APPENDIX B

THE SPECIFICATIONS FOR THE STUDY

REPUBLIC OF TUNISIA

THE STUDY
ON
THE RURAL WATER SUPPLY PROJECT (PHASE II)
IN
THE REPUBLIC OF TUNISIA

SPECIFICATIONS

JANUARY 2005

THE JICA STUDY TEAM

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I. INTRODUCTION

The Government of Tunisia has worked out the tenth programs of rural water supply project based on the National Tenth 5-year Development Plan. Japan Bank for International Cooperation (hereinafter referred to as “JBIC”) determined to finance 161 new subprojects out of the total 441 new subprojects of the Tenth Programs.

Upon request of the Government of Tunisia, the Japan International Cooperation Agency (hereinafter referred to as “JICA”) determined to conduct the Study on the Rural Water Supply Project (Phase II) in the Republic of Tunisia (hereinafter referred to as “the Study”) which originally consists of 57 subprojects for 2005 and 37 subprojects for 2006.

According to the framework of technical cooperation between the Republic of Tunisia and Japan, the JICA Study Team (hereinafter referred to as “the Team”) undertakes the Study by entrusting to the resident consultant companies in Tunisia.

These specifications are prepared for the Study on the subprojects for 2006.

However, since the study of 3 subprojects for 2006 have been completed, the Team intends to carry out the Study for 34 subprojects for 2006.

For the purpose of entrusting the Study to the resident consultant companies, these subprojects are divided into five packages as shown in Appendix 1.

The general characteristics of the existing socio-economic conditions of the area and proposed water supply system for the concerned subprojects will be given in the form of identification card as shown in Appendix 2.

Identification card of subprojects can be referred in the office of the Team.

The objective of entrusting the Study to the resident consultant companies is to determine the technical and economic alternatives which will better adapt to the local settings such as water source, the population concerned, the topography of the area, etc.

1. DEFINITION

Terms used in this document are defined in Article 1 of the General Conditions of Contract.

2. GENERAL

These Specifications shall be applied to the Study on the Rural Water Supply Project (Phase II) in the Republic of Tunisia (The Subprojects for 2006).

II. BASIC STUDY

The Basic Study of each subproject shall conform to the technical and financial guidelines given in Appendix 3 and to the methodology detailed herein:

3. SUBPROJECT IDENTIFICATION

This is to verify and complete the preliminary data in the identification forms elaborated by the Regional Directorate General for Agricultural Development (hereinafter referred to as “CRDA”) of each Governorate following the model given in Appendix 2. All the problems observed will be discussed with the CRDA, and solutions will be sought with the Team, especially those relating to the stretch of the project area. The Contractor shall verify the data on population, domestic animals and public institutions given in the identification form.

4. DETAILED SURVEYS AND SOCIO-ECONOMIC SURVEYS

This relates to the socio-economic and technical surveys that will be carried out in conformity with the Specifications citing the survey models advocated by the CRDA for updating and verifying the available data and for collecting supplementary information on the localities to be served, the beneficiary populations, the present condition of the water supply system (hereinafter referred to as “AEP”), the water sources, the availability of water supply system of the National Corporation for Water Development and Supply (hereinafter referred to as “SONEDE”) and the network of the Tunisian Corporation for Gas and Electricity (hereinafter referred to as “STEG”) in the subproject area, the access conditions in the area, the operation of the Collective Group of Water Users (hereinafter referred to as “GIC”), if already created, and any other information which will help to grasp the condition of the AEP in the subproject area.

Topographic maps of which scale is 1/25000 or 1/50000 used for the site reconnaissance should be obtain through CRDA and one copy should be prepared for the Study Team. The Engineer has already requested CRDAs to provide the data, information, drawings, etc. of existing GIC AEP system to the Contractor in case that projected water source is GR-Extension, however, the Contractor shall request by itself again at the commencement of the survey.

The Contractor shall verify the documents and data provided during the survey.

In case the subproject is an extension of the existing GIC AEP, the survey will cover the operation of the GIC and the existing one.

A socio-economic survey shall be carried out in order to grasp basic socio-economic setting and present conditions of water collection in each subproject area. The socio-economic survey consists of the followings:

1) Household survey
2) PRA method
    A) Community Mapping
    B) Priority Ranking
    C) Semi-Structured Interview

Tools of PRA (Participatory Rural Appraisal) Method such as the priority ranking on issues of community development and the community mapping for having community resources utilization, and the Semi-structured interview should be applied to the surveys. The application of these methods is explained in Appendix 4

The Team will hold an orientation workshop for the socio-economic survey and sensitization activities before starting the field survey.

The data collected through the socio-economic survey shall be submitted to the Engineer after finalizing its work before starting the first visit of the sensitization.

5. ANALYSIS OF THE DATA

For determination of the subproject components and for elaboration of the Basic Study, the following analysis should be conducted with regard to the basic data collected during the identification phase as well as during the detailed surveys:

- Verification and updating of the list of beneficiary families (methods of data collection and survey forms have to be determined with the Team).
- Interpretation of the hydrological characteristics of the water source in conformity with the Tunisian norms and the opinions of the regional health sectors.
- Acceptance by the beneficiaries of the water quality, namely taste, smell and color.
- Inventory of alternative water sources in terms of quantity and quality specifying their locations and distances.
- Questionnaires and interpretation of the socio-economic and technical surveys.
- Layout of the AEP network on survey map
- Layout of the network of STEG, SONEDE and any other existing infrastructures related to the subproject.
- Eventual agreement with SONEDE on the water supply from SONEDE system. (if applicable)
- Administrative and financial status of GIC (if exists).
- Appreciation of GIC (if exists) by Board of Directors
- Water costs beard by the beneficiary population.
- Level of commitment and financial means of the population.
- The cost and the presently applied price of one cubic meter (1 m^3) supplied of the existing and neighboring GICs.
- Other information pertaining to the subproject area.

The Basic Study will make it possible to identify the needs in sensitization and define the targeted sensitization actions in each locality concerned with the project.

6. DEFINITION OF THE PROJECT COMPONENTS

Taking into consideration the results of above-mentioned studies, the subproject components shall be defined which will include water sources, water treatment, power supply system, water tank, pipeline network, etc. These components constitute the basis for:

- the information and meeting with the beneficiary population.
- the execution of the topographical survey.
- the elaboration of the Basic Study

7. MEETING WITH THE BENEFICIARIES

(1st and 2nd visits for sensitization activities)

Unless otherwise specified in the Specifications, the Contractor shall carry out the Sensitization works according to the Sensitization Manual with its addendum, if any provided by the Engineer.

In order to adapt the concept of the project to the needs and legitimate desires of the beneficiaries and to ensure the optimum conditions of success for the water supply project, the resident consultant is under the obligation to organize information, meeting and sensitization sessions with the beneficiaries in coordination with the sections concerned of CRDA: District Agricultural Engineering Office (AGR) and Unit for GIC (CGIC).

These sessions will be divided into at least 3 visits per group of households. These visits will be combined with the essential phases of the Basic Study and will be carried out in a split up manner so as to conform to what is adopted in the Specifications.

Two of these visits must be held during the phase noted in this article.

- The first visits are objected to draw attention of the population and enhance the motivation to participate in the operation and maintenance and management of the projected AEP. The first visits shall be carried out by the time of preparation of the alternative AEP system concepts.
  It will be essentially centered on the following items:

  - Inconveniences of the present water collection
  - Introduction of the advantages of the new water supply system (sustainability and water quality)
  - Layout of the network
  - Management principles of the water supply system
  - Role of GIC and the beneficiaries obligations (membership, payment of consumption, contribution in the revolving fund)
  - Specific items of sensitization identified during the socio-economic survey

  The first visits shall also include identification of the desire of the population pertaining to the type and quantity and location of AEP facilities.

- The second visits are objected, prior to commencement of the topographic survey, to confirm the desire of the population pertaining to the AEP system so that it can be reflected in the design and ensure the understanding of the population with regard to the topics of the first visits of sensitization. The second visits shall accordingly start after the selection of the optimum concept of the projected AEP system described in the following Article. The second visits will deal with the following items:

  - Method of service and type of service facilities (communal taps, potences, etc.)
  - Method of payment: flat rate or commodity charge
  - Layout of the network and location of service points
  - Necessity of creation of GIC
  - Land Acquisition (The written commitment on the land transfer should be

collected at this stage)
- Selection of tap keepers
- Specific items of sensitization identified during the first visit of the sensitization and the socio-economic survey.

The third visits are detailed in Article 12.

Active commitment to the subproject by women is quite important for the planning and operation and maintenance of the water supply system. However, getting the requests and/or opinions from women who use the water supply facilities seems to be difficult in the meeting of a whole community. In this regard separate meetings for women shall be organized in parallel with the meetings for all people of the community up to the third visits of sensitization for proper understanding of the subproject by women.

By adopting this measure, all prospected beneficiaries will be deeply sensitized and will understand the AEP project. Then people will be expected to make their own opinions and recommendations on planning and design of the facilities.

A woman expert in sensitization from the Team may assist to ensure these outcome and sociologists, preferably women, shall take part in the sensitization team of resident consultants.

The Contractor shall provide in each Sensitization Report the minutes of meeting of all three (3) visits as described in the Sensitization Manual.

8. OPTIMUM CONCEPT OF PROJECTED AEP SYSTEM

The Contractor shall prepare at least three alternative AEP system concepts based on the outcome of the study described article 3 to 6 and the 1st visits of the sensitization activities.

The optimum concept for the subproject are should be selected in consultation with AGR and the Team. The Contractor shall prepare the minutes of meeting (PV) on the selection of the optimum concept.

The selection of the optimum concept shall be followed by the 2nd visits of the sensitization activities.

9. EXECUTION OF THE TOPOGRAPHICAL SURVEY

The Contractor shall be in charge of the topographical survey of the subprojects and shall execute it in conformity with the specifications provided in Appendix 6. The survey shall follow the 2nd visits of the sensitization activities.

10. ENVIRONMENTAL STUDIES

The Contractor shall be in charge of the environmental studies of the subprojects and shall execute it in conformity with the specifications provided in Appendix 8.

11. ECONOMIC AND TECHNICAL STUDIES

The Basic Study shall include presentation, analysis of the basic data, variants of the project technical concept along with the justifications of adopted choices and hypothesis, financial and economic analysis, and the management perspectives of the GIC.

The Contractor shall prepare the feasibility study report and the socio-economic report (hereinafter referred to F/S report and S/E report respectively) for the Basic Study. The F/S report shall generally include the followings:

- Generalities
- Basic data and computation of the water demands in the short/long terms (year of construction and the following fifteen (15) years)
- Justified choice of the water source in consultation with the beneficiary population
- Basic technical design for each technically feasible alternatives
  - Necessity of water treatment
  - Capacity and height of water tanks
  - Water transmission system to the water tanks
  - Influence by hydraulic transition phenomena such as water hammer, etc. with necessary protection for the system
  - Power to be supplied and specification of equipment
  - Type, number, disposition of the service points (communal taps, potences and animal drinking places)
  - Distribution pipe network with the definition of the type, diameter and class of pipes (to be supported with hydraulic analysis), etc.
  - Allocation of the number of families and water users per service point on the layout of the network on survey maps
  - Operation and control of the hydraulic system including manual and prospective automatic operation
  - Disinfection system
  - Operation, Maintenance and Management system of GIC (operation hours, personnel, necessary materials, etc.) so as to confirm the appropriateness of the basic design and to facilitate the following financial and economic analysis.
- Financial and economic analysis
  - Detailed estimates of the project investment cost based on unit prices adopted in the subproject area
  - Estimation of the operation cost of GIC
  - Estimation of the unit cost of one cubic meter (1 m^3) of water
  - Establishment of the provisional budget of the GIC with respect to families monthly flat rate
  - Establishment of the provisional budget of the GIC with respect to the metered rate of one cubic meter (1 m^3) of water
- Conclusion

The Contractor shall establish, based on the conclusions of the F/S report, a synthesis on the constraints and feasibilities of the subproject.

Furthermore, the report shall provide in appendices all the supporting documents such as list of beneficiaries, SONEDE agreement with respect to water supply to the

projected AEP, if necessary, characteristics of the water source with results of in-situ water quality tests, Field Notes and sketches in geographical survey, Minutes of Meetings, copies of agreement on land utilization for installations, etc., which were used to adopt the given alternatives, to confirm hypothesis and justify the commitment on or execution of given actions in the report.

The Contractor shall prepare, once the F/S report is approved by the Engineer and the CRDA, a form recapitulating the subproject following the model provided by the Team.

The legends of the AEP system to be shown in the drawings of the report shall conform to Appendix 5.

12. INFORMATION AND SENSITIZATION OF BENEFICIARIES

(3^{rd} visits of sensitization)

After approbation of the F/S report by CRDA, the 3^{rd} visits of sensitization will be held in collaboration with the Team, the sections concerned of CRDA and local officials. During these visits, the population will be informed on the followings (it is noted that meetings will be held separately for women and men according to local socio-cultural conditions):

- Technical data of the subproject
- Type, location, number and the disposition of the water supply facilities
- Operation of the projected AEP system
- Necessary investment cost
- Operation cost of the projected AEP system
- Unit production cost of water
- Flat rate, if adopted by the beneficiaries, for cost recovery
- Unit metered rate, if adopted by the beneficiaries, for cost recovery
- Amount of contribution to the revolving fund
- Necessity to contribute to the revolving fund for effective start of the GIC operation
- Necessity to maintain sanitary conditions in the area of service points.

During the visits, the population will be recognized on the objective of the subproject, the quality of services, the new conditions on hygiene and the necessity of regular payment of the membership fee of GIC and/or price of the consumed water in order to ensure the sustainability of the new drinking water supply system

The form of commitment of the beneficiaries to contribute to the revolving fund of the GIC according to the model provided by the Team shall be distributed to the beneficiaries and collected during the course of the Basic Study.

It is noteworthy to point out that the eligibility of the project depends on a commitment of at least 80% of the prospective beneficiary household heads to contribute in the revolving fund, which amounts to 4-months estimated water consumption cost of one household.

The Contractor will assign experienced sociologists in order to appropriately carry out the sensitization phases and the discussions with the beneficiaries in collaboration with

the section in charge of GIC in the CRDA. The minimum period of intervention of the sociologist is fifteen (15) days per subproject.

The Contractor should put emphasis on aspects related to the project management. He should get consent from the population upon the management system of the service points. In this context, he will define the mode of keeping of each service point (whether to be allocated on a voluntary basis to a family, or to a tap keeper in return for a monthly remuneration or a percentile on the receipts of the water sale). A sign of commitment should be secured from the person assigned to the task during the Study on the form provided by CRDA. These forms will be distributed, explained and collected by the sociologist assigned by the Contractor.
The remuneration of these tap keepers is a part of the operation cost and should be included in the water price.

