

### **7.3 Institutional Strengthening Plan**

#### **(1) The Central government**

##### Water Department of MoLWE

To date, the 12 experts assigned to the newly re-organized WD have not been assigned to the two divisions under it. Although the placement of personnel is finalized, it is still proposed that WD be given capacity building and training especially in water resources development in the collection, compilation and analysis of hydro-meteorological information and related water resource information tasks.

##### RAD of MoLG

In the three divisions of RAD, it has been identified that there is a gap in fulfilling the task of planning and software aspect of the project. In order to fill the gap in the function of these three divisions, it will be convenient for RAD 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 that three more experts will be added for each Division.

##### PMU under RAD

During the implementation phase of the project, a Project Management Unit (PMU) will be established under the Engineering and Project Management Unit of RAD. It is proposed that the Head of the PMU be an engineer with extensive technical knowledge and experience in water facility construction and first-hand knowledge of international cooperation. He will be assisted by three contractual experts including two engineers and one expert in community organization and management.

##### 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. Thus, the Debu Region will require 12 sanitarians.

#### **(2) Water Supply and Sanitation Authority (Local WSA)**

The existing WSS office of each town will be transferred to the newly established local WSA Office. It will be a semi-autonomous unit of the national WSA. The local WSA will be fully strengthened with trained staff and facilities. It will have its own board, and the board members will be the Water and Sanitation Committee members of the town. The key staff of the office will include a board chairman, manager, finance officer, technical officer, and sanitation officer.

#### **(3) Water and Sanitation Committee (WSC)**

In each town, WSC will be formed, whose members will be school directors, health center/clinic heads, religious leaders, town elders, the bank, and other notables in the town. It is the Committee that will act as the Board of local WSA.

#### (4) Communal Water Points Committee (CWPC)

CWPC will be formed for each public/communal water point in the town. The Committee will report to the local WSA board chairman. The Committee will comprise 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. It is proposed that at least 50% of the members of this committee be female including the office holders of the committee.

#### (5) Community Toilet Committee (CTC)

CTC will be formed for each zone of the town. The Committee will work, in close collaboration, with the sanitation officer, but will report to the local 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. It is proposed that at least 50% of the members be females.

### 7.4 Project Cost

#### (1) Project cost for water supply

Project cost for water supply is estimated as shown in the following table (Table 7.4.1).

**Table 7.4.1 Project Cost (1)**

Unit: Nakfa, thousand USD in ( )

Description	Debarwa	Mendefera	Adiquala	Dekemhare
<b>1. Construction cost</b>				
Borehole (Intake)	0	762,200	300,810	94,590
Well pump	204,110	798,220	233,350	486,400
Transmission pipeline	543,650	6,860,380	2,246,320	7,929,390
Booster pump	0	251,980	89,600	322,430
Pump pit	0	203,470	0	163,790
Reservoir	529,560	831,190	1,797,380	1,607,230
Distribution pipeline	3,900,570	6,486,630	2,700,450	9,180,920
Individual connection	0	0	0	0
Communal water point	298,630	323,520	199,090	497,720
Control house	205,620	1,269,470	413,300	974,130
Temporary road	207,900	1,633,500	89,100	59,400
<b>Sub total</b>	<b>5,890,040</b>	<b>19,420,560</b>	<b>8,069,400</b>	<b>21,316,000</b>
2. Engineering fee (10% of 1.)	589,000	1,942,060	806,940	2,131,600
3. Administration cost (2% of 1.)	117,800	388,410	161,390	426,320
4. Physical contingencies (10% of 1.+2.+3.)	659,690	2,175,100	903,770	2,387,390
<b>Total</b>	<b>7,256,530</b>	<b>23,926,130</b>	<b>9,941,500</b>	<b>26,261,310</b>
5. Price contingencies (6% p.a.)	896,910	2,957,270	1,898,980	3,245,900
<b>Grand total</b>	<b>8,153,440</b> <b>(1,165)</b>	<b>26,883,400</b> <b>(3,840)</b>	<b>11,840,480</b> <b>(1,691)</b>	<b>29,507,210</b> <b>(4,215)</b>

### Project Cost (2)

Description	Segeneiti	Adi Keyih	Senafe	Total
<b>1. Construction cost</b>				
Borehole	286,510	189,190	283,780	1,917,080
Well pump	215,880	511,770	465,600	2,915,330
Transmission pipeline	4,048,390	4,424,450	1,491,670	27,544,250
Booster pump	125,990	255,310	0	1,045,310
Pump pit	101,730	203,470	0	672,460
Reservoir	529,560	936,530	239,750	6,471,200
Distribution pipeline	2,195,790	4,363,090	3,458,700	32,286,150
Individual connection	0	0	0	0
Communal water point	248,860	223,970	199,090	1,990,880
Control house	471,110	1,031,940	501,250	4,866,820
Temporary road	891,000	891,000	148,500	3,920,400
<b>Sub total</b>	<b>9,118,820</b>	<b>13,030,720</b>	<b>6,788,340</b>	<b>83,629,880</b>
2. Engineering fee (10% of 1.)	911,480	1,303,070	678,830	8,362,980
3. Administration cost (2% of 1.)	182,300	260,620	135,770	1,672,610
4. Physical contingencies (10% of 1.+2.+3.)	1,020,860	1,459,440	760,300	9,366,550
<b>Total</b>	<b>11,229,460</b>	<b>16,053,850</b>	<b>8,363,240</b>	<b>103,032,020</b>
5. Price contingencies (6% p.a.)	2,145,000	3,066,540	1,597,510	15,808,110
<b>Grand total</b>	<b>13,374,460</b>	<b>19,120,390</b>	<b>9,960,750</b>	<b>118,840,130</b>
	(1,911)	(2,731)	(1,423)	(16,977)

### (2) Project cost for sanitation

Project cost for sanitation is estimated as following table (Table 7.4.2).

**Table 7.4.2 Project Cost for Sanitation**

	Nakfa, thousand USD in ( )							
	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Total
School Latrine	167,920	419,800	251,880	503,770	251,880	251,880	251,880	2,099,010
Public Latrine	251,880	419,800	251,880	419,360	251,880	419,800	251,880	2,266,480
<b>Total</b>	<b>419,800</b>	<b>839,600</b>	<b>503,700</b>	<b>923,100</b>	<b>503,700</b>	<b>671,600</b>	<b>503,700</b>	<b>4,365,200</b>
	(60)	(120)	(72)	(132)	(72)	(96)	(72)	(624)

## 7.5 Sustainability of Water Supply Facility

### (1) Capacity building for WSA

The Draft Water and Sanitation Law envisages the establishment of WSA whose mandate will be to manage the water and sanitation facilities and consequently ensure the provision of water supply and sanitation services to both urban and rural areas of the country. The current WSS shall be transferred to the new WSA for immediate establishment.

Organizationally, the local WSA shall be composed of 4 divisions and 7 sections under the supervision of the Manager, during first phase. Divisions comprise Administrative Service, Financial Service, Technical Service, and Sanitary Service.

The Manager will be responsible for the stable and successful management of the local WSA and will represent the local WSA in the dealings with the committees, the town municipality and National WSA.

