Description	Local C.	Foreign C.	Total	Remarks
1. Construction cost				
Borehole	45,009	717,189	762,198	
Well pump	52,802	745,422	798,224	
Transmission pipeline	1,990,949	4,869,427	6,860,376	
Booster pump	3,984	247,994	251,978	
Pump pit	125,531	77,941	203,471	
Reservoir	588,430	242,765	831,195	
Distribution pipeline	3,798,946	2,687,686	6,486,631	
Individual connection	0	0	0	
Communal water point	234,253	89,263	323,516	
Control house	1,197,963	71,506	1,269,469	
Temporary road	1,633,500	0	1,633,500	
Sub total	**9,671,366**	**9,749,193**	**19,420,560**	
2. Engineering fee	-	1,942,056	1,942,056	
3. Administration cost	388,411	-	388,411	
4. Physical contingencies	1,005,978	1,169,125	2,175,103	
Total	**11,065,755**	**12,860,374**	**23,926,129**	
5. Price contingencies	1,367,727	1,589,542	2,957,270	
Ground total	**12,433,483**	**14,449,916**	**26,883,399**	

Table 6.5.2 Project Cost in 2010

(Nakfa)

Description	Local C.	Foreign C.	Total	Remarks
1. Construction cost				
Borehole	66,145	1,366,386	1,432,531	
Well pump	52,603	712,847	765,450	
Transmission pipeline	2,564,402	7,275,885	9,840,287	
Booster pump	7,557	652,708	660,266	
Pump pit	271,342	198,186	469,528	
Reservoir	668,410	259,744	928,155	
Distribution pipeline	4,611,059	2,235,853	6,846,912	
Individual connection	0	0	0	
Communal water point	234,253	89,263	323,516	
Control house	1,394,922	82,229	1,477,151	
Temporary road	2,376,000	0	2,376,000	
Sub total	**12,246,694**	**12,873,101**	**25,119,795**	
2. Engineering fee	-	2,511,980	2,511,980	
3. Administration cost	502,396	-	502,396	
4. Physical contingencies	1,274,909	1,538,508	2,813,417	
Total	**14,023,999**	**16,923,589**	**30,947,588**	
5. Price contingencies	5,869,312	7,082,845	12,952,157	
Ground total	**19,893,310**	**24,006,434**	**43,899,745**	

Table 6.5.3 Project Cost in 2015

(Nakfa)

Description	Local C.	Foreign C.	Total	Remarks
1. Construction cost				
Borehole	1,558,372	321,701	1,880,074	
Well pump	0	0	0	
Transmission pipeline	9,503,366	28,883,447	38,386,813	
Booster pump	13,650	2,755,072	2,768,722	
Pump pit	521,169	364,950	886,119	
Reservoir	1,274,329	729,001	2,003,330	
Distribution pipeline	4,942,525	2,711,661	7,654,185	
Individual connection	0	0	0	
Communal water point	342,370	130,462	472,831	
Control house	746,676	50,204	796,879	
Temporary road	1,039,500	0	1,039,500	
Sub total	**19,941,956**	**35,946,498**	**55,888,453**	
2. Engineering fee	-	5,588,845	5,588,845	
3. Administration cost	1,117,769	-	1,117,769	
4. Physical contingencies	2,105,972	4,153,534	6,259,507	
Total	**23,165,697**	**45,688,877**	**68,854,575**	
5. Price contingencies	20,809,712	41,042,253	61,851,965	
Ground total	**43,975,410**	**86,731,130**	**130,706,540**	

6.5.2 Project Cost for Sanitation

Table 6.5.4 Cost Estimation of Latrines

Description		Year 2005	Year 2010	Year 2015
School Latrine - PFL	Construction cost	373,628	74,725	74,725
	Price contingencies	46,180	37,635	75,638
	Total	**419,808**	**112,360**	**150,363**
Public Latrine - CFL	Construction cost	323,627	74,725	74,725
	Price contingencies	96,181	37,635	75,638
	Total	**419,808**	**112,360**	**150,363**
Ground total		**839,616**	**224,720**	**300,726**

6.6 Sustainability of Water Supply Facilities

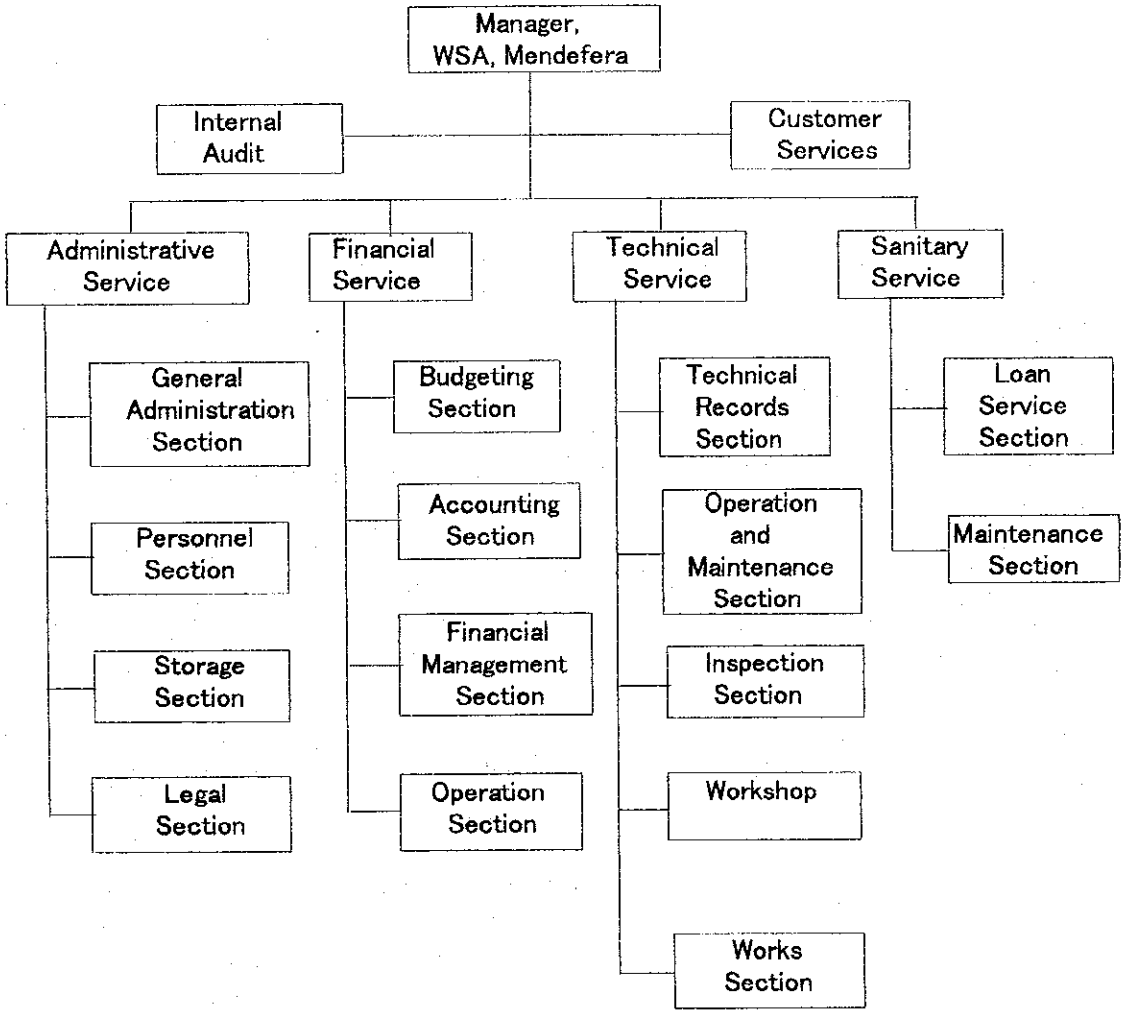
6.6.1 Capacity Building for WSA

The smooth and successful implementation of the water supply project being envisaged depends on how competent and capable the manpower of WSA Mendefera will be in both qualitative and quantitative terms.

Therefore, personnel planning in functions and numbers of personnel to be required in the future target years is of paramount importance.

The primary objective of WSA Mendefera is to supply clean and safe water in a sufficient, sustainable and efficient manner. To achieve this, WSA shall be fully competent technically, financially and legally. Figure 6.6.1 shows the organizational set-up of the WSA.

Figure 6.6.1 Proposed Organizational Set-Up of WSA, Mendefera (2015)



Organizationally, WSA Mendefera will ultimately be composed of Manager, Customer Services, Internal Audit, Administration Service, Financial Service, Technical Service and Sanitary Service.

The Manager is responsible for the stable and successful management of WSA Mendefera and represents the WSA in dealing with the committees, the town municipality and National WSA. Customer Service functions as a window or opening for communications with the consumers in general. Internal Audit is essential for a strict observance of rules and regulations in financial management.

Administration Service is composed of General Administration, Personnel, Storage and Legal sections. General Administration Section is in charge of secretarial/clerical work. Guards and sweepers also

belong to this section. Personnel Section is in charge of recruitment, assignment and training of personnel, and remuneration. The National WSA is proposed be to be basically responsible for the training of personnel. However, it is proposed also that a town WSA can re-train or newly train personnel as need arises, using its own fund. Storekeeping and procurement of materials/supplies are done by Storage Section. Such matters as complaints, lawsuits and penalties are taken care by the Legal Section.

Financial Service must be qualitatively and quantitatively fully manned. Its functions encompass budgeting, accounting, financial management and operation. Annual and monthly budget of income and expenditures is prepared by Budgeting Section. Accounting Section prepares financial statements based on daily financial transactions. Financial Management Section analyzes and evaluates financial performances. Operation Section is in charge of meter reading, billing and collection, and cash water selling.

The communal water points are proposed to be managed by the communities themselves. The study team does not elaborate such a proposal in terms of financial and personnel needs. It is assumed that WSA Mendefera helps communities in the management of the facilities in some manner.