Upon successful completion of the 3rd visits of the sensitization activities, the contractor shall prepare the S/E report reflecting the outcome of implemented all the sensitization activities and the socio-economic surveys. The S/E report shall generally include following items:

- Summary and conclusion
- Brief description of subproject area
- Regional administration
- Socio-economic conditions
- Present water collection
- Social circumstances
- Priorities to improve living conditions
- Beneficiaries (The list of the beneficiary families authorized by the local authority such as “omda” shall be attached so as to confirm the commitment rate attained)
- Summary of F/S report
- Topics of sensitization activities
- Assessment and analysis on socio-economic study and sensitization activities
- Outcome of sensitization activities
- Conclusion and recommendations
- Record of each sensitization activities (attached as reference data)
- Existing organization in the subproject area

III. DETAILED DESIGN STUDY

The Detailed Design Study shall be initiated after the approbation of the Basic Study (Feasibility Study) by the Engineer and CRDA in concert with the beneficiary populations and shall have to reconfirm the type and location of the service points.

The objective of the Detailed Design includes:

- Geo-technical survey of the structure foundation
- Detailed design of the water supply system.
- Construction cost estimate of the water supply system.
- Preparation of tender documents for the procurement of contractors to execute the works.
- Other necessary works related to the above

13. EXECUTION OF GEOTECHNICAL SURVEY

The Contractor shall be in charge of the geo-technical survey of the subproject sites and shall execute it in conformity with the specifications provided in Appendix 7.

14. METHODOLOGY AND REFERENCES

In order to standardize the rural water supply system of subprojects throughout the country, the Team will provide the Contractor with the standard designs prepared by DGGREE for such civil structures as pumping stations, semi-buried tanks, elevated tanks, control structures of pipeline, public taps, cattle drinking places.

Similarly, a standardization of the hydraulic and electro-mechanical facilities is available for the equipment of the pumping station.

The Contractor must abide by these standards in carrying out the Study.

Any improvement made by the local Consultant will be taken into consideration after evaluation by the Team in consultation with CRDA.

15. CONTENTS OF THE DETAILED DESIGN STUDY

The Detailed Design Study shall deal with the following aspects:

- Elaboration of the detailed design with necessary verification, complementary studies and dimensioning
- Definition of the operation of the water supply system, installations and necessary equipment along with the corresponding operation and maintenance instructions
- Verification and adaptation of the standard designs to the particular conditions of the Subproject site.
  These plans are presented under standardized forms and scales.
- Establishment of complementary plans such as general plans and those for the execution of particular works (cross section of roads or wadi....)
- Designing the piping layouts (plans, longitudinal and cross sectional drawings) and definition of pipe connection works
- Bill of quantities, cost estimates and the schedule of rates
- Detailed description of the Subproject and its components, including the plans

15.1 DETAILED STUDY ON TECHNICAL CONCEPT OF THE COMPONENTS OF THE WATER SUPPLY SYSTEM

The Contractor shall consider all the components determined through the feasibility study to update the available data based on supporting documents.

Technical concepts of the elements of the projected water supply system shall be studied in detail and verified again in order to ensure a good execution, which include:

- Equipment of the water source (dimensioning of pumps, pipes, chlorination station and external works.....)
- Pump house (selection and adaptation of standard designs)

- Energy source: electric or diesel
- Water tank: capacity and hydraulic devices
- Piping works: dimensioning and selection of applicable pressure class, taps and joints, pipe laying works and other particular works

The Contractor shall suggest in the study a model of public tap, potence as service points, and washing installations (to be used by women for laundry). These works will be designed taking into considerations of the natural and socio-cultural conditions of the area such as climate, water fetching, transport and storage traditions, sanitary situation around the area of the works, waste water evacuation along with the architectural specificities of the region.

The Contractor shall establish architectural plans of service facilities to be discussed with the Study Team and the officials concerned. Once these are approved, the Contractor shall establish the detailed plans (general plans, cross sections, and plans for forms and arrangement of reinforcing bars of concrete work) and the corresponding bills of quantities

15.2 DETAILED DESCRIPTION OF THE COMPONENTS OF THE WATER SUPPLY SYSTEM

The detailed description of the components of the projected water supply system will cover the following aspects:

- The water source including the civil works, hydraulic and electro-mechanical equipment, chlorination station and external works around the pumping station.
- The water tanks: height, capacity, hydraulic characteristics and devices, external works.
- The pipeline network: riser piping for submersible pump, transmission and distribution.
- The operation method: Annual water withdrawal in the initial year shall be evaluated on a monthly basis and the pump operation plan shall be proposed. Manual and automatic operation shall be detailed in order to facilitate the tasks of the pump operator.
- The working instructions of the pump operator shall be defined.
- The GIC management: based on the provisional annual water demand computed above, the provisional GIC budget shall be established in conformity with the model adopted by CRDA taking into consideration the cost recovery method selected during the sensitization and discussion with prospective water users.
- The confidential estimation: it shall be based on the evaluation of quantities and unit prices to adopt with respect to the local conditions. Due to its confidentiality, the estimation must be done in a separate document in order to restrict the persons concerned to access them.

15.3 ANNEXES

Supporting documents shall be attached as appendices to the Detailed Design Study report and shall include:

- The hydraulic diagram
- Hydraulic calculations

- Equipment dimensioning
- Detailed analysis of water quality
- Geotechnical survey
- Tank characteristics
- Land acquisition and temporary occupancy

16. COMPLEMENTARY WORKS

- Setting up of concrete bench marks to show the location of each installation of the projected water supply system.
- Detailed study on eventual connections with the STEG and SONEDE networks, if necessary
- Identification of land tenure problems: temporary occupancy, acquisition, compensation resulting from damages, etc...

17. DRAFT TENDER DOCUMENTS

The draft tender documents shall be prepared by the Contractor for each subproject. The CRDA will finalize the documents incorporating specific requirements of the government and use them for procurement of contractors for execution of the subprojects. These documents shall include:

- Administrative and financial clauses
- Tender model
- Unit prices schedule
- Detailed estimation per project component
- Plans including:
  - Overall location plan: 1/25000
  - Overall plan showing the implementation of all works 1/100, including the service points
  - Plans of adapted standard works: 1/50 to 1/20
  - Plans of particular works: 1/50 to 1/20
  - Pipeline route plan: 1/1000 or 1/2000
  - Longitudinal profile: H=1/1000 or 1/2000, V=1/100 or 1/200
  - Pipeline layout
  - List of fittings and pipes

APPENDIX 1. SUBPROJECTS TO BE STUDIED AND PACKAGES

First Package 7 projects

Governorate	Delegation	Subproject	Projected Population	Projected Water Source
ARIANA	EL MNIHLA	EL ACHICH	150	SONEDE CONNECTION
MANOUBA	MORNAGUIA	SIDI ACHOUR	126	SONEDE CONNECTION
NABEUL	MENZEL BOUZELFA	BOULAHOUADH	175	SONEDE CONNECTION
	KORBA	TASSELMINE ET SOUASSI	335	EXTENSION GR
BIZERTE	BIZERTE SUD	ETRAMIS-EDMAIN	610	DEEP WELL
	GHAZALA	EL KALBOUSSI	1120	DEEP WELL
	GHAR EL MELEH	SIDI HASSEN	353	SONEDE CONNECTION

Second Package 7 projects

Governorate	Delegation	Subproject	Projected Population	Projected Water Source
BEJA	NEFZA	AIN DAM-NEFZA	1480	SONEDE CONNECTION
	NEFZA	GMARA	2225	SONEDE CONNECTION
JENDOUBA	JENDOUBA NORD	EL FRACHICHE	802	DEEP WELL
SILIANA	ER-ROUHIA	GHANGUET ZGALASS	210	EXTENSION GR
	ER-ROUHIA	SIDI DAHER	950	EXTENSION GR
	MAKTHAR	AGBA	582	SONEDE CONNECTION
	MAKTHAR	NSIRAT	360	SONEDE CONNECTION

Third Package 7 projects

Governorate	Delegation	Subproject	Projected Population	Projected Water Source
KAIROUAN	EL OUESLATIA	GHANZOUR	800	DEEP WELL
	EL OUESLATIA	GOUAAD	570	DEEP WELL
	HADJEB	KHOUALDIA	450	EXTENSION GR
	NASRALLAH	HSAINIA	340	EXTENSION GR
SOUSSE	BOUFICHA	CHRAIFIA	188	EXTENSION GR
MAHDIA	SIDI ALOUANE	AMMAR	1500	SONEDE CONNECTION
	SIDI ALOUANE	ESSAAFI	522	SONEDE CONNECTION

Fourth Package 7 projects

Governorate	Delegation	Subproject	Projected Population	Projected Water Source
LE KEF	EL KSOUR	EL ARGOUB-ERRHAMNA	650	DEEP WELL
	KALAAT KHASBA	FORNA	625	SONEDE CONNECTION
	NEBEUR	EL OUENA	400	EXTENSION GR
KASSERINE	FOUSSANA	BNANA / OULED BENAJEH	1500	DEEP WELL
	HAIDRA	MKIMEN	1450	DEEP WELL
	SBIBA	CHAAIBIA	1500	DEEP WELL
	SBIBA	OUED LAHTAB	1500	DEEP WELL

Fifth Package 6 projects

Governorate	Delegation	Subproject	Projected Population	Projected Water Source
SIDI BOUZID	SIDI BOUZID EST	GARD HADID	500	DEEP WELL
	JELMA	AIN JAFFEL	1800	DEEP WELL
	BIR EL HAFEY	SOUASSIA	500	DEEP WELL
	REGUEB	SLATNIA	500	EXTENSION GR
	JELMA	OULED MOUSSA	350	EXTENSION GR
GAFSA	MDHILA	ENJAIMIA	660	SONEDE CONNECTION

APPENDIX 2

SUBPROJECT IDENTIFICATION FORM

ALIMENTATION EN EAU POTABLE DES ZONES RURALES
GOUVERNORAT DE .....

FICHE D'IDENTIFICATION
PROJET DE .....
Année de réalisation 19..

1/SITUATION GEOGRAPHIQUE/ADMINISTRATIVE

DELEGATION	
SECTEUR	
ZONE/LOCALITE	

2/ POPULATION, ELEVES, CHEPTEL PAR LOCALITE

Localités							TOTAL
Population							
Dispensaire							
Mosquée							
Ecole							
Elèves							
Ovins + Caprins							
Bovins + Equidés							

3/ SITUATION ACTUELLE DETAILLEE D'AEP

(Formulaire à remplir avec soin)

SEMFORIA XLS

4/ SOLUTION PROPOSEE ET COMPOSANTES DU PROJET

5/ RESSOURCES EN EAU ENVISAGEES

NATURE	Forage	Puits	Source
Existant			
A créer			
A aménager			

Piquage SONEDE	Extension GR

6/ COMPOSANTES DU PROJET

Réservoir

Volume (m3)	
Type	

Ouvrages de distribution

Désignation	Nombre
Borne fontaine	
Potence	
Abreuvoir	
Branchement particulier	

Conduites

Nature	Diamètre	Long (ml)

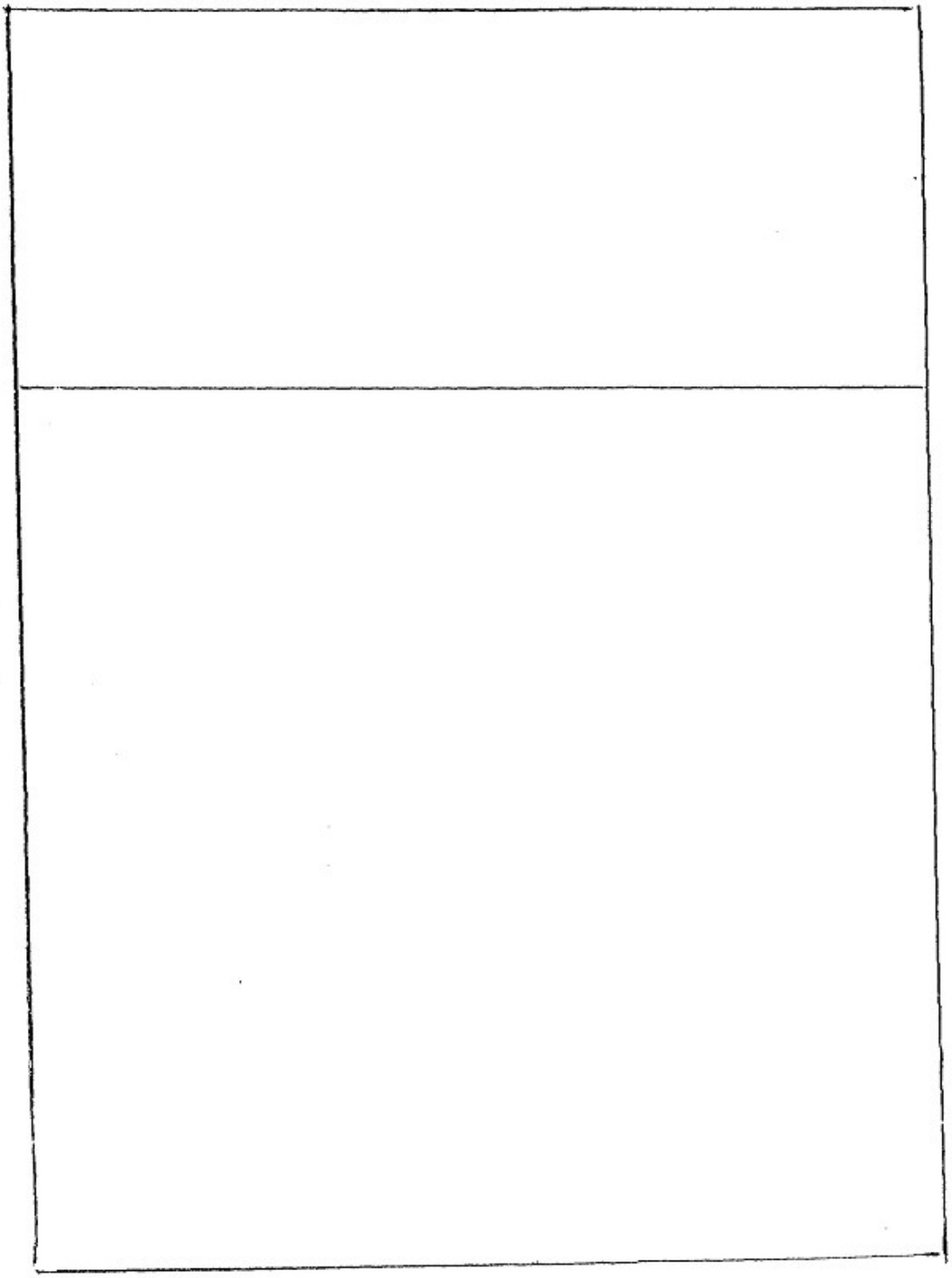
7/ ESTIMATION DES COUTS

Désignation	Coût
Ressource eau	
Réseau	
- fournitures	
- travaux	
Equipement	
Imprévus (15%)	
Total	

Coût/habitant

SEMFORM.XLS

SCHEMA D'AEP



APPENDIX 3

TECHNICAL AND FINANCIAL GUIDELINES

1.Technical Guidelines

1.1 The Project Life: 15 years from the commencement of the water supply project.

1.2 Water Demand

Domestic

For designing the water demands, a uniform consumption of 25 liter per capita per day (hereafter referred to as "lpcd") is applied to grouped settlements at the starting year of water supply and annual increasing rate of two point five percent (2.5%) shall be applied to the calculation of the future water demands from the grouped settlements.