## (2) O&M cost

All water supply facilities are to be operated and maintained under the full responsibility of the local WSA. O&M cost in the target year is estimated in the following tables:

**Table 7.5.1 Annual O&M Cost**

Description	Nakfa, thousand USD in ( )							
	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Total
1. Personnel cost	177,910	346,460	243,100	393,280	149,820	317,370	299,640	1,927,580
2. Electricity & fuel cost	55,190	295,070	97,130	315,760	161,880	270,050	76,520	1,271,600
3. Chemical cost	6,960	16,960	9,020	22,370	5,830	14,390	11,830	87,360
4. Repairing cost	33,520	112,590	46,160	121,680	52,020	75,880	39,890	481,740
5. Miscellaneous cost	27,360	77,110	38,640	85,300	36,950	67,870	42,790	376,020
<b>Total</b>	<b>300,900</b> (43)	<b>848,200</b> (121)	<b>434,100</b> (62)	<b>938,300</b> (134)	<b>406,500</b> (58)	<b>746,500</b> (107)	<b>470,600</b> (67)	<b>4,145,100</b> (592)

## (3) Community-based management and people's participation

Community-based management and people's participation are the both faces of the one issue: the owner of the project should be the people living there, looking the people as a mass or looking the people as a member. To achieve this, the following recommendations are forwarded:

- Communities must actually own the improved water points, with all that such ownership entails and participate in the management of the facility.
- Activities should be focused specifically on building self-reliance, self-confidence, technical and management skills, and so on.
- Frequent participatory appraisal techniques need to supplement committee meetings or contacts with opinion leaders, taking into consideration the improvement of software delivery.
- In respect of affordability, service delivery agents shall recognize that communities are consumers and would like to maximize the returns from the money they pay for the service required.
- To include a strong component of sensitization and awareness creation program in the project by employing a community agent, organizer and/or adviser during the execution and post execution of the project.
- The need for the continuous and active involvement of beneficiaries should be secured by establishing strong water and sanitation committees.
- Education and training will require a built-in system of any program that seeks the active involvement of communities in project planning, implementation and management.

## (4) Training plans

The major factor for a successful O&M on water supply facilities is the manpower of the local WSA, quantitatively and qualitatively. Especially, such personnel as financial, technical/engineering and legal experts occupy a crucial position in evaluating the overall manpower strength of the local WSA. Therefore the training/education of those experts deems to be an essential and urgent matter. It is, thus, proposed that a training center be established under the national WSA to meet the requirements of such experts in the seven towns with the target year set at 2005. The training need of those who will be engaged in water supply undertakings for each local WSA is summarized as Table 7.5.2. A Training Manual for staff of the local WSA was provided under the study, besides an Operation and Maintenance

Manual for Water Supply Facility, which has to be farther elaborated by consultants and contractors before commissioning of the proposed physical components.

**Table 7.5.2 Training Plan**

Item	Debarwa	Mende-fera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Total
<b>1. Financial/Economic Experts</b>								
Financial Service Head	-	-	1	1	1	-	-	3
Budgeting Experts	-	-	-	1	-	-	1	2
Accountants	1	1	1	1	-	1	1	6
Financial Analysts	-	1	1	1	-	1	1	5
Sub-Total	1	2	3	4	1	2	3	16
<b>2. Technical/Engineering Experts</b>								
Technical Service Head	-	1	1	1	1	1	1	6
Mechanics	1	1	1	1	-	1	1	6
Electricians	-	-	-	1	-	-	-	1
Motor Operators	-	2	1	1	1	2	2	9
Plumbers	2	-	-	1	1	1	1	6
Water Meter Technicians	-	-	-	1	-	-	1	2
Sanitary Technicians/Engineers	-	1	1	1	-	1	1	5
Sub-Total	3	5	4	7	3	6	7	35
<b>3. Legal Experts</b>								
Lawyers	-	1	-	1	-	1	-	3
Sub-Total	-	1	-	1	-	1	-	3
<b>Total</b>	<b>4</b>	<b>8</b>	<b>7</b>	<b>12</b>	<b>4</b>	<b>9</b>	<b>10</b>	<b>54</b>

## 7.6 Financial Plan

### (1) Water tariff analysis

To fulfill the financial objective of sustainable management for the local WSA, as well as the social objective of justice, water price is proposed to be at the highest level for the house connection users, at a medium level for the yard connection users and the lowest for the communal water point users. In the same context, the payment for water in terms of the percentage of income will also be higher for the house/yard connection users than for the communal water point users.

It is proposed that the water price per cubic meter will be 7-10 Nfa for house connection, 4-8 Nfa for yard connection, 2-4 Nfa for communal water point, in the target year of 2005, as shown in Table 7.6.1.

**Table 7.6.1 Proposed Water Tariff for 2005**

Item	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Average
House Connection	7.5	9.0	7.5	7.0	10.0	8.0	7.0	8.0
Yard Connection	4.0	6.0	5.0	5.0	8.0	6.0	4.0	5.4
Communal Water Point	2.0	2.0	2.0	2.0	4.0	2.0	2.0	2.3

(Nfa/m<sup>3</sup>)

Then, the affordability of low income group (less than 600 Nfa of monthly income) which is the user of communal water points is examined in detail. The group is further divided into four levels based on the income, and the ratio of monthly water tariff to the income is calculated, as shown in the table below.

The table indicates the share (percentage) of monthly expenditure for water to the monthly income, for every income level, is less than their willingness to pay, excepting Segeneiti. Even in Segeneiti, the monthly payment for water is slightly higher than willingness. Further, the ratio of tariff/income is thoroughly less than 4% which is the recommended limit by World Bank. Thus, the proposed water tariff for communal water points (2.0 Nfa/m<sup>3</sup>, 4 Nfa/m<sup>3</sup>), which are mostly utilized by the low income group, shall be reasonable.

**Table 7.6.2 Payment for Water as Percentage of Income (Low Income group)**

Household Income (Nfa/M)	Payment for Water as Percentage of Income (%)							Willingness to Pay as % of Income
	Debarwa	Mendefera	Adiquala	Dekembhare	Segeneiti	Adi Keyih	Senafe	
0-199	2.7	2.7	2.7	2.7	6.0	2.7	2.7	5.0
200-299	1.6	1.6	1.6	1.6	3.6	1.6	1.6	3.4
300-399	1.1	1.1	1.1	1.1	2.6	1.1	1.1	2.5
400-599	0.8	0.8	0.8	0.8	1.8	0.8	0.8	2.1

## (2) Revenue estimation

Taking into consideration the facts mentioned in section 6.8 (3), the projected revenue of the local WSA is estimated as follows:

**Table 7.6.3 Estimated Revenue**

(Unit: Thousand Nfa)

Debarwa	Year	2001	2002	2003	2004	2005	2006
	Revenue	436	474	517	563	614	582
Mendefera	Year	2001	2002	2003	2004	2005	2006
	Revenue	1,386	1,504	1,637	1,786	1,954	1,752
Adiquala	Year	2002	2003	2004	2005	2006	
	Revenue	678	738	806	881	790	
Dekembhare	Year	2001	2002	2003	2004	2005	2006
	Revenue	1,470	1,598	1,742	1,904	2,088	1,879
Segeneiti	Year	2002	2003	2004	2005	2006	
	Revenue	592	647	709	778	727	
Adi Keyih	Year	2002	2003	2004	2005	2006	
	Revenue	1,173	1,270	1,378	1,500	1,332	
Senafe	Year	2002	2003	2004	2005	2006	
	Revenue	771	828	892	963	818	

### (3) Cost analysis

Initial cost is composed of construction cost, engineering fee, administration cost and physical contingency. Each of the cost consists of local and foreign components.