Technical Service must also be fully staffed in terms of the numbers and competence. It covers Technical Records, Operations and Maintenance, Inspection and Works sections, and Workshop. Records of equipment and supplies such as acquired date, numbers, plans, dimension, breakdowns and repairs are kept in Technical Records Section. Operation and maintenance of pumping stations, reservoirs, pipelines, communal water points are taken care of by the Operation and Maintenance Section. Inspection of the above-mentioned facilities is regularly carried out by the Inspection Section. Repairing and manufacturing belong to Workshop. Works Section is in charge of rehabilitation/ replacement/construction of facilities.

In addition to the organizations related to water supply, it is proposed that WSA Mendefera provide an intermediary services for the diffusion of sanitary facilities as well as sanitation services. Sanitary Service is composed of Loan Service and Maintenance sections. Loan Service Section provides loan/subsidy to clients for the installation of septic tank toilets, and keep related records. Maintenance Section regularly empties toilets with a vacuum truck, and regularly cleans and maintains drainages.

The total numbers of personnel are proposed to be 19, 28 and 40 in 2005, 2010 and 2015, respectively (Appendix G, Table-1). They were worked out based on the volume of water to be produced.

6.6.2 O&M Cost

(1) Personnel cost

The number of personnel to be required in each target year has been projected based on the volume of water to be produced in a year.

Personnel cost is calculated by multiplying the number of personnel by the average remuneration per employee. The average monthly remuneration in a target year is calculated to be Nfa 616, while the estimated average yearly growth rate of salaries in real terms is 3%, taking into consideration the current average salary of the Water Supply Service Office (WSSO).

The estimated number of personnel in the target years is shown in Table 6.6.1, and the average remuneration per employee is estimated at Nfa 9,364, Nfa 10,855 and Nfa 12,584 at 1997 prices in years 2005, 2010 and 2015, respectively.

(2) Electricity and fuel cost

All mechanical equipment is operated mainly by electricity. Fuel is also required during emergency. Electricity requirements are calculated based on the volume of water to be produced in each target year.

The electricity cost has been calculated by multiplying electricity requirements in kwh by the unit electricity charge, and by adding 5% of its cost for fuel, in each target year.

The estimated electricity requirements in kwh/day in the target years are shown in Table 6.6.1, and the electricity charge per kwh is Nfa 20.16.

(3) Chemical cost

The chemical, hypochlorite or bleaching powder for disinfection to be consumed in each target year has been projected from the volume of water to be produced in such a year.

The chemical cost is calculated by multiplying chemical requirements in kg in each target year by the unit price of the chemical.

The estimated chemical requirements in the target years are shown in Table 6.6.1, and the unit price of the chemical is Nfa 6.5.

(4) Repairing cost

Maintenance and minor repairing works such as replacement of spare parts for pumps and valves, fixing of water leaking locations, checking of water level in the reservoir, etc. are carried out by the staff in WSA Mendefera. Repairing needs are calculated based on the initial cost for mechanical and electrical works as well as on the initial cost for civil works including pipe laying works in a target year.

Repairing cost is estimated at 1% of the initial cost for mechanical and electrical works, and 0.5% of the initial cost for civil works including pipe laying works, in each target year.

(5) Miscellaneous cost

The miscellaneous cost is assumed at 10% of the sum of the preceding four types of costs.

The results of cost calculation are presentedas Table 6.6.1.

Table 6.6.1 O&M Cost

(Unit: Nfa)

Item	Year 2005		Year 2010		Year 2015	
1. Personnel Cost	37 persons	346,467	59 persons	640,469	77 persons	968,998
2. Electricity and Fuel Cost	40.10 kwh/day	295,072	138.40 kwh/day	1,018,403	323.40 kwh/day	2,379,707
3. Chemical Cost	2,610 kg	16,963	5,952 kg	38,689	9,805 kg	63,736
4. Repairing Cost	Initial Cost for Pump 1,050,202 Nfa Initial Cost for Others 18,370,357 Nfa	112,589	Initial Cost for Pump 2,475,918 Nfa Initial Cost for Others 42,064,436 Nfa	258,589	Initial Cost for Pump 5,244,640 Nfa Initial Cost for Others 95,184,168 Nfa	581,204
5. Miscellaneous Cost		77,109		195,615		399,364
Total		**848,201**		**2,151,765**		**4,393,008**

6.6.3 People's Participation

(1) The path to development: self-reliance and people's participation

People's active participation and self-reliance constitute the main pillars of the Government's development policy. Participation is multi-faceted and may include, and involves almost all stages of the project cycle. For example, in the water sector, communities should could be involved right from the planning stage up to the final hand-over/management stage, after the project is completed, if sustainability of community based projects is desired. The most important principle is the inculcation within the community thinking the felling of ownership of the project.

Even today, self-reliance and people's participation, particularly through community organization, is still relevant in the economic and social transformation of Eritrea. Such a move will address the development needs of Eritrea which, cannot be achieved short of mobilizing the manpower and natural resources of Eritrea. However, self-reliance and popular participation cannot be replicated as in the days of the struggle. The EPLF was organized on a socialist ethos, where individuals were not paid for their services and owned nothing for that mater, and "everything to the war front was not a slogan but a survival strategy. Economic reconstruction of the country is much more complex and it will take place in an environment of liberal economy where the macro-economic policy of Eritrea paves the way for the private sector to play a leading role in the economic growth of the country. But the good news about Eritrea is that the new government works hard for self-reliance and popular participation of a kind compatible with market economies. Self-reliance should not be narrowly conceived to imply that everything is to be done by Eritreans only. Self-reliance is when the people take responsibility for their own future and map out strategies appropriate to their situation. Working towards organizing the people towards this endeavor is crucial to pull together people's resources.

(2) Reiteration of principles

In the broad context of this study, people's/community's participation simply refers to placing people at the center of urban water supply and sanitation development efforts. People based development is clearly enunciated in the Government's policy which is based on the five broad development principles

enumerated in Chapter 2 section 2.2. The implications of these five principles for people's participation are quite clear. But to reiterate, the following main points are elucidated:

a) Ownership of policies and programs: Projects' sustainability could not be guaranteed unless community/people get a sense of ownership of the programs and projects built in and around their locality in particular and the country in the broader sense. Therefore, such sense of collective ownership need to be built as a culture within the people.

b) Participatory politics: This policy principle implies that sustainability of projects becomes questionable if the people are excluded in all the stages of the project cycle, i.e., from the planning, to the implementation and latter on in the management of it. In the case of the project, 'Water Supply and Sanitation in Seven Towns of Debub', people's representative were briefed and their opinions sought right from the inception stage of the study, followed by a second meeting after the progress report was finalized. During these two meetings, extensive discussions were held and views exchanged in which the community representatives expressed their readiness to do whatever was expected of them.

c) Good economic management: As the civil service is planned to be efficient, accountable and lean, in like manner, the management of projects including those that involve communities need to be lean, efficient and accountable to their constituencies if projects at these level are to be sustainable.

d) Human Resources Development: At the macro level, this involves education and training to enhance the country's skilled manpower base. The implication for people's participation is that if communities are to effectively dispense their share in the planning, implementation and management of projects, they need to be trained and educated informally or formally as appropriate.

(3) Recommendations

Based on the implications drawn from the development principles elucidated above, the following recommendations are made to enhance people's participation, and therefore sustenance of projects in Mendefera for the stipulated development program.

a) Continuous sensitization and awareness creation program will need to be an in-built feature of the program for the development of water supply and sanitation in the seven towns.

b) The study team recommends on the broad strategy which the Government could follow in ensuring people's participation in the management and administration of water and sanitation facilities.

c) Introduce and develop a viable management system for water and sanitation facilities that will be managed by the communities.

d) Education and training need to be an in-built system of any program that seeks the active involvement of communities in project planning, implementation and management.

6.6.4 Community Based Management

In the spirit of the principles that govern people's participation as elucidated in section 6.6.3, community based management aims at placing communities at the center of the projects to be implemented, with true user ownership of facilities, including communal facilities. In Mendefera, community based management would, therefore, involve the following principles:

(1) Communities must own and manage the improved as well as unimproved or existing water points and sanitation facilities, with all that such ownership entails. This helps to understand the local values, knowledge and competencies which could eventually assist in the strengthening of community based management.

(2) Hardware and software components of the water supply and sanitation facilities need to be given equal attention. This is all the more important because, dealing with water and sanitation facilities involves managing resources which could be complex activities such as record-keeping, payment, excluding non-payers, punishing offenders, etc. For most communities failure will be common, and systems could fall into a stop and start manner, rather than move smoothly. Therefore, any intervention must recognize that software is not a straightforward task. Periodic failure could be common, even though failure itself needs to be considered as part of the learning process.

(3) The importance of linking hygiene and sanitation interventions with water supply infrastructures, is indeed obvious. However, given the difficulties that water point committee members could face, a separate sanitation committee also needs to be established to manage community toilets and govern on the same principle as that of the water committees.

There exist various interest groups in Mendefera, such as those pertaining to age, sex, income, occupation, values and attitudes. It is important, therefore, not to rely solely on community elders but rather to bring various groups, notably women and young men into the process. The exclusion of these groups may understate important inputs that will consequently undermine management success of community based projects.

(4) Perhaps, one of the considerations often lost in community based management of water and sanitation facilities is that the beneficiaries of services are consumers, and therefore, they have all the right to demand quality service for the value of their money. Attitudes of service delivery agents, including especially private contractors, do often ignore and/or forget to take consumers' interest into account, particularly during the early stages of service delivery (e.g., public water point and public toilet design and location).

(5) Finally, despite uniform opinion and lessons learned regarding the need to have a strong software component to both water supply and sanitation programs, this is often not translated into the relevant commitment in terms of financing and personnel allocation during the project implementation stage. This could simply put the returns to investment of such projects into jeopardy. It is not intended here to suggest how much should be allocated for the software component even after the completion of the project but to stress that the issue of what the software component should deliver be given adequate consideration.

On the basis of the above principles, the following recommendations are given for community based management in Mendefera.

(1) Communities must actually own the improved water points, with all that such ownership entails. In addition, such ownership and management should eventually incorporate unimproved water points into the system.

(2) If community based management is to function in a sustainable manner, both hardware and software components need to be given equal attention. The complexity of the software tasks should not be underestimated nor the amount of time it takes.