The water demands applied to the scattered settlements remains fixed with 20 lpcd.

The water demand for students estimated at 5 lpcd only is considered on sizing the connections to the schools.

Cattle

The water demands applied are:
Sheep and goats: 5 lpcd
Cows and horses: 30 lpcd

The water demands for the cattle is estimated at 40% of the domestic consumption of the final year of the project in case that no alternative source exists for cattle drinking.

1.3 Loss

The water loss is estimated at 15% of the water demand.

1.4 Peak Day and Peak Time

1.4.1 Peak Day (yearly peak factor)

The peak day factor (CP) shall be equal to 1.25 for the North and 1.5 for the South.
If vj = daily consumption without loss
vjm = average daily consumption with loss
vjp = maximum daily consumption
cp = peak day factor

where vjm = 1.15 vj
vjp = cp vjm
vjp = 1.15 cp vj

1.4.2 Peak Time

The peak time factor shall be equal to 1.8
If Qph = peak time factor
Qhm = average hourly consumption in a peak day
Qhm = vjp/24
Qph = 1.8 Qhm = 1.8 vjp/24

1.5 Velocity, Roughness, Residual Pressure for Pipe flow

Velocity 0.4 v 1.2m/s
Roughness k = 0.4mm
Minimum residual pressure at the service point: 1 bar

1.6 Head Loss of Pipe flow

The head losses are estimated according to the Colebrook or Hazen Williams formula..
The minor head losses are assumed to be included in the estimated head losses provided that the Roughness of pipe is equal to 0.4mm.

1.7 Flow Rate of the Service Points

For designing any hydraulic distribution network, the following unit flow rate shall be applied:

Public tap	0.5 L/s
Cattle drinking place	0.5 L/s
Gallows	2.0 L/s
Individual connection	0.5 L/s

1.8 Capacity of Distribution Tank

The capacity of the distribution tank shall be determined as follows:
50% of the average daily water supply of the final year of the project,
or
25% of the maximum daily water supply of the final year of the project,
whichever bigger.

2. Financial Guidelines

- The lifespan and rates of maintenance cost to be applied are given in the following table:
- An annual rate of 5% is applied to update maintenance cost.
- An annual rate of 5% is applied to update flat rate.
- Actual Receipts (flat rate or metered charge) are equal to 80% of the theoretical revenue of the GIC.
- Membership rate of the population to the GIC (beneficiary families) is equal to 60% at the beginning of operation with a yearly uniform increment of 2%. The rate is equal to 90% at the final year of the project.
- The number of persons per household is that from the CENSUS in 1994 of INS (National

Statistic Institute) related to the non-communal population of the governorate.

- The production cost of 1 m^3 water is calculated assuming the three cases of FIRR (Financial Rate of Return); 5%, 8% and 10% on the three components described below:

  - the investment cost
  - the fixed expenses
  - proportional costs.

LIFESPAN AND MAINTENANCE RATE of EQUIPMENT AND DEVICES

ITEMS	UNIT	UNIT PRICE (DT)	LIFESPAN	MAINTENANCE RATE %
1. SERVICE POINT				
Shallow well construction D= 3,00 m : depth: 30m	ml		20	1.0
Shallow well facilitation	set		20	1.0
Digging	ml		20	0.1
Intake of spring	set		20	1.0
2. EQUIPMENT				
Tube well or source	set		7	2.5
Booster pumping station	set		7	2.5
Equipment against hydraulic transient phenomena, Operating pressure 10 bar				
capacity 200 l	set		7	2.5
capacity 250 l	set		7	2.5
capacity 500 l	set		7	2.5
capacity 1000 l	set		7	2.5
capacity 2000 l	set		7	2.5
Equipment against hydraulic transient phenomena, Operating pressure 16 bar				
capacity 200 l	set		7	2.5
capacity 500 l	set		7	2.5
capacity 1000 l	set		7	2.5
capacity 2000 l	set		7	2.5
Disinfection (chlorination)	set		7	2.5
Chlorinating station (dosing pump)				
- pump capacity: 20 m3/h	set		7	2.5
- hydraulic pump	set		7	2.5
3. POWER SUPPLY from STEG				
Connection LV single or three-phase 1 to 60 m	set		25	0
Extra cost between 60 and 200 m	set		25	0
Connection MV single-phase, extension line MV	km		25	0
Transformer station MV/LV single-phase P = 10 kVA	set		25	0
Connection MV three-phase, line MV three-phase	km		25	0
Transformer station MV/LV single-phase, three-phase				
P = 10 kVA	set		25	0
P = 25 kVA	set		25	0
P = 40 kVA	set		25	0
P = 50 kVA	set		25	0
Switchgear and operating cubicle (10 kVA)	set		15	2.5
Switchgear and operating cubicle (25 kVA)	set		15	2.5
4. INDEPENDENT POWER SUPPLY (Generator)				
P = 7.5 kVA	set		7	4
P = 10 kVA	set		7	4
P = 15 kVA	set		7	4
P = 18 kVA	set		7	4
P = 25 kVA	set		7	4
P = 36 kVA	set		7	4
5. Material and devices for piping work				
PE piping PN6				
OD 32 (outside diameter)	ml		30	0.5
OD 40	ml		30	0.5
OD 50	ml		30	0.5
OD 63	ml		30	0.5
OD 75	ml		30	0.5
OD 90	ml		30	0.5
OD 110	ml		30	0.5
OD 125	ml		30	0.5
OD 160	ml		30	0.5
OD 200	ml		30	0.5

PE piping PN 10				
OD 32	ml		30	0.5
OD 40	ml		30	0.5
OD 50	ml		30	0.5
OD 63	ml		30	0.5
OD 75	ml		30	0.5
OD 90	ml		30	0.5
OD 110	ml		30	0.5
OD 125	ml		30	0.5
OD 160	ml		30	0.5
OD 200	ml		30	0.5
PE piping PN16				
OD 32	ml		30	0.5
OD 40	ml		30	0.5
OD 50	ml		30	0.5
OD 63	ml		30	0.5
OD 75	ml		30	0.5
OD 90	ml		30	0.5
OD 110	ml		30	0.5
OD 125	ml		30	0.5
OD 160	ml		30	0.5
OD 200	ml		30	0.5
Ductile cast iron piping PN 25				
ND 100 (Nominal diameter)	ml		30	0.5
ND 150	ml		30	0.5
Water Meter				
ND 150	set		15	2.5
ND 50	set		15	2.5
Pressure switch	set		15	2.5
10. STRUCTURES				
- RC ELVATED TANK H= 9 m				
Capacity 15 m^3	set		40	1
25 m^3	set		40	1
50 m^3	set		40	1
100 m^3	set		40	1
150 m^3	set		40	1
- RC ELEVATED TANK H= 15 m				
Capacity 15 m^3	set		40	1
25 m^3	set		40	1
50 m^3	set		40	1
100 m^3	set		40	1
150 m^3	set		40	1
- RC SEMI-BURIED TANK				
Capacity 12 m^3				
15 m^3	set		40	1
25 m^3	set		40	1
40 m^3	set		40	1
50 m^3	set		40	1
75 m^3	set		40	1
100 m^3	set		40	1
150 m^3	set		40	1
- BOOSTER PUMP				
Capacity 5 m^3	set		40	1
10 m^3	set		40	1
15 m^3	set		40	1
20 m^3	set		40	1
40 m^3	set		40	1
- PUMPING STATION	m^2		40	1
- GENERATOR CAGE	m^2		40	1
- EQUIPMENT INSTALLATION FOR ELEVATED TANK				
- 15 and 25 m^3	set		15	2.5
- 40 m^3	set		15	2.5
- 50 m^3 and 100 m^3	set		15	2.5
- 150 m^3	set		15	2.5

- EQUIPMENT INSTALLATION FOR SEMI BURIED TANK				
- 25 m^3 and less	set		15	2.5
- between 40 and 100 m^3	set		15	2.5
- MANHOLE	set		40	1
- BOOSTER PUMPINS STATION WITH 8m3 TANK	set		40	1
- EQUIPMENT INSTALLATION FOR BOOSTER PUMPING STATION WITH 8m3 TANK	set		15	2.5
- DISTRIBUTION WORKS				
- public tap	set		15	2.5
- cattle drinking place	set		15	2.5
- gallows	set		15	2.5
- individual connection	set		15	2.5
1.1 OTHERS				
- Extra cost for rocky grounds	m^3		30	0
- Connection to tank	set		20	0
- GALVANIZOD STEEL piping				
OD 80	ml		30	0.5
OD 100	ml		30	0.5
OD 125	ml		30	0.5
OD 150	ml		30	0.5
OD 200	ml		30	0.5
- AC piping				
OD 80	ml		30	0.5
OD 100	ml		30	0.5
OD 150	ml		30	0.5
OD 200	ml		30	0.5
Class 15 d OD 80	ml		30	0.5
OD 100	ml		30	0.5
OD 150	ml		30	0.5
OD 200	ml		30	0.5
6. JOINT PARTS SUPPLY				
Joints for PE piping				
OD 125 / OD 200	set	40% of the pipe price	30	0.5
OD 90 / OD 110	set	25% of the pipe price	30	0.5
OD 32 / OD 75	set	15% of the pipe price	30	0.5
Joints for Steel piping	set	25% of the pipe price	20	0.5
Joint for AC piping	set	20% of the pipe price	20	0.5
7. PIPE FITTINGS				
PE piping OD 32	ml		30	0.5
OD 40	ml		30	0.5
OD 50	ml		30	0.5
OD 63	ml		30	0.5
OD 75	ml		30	0.5
OD 90	ml		30	0.5
OD 110	ml		30	0.5
OD 125	ml		30	0.5
OD 160	ml		30	0.5
OD 200	ml		30	0.5
GALVANIZED STEEL piping				
OD 80	ml		30	0.5
OD 100	ml		30	0.5
OD 125	ml		30	0.5
OD 150	ml		30	0.5
OD 200	ml		30	0.5
OD 250	ml		30	0.5
AC piping				

OD 80	ml		30	0.5
OD 100	ml		30	0.5
OD 150	ml		30	0.5
OD 200	ml		30	0.5
8. PIPE TRANSPORTATION				
Add on piping price in %			PE	AC
- Tunis, Ben Arous, Ariana, Bizerte, Zaghouan, Nabeul				5
- Beja, Jendouba, Le Kef, Siliana				
- Sousse, Monastir, Mahdia, Kairouan, Sfax, Kasserine				15
- Gafsa, Tozeur, Kebili, Gabes, Medenine, Tataouine				20
9. PIPING EQUIPEMENT SUPPLY AND FITTINGS				
Cast iron taps, valves, flanges OD 40	unit		20	1
OD 50	unit		20	1
OD 65	unit		20	1
OD 80	unit		20	1
OD 100	unit		20	1
OD 125	unit		20	1
OD 150	unit		20	1
OD 200	unit		20	1
DRAIN	set		20	1
AIR VALVE	set		20	1

APPENDIX 4

SOCIO-ECONOMIC SURVEY METHOD

1. GENERAL

This Method shall be applied to the Socio-economic survey to be executed for the Basic Study of each subproject for 2006 under the Study on the Rural Water Project (Phase II) in the Republic of Tunisia.

2. OBJECTIVES

The socio-economic survey shall be implemented in order to grasp the present setting of target population, sociological characteristics of the target area.

3. BASELINE DATA

Following data is to be collected as the baseline data so as to fulfill the objectives of the Socio-Economic Survey of each subproject. Moreover the baseline data will be used to evaluate the development of the subproject area in the future.

The items of baseline data to be collected shall be determined through discussions among the Team, CRDA and the Contractor.

- Socio-economic settings
  - Existing infrastructures with their conditions
  - Major industries
  - Major (source of) livelihood
  - Household income
  - Daily activities of women and men
- Present conditions of water collection
  - Present water sources and/or water supply system
  - Water consumption
  - Satisfaction with the existing water sources (quantity and quality)
  - Person in charge of fetching water
  - Distance, period of time spent and means used to fetch water
  - Period of time devoted to fetch water per day
  - Waiting time to take water
- Willingness to participate in the Operation, Maintenance and Management of the projected AEP system as the beneficiaries of the subproject
- Hygienic conditions
  - Incidence of the diseases associated with water
  - Sanitary facilities in the house
- Needs and priority regarding the improvement of living conditions
- Sociological features (existence of conflicts, community sense, gender relation)

4. METHOD

Socio-Economic Survey shall be executed applying following methods: Some of useful tools of Participatory Rural Appraisal (PRA) will be also applied to the socio-economic survey.

(1) Household survey
(2) Some tools of PRA (Participatory Rural Appraisal) method

4.1 HOUSEHOLD SURVEY

This method is applied to collect quantitative baseline data based on the selected households. The number of the selected households shall be determined in proportion to the total number of households in the subproject area. Following table shows the standard number of the sampled households:

Number of households	Number of Sampled households
<60	20
60 -100	30
101-200	40
201-500	50
>500	60

The questionnaire will be provided by the Study Team.

The data collected through the household survey shall be arranged subproject by subproject immediately and saved as the electronic data. The format shall be Microsoft Excel. Each item shall be presented with the real number of replies obtained as well as percentage of the total ones. The number of effective replies shall be also indicated in the Socio-Economic Report.

4.2 PRA METHOD

The objectives of PRA method are also to collect the information, but this method emphasizes on sharing the information with the target beneficiaries through their direct participation in the survey. Following tools of PRA method are applied to the socio-economic survey of the Study.

1) Community Mapping
2) Pair-wise ranking
3) Semi-structure interview

The exercise of PRA method shall be conducted with a small group represented by resource persons in the subproject area.

4.2.1 COMMUNITY MAPPING

(1) Objectives

- To enable the target community people identify important issues and problems in

their life.

- To collect information and different views on the community
- To assist the target community people recognize that different groups in their community may have different perceptions.

(2) Method

One or several maps are drawn in a large-size sheet of paper by beneficiaries through the facilitation of sociologists. Following items are required to describe in the map(s). Other items are possible to include in the description.