Construction cost covers cost for pumps and other facilities taking into consideration the difference in depreciation period between two categories. Engineering fee, which belongs to foreign components, is assumed to be 10% of construction cost, while administration cost, which is generally composed of local currency is estimated at 2% of the construction cost. Finally, 10% physical contingency was added to the sum total of the above-mentioned cost.

Initial cost for water supply facility and sanitary facility as well as the estimated O&M cost are presented in Tables 7.4.1, 7.4.2, and 7.5.1 in the preceding section.

### (4) Projection of financial statement

The ratios such as revenue to cost ratio, cash to revenue ratio, and profit to assets ratio, etc., are summarized in Table 7.6.4. The figures indicated in the table show that the local WSA of all target towns will be financially successful and will have a stable management.

**Table 7.6.4 Financial Statements**

	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Average
Revenue to Cost Ratio (%)	123.8	124.5	122.6	122.4	110.3	129.8	124.3	122.5
Profit Rate (%)	18.7	19.3	18.3	17.9	9.1	16.4	19.4	17.0
Working Capital to Revenue Ratio (%)	44.4	47.0	43.4	46.3	40.3	40.3	39.4	43.0
Profit to Total Assets Ratio (%)	1.3	1.2	1.3	1.1	0.6	1.2	1.6	1.2

## 7.7 Project Evaluation

### (1) Economic evaluation

Cost benefit streams were prepared based on the conditions mentioned in section 6.9 (1) and assumptions as shown in Table 7.7.1. Most of the town show more than 10% of EIRR except Mendefera and Segeneiti.

Sensitivity analysis was performed to determine how EIRR will change if cost overrun of 20% occurs (Case-1 refers) or if the cost overrun of 20% and the 10% decrease of the benefits simultaneously happen (Case-2 refers). The results are shown in Table 7.7.1.

**Table 7.7.1 Economic Analysis**

	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Average
NPV (Thousand Nfa)	1,804	-1,046	2,876	3,551	-2,277	2,957	7,296	2,395
B/C	1.24	0.95	1.32	1.14	0.78	1.18	1.89	1.24
EIRR (%)	13.6	9.3	15.2	12.1	6.0	13.4	24.5	13.9
Sensitivity (%)								
EIRR in Case-1	10.5	6.7	11.7	9.2	3.1	9.8	19.7	10.1
EIRR in Case-2	8.4	3.3	8.2	6.5	0.5	7.4	15.3	7.1

Sensitivity analysis shows that the EIRR for most of the towns go below OCC under the most unfavorable situation of Case 2. Especially, EIRR of Mendefera and Segeneiti go down far below 10%, but stay above the discount rate of zero.

### (2) Financial evaluation

The financial internal rate of return (FIRR) cannot be estimated 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 in a manner as stated below.

A trial simulation on FIRR, under the conditions that the initial cost is to be born by the beneficiaries and the water tariff is to be twice of the proposed one, was conducted as a reference. The results are shown in the following table. As shown in the table, the FIRR of every town is less than 10% except Senafe. It means that the water tariff must be more than twice of the proposed one to achieve the discount rate of 10%, and it deems to be too heavy burden for the beneficiaries to bear.

**Table 7.7.2 FIRR (Trial)**

	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Average
FIRR (%)	8.8	7.9	9.0	7.5	6.1	9.4	11.9	8.7

Further, another simulation was performed under the conditions that the local portions of the initial cost is to be borne by the beneficiaries with no change to the proposed water tariff. As a result, FIRR's of 0.7% to 5.0% have been obtained.

### (3) Organizational evaluation

- a) The skeletal administrative/organizational structures of the PMU and national WSA will enable the smooth execution of the first phase of the project and indeed its management latter on.
- b) The organizational structure that will be realized in the year 2005 for local WSA is elucidated, and the management of communal water points and toilets will involve all the possible factors or beneficiaries in the town.
- c) In case of the local WSA, there will be the town's Water and Sanitation Committee that will also act as the board of local WSA. It will have power and responsibilities especially in seeing the efficient management of communal water points and toilets.
- d) The manager of local WSA has wide responsibilities and challenges to meet. He will be greatly assisted by the Board and the national WSA in all his efforts.



- e) The existence of a separate unit in the local WSA charged with sanitation issues will greatly improve the town's sanitation. It is expected that there will be easy access to credit facilities to construct latrines for those who should afford.

#### **(4) Technological evaluation**

Major facilities to be constructed under the Project are control houses (pump houses), transmission/distribution pipelines, reservoirs, booster pumps, some latrines, and so forth. All of these facilities are already common in this country. The construction works for those facilities have been conducted by the local contractor. Major materials required for the works are submersible pump, PVC pipe, ductile cast iron pipe, and cement, which are also common in the country. Thus, there is no difficulty in implementing the Project.

While, most of construction works are carried out by manpower at present, utilization of construction machinery shall be considered to minimize the construction period.

#### **(5) Social and WID evaluation**

- a) Both newly constructed and existing communal water points will be managed by the community, 50% of whom will be women.
- b) Well-managed community water and sanitation facilities are expected to minimize current community's frustration with opening hours, breakdowns and repairs, water tariff, etc. The community is expected to be financially self-sufficient and will be vested with decision of making powers in financial, personnel and when appropriate in technical terms.
- c) The following items shall be taken into consideration in the evaluation of social and WID:
  - The project should have a shift in the quality of life of all social groups from a lower level to a higher level.
  - By improving the piped water supply in the towns, the intended benefits will include the significant reduction of time and energy spent in the collection of water.
  - The construction of latrines and public toilets, will enable women and girls to have more privacy than they have had in the past for urination, defecation and menstruation.
  - The project will allow the community to determine of the location and design of the facilities in the town, thereby increasing their sense of empowerment in matters that directly concern them.

#### **7.8 Project Implementation Plan**

Major works of this project are borehole drilling work, pipe laying work, civil works, mechanical and electrical works, etc. Implementation schedule is divided into two stages: preparation stage and construction stage. Period of the implementation for both stages shall be around two years.

## 8. CONCLUSION AND RECOMMENDATION

### 8.1 Conclusion

The project of Groundwater Development and Water Supply for Seven Towns in Southern Region is concluded as follows:

#### (Field Survey)

- (1) Through the reconnaissance of the town and workshops held in the town, the current poor water supply and sanitary conditions, people's eagerness for water supply development, and inhabitants' good understanding on the importance of sanitary condition were recognized.
- (2) A series of hydrogeological investigations enabled to grasp the hydrogeological property of the area and test well and observation well drilling points were selected. A total of 10 test wells and 3 observation wells were drilled, and most of them indicated considerably high groundwater yield. Automatic water level recorders were installed in all observation wells and 6 selected test wells, and the groundwater monitoring is still continuing.
- (3) Within the scope of the hydro-meteorological survey, existing data were collected and a rain-gauge in each target town, two staff gauges along the Mereb, and staff gauges at two surface dams were installed. Observations using these gauges are still underway.
- (4) A series of socio-economic survey revealed the actual life-level and conditions of the inhabitants, such as occupation, income, current water supply means and volume of water consumed, as well as their consciousness and willingness-to-pay for clean water supply.