(3) Failure should be recognized to be part of the process; and if there is failure somewhere in the line, it should be considered part of the learning curve in the water and sanitation sector.

(4) In community based management, activities should be focused specifically on building self-reliance, self-confidence, and technical and management skills, and helping to solve problems in such a way that water and sanitation facilities are effectively managed locally.

(5) Participatory appraisal techniques need to supplement committee meetings/contacts with opinion leaders, in the consideration for improvement of software delivery.

(6) Within the context of affordability, service delivery agents need to recognize that communities are consumers and would like to maximize the returns from the money they pay for the service required.

(7) The sustainability of community based management for water supply and sanitation facilities may require software interventions up to five year period with multiple visits and strengthening activities taking place over this period. The final measuring rod for empowerment of the community will therefore lie in the commitment of software fund over time, and not simply at the initial stages of service delivery.

6.7 Sustainable Sanitation Improvement

6.7.1 Sanitation Management Plan

While assessing the present public sanitation condition the very basic problem of Mendefera with respect to sanitation is not lack of facilities provision but misuse of facilities and lack of maintenance. The solution of this basic problem to some extent is addressed in the facilities design stage. The technology adapted are to the level of economy and knowledge of the people. Basic latrine design considerations for easy management are:

- The school and public latrines proposed are in a way which minimize water wastage and avoid frequent breakage of cisterns by replacing the cistern with a simple tap at low level for collecting water with jug and pour flush.
- Misuse of school and public latrines in the absence of attendant is addressed in the proposed latrine by providing iron bar mesh fence which will also provide access for inspection by the attendant while in use.
- The septic tank for the school and public latrines is proposed with dry masonry wall lining for soak-away purpose, to minimize the frequent requirement of vacuum track.
- The household latrines recommended for low income group are self manageable. The proposed type of latrine is a double pit ventilated latrine with exchangeable squatting holes and vent holes. The decomposed matter can be removed by family members from shallow depth pit and can be used as manure.

However, the other basic factor for a sustainable sanitary facility is management plan. At present the managing body for all public facilities is the town administration. The town administration having big duties and responsibilities, handling such petty jobs to the extent of managing public latrine as observed is not only too much to manage but also ineffective.

Therefore, introduction of autonomous management systems are highly recommended. The town administrator remaining to be the overall inspector of the facilities with respect to the cleanliness and functionality, the management responsibility of public facilities shall be given either to an individual on contractual or rental basis or a community sanitary facilities committee which shall be formed to operate and manage the systems. The first option is preferable for the very reason that the responsibility lies on an individual only. Moreover, the contractual agreement for rent shall include performance bond for any damages and irresponsible acts of the tenant and clause for termination of the agreement.

The public latrines proposed incur minimum cost which is limited to monthly expenses of water, detergent and cleaning material and once in two to three years of de-sludging

For instance, if a latrine gives service for an average of 300 people per day for defecation and 25 cents is charged per visit, the monthly gross income shall amount 2250 Nfa. This amount of money after covering all the expenses provide a good earning for an individual. For Mendefera town administration Nfa 2,250/- is very trivial sum of money but the burden for an effective management is beyond capacity.

The school latrines do require an attendant who follow up the general condition of the latrines and practices of the students in handling and using the latrines. Cleaning and keeping the latrines in good condition however shall be the students responsibility for the very reason of creating hygienic perception and practical change in their behavior on sanitation and hygienic habits.

(1) Solid waste management

The solid waste management at present is the town administrations responsibility with a great deal of cooperation of the people. The cleaning campaign which is conducted once in a while has a good effect in creating sanitation awareness in the society and keeping the town clean. But for more effectiveness it is highly recommended to develop a plan which introduce a waste handling norm which involves the participation of all groups of the society in a day to day life. Such plan includes:

- Provision of refuse collection bins in the public areas and streets.
- Provision of garbage containers in all residential areas.
- Provision of refuse truck.
- Provision of vacuum truck

Provision of the above facilities and developing realistic work plan is the town administration' responsibility while appropriately using the facilities is duty and responsibility of each of the society member in day to day life.

Provision of garbage containers to all residential areas may not be at present economically feasible to Mendefera. In this case the refuse truck may go round to all the residential areas and collect garbage directly from the residents on fixed days and timing.

The management for solid waste which includes collection of refuse and ultimate disposal to an environmentally safe place outside the town shall be the responsibility of the town administration. However, wide range of cooperation by all groups of beneficiaries is vital for a successful sanitation improvement program.

(2) Wastewater and soil waste management

The kind of wastewater system proposed for Mendefera is on-site disposal. Therefore, the management of wastewater disposal is communities responsibility.

With regard to de-sludging of septic tanks, up to the year 2005 Mendefera town administration may have to rely on the vacuum truck from Asmara for anticipated few number of septic tanks. However, for effective operation private vacuum truck owners should be encouraged.

(3) Proposed sanitation management structure for Mendefera town administration

Mendefera town administration already has sanitation section. However, in this study it is recommended to redefine duties and responsibilities of the section and promote the technical staff know-how.

As shown in the chart below the sanitation section should include Waste disposal division, Public & Household latrine division and Sanitation/Hygiene education division. The duties and responsibilities of each division is defined as follow:

The sanitation section is responsible for pubic relations service and overall control of works and performance evaluation of the three divisions. In addition this section shall be responsible to the staff strengthening of the three divisions. Arranging training programs by looking for fund and institution to promote staff is vital duty of the section.

Duties and responsibilities of Waste disposal division

- Clean the town
- Collect household refuse by going round the town on schedule
- Arrange vacuum truck facility
- Develop monitoring and evaluation technique explicitly on sanitation improvement in the community.
- Monitoring the community solid and wastewater handling
- Follow up violation of regulation by the community such as solid waste disposal to their surrounding area and open field deification.
- Assess environmentally safe area for ultimate solid and soil waste disposal.
- Conduct periodical environmental impact assessment of the disposal area.
- Evaluate and monitor the waste disposal mechanism of factories and industries.
- Regularly clean and maintain drainage system.

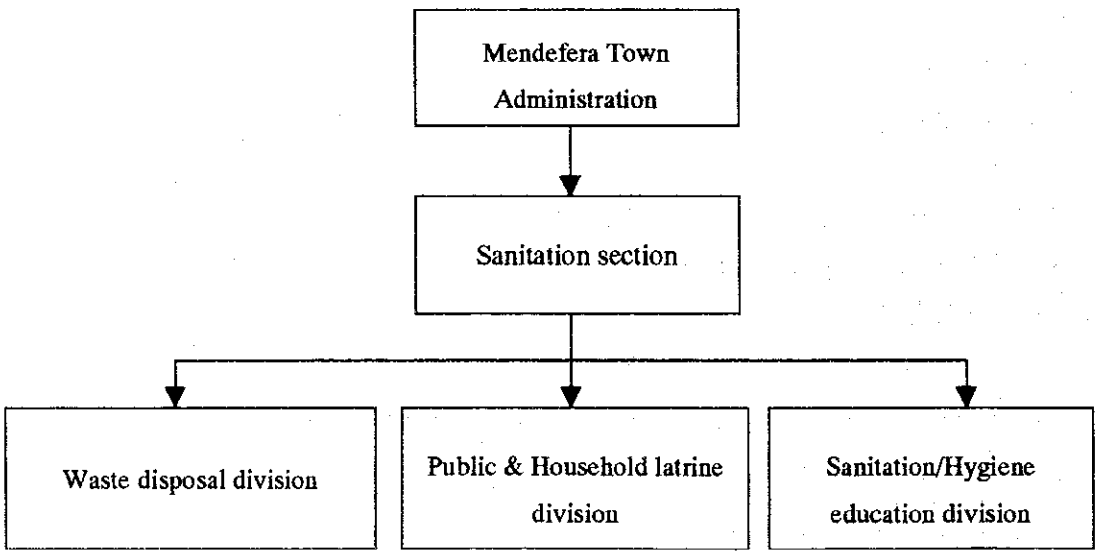
Duties and responsibilities of Public & household latrine division

- Assess public and household latrine coverage.
- Assess public areas which require latrine
- Arrange fund for public latrines construction.
- Facilitate low interest and long repayment loan for low income group level household latrine construction.
- Facilitate tendering of public latrine rental contract.
- Evaluation and monitoring of the public and household latrines condition.
- Develop a monitoring and evaluation technique on sanitation improvement of the community with regard latrines.
- Training household latrine builders.
- Giving technical advise to household latrine builders.
- Follow up the repayment of loan.

Duties and responsibilities of sanitation/ hygiene education division

- Arrange educational program for communities.
- Correspond with different bodies with relative field of interest and who could possibly cooperate by giving fund or arrange an educational program such as ministry health, education, and other non governmental organizations.
- Develop a monitoring and evaluation technique on sanitation improvement technique on sanitation improvement of the community with regard sanitation behavioral changes.
- Evaluate and monitor sanitation/hygiene behavioral changes of the community.

Figure 6.7.1 Sanitation Management Structure



6.7.2 Educational Program Development

An effective sanitation improvement program is achieved if and only if the provision of sanitation facilities and good management plans are backed by a hygiene education program. Compared to facility provision and management plan, developing and conducting an educational program is a difficult task.

The educational program developed should be able to address different groups of beneficiaries by age, sex, education, cultural and religious background. The educational program once developed does not mean the end of it. Every time the program shall be updated to fit to whom it is addressed and the type of teaching mechanism used.

Implementation of the educational programs is rather more difficult than that of developing the program. Choosing appropriate teaching mechanism to fit the addressed target group is very important. The following teaching mechanism can be used for hygiene/sanitation education programs.

Table 6.7.1 Teaching Mechanism and Media

Teaching mechanism	Teaching media
Audio	Radio
Visual	Posters
Audio visual	TV, video films
Communication	Face to face

Easy and less expensive means of conducting the hygiene/sanitation education program is to make use of existing institutions such as schools, churches, mosques, women association, youth association, radio and television stations etc.