- Road and other access
- Existing water sources by type
- Public institutions (mosque, dispensary, school, post, etc)
- Meeting point in the community (grocery, cafe, mosque, private house, etc.)
- Elements that the community is proud of:
- Points that the community wishes to improve.

The mapping is followed by discussion on what they have drawn and what they have discovered. The map shall be continuously used in the course of the sensitization, to review existing conditions of the subproject area with participants in sensitization meetings.

The original map shall be submitted to the Study Team after the 3rd visits of sensitization immediately. The contractor shall take digital image and describe its print-out in the socio-economic report.

4.2.2 PAIR-WISE RANKING

(1) Objective

This tool shall be applied to verify target people's concerns and priorities with community people in improvement of its living conditions and to know the position of concern for water in the entire priorities.

(2) Method

Sociologists ask participants (representatives of beneficiaries) to mention needs for improvement of their community. Then, these needs are compared pair by pair by asking to the participants of their preference of the twos and their reasons.

4.2.3 Semi-structure interview

(1) Objective

- This tool aims at ensuring the quality of information gathered by pre-set questionnaire through triangulation of information collected through quantitative

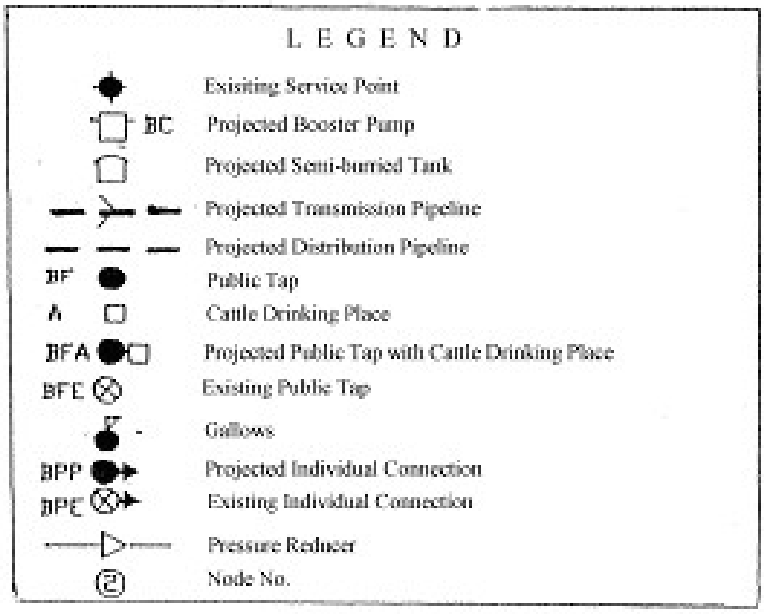
data collection and other PRA tools.

(2) Method

- Following list of predetermined questions and topics are to be asked to participants (representatives of beneficiaries). The discussion will be organized at least two persons (one shall be sociologist) so that one may focus on facilitating the discussion and another keeps record of discussion.
- Existing localities and relation among them
- Boundary (space and border, meeting place, places where inhabitants are proud of, etc.)
- Basic infrastructure (road, electricity, education, health, telecommunications, etc.)
- Sociological specificity (customs, habits, etc.)
- Socio-economic activities (division of labor by gender, access and control to resources)
- Present water collection (sources, quality, persons in charge, distance, utensils, means of transportation, time spent, inconvenience)
- Existing organizations (informal, formal, traditional, and recent ones) with objectives, activities, experience, and members, participants and clients, etc.)
- Community participation in the Operation, Maintenance and Management of AEP system by GIC (perception on existing GICs, c capacity of management, etc.)
- Others, if any

APPENDIX 5

LEGEND SHOULD BE USED FOR DRAWINGS



APPENDIX 6

TECHNICAL SPECIFICATION ON TOPOGRAPHICAL SURVEY

1. GENERAL

This specification shall be applied to the topographical survey works (hereinafter referred to as the Survey) for the Detail Design Study on the Rural Water Supply Project in the Republic of Tunisia, which is to be executed by the JICA Study Team (hereinafter referred to as the Consultant).

2. OBJECTIVE OF THE SURVEY

The objective of the Survey is to prepare topographical maps at a scale of 1:100 with contour intervals of 0.5 m, longitudinal profile and flat plan at a scale of 1:2,000 with contour intervals of 1 m on longitudinal profile section sheets for basic materials to be used for the detail design works in the Study.

3. SCOPE OF THE SURVEY

The Survey shall cover 46 subproject sites including the projected pipelines; installation sites such as pump stations, tanks and the surrounding area. The Survey shall be executed by the Contractor in accordance with the conditions, requirements of the Contract and the Specifications under the supervision of the Consultant. The Survey shall include the following items and volumes:

(1) Route Survey along Pipeline Routes

1) Centerline survey
   a) Setting up of permanent centerline points
   b) Setting up of 50m centerline pegs
   c) Leveling
2) Longitudinal profile leveling
3) Detail survey
   The objectives of the Detailed survey are to identify any steep topographical variation points, rivers, ponds, rocks, houses, fences, bridges, etc.
4) Plotting and fair drawing (longitudinal profile section with 1/2,000 scale flat plan with contour intervals of 1 m)

(2) Topographical Survey of Pump stations, and Tanks

1) Setting up of permanent points
2) Details survey
3) Plotting and fair drawing (1/100 scale topographical map with contour intervals of 0.5 m)

Quantity of the Survey shall be as specified in the Bill of Quantity.

4. WORK PLAN

The Contractor shall submit to the Consultant for his approval proposed time schedule and field operation program. The Survey shall be executed in accordance with the approved time schedule and the approved program.

5. WORK PERIOD

The Survey shall start after the 2nd visits of the sensitization activities and shall complete by the end of May at the latest.

6. ROUTE SURVEY

6.1 General

The Specifications mentioned hereunder have been designed in order for the Contractor to carry out route survey and prepare longitudinal profile sections, and their topographical data covering the projected 46 pipeline routes and then surrounding area to be used for the detail design in the Study.

The mapping work consists of centerline survey, longitudinal profile leveling, detail survey, plotting, and fair drawing.

6.2 Location of Pipeline Routes, Beginning Points and End Points

Location of pipeline routes and their beginning points and end points will be instructed by the Consultant.

6.3 Datum Height and Coordinates

The Contractor shall prepare a provisional benchmark, at least one point for each subproject site, on a permanent, solid and fixed substance. This benchmark shall correspond to a national triangulation point or a level point or equivalent. In case that such points are not available, points to which a coordinate and elevation can be acquired in the topographic map issued by OTC (Office de la Topographie et de la Cartographie) can be applied, however the contractor shall get the approval of the Engineer in advance. The Contractor shall submit the data on the setting of the benchmark with field photo to the Engineer and CRDA before completion of field works. A description form is shown in the end of this specification. The Engineer and/or CRDA can examine the accuracy of the height and coordinates of the benchmark any time.

6.4 Centerline Survey

Centerline survey shall be carried out by setting up the beginning points, end points, permanent centerline points and 50 m centerline pegs having height and coordinates fixed by traversing or GPS survey and leveling. Beginning points shall be located at water source and when the pipeline route is branched off; the beginning point of the lateral route centerline survey shall be located at branched point in the main pipeline route.

6.4.1 Setting up Permanent Centerline Points

Permanent Centerline Points shall mean the points, which locate on the projected pipeline and related installations, specified as follows:

- Beginning point of the projected survey line
- Projected branching points
- All the service points and the center point of each installation
- Traverse points which mean the points where pipeline shall change its direction
- Supplementary points, which shall be set up every 300m pitch in case that the minimum distance between the above two points on the project pipeline is 400m and over.
- End point of the projected survey line

The contractor shall set a 50cm long and 16mm in diameter iron peg in the dug hole with 50cm in depth and 30cm in diameter and the iron peg shall be reinforced by concrete.

6.4.2 Traverse

Traverse routes shall start from the beginning point and close at the end point. The traversing shall be observed and measured in accordance with the following manners:

(1) Horizontal angle measurement
   1) Horizontal angles shall be observed by 2 rounds of angle on 2 different zero setting.
   2) Total-station or theodolite with Electrical Distance Meter (EDM) shall be used.
   3) Allowance and others are as follows:
      a) Set numbers : 2 sets
      b) Allowance of double angle : 40 seconds
      c) Allowance of difference of angle : 30 seconds
      d) Zero positions : 0, 90

(2) Distance measurement
   EDM shall be used for distance measuring. Accuracy of EDM shall be less than 10 mm + 5 parts per million (ppm) x D (D: measured distance (mm)). Required number of the measured set and discrepancies between sets shall be as follows:
   1) Set numbers 2 sets (4 reading)
   2) Discrepancies $\pm$ 1 cm

(3) Accuracy of traverse
   Linear error of closure of the traverse shall be less than 1/8,000.

6.4.3 GPS Survey

GPS (Global Positioning System) survey shall be observed and measured in accordance with the following manners:

(1) GPS Observation and Measurement

   1) More than three GPS instruments having the following accuracy shall be used.
      a) Horizontal : $\pm$ 5 ppm x Distance between beginning and end points(50mm per 10 km)
      b) Vertical : $\pm$ 5 ppm x Distance between beginning and end points(50mm per 10 km)
   2) Elevation mask shall be 15 degrees.
   3) Observation shall be simultaneously at 3 points.
   4) Signals from more than 3 satellites shall be received at each point simultaneously.
   5) Observation shall be more than 1 hour.
   6) Measuring distance between observation points shall be less than 10 km.

(2) Expected accuracy of GPS traverse
   Error of closure of GPS traverse shall not be more than 5 ppm x measured distance.

6.4.4 Leveling

Leveling shall start from the beginning point and close at the end point. The leveling shall be carried out twice. The leveling shall be measured in accordance with the following manners:

(1) Automatic level or digital level shall be used.
(2) Error of closure of leveling between beginning and end points shall not exceed $\pm$30 mm $\sqrt{D}$, where D is distance in kilometers between the beginning and end points.

6.4.5 Setting up of 50m Centerline Pegs

Centerline pegs shall be set up at an interval of 50meters along the pipe centerline from the beginning point using iron pegs of 20 mm in diameter and 60 cm in length. Position of 50m centerline pegs shall be measured and set up in accordance with following manners and accuracy.

(1) Total-station, theodolite with EDM and steel tape or the equivalent shall be used.
(2) Position of 50m centerline pegs on the pipe centerline shall be set up by single measuring of radiation traverse from beginning point, end point and permanent centerline point.
(3) In case that 50m centerline peg coincides with a rock or artificial structures, the peg shall be marked by painting.
(4) In case that 50m centerline peg coincides with a pond, canal, stream, house and other obstacles, the peg shall be shifted from the pipe centerline.
(5) Accuracy of 50m centerline pegs
Alignment error on the centerline shall be within $\pm$ 3 cm from beginning point, end point or permanent centerline point .

6.5 Longitudinal Profile Leveling

Longitudinal profile leveling shall start from the beginning point and close at the end point. The pipe centerline shall be measured in accordance with the following manners and accuracy.

(1) Total-station, Theodolite with EDM, automatic level and steel tape or the equivalent shall be used.
(2) Ground height and distance between points along the pipe centerline shall be measured at:
    1) an interval of 25 meters,
    2) 50m centerline pegs,
    3) slope changing points, and
    4) points of the projected installations.
(3) Accuracy of longitudinal profile leveling
Error of closure of longitudinal profile leveling between beginning point and 50m centerline pegs or end point shall be within $\pm$30 mm $\sqrt{S}$: S = km
(4) Height error of longitudinal profile points on the installations and of slope changing points shall be within $\pm$1 cm and $\pm$ 3cm from 50m centerline peg respectively.
(5) Distance error between 50m centerline peg and the permanent centerline points shall be within $\pm$5 cm.

6.6 Detail Survey

Based on the data of the centerline survey and longitudinal profile section (hereinafter referred to as L/S) leveling, a detail survey for the width of 20m shall be carried out along the pipeline routes by radiation traverses. The survey shall be carried out in accordance with the following manners:

(1) Automatic-level, Total-station, EDM, Theodolite and surveying tape shall be used.
(2) Position and height of natural features and existing structures on the ground such as gardens, vegetations boundaries, roads/footpaths, houses, rivers/streams, bridges, culverts, water tanks, water pipes, wells, deep wells, ponds, rocks, cliffs, landslides, cuttings, embankments, fences/hedges, change of slope points and other artificial structures shall be measured from 50m centerline pegs, beginning point, end point or permanent centerline points by the radiation traverse.
(3) Accuracy of radiation traverse and cross section survey
Error in positioning and point height relative to the traverse points shall be within $\pm$ 3 cm.

6.7 Plotting and Drawing

All the results of L/S, leveling and cross section survey shall be plotted by manual method or digitized by surveying program. Drawing shall be carried out by a standard drafting method or an auto plotter with black ink in accordance with the following manners and accuracy:

(1) Polyester film shall be used for the drawing sheets.
(2) Neat size of L/S drawing sheets shall be A1 (594mm x 841mm).
(3) Margin settings of drawing will be instructed by the Consultant.
(4) Drawing scale shall be as follows:
1) L/S scale: shown in the following table, however, the Contractor shall confirm the scale to be applied with concerned of CRDA in advance.

	H	V
ARIANA	1/2000	1/100
MANOUBA	1/2000	1/100
NABEUL	1/1000	1/100
BIZERTE	1/2000	1/200
BEJA	1/2000	1/100
JENDOUBA	1/2000	1/100
LE KEF	1/1000	1/100
SILIANA	1/1000 or 1/2000	1/100 or 1/200
KAIROUAN	1/2000	1/100
KASSERINE	1/2000	1/100
SIDI BOUZID	1/2000	1/200
SOUSSE	1/1000	1/100
MAHDIA	1/1000	1/100
GAFSA	1/2000	1/200

2) Flat plan scale :1/2,000

(5) L/S leveling and detail survey data such as 1m contour lines, 50m centerline points, permanent centerline points, L/S lines, houses, roads, streams, canals, gardens, culverts, bridges, fences, and other structures shall be drawn on the flat plan of L/S sheet.
(6) Accuracy of drawing
L/S points and other planimetric details shall be within $\pm$ 0.2 mm of their true position on the maps.

6.8 Survey Mark Description of Permanent Centerline Points and Diagram (Location Map) of Pipeline Routes

Survey mark description for permanent centerline points including beginning and end points with field photo shall be prepared. A description form is shown in the end of this specification "Survey Mark Description". Diagram of pipeline routes shall also be prepared on copy of 1/25,000 scale topographical maps.

6.9 Required Output

The following outputs shall be delivered by the Contractor to the Consultant, together with delivery note showing contents and quantity at each delivery.