#### (Formulation of Development Plans)

- (5) The project for water resources development, water supply and sanitation improvement was formulated as phased plans with horizons of 2005, 2010, and 2015. The water resources development focuses on groundwater, and the domestic water supply was given priority.
- (6) Both future population and domestic water consumption rate of each town are projected. Based on these figures, as well as with consideration of other water use purposes, extension of the service area, etc., the water demand of every town is projected for each target year.
- (7) Groundwater development potential is, in most towns, high enough to meet the water demand of all three time horizons. The exception is the case of Mendefera, where the groundwater potential is estimated to be enough to meet the water demand only up to the year 2010. Development of alternative water source shall be required for the year 2015 in Mendefera.
- (8) Mereb-5 site in the Mereb basin was selected as a proposed dam site for surface water development. The dam shall have 25.0 MCM of reservoir capacity against 665,000 m<sup>3</sup> of embankment volume.
- (9) Planned water supply facilities comprise boreholes, reservoir tanks, transmission pipeline, distribution pipeline, control houses, booster pumps, pumping pits, etc.
- (10) Planned sanitary facilities are public latrines and school latrines. Besides, sanitation improvement plans such as waste water and storm water drainage, refuse disposal, etc., as well as an educational program on sanitation, were studied and recommended.
- (11) Institutional strengthening plans on MoLWE, MoLG, MoH, national WSA, local WSAs and some other local agencies were studied and several recommendations are presented.
- (12) Project costs on water supply and sanitation facilities, as well as O&M cost, are estimated as follows:

**Table 8.1.1 Project Cost**

(Thousand USD)

	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Total
2005								
Water Supply	1,165	3,840	1,691	4,215	1,911	2,731	1,423	16,977
Sanitation	60	120	72	132	72	91	72	624
Total	1,225	3,960	1,763	4,347	1,983	2,822	1,495	17,601
Annual O&M cost	43	121	62	134	58	107	67	592
2010								
Water Supply	891	6,271	2,987	3,330	1,478	7,986	2,901	25,845
Sanitation	32	32	32	32	32	32	32	225
Total	923	6,303	3,019	3,362	1,510	8,018	2,933	26,070
Annual O&M cost	80	307	124	223	95	198	837	1,140
2015								
Water Supply	2,410	18,672	2,441	9,454	2,413	4,011	3,039	42,443
Sanitation	43	43	43	43	43	43	43	301
Total	2,453	18,715	2,484	9,497	2,456	4,054	3,082	42,744
Annual O&M cost	132	628	222	435	136	299	194	2,045

- (13) Through the financial analysis, water tariffs of 6.5-12 Nfa/m<sup>3</sup> for a house connection, 4-9 Nfa/m<sup>3</sup> for a yard connection, and 2-4 Nfa/m<sup>3</sup> for communal water points were proposed.
- (14) As a result of the economic evaluation most towns show economic soundness of the Project. Only two towns (Mendefera and Segeneiti) show less than 10% of EIRR because of high construction cost. However, it may be tolerable considering its social nature. Sensitivity analysis indicates low EIRR with unfavorable conditions, but still substantially above zero.
- (15) Financial evaluation shows a reasonable extent of profit which allows to create a sufficient reserve working capital to provide for unpredictable expenditures and to prepare for replacement of facilities as well as the returns from the invested assets.
- (16) The project is, thus, feasible from the viewpoint of economic and financial evaluation. The project holds also from the standpoint of organizational, technological, social and WID, and environmental evaluations.
- (17) Project implementation plan is formulated as follows:  
from 1999 or 2000 for the first phase implementation, from 2003 or 2004 for the second, and from 2008 or 2009 for the third. Each phase shall have about one year of preparatory work period and following one year of actual construction period.

**(Feasibility Study)**

- (18) Project feasibility was studied for the priority projects targeting the year of 2005.
- (19) The first phase implementation for the priority projects is feasible on the condition that the initial cost will be subsidized by the government, and to be promoted by the Ministry of Local Government with appropriate foreign assistance.
- (20) Groundwater can meet the water demands of all target towns up to the year 2005. Most towns will be sufficiently supplied with water from the test well(s) drilled under the Study, or together with the existing wells. Only Mendefera requires additional production well drilling.
- (21) Designed facilities to be constructed under the Project are boreholes, well pumps, transmission pipeline, distribution pipeline, reservoirs, booster pumps, pumping pits, communal water points, temporary access roads, control houses, school latrines, and public latrines.
- (22) Project cost for water supply and sanitation and O&M cost for the first phase are estimated in the

following table.

**Table 8.1.2 Project Cost**

	(Thousand USD)							
	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Total
Water Supply	1,165	3,840	1,691	4,215	1,911	2,731	1,423	16,977
Sanitation	60	120	72	132	72	96	72	624
Total	1,225	3,960	1,763	4,347	1,983	2,822	1,495	17,601
Annual O&M cost	43	121	62	134	58	107	67	592

(23) For smooth implementation and effective O&M of the facilities, a capacity building of local WSA as well as establishment of local sanitary committees, are required.

(24) Water tariff to be applied under the Project is estimated as follows:

**Table 8.1.3 Proposed Water Tariff for 2005**

	(Nfa/m <sup>3</sup> )							
Item	Debarwa	Mendefera	Adiquala	Dekemhare	Segeneiti	Adi Keyih	Senafe	Average
House Connection	7.5	9.0	7.5	7.0	10.0	8.0	7.0	8.0
Yard Connection	4.0	6.0	5.0	5.0	8.0	6.0	4.0	5.4
Communal Water Point	2.0	2.0	2.0	2.0	4.0	2.0	2.0	2.3

Revenue estimation based on the tariff suggests sound management of the local WSA.

(25) Analyzed cost/benefit streams suggests soundness of the Project for most of the towns. Only two towns (Mendefera and Segeneiti) show less than 10% of EIRR, and quite a low rate of sensitivity analysis with unfavorable conditions, but still above zero.

(26) Financial evaluation shows that the local WSA will have a reasonable profit, a sufficient reserve working capital, to be invested in the years to come as a nominal profit to assets.

(27) The Project is feasible for organizational, technological, social and WID aspect evaluations.

(28) Implementation schedule is to be divided into two stages: a preparatory stage and construction stage.

(29) The Project is, thus, considered to be feasible.

## 8.2 Recommendation

(1) The Government of Eritrea is recommended to consider financing of the Project of Groundwater Development and Water Supply for Seven Towns in Southern Region to implement the first phase of the phased plans targeting 2005.

(2) Institutional strengthening of RAD of MoLG, WD of MoLWE, EHU of MoH is quite important, not only for the Project but also for all other national development programs.

(3) PMU of the Project, under RAD of MoLG, shall be established as soon as possible.