School children can be given the education in the schools, and youth association. The hygiene/sanitation aspects need to be included in the students curriculum. In Eritrea organizations such as UNICEF are trying to incorporate the theoretical background of hygiene/sanitation program in the students curriculum. However, from similar project experience in Eritrea the most effective way of teaching children in sanitation and hygiene is to practically make them get used to clean latrine usage, develop hand washing habit after using latrine and cleaning latrine. These are simple norms a student can practice daily in the school, which in a short while expected to change his/her hygiene/sanitation perception and their changed perception is anticipated to be reflected in their family and their society. A latrine attendant or instructor shall be constantly around the toilet, observing and instructing the students to follow simple rules of using latrines. The rules may include only five points:

- To avoid blockage of latrine to make them use only water or paper not stone for anal cleansing
- To put paper used in the basket
- To pour water after using latrine
- To wash hands after using latrine

- To clean latrine by turn daily after class

Church and Mosque are places where elderly people have trust. These institutions if possibly be used to reach elderly people in hygiene/sanitation educational programs effective outcome can be envisaged.

The housewives in Eritrea in general are very tied up with routine home duties such as cleaning, cooking, washing, gardening, shopping etc. Moreover, the social obligation such as helping a relative or neighbor preparing food and drinks for a wedding ceremonies which takes many days, going to funeral which sometime takes place to far away village and visiting the family home for a consecutive days, going to associations, visiting sick person, delivered woman, relatives, going to church etc. are part of the cultural norms of women specially housewives which makes them busy. In addition for a small town like Mendefera fetching water is another burden besides the busy daily life they have. For these reasons an independent hygiene/sanitation program schedule may not be effective and realistic. A more effective and easy way of addressing women might be through the existing radio educational programs which is broadcast during working hour while at the same time carrying out their home duties or through existing institution such as the Eritrean women association, community administration (Mimihidar), church or mosque. Women normally tend to listen the radio educational program, but for those who do not some encouragement by women association or community administration is vital.

In this study the hygiene/sanitation education program development is limited to the preparation of a general educational guideline manual and development of some basic illustrative posters.

The educational emphasis developed in the posters illustrate typical areas for the sanitation improvement of the town. The intended messages to be conveyed in the posters are:

- Explanation on risk of pathogens on health
- Keeping food and water safe from contamination.
- Responsibility of the society on protecting the environment and surface waters from pollution
- Developing habit of hand washing.
- Developing habit of latrine usage
- Demonstration of low cost, safe household latrine.
- Demonstration on household latrine handling.
- Responsibilities in public sanitation facilities usage.
- Risk of infant excreta.
- etc.

The sanitation and hygiene educational manual prepared gives a guideline how to communicate and convey the education to the community. The manual includes the following contents

- How to establish good relationship
- How to analyze the situation and identify community
- How to develop work-plan
- How to select appropriate methods

- How to develop educational method
- How to evaluate the result

6.8 Financial Plan

6.8.1 Willingness-to-Pay

Households were classified into three groups based on the size of their monthly income. It was assumed that those households with the monthly income of up to Nfa 599 belong to the low income group, those with the monthly income of Nfa 600 to Nfa 999 the middle income group and those with the monthly income of Nfa 1,000 and more the high income group.

According to the socio-economic questionnaire survey conducted by the JICA study team, the average monthly income and the share of each income group works out as shown in the table below. It shows that income is widely apart from group to group. It also shows that the income and the share are negatively correlated.

The average willingness-to-pay for water is Nfa 11.7 in monthly amount and 1.5% as the percentage of income.

Income group wise, the average willingness-to-pay is Nfa 9.0, Nfa 11.8 and Nfa 16.8 in monthly amount in the low, middle and high income groups respectively, while it is 2.4%, 1.5% and 1.1% as the percentage of income in the respective groups.

The table shows that the richer you are, the more you are willing to pay for water. However, it is noticed at the same time that there is not so much difference in the willingness-to-pay in monthly amount as in the size of income between groups. It results in the fact that the richer you are, the less you are willing to pay for water in terms of the percentage of your income.

Item	Low Income	Middle Income	High Income	Total
1. Average Monthly Income, 1997 (Nfa)	369	769	1,565	774
2. Share (%)	41.8	36.6	21.6	100.0
3. Willingness to Pay for Water (Nfa/m)	9.0	11.8	16.8	11.7
4. Willingness to Pay for Water (%)	2.4	1.5	1.1	1.5

The low, middle and high income groups are assumed to be the candidates for the users of communal water points, yard connections and house connections, respectively.

6.8.2 Water Tariff Analysis

According to the results of the socio-economic survey, the high, middle and low income groups in Mendefera are willing to pay monthly at Nfa 16.8, Nfa 11.8 and Nfa 9.0 for water, respectively. However, in terms of percentage of income, their respective willingness-to-pay for water works out at 1.1%, 1.5% and 2.4%.

To achieve the financial objective of sustainable management for WSA Mendefera as well as the social justice, water price is proposed to be the highest for the house connection users, at a medium level for the yard connection users and the lowest for the communal water point users. The house connection users include non-domestic customers. In the same context, the payment for water in terms of the percentage of income will be higher for the house/yard connection users than for the communal water point users. The latter proposal defies the results of the socio-economic survey. The underlying concept is the cross-subsidizing among income groups.

After series of mathematical model simulations to attain financial viability and stability for WSA Mendefera and at the same time to fulfill social fairness and justice, water prices in the target years are proposed and shown in Table 6.8.1.

Table 6.8.1 Payment for Water by Service Mode - Mendefera

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point		Total	
	Income/m	Share (%)	Income/m	Share (%)	Income/m	Share (%)	Income/m	Share (%)
2000	1,592	25	840	30	434	45	845	100
2005	1,726	29	874	33	503	38	980	100
2010	1,856	34	765	66			1,136	100
2015	1,990	39	887	61			1,317	100

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point	
	lcd	Price/cm	lcd	Price/cm	lcd	Price/cm
2000	30	9	20	6	15	2
2005	35	9	22	6	15	2
2010	40	12	24	9		
2015	47	12	27	9		

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point	
	Payment/m	Payment %	Payment/m	Payment %	Payment/m	Payment %
2000	44	2.7	19	2.2	4	0.9
2005	52	3	21	2.4	4	0.7
2010	79	4.2	35	4.5		
2015	93	4.6	40	4.5		

The shares and lcd for the three types of water facility users in the target years were previously determined by the study team based on the current water supply and other conditions in Mendefera, which were clarified as a result of the socio-economic survey. The monthly income by type of users was

projected based on the existing economic conditions and socio-economic survey conducted. In doing so, the annual average growth rate of income in real terms was assumed at 3%.

It is proposed that the water price per cubic meter will be Nfa 9, Nfa 6 and Nfa 2 for house connection, yard connection and communal water point users respectively up to the target year of 2005. Also, it will be Nfa 12 and Nfa 9 for house connection and yard connection users, respectively, up to the target year of 2015.

Thus, the monthly payment for water will be Nfa 52, Nfa 79 and Nfa 93 for house connection users in 2005, 2010 and 2015 respectively, Nfa 21, Nfa 35 and Nfa 40 for yard connection users in the respective target years, and Nfa 4 for communal water point users in 2005. In terms of the percentage of income, it will be 3%, 4.2% and 4.6% for house connection users, 2.4%, 4.5% and 4.5% for yard connection users, in the respective target years, and 0.7% for communal water point users in 2005.

From 2010 onward, the percentage of the payment for water to income for both house connection and yard connection users will exceed 4%, which is the upper limit recommended by the World Bank.

6.8.3 Revenue Estimation

The revenue sources of WSA Mendefera are water charge, technical service charge, meter rent and miscellaneous revenues.

Water charge is the central revenue source. It is collected from the house connection, yard connection and communal water point users. House connection users include commercial, industrial and institutional clients. Water charge has been calculated from the number of households/non-domestic customers, family size, lcd and water price by the mode of water supply in each year for the whole period from the completion of the first phase project up to the final target year. In translating the amount of water charge into the revenue, bill collection efficiency was assumed to be 98% based on the current situation where it is virtually 100%.

The second revenue source is the technical service charge. When WSA Mendefera installs an individual connection for a customer, this technical service charge will be collected in addition to the material cost. It is calculated at Nfa 378 on average. The number of individual connections to be installed is estimated at 2,953, 1,307 and 1,777 in 2005, 2010 and 2015, respectively.

The third revenue source is the revenue from meter rent. The rental fee is assumed to be Nfa 1 per month per individual connection.

The last revenue source is miscellaneous revenues such as those from the sale of materials, fines, etc. They were not taken into account because they are of an irregular and unpredictable nature on one hand, and not substantial in amount on the other hand.

The revenue deriving from the above-mentioned sources must be sufficient and stable enough to sustain the management of WSA Mendefera in the years to come.

Taking all the above-mentioned into consideration, the future revenue of the WSA is estimated as follows:

(Unit: Nfa thousand)

Year	2001	2002	2003	2004	2005	2006	2007	2008
Revenue	1,386	1,504	1,637	1,786	1,954	3,745	4,133	4,642
Year	2009	2010	2011	2012	2013	2014	2015	2016
Revenue	5,303	6,163	6,762	7,435	8,191	9,041	9,998	9,859

6.8.4 Cost Analysis

(1) Initial cost

Initial cost is comprised of construction cost, engineering fee, administration cost and physical contingency. Each of the above-mentioned cost was divided into local and foreign components.

Construction cost was classified into the cost for pumps and other facilities because of the difference in depreciation period between the two categories. The depreciation period is assumed to be 15 years for the pumps and 50 years for other facilities.

Engineering fee, which belongs to foreign components is assumed to be 10% of construction cost, while administration cost, which is usually composed of local currency is estimated at 2% of construction cost. Finally, 10% was added to the sum total of the above-mentioned cost as physical contingency.

Initial cost is estimated at Nfa 23,926 thousand, Nfa 30,948 thousand and Nfa 68,855 thousand at 1997 prices for the works for the target years of 2005, 2010 and 2015 respectively. (Refer to the tables below.)