(1) One set of Survey Mark Description of beginning points, end points and permanent centerline points,
(2) One set of Diagram of pipeline route on 1/25,000 scale topographical maps,
(3) One set of field note and computation sheets for centerline survey, longitudinal profile leveling and detail survey,
(4) One set of original L/S sheets or L/S sheet data, Auto CAD format in Diskette,
(5) One set of sepia film copy of original L/S and
(6) Two sets of photo or dyeline paper copies of L/S sheets.

7. TOPOGRAPHICAL SURVEY FOR INSTALLATIONS

7.1 General

Topographical survey shall be carried out to prepare 1/100 scale topographical maps covering the projected pump stations and tanks at 47 subproject sites to be used for the detail design in the Study.
Topographical survey consists of setting up of permanent points, detail survey, plotting and drawing.

7.2 Location of Surveying Sites

Location of 1/100 scale surveying sites shall be pumping stations and distribution tanks

7.3 Setting up of Permanent Points

Minimum 2 permanent points shall be set up at each site by concrete pegs. The concrete peg shall be prepared as follows:
Setting a 50cm long and 16mm in diameter iron peg in the dug hole with 50cm in depth and 30cm in diameter and the iron peg shall be reinforced by concrete.

The same manners and accuracy as explained in the Section 6.3, 6.4.2 and 6.4.4 of the specifications are applied for the establishment.

7.4 Detail Survey

The survey shall be measured in accordance with the following manners:

(1) Position and height of natural features and existing structures on the ground such as vegetation boundaries, roads/footpaths, houses, rivers/streams, bridges, culverts, water tanks, water pipes, wells, deep wells, ponds, rocks, cliffs, landslides, cuttings, embankments, fences/hedges, change of slope points and other artificial structures shall be measured from permanent points by the radiation traverse.

(2) The Survey area shall be divided uniformly into rectangular sections of 5m X 5m and every point of intersection shall be measured.

(3) Accuracy of radiation traverse
Error in positioning and height of the radiation traverse points relative to the permanent points shall be within $\pm$ 3 cm.

7.5 Plotting and Drawing

All results of detail survey for 1/100 scale topographical maps shall be manually plotted or digitized by surveying program. Drawing shall be performed by a standard drafting method or an auto plotter with black ink in accordance with the following manner and accuracy.

(1) Polyester film shall be used for the drawing sheets.

(2) Neat size of map sheets shall be A1 (594mm x 841mm).

(3) Marginal settings of drawing will be instructed by the Consultant.

(4) Planimetric detail
All natural and artificial features on the ground including permanent points, vegetation boundaries, roads/footpaths, houses, rivers/streams, bridges, culverts, water tanks, water pipes, wells, deep wells, ponds, rocks, cliffs, landslides, cuttings, embankments, fences/hedges, and other artificial structures shall be plotted and drawn on the original plotting sheets.

(5) Height and contours
1) All radiation traverse points shall be plotted and drawn on the original plotting and map sheets.
2) Contours shall be delineated at interval of 0.5 meter on 1/100 scale maps by interpolation method.

(6) Accuracy of heights
Reading errors on plotted points shall be within $\pm$ 0.125m between an original plotting data and height read by contour lines. Ninety percent (90%) of the plotted points shall satisfy the accuracy.

(7) Accuracy of drawing
Grid line, radiation traverse points, planimetric details and counter lines shall be drawn within $\pm$ 0.2 mm of their true position on the maps.

7.6 Survey Mark Description of Permanent Points and Location Map of Topographical Surveying Sites

Survey mark description for permanent points with field photo shall be prepared. A description form is shown in Appendix 1 “Survey Mark Description”. Location map of surveying sites shall also be prepared on a copy of 1/25,000 scale topographical map.

7.7 Required Outputs

The following outputs shall be delivered by the Contractor to the Consultant, together with delivery note showing contents and quantity.

(1) One set of 1/100 scale original topographical maps or topographical data, Auto CAD format in Diskette,
(2) One set of sepia copies of 1/100 scale topographical maps,
(3) Two sets of photo or dyeline paper copies of 1/100 scale topographical maps,
(4) One set of location map of topographic mapping area on 1/25,000 scale topographical map,
(5) One set of field note and computation sheets, and
(6) One set of Survey Mark Description for permanent points.

8. INSPECTION AND ACCEPTANCE OF OUTPUTS

The Consultant will inspect required outputs specified in Section 6.9 and Section 7.7 in this specification, within 1 week from the date of submission. When any missing and/or data error in the results are found, the Consultant will return them with technical instructions to the Contractor. Results of resurvey shall be submitted to the Consultant for his approval and acceptance.

SURVEY MARK DESCRIPTION

Station No. :	N :	Height :	Surveyed by :
Type :	E :	Date :	Checked by :
Location Map :			
Field Photo :			

APPENDIX 7

TECHNICAL SPECIFICATIONS ON GEOTECHNICAL SURVEY

1. General

These specifications shall be applied to the geotechnical survey (hereinafter referred to as the "Survey") of test boring by rotary drilling together with the standard penetration test at site for the Study on the Rural Water Supply Project (Phase II) in the Republic of Tunisia. The purpose of the survey is to grasp geological profile and allowable bearing value of soil at the projected site for each elevated tank of which height is 12m or more. The JICA Study Team will judge the safety and soundness of the foundations based on the technical data to be collected through the geotechnical survey.

2. Scope of the Survey

(1) Test Boring by rotary drilling
- Depth of the borehole: 10 m
- Diameter of the hole: about 70 mm

(2) Standard Penetration Test
Test shall be executed 1m interval starting from the depth of 1m. The accumulated number of blows when the penetration depth reaches 30cm shall be recorded. In case the accumulated number of blows reaches before penetration depth reaches 30cm, the penetration depth at that blow shall be recorded.
Test shall be executed according to the applicable standard in Tunisia.

3. Location

The geotechnical survey shall be conducted for the following subprojects:

GOVERNORATE	Name of Subproject
SOUSSE	CHRAIFIA
KAIROUAN	GOUAAD
GAFSA	ENJAIMIA

The exact locations of the boreholes will be determined at the selection of the optimum AEP system concept.

4. Survey Period

The geotechnical survey shall be completed before starting the detailed design study. However, the Team strongly recommend to complete it as soon as possible after the selection of optimum AEP system concept so as to confirm the appropriateness of it.

5. Boreholes

5.1 Drilling Equipment

The core drilling equipment to be used for the works shall be of a rotary type with sufficient power and capacity of drilling hard rock to a depth greater than 50 meters with a drilling diameter not less than 65 millimeters.
A core tube shall be used to recover the core samples as much as possible. Core tube shall be one (1) meter or 1.5m long.

For the ordinary hard rocks, ordinary metal bits shall be used. However, if very hard rocks are encountered, appropriate bits shall be used with prior approval of the Engineer.

5.2 Drilling Method

The drilling rotation speed, drill bit pressure and water circulation quantity shall be adjusted according to the encountered materials in order to secure as much as possible the highest core recovery.

5.3 Observation, Measurement and Recording

The drilling shall be recorded the following items on the drilling log:

(1) Name of driller, machine type used and dates,
(2) Number of boreholes,
(3) Depths or elevations measured at the beginning of daily works, the borders of changed layers, abnormal phenomena encountered, and the ending of daily works,
(4) Rock type classification,
(5) Core recovery rate in percentage,
(6) Kinds of bits used, and
(7) Other special conditions observed during drilling works, such as sustained color of circulating water, sudden change of water return quantity, non–resistive drop of boring rod, etc. which are normally recognized in drilling techniques.

The responsible site representative of the Contractor shall submit the drilling log to the Engineer within two days after the borehole is completely drilled to the specified depth.
After completion of boring operations, the hole shall be blocked with a wooden plug with the boring number on the top.

5.4 Submission of Core Samples Recovered and Color Photographs

The Contractor shall put the core samples recovered in a good order in wooden core boxes.
The core box shall be in size and design as shown on Figure-1 attached hereto, which is made of timber board with sufficient strength to carry to the designated store house.
The core box shall have five (5) rows in approximately 100cm in length to accommodate one (1) meter long core samples in each row.
The number of boreholes, the depths of the core samples at the beginning and ending, and the total depth drilled shall be clearly marked on both sides of the cover board of the core box and both sides of box having shorter length as shown on the attached Figure-1.
Small wooden separators shall be put with indication of depth at each end of core samples recovered in every lift of core barrel. For section of no core recovery, the equivalent length of the section shall be kept vacant in the core box with small wooden separators at both ends.
The Contractor shall carry all the core boxes accommodating the core samples to the designated store house and pile them in good order as instructed by the Engineer.
The Contractor shall take color photographs of the core samples accommodated in the core boxes and submit all the original color negatives with one printed copy to the Engineer within two weeks after completion of each part of the works. In taking the photographs, the core box shall be put in a place well lighted but not exposed to direct rays, and the surface of the dried core shall be wetted by water.

5.5 Standard Penetration Test (SPT)

(1) Testing equipment
The followings are the descriptions of required testing equipments. The Contractor can propose and apply alternative equipments conforming to the Tunisian standard with the approval of the Engineer.

1) Boring equipment
The boring methods are conventional rotary drillings required to provide a reasonably clean hole, without unnecessary disturbance at the bottom of the hole. The diameter of the hole is 65mm to 150mm in general.

2) Sampler : Laymond sampler or the equivalent of Tunisian standard

3) Drive hammer assembly
Hammer : 63.5 kg in weight or the equivalent of Tunisian standard
Guide pipe : sufficiently long to allow 75cm or the equivalent in Tunisian Standard free fall
Knocking head : as shown in Figure-2 or the equivalent of Tunisian standard
Rope, pulley, etc: as shown in Figure-2 or the equivalent of Tunisian standard

4) Rod : driving rod, 40.5 to 42 mm in diameter, or the equivalent of Tunisian standard

(2) Testing method
The knocking number by the hammer to penetrate the SPT sampler shall be counted for 30cm penetration (Recognized as "N value"). The penetration depth for each hammering shall be measured and recorded as accumulated number. The record shall be taken for every 10cm penetration in case that each penetration is less than 2 cm. Prior to the above main test, preparatory knocking shall be carried out to penetrate 15cm depth. Also, final knocking shall be carried out to penetrate 5cm depth posterior to the main test.
If the tested layer is considerably hard and even 50 knockings cannot penetrate the sampler 30cm depth, the test shall be stopped at the depth on 50 knockings and the total penetration depth shall be recorded.

(3) Records to be submitted
The Contractor shall submit the following test records to the Engineer within two days after completion of the test:
1) Number of knockings in the main test with the starting depth and stopping depth,
2) Penetration depth in the main test, if penetration depth is less than 30cm within 50 knockings because of hard material, and
3) Samples obtained by the sampler.

(4) Reports
On completion of the field survey for the core drilling and standard penetration test, the Contractor shall submit a comprehensive report together with the drill logs.

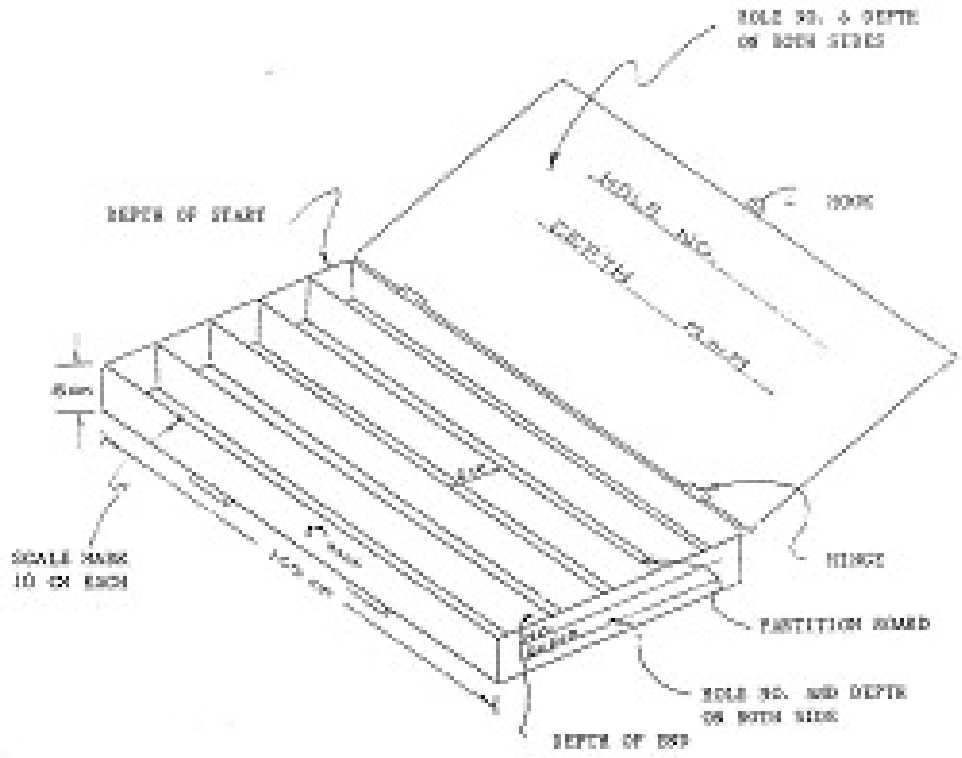
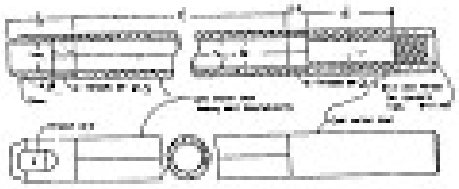


Figure-1 Sketch of Core Box

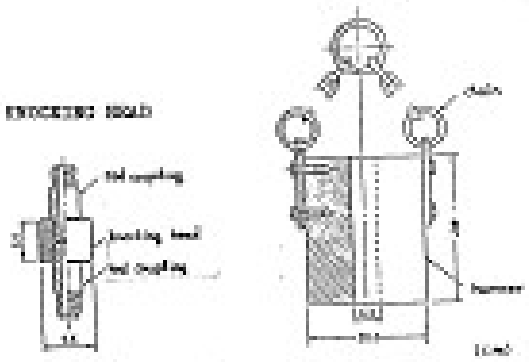
SAMPLER (BAYROCK SAMPLER)



a.	total length	81.0
b.	length of shoe	7.5
c.	length of split-tube	56.0
d.	length of connector head	17.5
e.	outside diameter	5.1
f.	inside diameter	3.5
g.	angle of shoe	19° 47'

(mm.)