(4) Smooth and complete establishment of WSA both of national and local levels, as well as the associated local committees based on autonomous management, are highly recommended.

(5) Establishment of a training center under the national WSA, for financial, technical, and legal personnel of local WSA, is recommended.

(6) The concept of community based management and people's participation shall be taken into consideration throughout the project implementation and O&M after construction.

(7) Beside the provision of public/school latrines under the Project, provision of on-site drainage

systems for sewerage, and trucks/containers for refuse disposal, are recommended.

- (8) Educational program is also of vital importance for sanitation improvement, against the construction of sanitary facilities. Thus, carrying out this educational program formulated under the Project is recommended.
- (9) Monitoring of groundwater, observation of rainfall, and measuring of river runoff are essential for the Project and for future water resources development programs. Continuation of these measurement is highly recommended.

## **Appendix**

Figure 6.2.1. WATER DEMAND AND RESOURCES PLAN

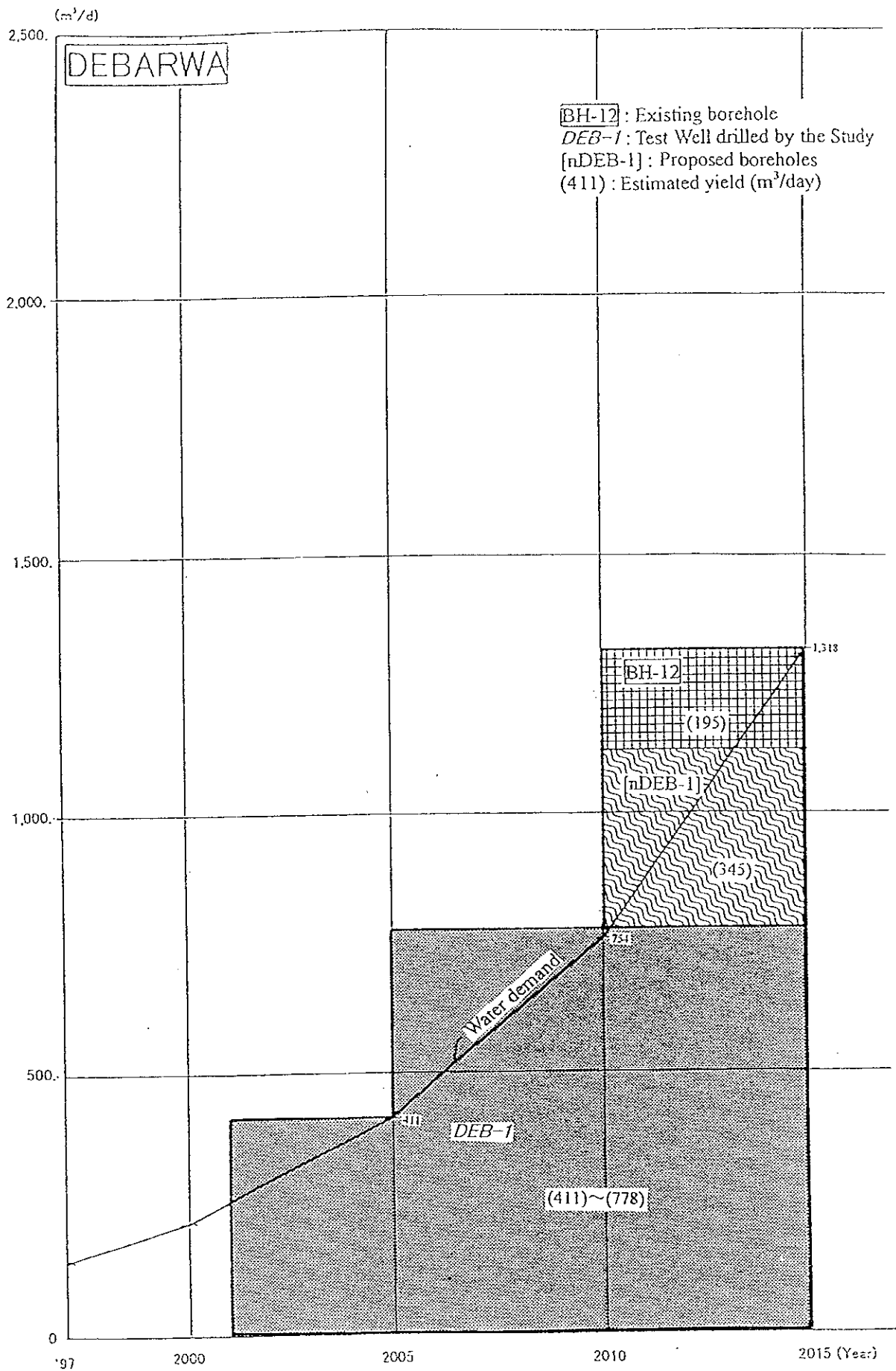


Figure 6.2.2. WATER DEMAND AND RESOURCES PLAN

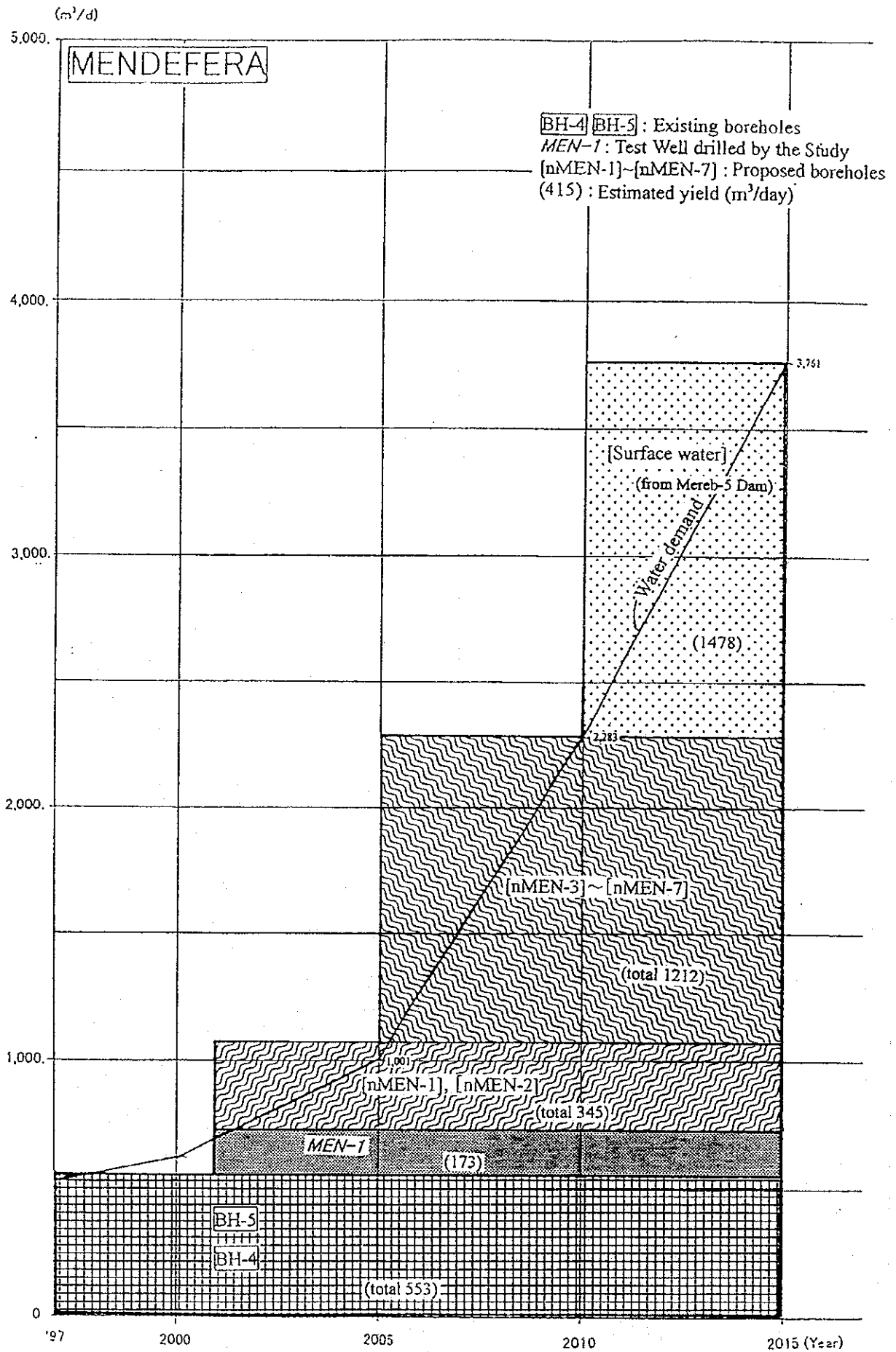




Figure 6.2.3. WATER DEMAND AND RESOURCES PLAN