- Year 2005

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	57	993	1,050
Other Facilities	9,614	8,756	18,370
Sub-Total	9,671	9,749	19,420
2. Engineering Fee	-	1,942	1,942
3. Administration Cost	388	-	388
4. Physical Contingency	1,007	1,169	2,176
Total	**11,066**	**12,860**	**23,926**

- Year 2010

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	61	1,366	1,427
Other Facilities	12,186	11,507	23,693
Sub-Total	12,247	12,873	25,120
2. Engineering Fee	-	2,512	2,512
3. Administration Cost	502	-	502
4. Physical Contingency	1275	1,539	2,814
Total	**14,024**	**16,924**	**30,948**

- Year 2015

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	14	2,755	2,769
Other Facilities	19,928	33,191	53,119
Sub-Total	19,942	35,946	55,888
2. Engineering Fee	-	5,589	5,589
3. Administration Cost	1,118	-	1,118
4. Physical Contingency	2,106	4,154	6,260
Total	**23,166**	**45,689**	**68,855**

(2) Implementation schedule

Implementation for the first, second and third phases of works is scheduled as follows. Each phase of the works covers two years, the first year will be for detail design and the second year for construction.

1999	2000	2001	2002	2003	2004	2005	2006	2007
2008	2009	2010	2011	2012	2013	2014	2015	

(3) O&M cost

Operation and maintenance cost to be incurred annually after the completion of each phase of works is estimated as follows.

(Unit: Nfa thousand)

2005	2010	2015
848	2,152	4,393

6.8.5 Projection of Financial Statement

In preparing projected financial statements based on the estimated revenue and cost as explained in sections 6.8.3 and 6.8.4, it was assumed that:

(1) Initial cost will be totally subsidized by the government, viz., the people of the town will not be obliged to repay the initial cost.

(2) The people of the town will shoulder the replacement cost of all facilities.

(3) No tax will be imposed on the profit from water supply operations.

(4) Project life will be 30 years since the start of the implementation of the first phase of works.

The resultant financial statements including income statement, funds statement and balance sheet are shown in Appendix G, Table-2.

Revenue to Cost Ratio	Cash to Revenue Ratio	Profit to Assets Ratio
120.2%	40.0%	1.1%

As the table shows, WSA Mendefera will be financially successful and have a stable management in the years to come, if all the conditions mentioned in the preceding sections concerned are met.

6.9 Project Evaluation

6.9.1 Economic Evaluation

(1) Benefits of water

Implementation of the Project will provide a reasonable amount of clean and safe water to the wide ranges of the people of the town. It means that women, girls and boys will be set free from the daily repetition of water fetching drudgery. Also, the incidence of water-related diseases such as diarrhea, dysentery, parasitic diseases and skin diseases will be drastically reduced, whereby contributing to the improvement of the health of the people in general.

These economic benefits can be considered to be reflected in the prices of water. Currently, the prices of water in the town is institutionally fixed, ranging from Nfa 1.5 to Nfa 6.25 per cubic meter depending on service modes. Such water prices only partially represents the economic benefits of water, but not fully due to institutional consideration. The economic benefits of water can be regarded to be fully reflected in the prices of the water bought from water vendors. In Debarwa, where the scarcity of piped water is the most severe among the seven towns, water prices from water vendors range Nfa 16 to Nfa 40 per cubic meter according to the socio-economic survey.

The economic benefits of piped water are assumed at Nfa 20 per cubic meter.

(2) Future lcd and population in the without project case

The lcd or the per capita per day piped water consumption in liters under the existing circumstances in the seven towns is calculated at 10.3 on average based on the results of the socio-economic survey. The value is 74% of 13.9, which is an lcd including water from shallow wells, rivers/springs and rain.

In the "without project" case, it is assumed that the lcd will continue to be 10.3 throughout the project life period.

If the Project is not implemented, it is expected that the population of the town will not grow as fast as envisaged in the "with project" case due to constraints in water supply.

In the "without project" case, it is assumed that the growth rate of population will go down to a half of the rate foreseen in the "with project" case.

(3) Other conditions/assumptions

In performing economic analysis, the following conditions/assumptions were presupposed besides the above ones.

a) Project life:..... 30 years from the start of the first phase works

b) Opportunity cost of capital: ..... 10%, an average value perceived appropriate by the World Bank

c) Cost and implementation schedule:..... (see 6.8.4.)

d) Standard conversion factor: ..... 0.9, to be applied to local components of initial cost

(4) Results of economic analysis

Cost benefit streams were prepared based on all the above-mentioned conditions and assumptions, as shown in Appendix G, Table-3.

Using the streams, economic analysis of the Project was carried out, producing the economic criteria as shown in the following table.

Economic Criteria	NPV (Nfa thousand)	B/C	EIRR (%)
Value	-18,825	0.75	6.2

The table shows that the EIRR of the Project is 5.7%, which is below 10% or the assumed opportunity cost of capital (OCC). However, the value can be regarded as a reasonable one, considering the social nature of the Project.

(5) Sensitivity analysis

Sensitivity analysis was performed to determine how EIRR will change if cost overrun of 20% occurs or if the cost overrun of 20% and the 10% decrease of benefits simultaneously happen. The results are

shown below.

EIRR (%)

Case	Base Case	Case 1	Case 2
Conditions	-	Capital Cost: +20% O & M Cost: +20%	Capital Cost: +20% O & M Cost: +20% Benefits: -10%
Value	6.2	3.8	1.9

The table shows that the EIRR stays substantially above the discount rate of zero even under the unfavorable situation of Case 1, and still stands above zero even under the severest assumption of Case 2.

6.9.2 Financial Evaluation

Financial internal rate of return (FIRR) cannot be calculated due to the peculiar state of cost benefit streams, characterized by the absence of initial cost in the cost stream.

Therefore, financial evaluation was done for the projected financial statements only.

The projected financial statements as shown in Appendix G, Table-2 are summarized in the management indice tabulated below.

(Unit: %)

Management Indice	Revenue to Cost Ratio	Profit Rate	Working Capital to Revenue Ratio	Profit to Total Assets Ratio
Formula	Revenue / Cost x 100	Profit / Revenue x 100	Working Capital / Revenue x 100	Profit / Total Assets x 100
Value	125.5	17.1	46.3	1.2

The table shows that WSA Mendefera will have a reasonable extent of profit to cushion unpredictable financial turbulences, a substantial reserve of working capital to prepare for replacement of facilities and a nominal profit to the assets invested in the years to come.

6.9.3 Organizational Evaluation

At the national/central level, strengthening of the various Departments of the MoLWE, MoLG and the MoH is proposed. While the task allocation at the central level seems to be clear, those of the region needs much refinement and clarification, especially so far as the relationship with sector at the center is concerned.

While the establishment of the WSA is expected after the promulgation of the Water and Sanitation Law, it is however, proposed to establish the PMU much earlier to facilitate the implementation of the first phase of the project.

In the following are presented the proposed organizational/institutional measures:

(1) There is a need for strong component of institutional capacity building as well as training of middle level and lower level manpower for the main focal ministries at the central level, i.e., MoLWE, MoLG and MoH. WSA staff in Mendefera also need a strong component of re-training. As a precondition to this, however, stronger and more transparent division of responsibilities between the central focal ministries for water and sanitation and the regional counterparts needs to be established. If RAD/MoLG is to gradually hand-over its executing and supervisory role to the regional level, it is also necessary to build the capacity and the level of skills of regional institutions and regional level manpower.

(2) It is proposed that all training of middle and lower level manpower be centralized and that the national WSA be entrusted with all training responsibilities related to water supply facilities. This will have a number of merits which include better training needs assessments, uniformity in equipment and materials, cost savings, etc.

(3) A close look at the organizational/institutional framework of the three ministries also reveals that the planning function is separate from the main departments responsible for water or sanitation. Though all of them have Planning and Human Resources Department it is not clear how, by whom and where, for example, water demand projection and facility planning will be done. Are these the functions of central level ministries or regions? Or should it be given to the envisaged WSA? The decision need to be taken in order to set the track for a proper management of water and sanitation projects.

(4) In the wake of the establishment of WSA, it needs to be vested with decision making powers in setting water tariffs (which needs to be based on a thorough study of local conditions), as well as personnel management, execution of small-scale rehabilitation and maintenance works, purchasing of equipment and supplies. Approval will be given by the RAD/MoLG and reported to the Board.

(5) With regards to sanitation, training will have to continue to be given by the MoH. It seems, however, that there is duplication and overlap between the functions of the Environmental Health Unit of the MoH and those of the MoLWE concerning issues related with policies, regulations and supervisory role. The same is also true with regards to tasks of the MoLWE and those of the MoLG/RAD in relation to water demand projection and facility planning.

(6) Existing sanitation/health committees will be strengthened in Mendefera, by including members from schools, hospital/health center, the bank, regional WSA staff and the community. The major objective of the committee will be to promote, coordinate and unify activities so that sanitary awareness of the people and the installation of facilities will be effectively promoted.

(7) According to the socio-economic survey conducted by the study team, the sampled households in the study areas are not in favor of communal water points. However, to the extent that the majority of the town residents are from the lower income group, and to the extent that they may not afford private house connections or yard connections, there could be no option rather than to reorganize these committees and empower them with decision making powers in financial, personnel, and technical terms.

(8) Construction of private latrines will be promoted. But communal toilets will be constructed only after due consultation with communities concerned.

(9) The software aspect of the project will be given equal attention as that of the hardware, including assistance to community in water and sanitation management along with continuous sensitization and awareness creation program.

(10) Given that women are the most concerned with water and sanitation matters, and given that they constitute the majority of the unemployed in the towns, it is proposed that women make up not less than 60 percent of the committee members of communal water points and communal toilets.

Summing up, the following evaluation of the above organizational measures can be made:

(1) Planning and execution of water supply and sanitation projects in the country and indeed in Mendefera will be streamlined and properly effected, and appropriate capacity building measures will be taken to ensure this.

(2) A viable training component will be developed in order to meet the skilled manpower requirements at the country, Debub region and Mendefera town levels.

(3) Project execution will be effected by the PMU which will be established in the MoLG.

(4) WSA will be established in Mendefera and assistance rendered to strengthen it institutionally and to the training of skilled personnel.