HAMMER



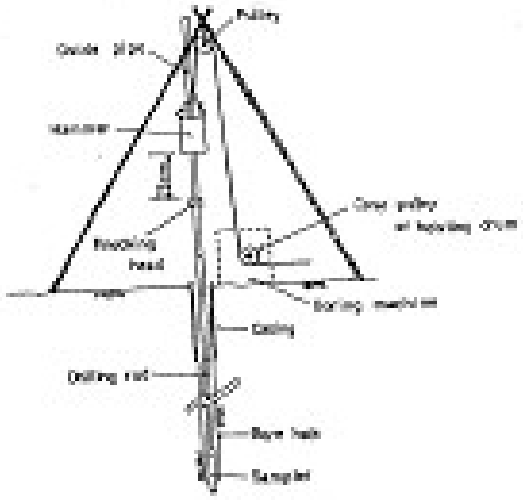


Figure-2 Sketch of Standard Penetration Test Equipment

APPENDIX 8

SPECIFICATIONS ON ENVIRONMENTAL STUDIES

1. General

This specification shall be applied to the Environmental Studies under the Study on the Rural Water Supply Project (Phase II) in the Republic of Tunisia.

2. Objective of the Environmental Studies

Objective of the Environmental Studies is to abate or avoid Environmental Impacts, which may take place as a result of the implementing subprojects, through Environmental Considerations.

3. Scope of the Environmental Studies

The Environmental Studies shall be conducted for each subproject by Environmental Evaluation Experts as shown in the Bill of Quantities.

The work shall be:

1) Initial Environmental Examination (IEE)
2) Environmental Impact Assessment (EIA), if significant environmental impacts are anticipated in IEE

4. Period of Execution

The Environmental Studies shall be executed during the course of the Basic Study. Initial Environmental Examination shall be executed at the initial stage of the Basic Study and all the work should be completed by July 2005. The schedule of Study is shown in following table.

Schedule of Study

Work Items	2005					
	Feb	Mar	Apr	May	June	July
IEE Study	■	■				
(EIA Study)					▒	▒
Reporting		▲ (1)				▲ (2)

Reporting
(1) IEE sheets, attached at the end of this document, for all subprojects
(2) Draft EIA reports (if necessary)

5. Environmental Studies

5.1 Initial Environmental Examination (IEE)

The Contractor shall carry out the Initial Environmental Examination for each subproject. The Contractor shall refer "JBIC Guideline for Confirmation of Environmental and Social Considerations" (April 2002)(hereinafter referred to as the "JBIC Guidelines").

For each item listed on the checklist of the JBIC Guidelines, the contractor shall fill the blanks in the checklist shown in the following page with anticipated impact, positive or negative impact and significance of impact after the examination of the subproject area. The checklist shall be prepared subproject by subproject. When evaluating a item as significant to the environment, the Contractor shall present facts observed in the subproject area so as to show such evaluation appropriate.

Furthermore, the screening sheet attached with the JBIC guideline is shown in the end of this specification.

Environmental Checklist: Water Supply

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	1) Have EIA reports been officially completed? 2) Have EIA reports been approved by authorities of the host country's government? 3) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? 4) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	
	(2) Explanation to the Public	1) Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? 2) Are proper responses made to comments from the public and regulatory authorities?	
2 Mitigation Measures	(1) Air Quality	1) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	
	(2) Water Quality	1) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	
	(3) Wastes	1) Are wastes, such as sludge generated by the facility operations properly treated and disposed of in accordance with the country's standards?	
	(4) Noise and Vibration	1) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	
	(5) Subsidence	1) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	
3 Natural Environment	(1) Protected Areas	1) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	

	(2) Ecosystem	1) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? 2) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? 3) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? 4) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	
4 Social Environment	(1) Resettlement	1) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? 2) Is adequate explanation on relocation and compensation given to affected persons prior to resettlement? 3) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? 4) Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? 5) Are agreements with the affected persons obtained prior to resettlement? 6) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? 7) Is a plan developed to monitor the impacts of resettlement?	
	(2) Living and Livelihood	1) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? 2) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	
	(3) Heritage	1) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	

	(4) Landscape	1) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	
	(5) Ethnic Minorities and Indigenous Peoples	1) Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples? 2) Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?	
5 Others	(1) Impacts during Construction	1) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? 2) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? 3) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? 4) If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	
	(2) Monitoring	1) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? 2) Are the items, methods and frequencies included in the monitoring program judged to be appropriate? 3) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? 4) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	
6 Note	Note on Using Environmental Checklist	1) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Screening Form

Name of Project：

Name of Project Execution Organization：

Name of Borrower：

Please provide the name, department, job title, and contact details for the person who is responsible for filling out this form.

Name：

Department and title：

Name of Company or Organization：

Telephone number：

Fax number：

E-Mail address：

Date：

Signature：

Questions

Q1. Please provide the address of the project site.

Address of the project site：

Q2. Please provide brief explanation of the project.

Q3. Will JBIC loan be applied to a new project or an executing project? In case of executing project, please inform the presence of strong claims by local residents.

☐ New Project ☐ Executing Project (with Claim)
☐ Executing Project (without Claim) ☐ Others（Please specify ）

Q4. In case of this project, is it necessary to execute Environmental Impact Assessment (EIA) based on the laws or regulations? If necessary, please inform the progress of EIA.

☐ Required (Completed) ☐ Required (Under execution or under planning)
☐ Not Required ☐ Others (Please specify)

Q5. In case that EIA is already completed, pleases inform whether EIA report is already approved based on the environmental assessment system or not. If EIA report is already approved, please provide the date and name of authorities of the approval.

☐ Approved (without condition) ☐ Approved (conditional)
☐ Under approval process ☐ Others (Please specify)

Date of Approval：
Name of Authorities：

Q6. If environmental permit(s) other than EIA is required, please provide the name of required permit(s). Have you obtained required permit(s)?

☐ Obtained ☐ Required, but not obtained yet
☐ Not required ☐ Others (Please specify)

Name(s) of required permit(s)：

Q7. Will the loan be used for the undertaking that cannot specify the project at this stage (e.g. export or lease of machinery that has no relation with specific project, or Two Step Loan that cannot specify the project at the time of loan agreement)?

(Yes / No)

If you answered “Yes”, it is not necessary to reply to the following questions.
If you answered “No”, please reply to the following questions.

Q8. Are there any environmentally sensitive area shown below in and around project site?

(Yes / No)

If you answered "Yes", please select applicable items by marking, and reply to following questions.
If you answered "No", please reply to questions 9 and after.

- ☐ (1) National parks, protected areas designated by government (coastal areas, wetlands, habitats of minorities or indigenous populations, heritage sites, etc.)
- ☐ (2) Primeval forests, tropical natural forests
- ☐ (3) Ecologically important habitats (coral reefs, mangrove, tidal flats, etc.)
- ☐ (4) Habitats of endangered species of which protection is required under local laws and international agreements.
- ☐ (5) Areas that have risks of large scale increase in soil salinity or soil erosion
- ☐ (6) Desertification areas
- ☐ (7) Areas with special values from archaeological, historical and/or cultural viewpoints
- ☐ (8) Habitats of minorities, indigenous populations, nomadic people with traditional life style, or areas with special social value

Q9. Does the project involve following elements?

(Yes / No)

If you answered "Yes", please describe the scale of applicable elements, and reply to the questions 10 and after.
If you answered "No", please reply to questions 11 and after.

- ☐ (1) Involuntary resettlement (Number of resettlers:)
- ☐ (2) Pumping of groundwater (Scale: ton/year)
- ☐ (3) Land reclamation and/or development (Scale: ha)
- ☐ (4) Deforestation (Scale: ha)

Q10. Please reply to this question only in case that the project involves some of the above (1) to (4) elements. In the country where the project is planned, are there any regulations on a scale of the elements asked in question 9? If the country has such regulation, please answer whether the project satisfies the regulation or not.

☐ Regulation is applicable (☐ satisfied ☐ not satisfied) ☐ No regulation
☐ Others (Please specify)

Please reply to questions 11 and after.

Q11. Will JBIC share in the project be equal or less than 5% of the total project cost, or the total amount of JBIC loan equal or less than SDR 10 million?

(Yes / No)

If you answered "Yes", it is not necessary to reply to the following questions.
If you answered "No", please reply to questions 12 and after.

Q12. Does the project belong to either of the sectors that impact on the environment is deemed immaterial or is not anticipated under normal conditions (e.g. maintenance of the existing facilities, non-expansionary renovation project, acquisition of rights or interest without additional plant investment)?

(Yes / No)

If you answered "Yes", it is not necessary to reply to following questions.
If you answered "No", please reply to the questions 13 and after.

Q13. Does the project belong to the following sectors?

(Yes / No)

If you answered "Yes", please specify the sector by marking, and reply to questions 14 and after.
If you answered "No", it is not necessary to reply to the following questions.

- ☐ (1) Hydro power plant, Dam or water reservoir
- ☐ (2) Thermal power plant
- ☐ (3) Mines
- ☐ (4) Development of oil and gas
- ☐ (5) Pipeline
- ☐ (6) Steel industry (with large scale furnace)
- ☐ (7) No-ferrous metal refining
- ☐ (8) Petrochemical (including manufacturing of raw materials and petrochemical complex)
- ☐ (9) Terminal of oil, gas and chemicals
- ☐ (10) Petroleum refining
- ☐ (11) Paper and pulp
- ☐ (12) Manufacturing and/or transportation of hazardous substances (specified by international agreement)
- ☐ (13) Road, railway or bride
- ☐ (14) Airport
- ☐ (15) Port
- ☐ (16) Waste material processing or treatment
- ☐ (17) Treatment of sewage and/or waste water that includes hazardous substances or executed at environmentally sensitive area
- ☐ (18) Power transmission and/or distribution lines (including large scale involuntary resettlement, large scale deforestation or submarine cable)
- ☐ (19) Tourism (Construction of hotel, etc.)
- ☐ (20) Forestry or tree planting
- ☐ (21) Agriculture (large scale project and/or project including irrigation)

Q14. Please provide information on the scale of the project (project area, area of plants and buildings, production capacity, amounts of power generation, etc.) Further, pleased explain whether an execution of EIA is required on account of the large scale of the project in the country where the project is implemented.

APPENDIX C

NOTES FOR THE STUDY

(Supplementary document of the Sepecifications)

Points to be considered for the Feasibility and Detailed Design Study

I Basic Design

1. The design of the Water Supply System should take into consideration the easiness of operation and maintenance of it.

2. C value (hydraulic factor related to the roughness of the pipe inner surface) of William-Hazen formula shall be 120 considering the long term use.

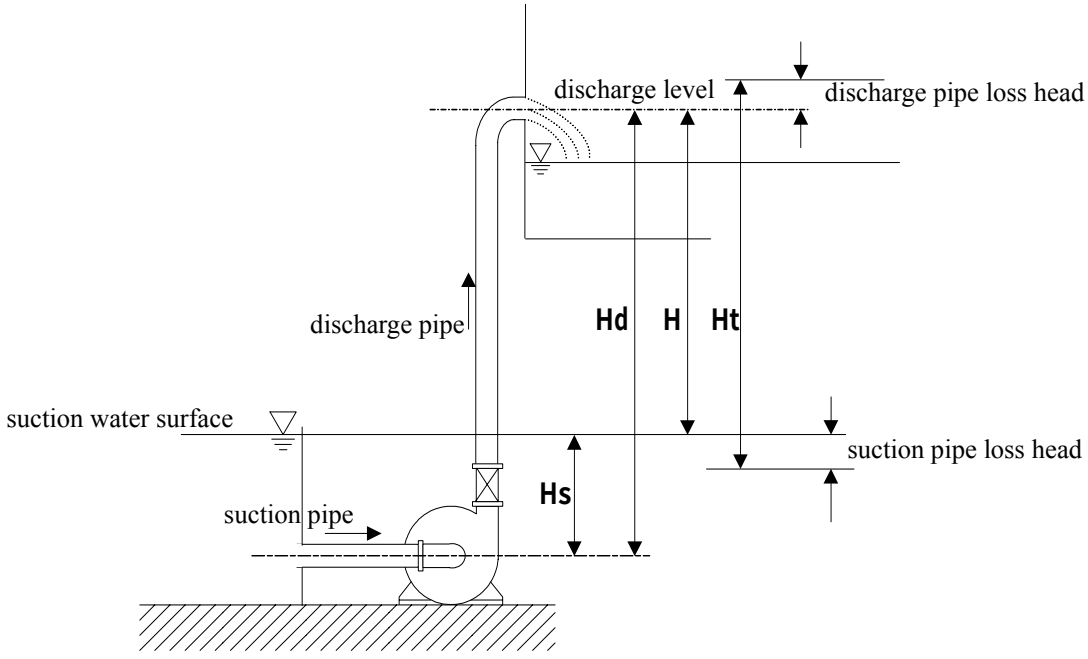
3. The hydraulic modeling software named "LOOP" should be applied to the hydraulic simulation of the distribution system. The Study Team recommends verifying the output of "LOOP" by "EPANET" which can be obtained from the public domain.

4. If the pipe inner velocity and the minimum dynamic pressure of the distribution system can not meet the value specified in the design guidelines prepared by DGGREE, it is necessary to consult the JICA Study Team about a solution.

5. If the pipe inner water pressure exceeds 16bars, the ductile cast iron pipe should be applied. The JICA Study Team can not recommend using galvanized steel pipe.

6. The specifications of existing equipment (a pump, etc.) should be made clear.

7. The total pump head shall be calculated in conformity with the following drawing.



H_s: Pump Suction Head

H_d: Pump Discharge Head

H: Actual Pumping Head

H_t: Total Pumping Head

8. The computation of motor output shall be in conformity with following formula:

$$P = \frac{9.81 \times Q \times H}{\eta_p/100}$$

where P : Motor Output (W)

Q : Discharge Rate (l/s)

H : Total Pumping Head (m)

η_p : Pump Efficiency (%)

9. Rated motor output shall be selected from the standard products which is available in the market. (The rated motor outputs of the standard products（kW）: 0.37, 0.55, 0.75, 1.1, 1.5, 2.2, 3, 4, 5.5, 7.5 ……) The rated motor output shall be the nearest value to the calculated one but bigger than it.

10. The estimation of the energy cost shall be made based on the efficiency of the selected motor. Following table shows the example of the energy cost computation.

Computation of the Unit Energy (STEG) Cost Price per one (1) cubic meter.