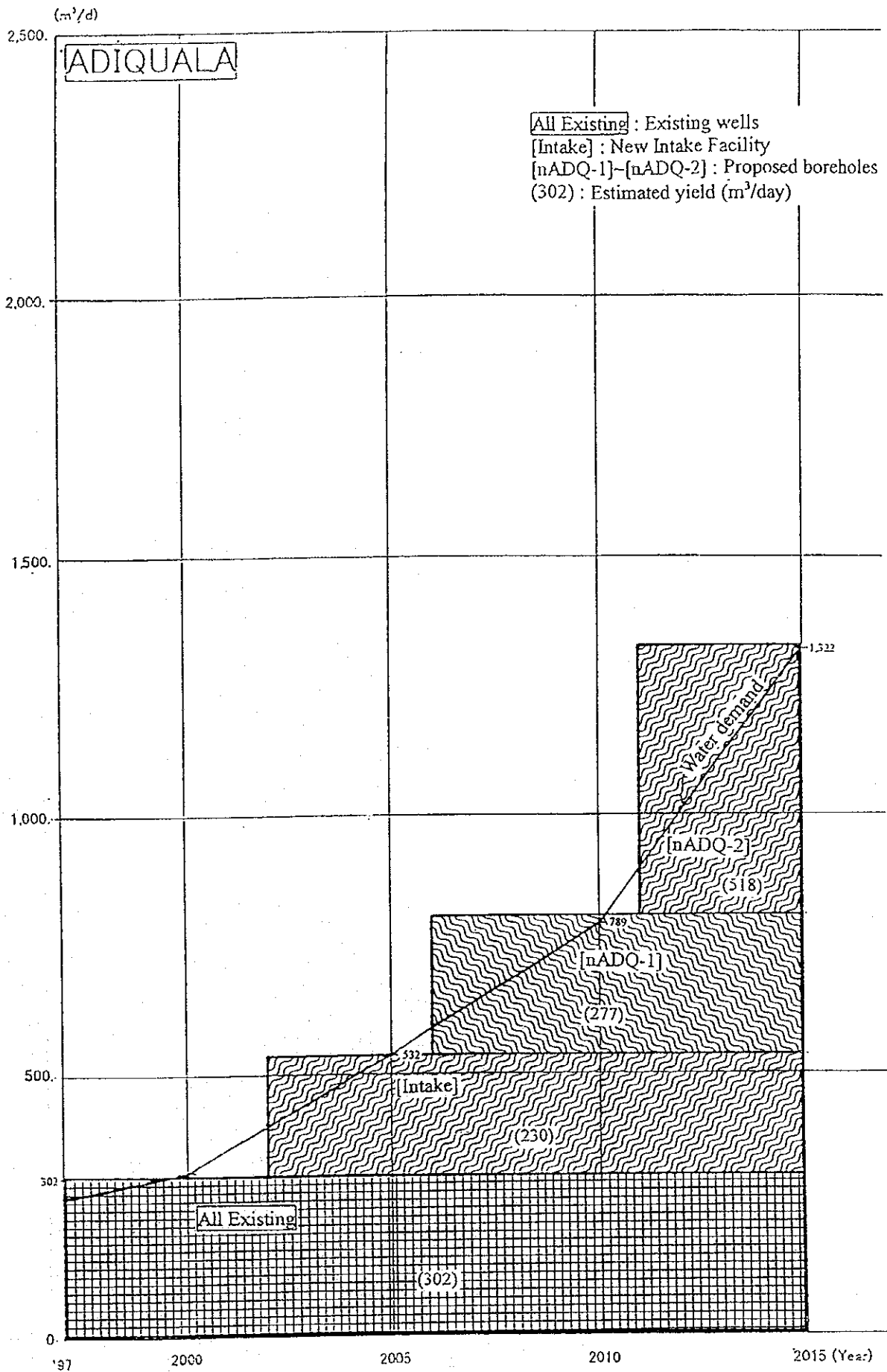


Figure 6.2.4. WATER DEMAND AND RESOURCES PLAN

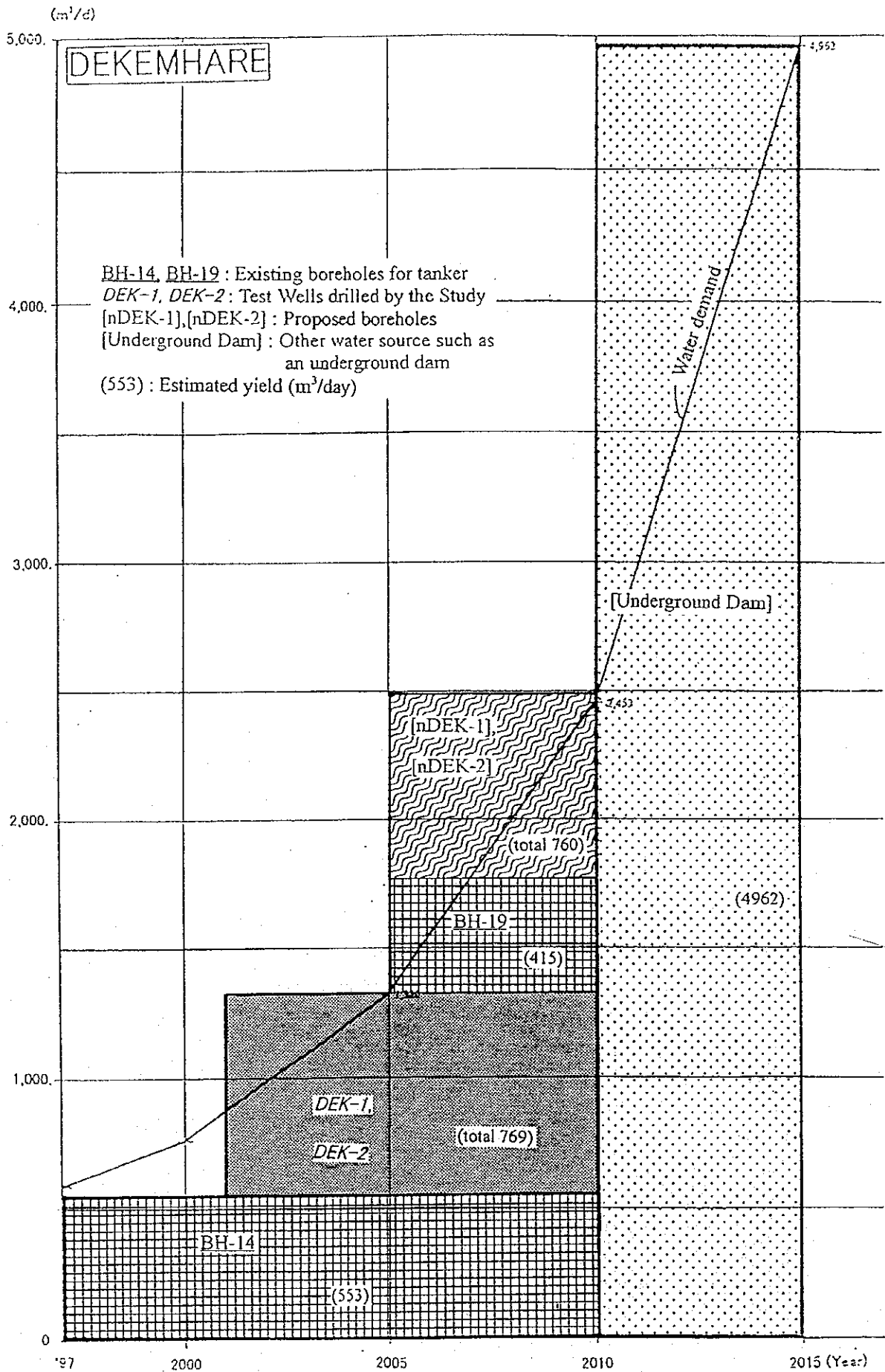


Figure 6.2.5. WATER DEMAND AND RESOURCES PLAN

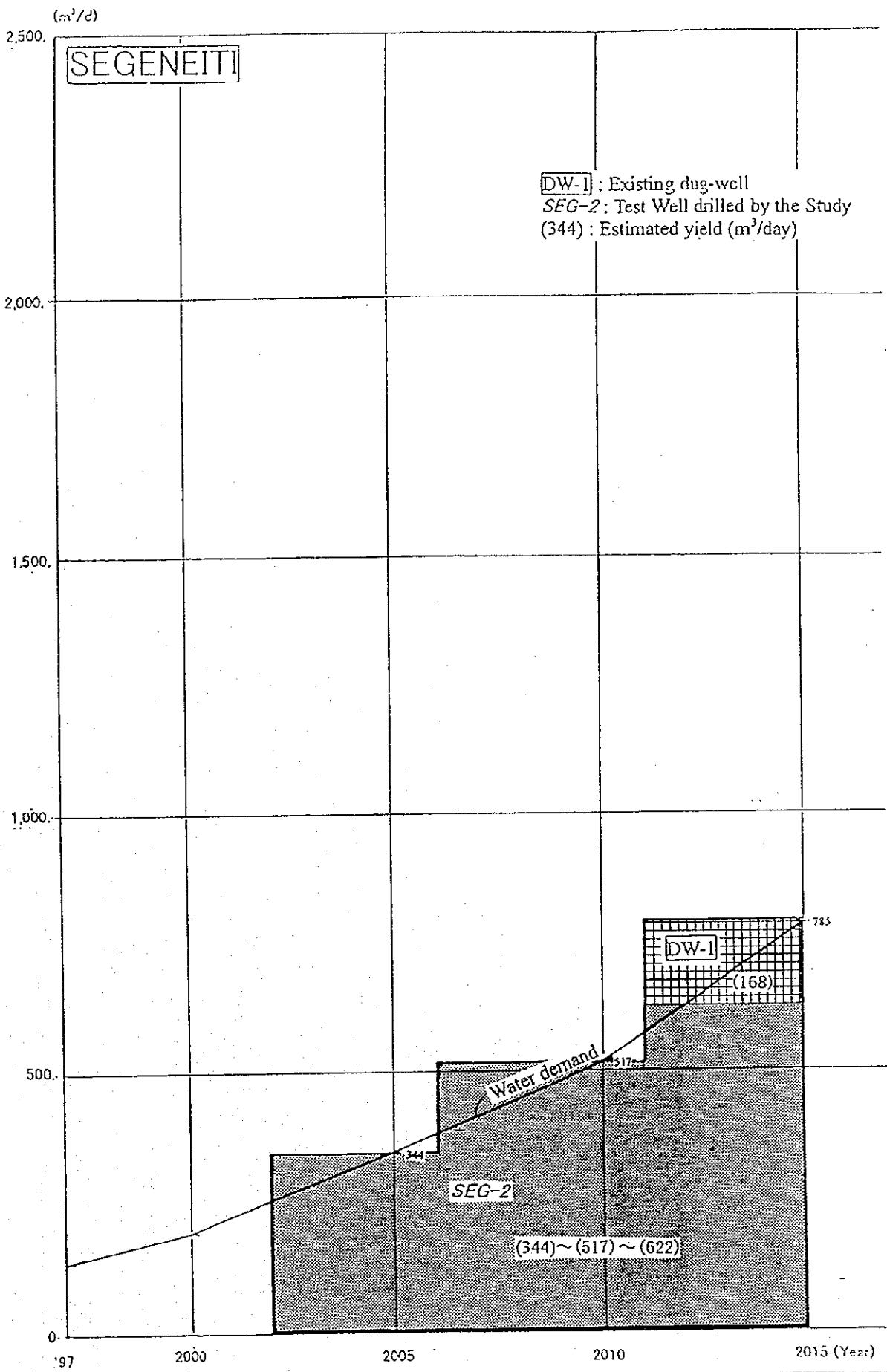


Figure 6.2.6. WATER DEMAND AND RESOURCES PLAN

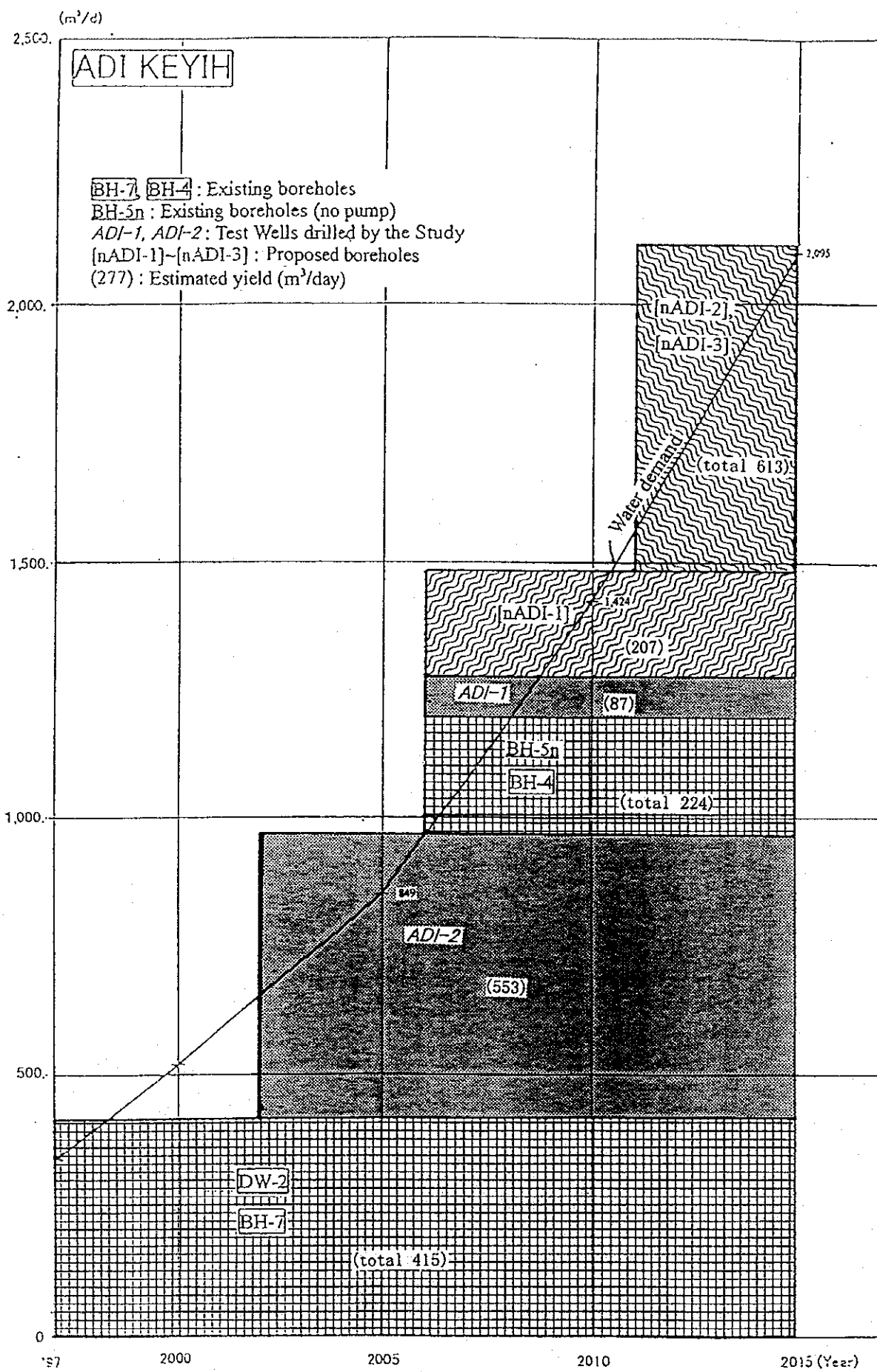
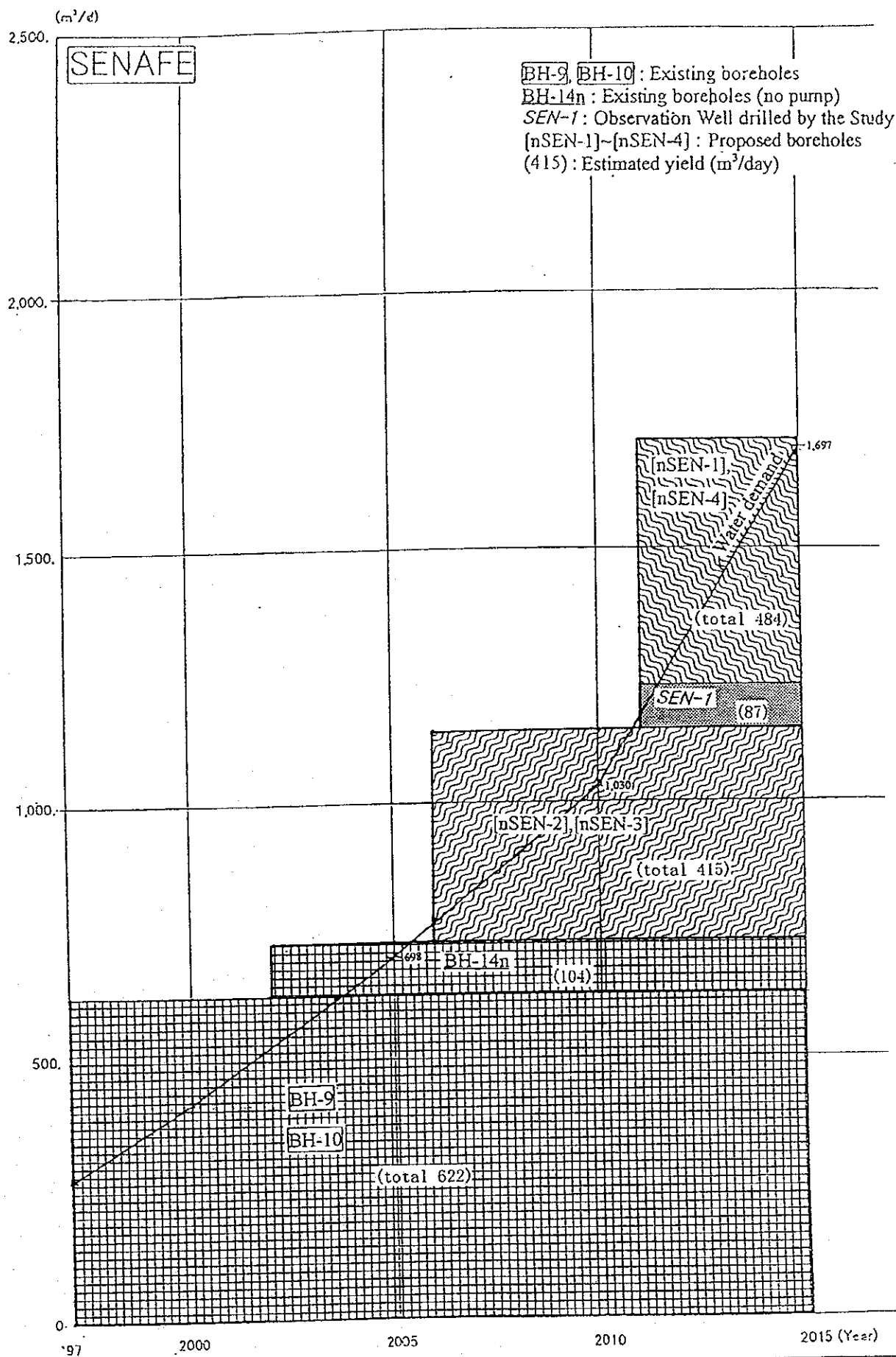


Figure 6.2.7. WATER DEMAND AND RESOURCES PLAN







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