(5) Sanitation and environmental health will institutionally occupy its proper position in the town's WSA to fulfill the urgent needs for its sanitary improvement.

(6) The community in Mendefera will assume prime position in the planning, implementation and management of water and sanitation facilities in their locality.

6.9.4 Technological Evaluation

The proposed water supply system is composed of relatively simple facilities, those of which are not quite different from the existing ones. Main materials for the project, such as PVC pipe for casing and screen, submersible pump for well pump, ductile cast iron pipe for transmission pipeline and PVC pipe for distribution pipeline, are recently very common in Eritrea. There are a few agents of these materials in Asmara. Although a new material made of fiberglass reinforced plastic is to be introduced for elevated tank, the light material could facilitate the construction work very smoothly. The material is also expected to have a long life span comparing with other conventional materials, thus the long run cost could be reduced for the reservoir.

The construction works are carried out by manual labor at present. Soil features are sometimes fresh rock, and topographical configurations are various and steep. Moreover, the lengths of transmission and distribution pipelines are so long. Therefore, use of construction machinery shall be considered to minimize the construction period. Also, the construction works by machinery will be useful and popular in future in Eritrea.

Under the project, several numbers of boreholes are newly required. Their locations are distant from the town and/or distant each other, or sometimes away from others. Therefore, mobilization of these well

pumps and boosting pumps is required for periodical or daily operation. In this regard, transportation shall be strengthened by means of vehicle or motorbike.

6.9.5 Social and WID Evaluation

The value added to women in the town of Mendefera are as follows:

(1) The improvement in piped water supply in Mendefera, will, among other things, result in the significant reduction of time and energy spent in the collection of water, particularly for women, girls and boys. This will allow boys and girls to devote more time for their studies and for women to have more time for other activities, including more leisure time or more opportunity for income generation activities.

(2) This should improve the quality of life for these social groups, making Mendefera town a more pleasant place to live. The health and well-being of residents will improve and eventually these towns will attract more residents thus relieving the pressure on big cities like Asmara..

(3) By the provision of toilets, there will be not only more hygienic environment, but will also allow women and girls the privacy which they have been not allowed to have. Also females will be freed from inconveniences peculiar to them in the absence of proper sanitation facilities.

(4) The project will allow the participation of the community in making decisions regarding the location of public water and sanitation facilities, thus enhancing their sense of empowerment. In addition, the project could provide employment opportunities for women during its implementation and operation stages.

6.9.6 Environmental Impact Assessment

(1) Institutions and policies

The Eritrean Environment Proclamation was drafted in 1996 as a policy instrument for the integrated management of the environment. The Eritrean council for the environment was established under the (draft) proclamation as the organ responsible for integrating national development policies and objectives. At present Department of Environment (previous name was Eritrean Agency for the Environment (EAE)) is the only organization under the Ministry of Land, Water and Environment which deals with the environmental aspects of the country. Since the independence, Eritrea has taken seriously the issue of degraded environment of the country. As a first step, the government of Eritrea has formulated an "Environmental Management Plan for Eritrea" as a blue print for the protection of environmental resources and for the promotion of sustainable development. The Plan represents the framework within which phased actions should be taken to build up the capacity to manage the environment. The plan emphasizes on optimizing rather than maximizing resource use.

In Eritrea, environmental assessment is not yet a legal requirement for any development project, except for those projects covered by sectoral regulations (e.g. mining activities, oil and gas exploitation etc.) due to the absence of national environmental legislation. Therefore, some individual organizations have developed their own guidelines or follow other organization's one. For example, Department of Energy and Mines have developed its own sectoral guidelines for Environmental Assessment (EA) which have

some legal status. The Ministry of Trade and Industry is currently following UN guidelines for EA. Eritrean Community Development Fund (ECDF) within the Ministry of Local Government has developed two volumes of "Natural Resources Management Handbook" which contains checklists and mitigation measures for environmental impacts of selected projects.

Since the past years, the Department of Environment has been working on "Eritrean National Environmental Assessment Procedures and Guidelines-1998" with the Environment and Development Group of Oxford, UK. They have already prepared a draft and organized seminars for comment and now they are sending it to the regions for further discussions and comments. According to the guidelines there is a list projects and with categories. The projects listed in category-A are subject to perform a full EIA, projects in category-B will only need environmental evaluation and for category-C no environmental assessment is required.

(2) Initial Environmental Examination (IEE)

As it is mentioned in the earlier chapter that as a whole Eritrea's environment has been degraded in many ways due to many reasons. Especially, forestry of the country has been badly affected, then in relation to this, soil erosion has also become an important environmental issue. Mendefera is also not free from all these problems. Poor standard of sanitation and hygiene need to be addressed. Solid waste disposal system is still to be established. The quality of drinking water is not of that high grade and reports of water-borne diseases are there. The pressure on groundwater is always in increasing trend and causing depletion of water level.

According to the JICA regulations, all development projects are subject to carry out an Initial Environment Examination (IEE) and then, on the basis of the result of IEE, decision for EIA shall be taken. For this purpose, existing environmental conditions in the region and present status of the government policies have been studied and stated above.

The characteristics of the subject project is to develop groundwater for drinking in the seven urban towns, which includes Mendefera. The scale of the project is not a large one. There is no major construction involved except bore-hole digging at one location. The diameter of the bore-hole will range between 6"-10". The depth of the well is assumed to be around 50m. Average rate of withdrawal is expected to be 2 lit/sec. The construction time will not require more than a week. The conveying means will be pipe lines of 150mm diameter. Apart from a very minor possibility of depletion of groundwater level, no major negative impact on the environment is expected due to this project in terms of social, natural environment including pollution. Therefore, attention should be given on the amount of water that will be planned to withdraw from the source and its effect on the surroundings. For this purpose regular monitoring of water level is recommended. The proposed 35 km supply line from M5 reservoir in order to meet the envisaged demand after the year 2010 will be constructed along the road side. Therefore, requisition of new land or destruction of forests are not expected. However, proper attention should be given in selecting the supply route to avoid any social conflict. On the other hand, supply of safe water will improve the living conditions and formulation of sanitary education plan will upgrade the existing health and hygienic conditions of the inhabitants.

However, environmental screening and scooping for IEE in JICA format have been performed for this sub-regional town. From the result of the IEE it was concluded that no EIA is necessary for this project. The checklists for screening and scooping are presented in Appendix F.

6.10 Project Implementation Plan

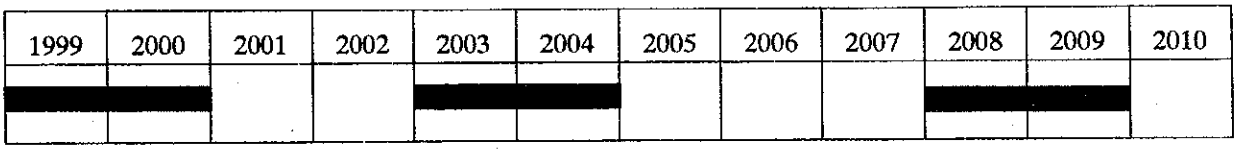
Major works of this project are borehole drilling work, pipe laying work, civil works, mechanical and electrical works, etc. These works have been carried out mostly by manual labor in Eritrea. However, it would be recommended to introduce a certain number of construction machines in order to minimize the construction period.

The implementation schedule is divided into three phases to meet the target year and into two stages, namely, a) preparation of finance including the foreign currency portion and of detail design together with tender documents, and b) implementation of the project.

Seven towns are also divided into two groups. Group 1 is 3 towns of Debarwa, Mendefera and Dekemhare. Locations of these towns are near the capital of Asmara and the population projection is higher than other towns. Group 2 is remaining 4 towns.

The schedule is proposed in the following, taking into consideration the above two stages groups.

Figure 6.10.1 Implementation Schedule



CHAPTER 7 PROJECT FEASIBILITY STUDY

Project feasibility was studied for the priority projects targeting the year of 2005.

7.1 Groundwater Development Plan

7.1.1 Hydrogeological Condition

Mendefera situates on the corridor-like narrow plateau in NNW-SSE direction, so-called Mendefera plateau. Both sides of the corridor are quite steep cliffs dissected by the Mereb and by the Oblow River, but the ground surface on the plateau is very gently undulated and several remaining hills are scattered here and there. A minor tributary of the Mereb, named Mai Takhala, flows down to SSE along almost center of the corridor.

The plateau-forming Tertiary basalts, of which the thickness might be several 100 meters, are exposed over a wide range in this area. Precambrian basement exposes only in the flood plain of the main Mereb, far northwest of Mendefera. Because of the geological situation, a major aquifer in the area is to be a fissure aquifer type of basaltic volcanics, associated with aquiclude consisted of fresh basalts. Alluvial deposits along Mai Takhala are usually less developed, so that there is no alluvial aquifer but combined aquifer with basaltic aquifer.

7.1.2 Water Resources

(1) Current water resources

Current public water sources of the town are those three of dug-wells and two boreholes of BH-4 and BH-5. All of dug-wells are located at the downstream of Kilowlie Dam and Mai Aron Dam. Groundwater from the dug-well is utilized through water tanker and by manpower directly. While, the boreholes are drilled along the upstream of Mai Takhala, utilized as water sources of pipe-born water.

(2) Test Well under the Study

Both Test Wells and Observation Wells were drilled in Mendefera, MEN-1 and 2 as Test Well and MEN-3 and 4 as Observation Well. Lithological logs of these boreholes are attached in Appendix-C, and the lithological conditions are explained in the previous section (4.1.3).

In MEM-1, groundwater was detected at 6m in depth. Then, the yield increased at 28m and slightly but increased at 48m, both of them were crack rich weathered zones. Finally, the yield increased to almost double (total around 2.2 lit/sec), through drilling the pyroclastic from the depth of 63 to 71m. Screens were set, therefore, at three spans of 16-22m, 28-34m and 43-73m. Through the test, 2.0 lit/sec of yield and 2.5 m^2/day of transmissivity were obtained. While, MEN-2 showed only 0.2 lit/sec of yield, so the following pumping test was omitted.