TOTAL PUMPING HEAD (H)	m	120	
PUMP EFFICIENCY: r_p	%	68%	
MOTOR EFFICIENCY: r_m	%	75%	
Cosφ		0.85	In case that no information is available
FLOW RATE (Q)	l/s	3	
MOTOR OUTPUT	kW	5.19	=1/1000x9.81xH(m)xQ(l/S)/(r_p/100)
RATED MOTOR OUTPUT	kW	5.50	
ENERGY CONSUMPTION	kWh	6.92	=5.19/（(r_m/100)XCos**ϕ**） **Cos**ϕ**is considered in the STEG charge.**
CONSOMMATION/m^3	kWh/m^3	0.64	
COST PRICE / kWh (Low Voltage)	DT/kWh	0.073	Flat Rate
municipal tax	DT/kWh	0.003	
TVA18%	DT/kWh	0.014	
COST PRICE / kWh with tax	DT/kWh	0.090	
ENERGY COST PRICE / m3	DT/m^3	0.058	
DISINFECTION :	DT/m^3	0.010	Javel （12%）
Total	DT/m^3	0.068	

11. A reserving pump set should be considered.

12. Capacity of Transformer shall be calculated according to the following

Single Phase: (1) P=U x I

Triple Phase: (1) P=$\sqrt{3}$ x U x I

U : Secondary Voltage

I : Secondary Current

(Secondary: the side to be connected equipment)

(2) P={motor output (kW) / η (motor efficiency)}/cos Φ

Pump output is (1) or (2) whichever bigger.

Total electric power = P + electricity for lighting and used through plugs

13. When selecting a type of hydraulic installations, for example, an elevated tank or a semi-buried tank, a communal tap or a potence, etc., technical and financial justification is required.

14. If electrification is required, the three-phase current of 380V should be considered, however, per capita construction cost ceiling as the financial eligibility of the sub-project should be respected.

II Feasibility Study

1. The scope of the Study is to execute the feasibility study, socio-economic study, detailed design study and preparing the draft tender documents for the rural water supply system by communal taps, potences, individual connections to public institutions. It should be noted that private connections such as yard taps, house connections, etc. are out of the scope.

2. The project period for the financial analysis shall be 15 years from the year when the water supply service is started. Following table explains the project period of the subprojects for 2006:

year	cumulative year of the project period	water demand per capita	Population Projection (ex. growth rate=1.3%)	average water demand	peak demand (ex. peak factor =1.5, Loss=15%)	financial analysis (revenue & expenses)
		(liter)		(m^3/day)	(m^3/day)	(TD)
2005	execution of the Study		1000 (for example, based on the socio-economic survey)			
2006	execution of the construction works		1013			construction cost (expenses)
2007	1	25.0	1026	25.65	44.25	revenue and expenses
2008	2	25.6	1039	26.60	45.89	revenue and expenses
2009	3	26.2	1053	27.59	47.59	revenue and expenses
2010	4	26.9	1067	28.70	49.51	revenue and expenses
2011	5	27.6	1081	29.84	51.47	revenue and expenses
2012	6	28.3	1095	30.99	53.46	revenue and expenses
2013	7	29.0	1109	32.16	55.48	revenue and expenses
2014	8	29.7	1123	33.35	57.53	revenue and expenses
2015	9	30.4	1138	34.60	59.69	revenue and expenses
2016	10	31.2	1153	35.97	62.05	revenue and expenses
2017	11	32.0	1168	37.38	64.48	revenue and expenses
2018	12	32.8	1183	38.80	66.93	revenue and expenses
2019	13	33.6	1198	40.25	69.43	revenue and expenses
2020	14	34.4	1214	41.76	72.04	revenue and expenses
2021	15	35.3	1230	43.42	74.90	revenue and expenses
2022						value residual of asset

3. The water demand per capita for the grouped population shall be 25 liters in the first year of the water supply service.

4. In case of “Extension GR” project, the capacity of existing facilities and installations should be studied, the discharge rate of pump, diameter of pipelines, capacity of the distribution tank, etc. are especially. The layout plan of existing facilities, installations, etc. should be attached to the feasibility study report.

5. In the same case of above, if a part of the existing water supply system should be included in the operation and maintenance cost estimate of the GIC, the passed years from starting the operation and the lifespan of facilities and installations of the existing water supply system should be considered.

6. The cost estimate should be made on the basis of the unit price of construction materials and works. The consultant companies should study markets in the region to have actual price, which should be reflected to the unit prices, of them without depending on their experiences.

7. The summary of the socio-economic report should be included in the feasibility study report.

8. The sub-project designs to make use of a pump set, power line, etc. which will be arragned by another project, the time when such facilities will be available should be studied and described it in the feasibility study report. Furthermore, the implementation program should be prepared reflecting such events.

9. Following information related to the water source should be clearly mentioned in the feasibility study report.
   - the possible groundwater withdrawal, the maximum design withdrawal and operation hours for the deep well
   - in case of the spring, the minimum capacity and the maximum desing withdrawal for the sub-project
   - concerning « SONEDE Connection », agreed flow rate with the minimum dynamic pressure at the connection point
   - as for « Extension GR », the capacity of the water source and an intake pump, the maximum daily water demand, the operation hours of the existing system

10. Investment Cost shall be classified according to the following items :
   - Cost for Water Source; the work to be entrusted to SONEDE
   - Pipe Materials; pipe and fittings
   - Pipelines; pipe laying, ancillary works (air valves, sluice valves, wash outs, pressure reducing valves, etc. handholes (les regards) should be included in this item)

- Equipment; pumping facilities, disinfection facilities, automatic pump on-off system
- Power supply; the work to be entrusted to STEG
- Civil Work; distribution tank, pumping station, break pressure, etc.

11. Operation, Maintenance and Management System (OM/M System) of the projected GIC water supply system should be established refering the attached model.

12. Adequacy of number of BFs and potences and the capacity of the distribution tank should be verified refering the material provided by the Study Team.

13. The Contract of the land transfer shall be made in the second visit of the sensitization and the copy of it shall be attached to the feasibility study report.

APPENDIX D

CONCEPTION

OF

MODIFIED DISTRIBUTION SYSTEM MODELING

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1 . DESIGN OF DISTRIBUTION SYSTEMS AND SERVICE INSTALLATIONS

1.1 Introduction

The study of the Rural WSS is composed of two phases:

- Feasibility study
- Detailed design study and tender document

The feasibility study itself is composed of ten major stages which are:

1. Identification
2. Detailed survey and Socio-economic Survey
3. Data Analysis
4. Definition of the project components
5. 1st Sensitization Visit
6. Selection of the optimum design of the Rural WSS
7. 2nd Sensitization Visit
8. Topographic Survey
9. Technical and Financial Studies
10. 3rd Sensitization Visit

In this chapter we are going to focus on the design of the Rural WSSs. The JICA Study Team introduced an important stage which is the selection of the preliminary design. The resident consultant company proposes at least three alternatives in which the optimum design is selected from them. This selection is based on the hydraulic modeling, the financial analysis and ensuring an easy management of the WSSs by the GICs. So, we notice that with the modifications introduced by the Team, the hydraulic modeling that determines the capacity and the stability of the projected WSS should be done for the two following stages : a preliminary simulation based on data (heights and distances) obtained from the CEM or by GPS for the choice of the optimum design and the final calculation based on the topographic survey for the establishment of an effective design during the technical and financial studies above mentioned.

Then, we are going to discuss the hydraulic simulation which remains the basis of the design of a rural WSS and one of the principal factors that determines the choice de the optimum design.

1.2 Reminder on the presently applied design method

The design of a rural WSS starts with the preparation of alternatives. It is necessary to do the hydraulic modeling and economic analysis for each alternative. The economic analysis is based on the project components that are determined on the basis of the hydraulic modeling. The design of transmission and storage facilities are determined based on the water demand of the

population; whereas the distribution system is designed based on the flow supplied by the service installations. The present design method of distribution systems is based on the following hypotheses:

(1) Flow rate of service installations for the hydraulic simulation of distribution systems are fixed; 0.5 L/s for the communal taps (BF) and for the connections for public institutions (BP), and 2 L/s for the potences.
(2) Minimum dynamic pressure is 1 bar.
(3) Water velocity in the pipelines must be between 0.4 and 1.2 m/s : $0.4 \leq V \leq 1.2$.

With these conditions we determine the pipeline diameters of the distribution system.

1.3 Restrictions of this method

The above mentioned hypotheses are subject to some assumptions:

(1) Flow of service installations:

Service installations are not equipped with necessary instruments in order to give constant flows as indicated above and consequently the flow of the service installations will be variable from one service installation to another and this depends on the design of the distribution system, the service pipe and installations (a pipe connect the distribution pipe to the service installation) and the available pressure.

(2) Dynamic pressure

Though it was not specified in DGGREE guidelines, based on the present method the designated dynamic pressure is the one at the branching saddle at the connection point of distribution pipe to the service installation. In fact, it is evident that the pressure of water at the outlet of service installations is almost null (equal to $V^2/2g$) so with the minimum pressure of 1 bar at the branching saddle, the flow rate supplied by the service installation is depended on the characteristics of the service installation.

(3) Minimum velocity

Velocity depends on the pipe inner diameter and the flow rate. It is evident that for small flow rate of 0.5 L/s with minimums diameter suggested by CRDAs such as 75 or 90 mm, the velocity becomes low (around 0.22 for DE(Outside Diameter)75mm and 0.16 m/s for DE 90 mm). Consequently, this condition cannot be respected mainly because the minimum diameter for all the Rural WSSs was fixed by DGGREE at 63 mm.

1.4 Shortcomings of the presently applied method

Taking into account the above mentioned assumptions, the present method can impose the following shortcomings to the design:

- Distribution system and service installations are not designed based on the water demand of the population :
  The flow rates at the service installations are fixed (0.5 L/s for the communal taps (BF) and the connections to public institutions (BP) and 2 L/s for the potences). As a result of it, distribution systems as well as service installations are designed without taking into account the number of the beneficiaries who will be supplied with water through the service installation.
- It is possible that the flow rate of service installations cannot satisfy the water demand of the population :
  In fact, since the flow rates at the service installations are not controlled by appropriate devices, they will vary from a service installation to another. Consequently, there will be some service installations with small flow rates and other ones with high flow rates and it is possible that the flow of some service installations cannot satisfy the water demand of the population.
- It is possible that water does not reach some service installations:
  The above mentioned phenomenon may be serious and the variation of flow rate at some service installations that are situated at a hydraulically unfavorable sometimes cause the suspension of water supply during the peak water demand.
- Unreliable meter measuring:
  Since several years DGGREE has been orienting the Rural WSSs that are managed by GIC towards commodity charge, volumetric water meters for their better precision are the mostly used. Nevertheless, with the above mentioned design conditions, flow rates may vary considerably whether increase or decrease and these variation may exceed the nominal flow and even the maximum flow of the water meter. The brief explanation on technical characteristics of a volumetric water meter, which is used a lot in recent years in Appendix 7.
- Risk of cavitation :
  The distribution system and service installations that were designed based on fixed distribution flow rates at the service installations while they actually might have bigger flow rates. This variation can cause water hammer and phenomena of cavitation.

1.5 Proposed modifications

Considering the mentioned-above, the JICA Study Team introduced some modifications for the design of the distribution systems and service installations.

1.5.1 Maximum hourly water supply

As it was mentioned, the transmission and storage facilities are designed according to the water demand of the beneficiary population. The water demand taken into consideration for the design of the facilities is the peak daily water demand. The JICA Study Team also introduced

the peak hourly water demand of the population in the design of the distribution system not only considering the determination of the number and type of the service installations but also determine the flow rate and capacity of each service installation according to the number of population to be supplied. Following are the points to be taken into consideration:

- Concerning the collective water supply, some period of time is being wasted when changing the utensils to take water. This time was assumed to be 1/3 of the utilization time of the service installation. The necessary flow rate at a service installation will be equal to 1.5 of the hourly peak demand of the locality to be supplied accordingly.
- In order to avoid the excessive design of distribution system, the total of the flow rates of all the service installations limited to conform to the design guidelines of DGGREE, i.e. the total should be almost the same to that multiplying all the number of service installations by 0.5 L/s.

Details of computation of the hourly peak factor as well as the necessary flow rates of service installations are presented in Appendix 1.

The design of the distribution system is set at first with the necessary flow rate for the service installations instead of the flow rates fixed by DGGREE guidelines (0.5 L/s for communal taps (BF) and connections for public institutions (BP) and 2 L/s for potences). With these flow rates, it is necessary to guarantee the minimum dynamic pressure of 2 bars in the distribution system. After this preliminary design, the basic design of distribution system without specifying the flow rates at the service installations.

1.5.2 Flow rate when a tap fully opens

The above mentioned stage that consists of design the distribution system through calculated flows which are equal to the necessary flow of service installations is the preliminary design. These flows reflect actual-like situations at taps and they follow the pipeline diameters that have been already fixed during the above-mentioned design stage, the dynamic pressure in the distribution system and the characteristics of the service installation.

Diameters are determined, the hydraulic pressure is given by the distribution tank which was already implemented during the preliminary design. What remains are the characteristics of the service installations. No information is available about the characteristics of the service installations even in the standard plan of service installations (Communal tap and Potence). The diameters of the service installations are only available for the WSS design that are 20 mm (it corresponds to inside diameter of 19mm of PEHD DE 25 PN16) for the communal taps (BF) and the particular connections for public institutions (BP); mostly used diameter for the potence is nominal diameter 40mm suitable for the galvanized steel fittings that correspond to PEHD DE 40 PN16 which gives the inside diameter of 32 mm. Considering scarce data on the service installations, the JICA Study Team estimated the equivalent pipeline length of PEHD

DE25 PN16 to the communal tap which is designed for 0.5 L/s with the minimum dynamic pressure of 1 bar according to the guidelines prepared by DGGREE. The equivalent pipeline length can take place almost the same pressure loss to that of the communal tap when the flow rate of 0.5 L/s is given. The result of estimation indicates 35m to the PEHD DE25 PN16 of which inside diameter is 19 mm. The various components of communal taps as well as the principle of calculation of the equivalent length are presented in Appendix 2.

Having the diameter, length and height of the distribution tank and also the dynamic pressure at a tap outlet which is equal to $V^2/2g$ (can be considered as nearly equal to zero), we can determine the flow rates provided by the service installations. These flow rates can be calculated by the BERNOUILLI's formula or the hydraulic modeling computer software such as LOOP, EPANET, etc., which are all developed based on the general hydraulic formulas such as Hazen-Williams formula. An example of the determination of the tap outlet discharge is presented in the Appendixes 3.1 and 3.2.

Then, the discharge of tap under the design conditions will be compared with the water demand of the population which are expressed as the necessary flow rates of the service installations. It is difficult to guarantee always these necessary flows due to economical and technical constraints and therefore the Study Team recommends to satisfy at least the following conditions:

	BP and BF		Potence
Necessary Flow	= > 0.5	< 0.5	2.0
Minimum Flow	0.5	Necessary Flow	2.0
Maximum Flow	0.9	0.9	2.5

If the water demand of a service installation exceeds the above mentioned values, another communal tap (BF) should be added.

To ensure the minimum flow, it is sometimes necessary to take measures such as changing the pipeline diameters, dividing the distribution system considering the static pressure, installing flow and/or pressure control devices etc.