(3) Groundwater potential and water quality

Averaged annual rainfall in Mendefera area is around 611.2 mm/a, and the groundwater recharge volume is estimated as 69.0 mm/a. The area of Mendefera groundwater basin is 165 km^2 in total, resulting that

the maximum yearly groundwater recharge volume is 11.4 MCM/a. While, the major aquifer of the basin is fissured aquifer in basaltic volcano, having no-good continuity and heterogeneous aquifer property. The situation, supposedly, severely restricts the groundwater utilization ratio, less than 10% of the renewal groundwater volume. Thus, the groundwater development potential of this basin can be estimated as around 0.95 MCM/a, converted as around 2600 m^3/day.

Chemical property of groundwater in Mendefera is generally good, while the surface water in Kilowlie dam shows high turbidity and total hardness. Bacteriologically also, a dug-well beneath the dam, reservoirs and some taps were found contaminated by faecal coliform bacteria, those samples were taken after unusual heavy rains though. Non of boreholes, including Test Wells, was contaminated by the bacteria.

(4) Water resources for the target year

The existing groundwater resources including the Test Well MEN-1 have a total yield of 725.7 m^3/day, which can cover the water demand in 2000 but 2005. To cover the water demand in 2005 (1001 m^3/day), another two production wells shall be required, because around 275 m^3/day of the shortage water in 2005 can hardly be supplied by one well, considered from the aquifer property.

7.1.3 Groundwater Development Plan

Groundwater development plan, for Mendefera town targeting 2005, shall be as follows:

a) Completion of MEN-1 as one of the water sources for 2005,
- pump installation, pumping house and a panel board, supply pipe line, etc.-

b) Completion of existing BH-4 and BH-5, also as one of the water sources,
- pump installation, pumping house and a panel board, supply pipe line, etc.-

c) Siting for new water sources, at along Mai Takhala (refer to the Figure 7.1.1),
- hydrogeological reconnaissance, TEM prospecting, comprehensive analysis, etc.-

d) Drilling of new water sources (two success wells among three drilled, most probably),
- drilling, borehole logging, pumping test, water quality analysis, etc.-

e) Completion of newly drilled nMEN-1 and nMEM-2, also as one of the water sources.
- Pump installation, pumping house and a panel board, supply pipe line, etc.-

The standard well structure for newly drilled production well (nMEN-1 and nMEM-2) is shown in Appendix-C, together with the technical specifications.

7.2 Facility Design

7.2.1 Facility Design for Water Supply

(1) Well pump

Submersible pump is recommended as well pump. Capacity and total head of pump are designed to meet the water demand in 2005 and loss head of transmission pipeline. Specification of the well pump is shown in the following.

Table 7.2.1 Specification of Well Pump

Well No.		BH-4	BH-5	MEN-1	nMEN-1	nMEN-2
Discharge	M^3/m	0.288	0.096	0.120	0.120	0.120
Elevation of intake	EL.m	1939.45	1932.2	1942.43	1852	1826
Water level	GL-m	11.0	11.0	18.6	10.0	10.0
Elevation of reservoir	EL.m	1983.0	1983.0	1983.0	1855	1855
Water level	GL+m	3.5	3.5	3.5	3.5	3.5
Actual loss head	m	58.05	65.30	62.67	16.5	42.5
Loss head by pipeline	m	17.79	15.74	25.02	1.62	25.93
Total head	m	75.84	81.04	87.69	18.12	68.43
Number of unit	Set	1	1	1	1	1

(2) Transmission pipeline

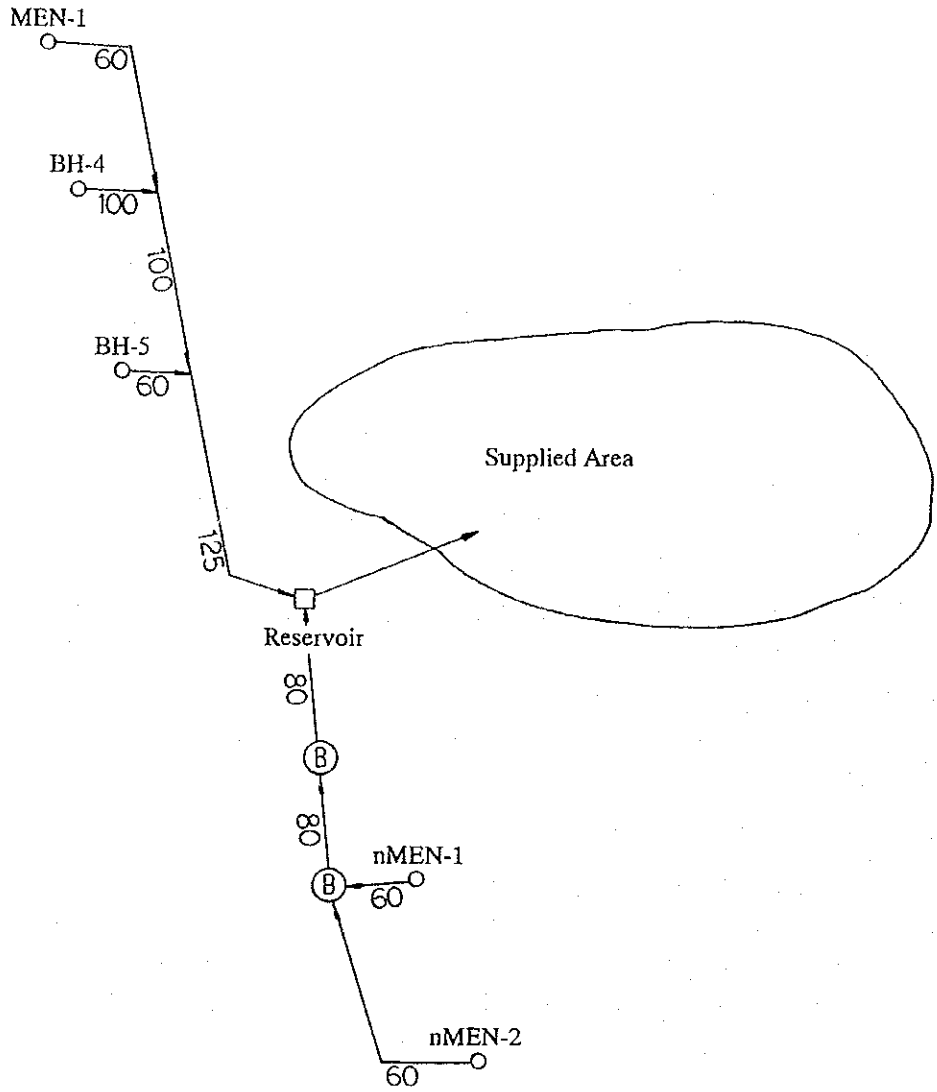
As mentioned in "5.4.3. Facility Plan", transmission pipeline and main distribution pipeline are difficult for expansion to meet the future demand. Therefore, diameters of these pipelines shall be decided for the water demand in the target year 2010 under this project. On the other hand, other facilities like well, pump, reservoir, etc. shall be designed for the water demand in the target year 2005 because they are easy for expansion.

Normally, diameters of pumped pipeline shall be subject to flow velocity in the pipe. In case of small diameters (less than 300) under the project, the most suitable velocity in pipe is from 0.6 m/s to 1.0 m/s. Therefore, the flow velocity for the water demand in 2005 shall be more than 0.6 m/s. Ductile cast iron pipe is selected for the transmission pipeline.

Two pipelines shall be planned; one is from MEN-1, BH-4 and BH-5 to new reservoir, and another is from nMEN-2 and nMEN-1 to reservoir. These pipeline route is selected nearly straight line.

Hydraulic feature of the transmission pipeline is shown in the following.

Figure 7.2.1 Plan of Water Sources and Transmission Pipelines (2005)



(3) Booster pump

Booster pump shall be planned in case that the static head is more than 130m. Because dynamic head including water hammer is considered more than 200m and its pressure may cause some unfavorable influence to the transmission pipeline. Type of pump adopted is centrifugal pump. Specifications of the booster pump are shown in the following.

Table 7.2.2 Specifications of Booster Pump

Booster No.		BP No.1	BP No.2	Remarks
Discharge	M^3/m	0.240	0.240	
Elevation of intake	EL.m	1855.0	1911.0	
Water level	GL-m	0.0	0.0	
Elevation of reservoir	EL.m	1911.0	1983.0	
Water level	GL+m	3.5	3.5	
Actual loss head	M	59.5	75.5	
Loss head by pipeline	M	40.3	25.57	
Total head	M	99.8	101.07	
Number of unit	Set	1	1	

(4) Pump pit

Pump pit is planned for the booster pump with a capacity is 30-minute discharge by booster pump. However, a minimum capacity of 15 m^3 and future additional capacity shall also be considered. Design capacity of the pit is shown in the following.

Table 7.2.3 Capacity of the Pump Pit

Pump pit No.		BP No.1	BP No.2	Remarks
Max. Water Demand	M^3/m	0.240	0.240	
Necessary capacity	m^3	7.2	7.2	
Design capacity	m^3	15	15	
Number of unit	Set	1	1	

(5) Reservoir

A reservoir is newly planned beside the existing reservoir. Capacity of the reservoir is 8-hour max. daily water demand. Design capacity of the reservoir is shown in the following.

Table 7.2.4 Capacity of Reservoir

Reservoir No.		Reservoir 1	Remarks
Type		Ground	
Max. Water Demand	M^3/d	1,001	
Necessary capacity	m^3	334	
Design capacity	m^3	340	

(6) Distribution pipeline

Main distribution pipeline is also designed for the water demand in the target year 2010 under this project. The minimum diameter of the distribution pipeline adopted is 50 mm. Pipeline network of the main distribution pipeline is designed by use of Hardy-Cross formula, and the diameters of distribution pipes

and water level in the reservoirs shall be installed so as to maintain the terminal pressure more than 7m. Detailed hydraulic calculation is shown in Appendix D.

(7) Service facilities

Number of individual connections is estimated from the percentage of consumers in the target year 2005. Communal water points are planned close to the area of low income houses and the vicinity. Communal water points are arranged to cover up the area by approx. 150m-radius circles. Service facility plan for each target year is as follows:

Number of individual connections:	2,593 sets
Number of communal water points:	13 sets

(8) Control house

Control houses are planed for the panel for pump, booster pump, generator for future plan, etc. Type A and B of the control house are for well pump, and type C and D are for booster pump. There is a generator room in the Type B and D. Number of control house is 3sets of type A, 2sets of type B and 2sets of type C.

Item		Unit	Year
Facility	Description		2005
Intake Facility	New borehole	sets	2
	Existing borehole	sets	2
	Test well	sets	1
Well Pump Facility	Submersible pump		BH-5, 0.096m³/min 81.0m, 1set
			MEN-1, 0.120m³/min 87.7m, 1set
			nMEN-2, 0.120m³/min 68.4m, 1set nMEN-1, 0.120m³/min 18.2m, 1set
			BH-4, 0.288m³/min 75.8m, 1set
	(Sub-total)	sets	5
Transmission Pipeline	DCIP 125mm	m	1,779.0
	ditto 100mm	m	624.0
	ditto 80mm	m	4,577.0
	ditto 60mm	m	2,667.0
	(Sub-total)	m	9,647.0
Booster Pump Facility	Centrifugal pump		BP.1, 0.240m³/min 99.8m, 1set
			BP.2, 0.240m³/min 101.1m, 1set
Pump Pit	Made of concrete		15m³, 2set
Reservoir	Made of concrete		340m³
Distribution Pipeline	PVC 200mm	m	980.0
	ditto 150mm	m	832.0
	ditto 125mm	m	1,970.0
	ditto 100mm	m	454.0
	ditto 75mm	m	1,114.0
	ditto 50mm	m	22,716.0
	(Sub-total)	m	28,066.0
Control house		sets	7
Communal W.P.		sets	13
Individual Connection		sets	2,593
Temporary Road	Width 3.0m	m	5,500

7.2.2 Facility Design for latrine

The type of toilet designed is one unit with two compartments, for girls and for boys in the opposite direction. Each compartment is having five latrines. The height and area of the latrine is sized just for economic reason. The latrine is water carriage type, but in order to avoid water wastage and breakage of flushing system pour flush latrine with tap provided at lower level on the side of the Turkish WC. The

tap water shall also be used for anal cleansing purpose. For those who prefer to use paper basket shall be provided. The latrine also has a 30 m^3 capacity septic tank with dry masonry wall for soak-away purpose.

In order to avoid misuse of the toilet by external people after school hour when their is no attendant the toilet is provided with two main doors and iron bar mesh fence. The iron bar mesh fence also help to inspect students while using latrine.

For students in order to develop hand washing practice after using the toilets, hand wash troughs are provided for both girls and boys section.

The type of public toilet recommended is the same as that of school toilets which is pour flush with septic tank and two compartments for ladies and gents with entrance in the opposite direction.

- School latrine – PFL 5 units
- Public latrine – CFL 5 units

7.3 Institutional Strengthening Plan

7.3.1 Central Government

(1) Water Department of MoLWE

To date, the 12 experts assigned to the newly reorganized WD have not been assigned to the two divisions under it. Even though the specifics regarding capacity building and training requirements should be worked out after the placement of personnel is finalized, it is proposed here that the WD be given capacity building and training in areas of water resources development; in collection, compiling and analysis of hydrometeorological information; and water resource information related tasks.

(2) Ministry of Local Government (MoLG)

In all the three divisions of RAD, there are 12 staff, six of them under the Infrastructure Services Division, where the PMU is placed. At the same time, it has been identified that there is a gap in fulfilling the task of planning and demand projection, facility design and social organization (software aspect of the project). In order to fill the gap in the function of these three areas, it will be convenient for RAD (at least in the long-run), to assign the task to the three divisions under it. Accordingly, the Economic Division will assume the responsibility of planning and demand projection, the Social Service will take care of the software aspects and the Infrastructure Services for facility design. This, in effect, means adding three more experts one each for each Division. To enhance the skill of these three experts, it is proposed that an arrangement be made for a short term overseas training.

During the implementation phase of the project, a Project Management Unit (PMU) will be established under the Engineering and Project Management Unit of the Infrastructure Division of RAD. It is proposed that the Head of the PMU be an expatriate with extensive technical knowledge and experience in water facility construction and first hand knowledge in the procedures of donor grant assistance. He will be assisted by three contractual national experts; two engineers and one expert in community organization and management. One of the two engineers will be responsible for the supervision of the

construction activities in Debarwa, Mendefera and Adiquala, while the other one will take care of and Dekemhare, Segeneiti, Adi Keyih and Senafe. Construction works will be given to private contractors.

(3) The Environmental Health Unit of the MoH

There are 5 experts under this Unit, but one graduate in public health sanitation is required for each region of the country. Additionally, at least one sanitarian will be required for each of the 52 sub zones of the country. Presently, there are only 26 and it will be necessary to train another 26. This means that Debub Region will require 12 sanitarians including one for Mendefera. There is a need to support the in-service-training for at least one sanitarian for Mendefera in personal hygiene, environmental hygiene (latrines, garbage disposal, safety of drinking water, etc.).

7.3.2 Local Organizations

(1) Water Supply and Sanitation Authority (WSA Mendefera)

The existing WSS Mendefera office, will be transferred to the newly established WSA Mendefera Office. It will be a semi autonomous unit of the national WSA. Mendefera WSA will be fully strengthened with trained staff and facilities. It will have its own board, whose chairman will report to the town administrator. The board members will be the Mendefera Water and Sanitation Committee members. The appointed manager, who will be accountable to both the Board and the national WSA, will run the daily affairs of the office. He will also act as secretary of the Board. The number of board members as well as the size of the office will depend on the size and complexity of the water supply system. The proposed duties and responsibilities of the core staff in the structure of Mendefera WSA is indicated below.

a) Board chairman:

- calls and chairs all board meetings,
- monitors the performance of water and sanitation committees,
- solves disagreements between residents and committee members,
- represents the board at official meetings and public gathering, and
- prepares reports for the board and the town administrator.

b) Manager

- acts as the secretary of the board,
- prepares quarterly report on water supply and sanitation condition of the town to the national WSA and the board through the chairman,
- manages the office, prepares annual and quarterly plans and target achievement, and budget of the office,
- prepares monthly report to WSA HQ,
- co-signs WSA finance with the finance officer,
- receives and sends incoming and outgoing correspondences,

- approves purchase/requisition of supplies and materials from the national WSA central store,
- supervises the performance of all staff and works closely with the technical officer to ensure reliable water supply and sanitary condition of the town.

c) Finance officer

- ensures that all water bills are collected at the right, and maintains accurate record of all water committees' income,
- prepares monthly financial statements for the manager and the water committees,
- co-signs WSA finance with the manage, and
- prepares annual budget, monthly payroll, etc.

d) Technical officer

- guides the water system operators and evaluates their performance,
- ensures that there is uninterrupted supply of water in the town by speedy maintenance and repair services including that of the communal water points,
- ensures that appropriate records of the performance of the pumping facilities, generators, etc. are kept,
- ensures that a reasonable stock of all fast moving spare parts, fuel, lubricants etc. are in the WSA store,
- work closely with the manager and all other staff to ensure reliable water supply for the town, and
- prepares training plan for WSA staff.

e) Sanitation officer

- in collaboration with the town WSC, conduct public relation activities to sensitize and enhance the awareness of the town residents on private, public health and environmental hygiene conditions and practices,
- Organize community to form Public Toilet Management Committee to operate public toilets and keep the town's cleanliness,
- prepare yearly plan on sanitation program, including construction of private latrines, garbage disposal, and education sessions to be conducted,
- undertake regular inspection of the sewerage system and report to the technical officer,
- on the basis of the number of people who want to construct public latrines, prepare loan formality and pass it to the bank for financing,
- undertake monthly inspection of all public sanitary facilities including that of schools, clinics/health centers, hotels, bars, restaurants, etc.
- prepare monthly report to the manager of WSA and to the town clinic/health center/MOH, and
- supervise the staff working under him

(2) Water and Sanitation Committee (WSC)

In Mendefera, a Water and Sanitation Committee (WSC) will be formed, whose members will be school directors, health center/clinic heads, religious leaders, WSA, town elders, the bank, and other notables in the town. It is this committee that will also act as the Board of Mendefera town WSA.

Among the responsibilities of WSC include:

- in collaboration with the WSA sanitation officer, conduct public relation activities with the aim of sensitizing and enhance the awareness of the town residents on private, public health and environmental hygiene conditions and practices,
- undertake continuous campaign on the need to utilize water judicially and protect water facilities and their catchment areas,
- work very closely with the sanitation officer and advise him on matters concerning community organization and management, and
- promote the construction of private latrines for those who can afford and help facilitate that beneficiaries secure loan facilities from the Bank or other micro-credit institutions.
- help form Communal Water Point Committees (CWPC) and Community Toilet Committees (CTC) and try to solve their problems accordingly in collaboration with the town sanitation officer.

(3) Communal Water Points Committee

Communal Water Points Committees (CWPC) will be formed for each public/communal water point in Mendefera. The committee will report to the town's WSA board chairman. It will have a secretary, technical officer and members who will be given specific assignments when the need arises. Members will be volunteers serving the community without pay, except for the water point care-taker/guards who will be paid agreed monthly salary. It is proposed that at least 50 percent of the members of this committee be females including office holders of the committee, especially for the paying job. It is also proposed that the WSA technical staff assume the responsibility for major maintenance and repair activities.

(4) Communal Toilet Committee

Communal Toilet Committees (CTC) will be formed for each zone of Mendefera town. The committee will work in close collaboration with the sanitation officer, but will report to the town's WSA Board Chairman. It will have a secretary, technical officer and members who will be given specific assignments when the need arises. Members will be volunteers serving the community without pay, except for the community toilet guards who will be paid agreed monthly salary. It is proposed that at least 50 percent of the members of this committee be females including office holders of the committee, especially for the paying job. It is also proposed that the WSA technical staff assume the responsibility for major maintenance and repair activities.