1.5.3 Flow or pressure control pressure devices

It is common to find one or many intermediate tanks in the distribution system. An intermediate tank is equipped with a float valve that opens when the water level becomes low. However, installation of the intermediate tank sometimes affect the pressure and flow rate of the service installations in the upstream vicinity of it. Because, when the float vale, which is installed at the inlet pipe of the tank, open, the inner pressure of the inlet pipe is almost the same to the atmospheric pressure, i.e. null and it makes the pressure low in the pipe to the said

service installations due to such pressure drop. It is evident that with the presently applied design method, which is based on the assumed fixed flow at the service installations and even at the inlet of the intermediary tank, the phenomenon of such pressure drop remains invisible and unknown. The analysis of the distribution system when all the taps fully open shows that the service installations situated in the upstream vicinity of the intermediary tank may have small flows and sometimes null during the opening of the float valve of the tank. The JICA Study Team recommends to install flow control valves in the inlet of these intermediary tanks in order to ensure the stability of the network. These devices can be installed at the service installations to adjust the flow. Nevertheless, flow control valves that give flow rate less than 1 L/s with 20 mm diameter (it corresponds to the service pipe diameter of the communal tap) are not available in the market of Tunisia. Consequently the JICA Study Team recommends using pressure reducing valves that are available in the market and which were tested by the Team in the field and showed a good function in order to control the pressure as well as flow rate of the service installation.

2 DISTRIBUTION TANK BEHAVIOR

The distribution tank capacity is determined according to DGGREE guidelines on the basis of 50 % of the average daily water supply in the final year of the project period. This volume does not take into account the fluctuation of consumption during the day. In reality, the consumption is especially concentrated on a few hours in the morning and in the afternoon in the rural areas with the collective water supply. The JICA Study Team tried to include this factor to determine the appropriate capacity of the tank.

2.1 Operation hours

The information about the hourly consumptions during the day is not available for the Rural WSSs. The JICA Study Team tried to collect this information from the beneficiary population during the second visit of the sensitization activities and the selection of the sites for the service installations with the population. The resident consultant companies asked the beneficiaries about the opening hour of the service installations that they prefer especially during summer i.e. the peak period. This data was collected and analyzed and then used for the analysis of the tank behavior. Based on the obtained results, it was demonstrated that the tanks designed on the basis of 50 % of the average daily water demand do not generally satisfy the water demand of the population during the peak hours. Hence, we can conclude that the hourly consumptions during the peak day is an important factor that should be studied carefully.

2.2 Impact of potences on the tank behavior

A potence can supply 5 m^3 of water within one (1) hour. This quantity exceeds the daily consumption of a family. Therefore estimating the peak hour water consumption from the peak day water consumption is not necessarily correct because families who use the potence get

three or four day's quantity within one hour. The existence of one or two potences in the distribution system can consequently empty the distribution tank. The JICA Study Team introduced the potences to determine the appropriate capacity of the distribution tank.

2.3 Type of control

The analysis of the tank behavior was made to have cumulative inflow and outflow of the tank and to examine the hourly balance of water in it. As it was mentioned, the outflow depends on the consumption of the population and its repartition in terms of time while the inflow of the tank depends on the operation hours of the pump. In case of the automatic pump on-off control according to the low and high water level in the distribution tank, the several studies on the distribution tank behavior show that there is the risk that the tank become empty after resuming the operation of WSS. Because there is always the possibility that the water level comes to near the low water level where an installed sensor transmit the signal to start a transmission pump through pilot cable or radio at the stop of an WSS operation, and if the water consumption is bigger at the beginning of the following operation comparing with the transmission capacity of the pump, the remaining water in the tank can not meet the difference between the consumption and transmission of water. To remedy this situation, the JICA Study Team proposed to add an adjustable timer that starts the pump each morning few hours before starting the water supply to the automatic control system,.

The example presented in Appendix 4 illustrates the introduction of these various factors in the analysis of the tank behavior.

3 SIMPLIFICATION OF THE FINANCIAL ANALYSIS

The simplification of the financial analysis mainly concerned two following points:

- Analysis of monthly family flat rate
- Calculation and introduction of the amount of the revolving fund in the financial analysis.

3.1 Cash flow and family flat rate

The analysis of monthly family flat rate according to DGGREE guidelines includes two cases. The first case considers that all the beneficiaries pay for its consumption and the second case considers that only 80% of the beneficiaries pay the cost of water consumed. For each case, it is necessary to study two conditions: balanced cash flow and the cash flow with surplus at the end of the project period. These two cases clearly show that GIC's cumulative balance comes to a deficit for the first seven or eight years from starting the operation of WSS and the methodology proposed by DGGREE indicates that a capital contribution in form of subsidy or credit should be provided to GIC so as to balance its budget. Yet, in reality and practically the GICs have never had neither subsidy nor credit and finally find themselves with deficits.

Moreover, the notion of the revolving fund came after the establishment of the methodology of the financial analysis by DGGREE. In case of the study with balanced cash flow, i.e. when only 80% of beneficiaries pay their contributions, the determination of amount of revolving fund was worked out by DGGREE method which specifies that it is equivalent to four month's flat rate. This method determines the calculation mode of the amount of the revolving fund but this amount of money, which should be in principle collected from the beneficiary families, is not included in the financial analysis and it is not instructed by DGGREE in any forms. The JICA Study Team simplified and improved the method of the financial analysis, e.g. the amount of the revolving fund was introduced in the cash flow analysis of the GIC.

The amount of the revolving fund was determined based on the cash flow balance. In fact, the cash flow balance of the GIC should not be deficit during the project period so as not to necessitate any subsidy or credit. Since the cash flow balance depends on two important factors: the water charge and the amount of the revolving fund, two cases were studied:

1) Case 1 : the proposed water charge is equal to the cost price of water

With a water charge proposed to the beneficiaries equal to the cost price of 1 m^3 water, we determine the amount of the revolving fund which makes the cash flow of the GIC balance during the project period. Then, we analyze the amount of family contribution to the revolving fund. If this amount exceeds the affordability of the population, we study the second case.

2) Case 2: the amount of the revolving fund that covers the expenses of the four months of the first year of water supply service.

As mentioned above, the objective of the revolving fund is to cover the expenses of the GIC, which is mainly fixed cost, during the first several months because the GIC is not able to have sufficient income in this period to pay for said expenses due to the delay of water charge collection which is always after the supply and less subscription for water supply than budgeted. If the study of case1 shows that family contribution to the revolving fund is judged excessive against the affordability of the population, we should limit the amount of revolving fund equivalent to the expenses of the four months of the first year of operation and should determine the water charge that balances the cash flow.

The two cases analyzed in the above are based on the hypothesis that all the member families pay their contribution. In addition, it should be signaled that the amount of membership fee, which is only 1 TD per family per year, was introduced in the analysis of the cash flow for the two cases even though it was a symbolic contribution and the total collected amount is negligible. Appendixes 5.1 and 5.2 present the examples of above two cases.

4 DISTRIBUTION SYSTEMS PROPOSED BY THE TEAM

4.1 Balance of distribution systems

For the design of the distribution system, the important point is "*How to maintain the necessary minimum dynamic pressure and how to control its fluctuation while the service pipeline is in principle designed according to designed flow rates*".

Following merit and demerit of two main type, direct type service system and receiving tank type service system, of service system applied to urban water supply system seem to be useful to consider an appropriate rural water supply system.

	direct type service system	receiving tank type service system
description	Taps (BFs) are directly connected to a distribution pipe through service pipe.	Water is stored in a receiving tank (small distribution tank*) and then it is supplied through taps (BFs).
advantage	It does not necessitate the construction cost, space, maintenance with its cost and regular cleaning of a receiving tank.	The fluctuation of the pressure in the distribution system does not affect to the service system (BFs). It is possible to use a large amount of water in a certain period of time, e.g. for fire fighting (potence). The water in the tank can be used even during the trouble of the distribution system (suspension of water supply).
disadvantage	Troubles of the water supply system directly cause the suspension of water supply. Though it depends on the capacity of the distribution pipeline system, the availability of water supply is sometimes limited. (The flow of the BF located in the hydraulically disadvantageous area will decrease or stop)	It necessitates the construction cost, space, maintenance with its cost and regular cleaning of a receiving tank (small distribution tanks). (In case of the RWS, since the pipe diameter of upstream of the small distribution tanks can be reduced, the total construction cost may not be bigger than that of "direct type".) Low maintenance will cause the degradation of drinking water.

Words in parentheses show the case applying to the RWS system.

* small distribution tank is considered to install in the distribution system to isolate a certain service area from the main distribution pipeline system in order to regulate the pressure, etc.

4.2 Examples

The distribution tank is generally located in a high area, dominating all the service installations. Since water is distributed from the tank directly to each service installation, when the number of service installations increases and/or when the service area becomes larger, the head loss in the distribution main fluctuates a lot and it affects the pressure due to considerable fluctuation of water consumption. Consequently, the flow of the service installations that are situated in unfavorable zones may decease considerably in the period of peak water demand.

The Team recommends making the pressure fluctuation less as much as possible in order to avoid significant variation of flow rates of the service installations. The ideas how to control the pressure in the distribution system are shown in the following three case studies and the Team requests all the concerned parties to discuss about the design of the rural water supply projects from the viewpoints mentioned-above.

1) AIN DAM

This project is located in the mountainous area of Northwest region and the project area is up and down. The proposed design in the draft feasibility study report consists of a transmission pipeline between a relay tank supplied by SONEDE network and the distribution tank situated in high zone that dominates all the localities to be supplied. This tank distributes water to five (5) communal taps (BF) and a particular connection for public institutions (BP), then a second distribution tank situated at the place around 1 Km from the first tank. This second tank covers seven (7) BFs, a third tank and a break pressure. The seven (7) BFs are set between around 1.2km and 3km from the tank. The Team proposed to change the location of this tank to a site in the centre of these seven (7) BFs so as to decrease the difference of flow rates among seven (7) BFs because it makes the distribution pipeline length shorter to each BF than that in the initial design. The objective of this example is to show that it is better to divide the distribution system in several service sub-areas and to supply them through small distribution tanks and also to get storage facilities closer as much as possible to the zones to be supplied (See Appendixes 6.1.1 and 6.1.2). This alternative, apart from ensuring a more stable system, is also less expensive.

2) SLATNIA

The design proposed to locates a distribution tank that covers all the localities. A distribution main starts from this tank to supply four (4) BFs and to connect with a BP. Then this pipeline is divided into two (2) main branches for two (2) service sub-areas. The first branch pipeline covers the high zone and the end of this pipeline is near to the route of the second branch pipeline (See Appendix 6.2.1). Considering this favorable condition, the Team proposed to design the looped distribution in order to establish the stable network and to make it easy to expand the service area in the future. This alternative with easy operation is not so expensive. The difference in the cost between the two alternatives is only around four thousand Dinars.

3) OULED MOUSSA (two service areas according to the elevation of service installations)

The design initially proposed to supply the service area with water from an existing distribution tank. The distribution main from the tank is branched into several pipelines to left and right toward the localities to be supplied. Yet, this main crosses a low zone where three localities are to be supplied, then, it rises to cross the highest zone with four target localities in the service area. Then it goes down again to supply a low zone of which elevation is almost the same to the first low zone. The initial design applies relatively big diameter to the distribution main and considers pressure reducing valves for low zones in order to guarantee stable supply of said three sub zones. The Team presented a more stable solution which incorporate a second distribution tank in the highest zone. This tank is directly transmitted water from the first tank through an independent pipeline. This solution makes the network more stable without using any devices to control flow or pressure. Moreover, this solution is less expensive than the initial design. The cost difference is around 35 thousand Dinars.

5 THEMES TO BE STUDIED

5.1 Hydraulic characteristics of service networks

As mentioned above, the standard design of service installations available in the DGGREE does not specify the characteristics of the service pipe as well as devices such as water meters, valves, bend etc…

In paragraph 1.5.2 we defined an equivalent length to the service installations to have similar pressure head loss under the same flow rate so as to calculate the flow rates in the projected WSS easily. However, this length is still theoretical and can be away from reality. The Team recommends making the determination of the technical characteristics of service installations by measuring it in the field with the aid of appropriate catalogues.

5.2 Appropriate number of families per service installation

If the number of the population that is using a communal tap (BF) is very big, and even though the flow rate of BF is sufficient, it seems inconvenient for the beneficiaries to fetch water from BF.

The Study Team proposed to fix a standard flow for the service installations shown in the following table:

	Standard Flow	Maximum Flow
communal taps (BF) and connections for public institutions (BP)	0.7 L/s	1.0 L/s
Potence	2.0 L/s	2.5 L/s

The above mentioned numbers are determined considering the nominal and the maximum flow for a volumetric water meters that are commonly used for the Rural WSSs and also by taking into consideration the pipe inner velocity that does not cause cavitation.

When applying the standard flow of the communal tap (BF), an appropriate number of BFs must be determined based on the number of population in a locality instead of increasing the flow rate of the communal tap (BF).

5.3 Impact of potences on the stability of the distribution system

The designed flow of the potence is far bigger than that of BF and it is mainly used for the supply to $5m^3$ or $3m^3$ tank with water by taking certain period of time. Therefore it seriously affects the pressure of the distribution system for 30minutes to one hour continuously. In case of Gard Hadid sub-project in Sidi Bouzid, one (1) potence is projected. Using this potence affects neighboring 10 BFs to decrease their flow from 10% to 20%.

On the other hand, the diameter of service pipe for the potence is not specified in the standard drawing prepared by DGGREE. It should be specify the appropriate diameter of potence in order to regulate the flow of it when the potence is planned for a project.

The Study Team consequently recommends avoiding to construct it as much as possible. In case that the local settings necessitate potences, the Study Team proposed to install them in the distribution system by directly connecting to the distribution tank so as not to disturb the distribution system operation.

After then, the head loss of the potence should be measured in the field.

Furthermore, since the water consumption through the potence is intensive, it drives up the peak water demand and then it may necessitate to increase the capacity of the distribution tank.

6 REVISION OF THE PRESENTLY APPLIED DESIGN GUIDELINES

6.1 Specific consumption

The specific consumption is specified at 25L/capita/day (lpcd) for the grouped population and 20 lpcd for the scattered population should be revised based on a field survey. The survey should also confirm the specific consumption of livestock.

6.2 Peak factors

The daily peak factor, which is the multiplying factor between the maximum water supply and the average daily water supply, seems to be common in the whole country because it does not take into account not considerable difference of maximum temperature between the regions North, Centre and South.

Also, the hourly peak factor, which is the multiplying factor between the maximum hourly water supply and the average hourly water supply, 1.8 is the value indicated in the guidelines for the studies of Rural WSS. However, if we calculate based on the data available, it seems that this value is not appropriate.

Consequently, it is recommended that DGGREE should review the peak factors based on data collected in the field in order to design appropriate Rural WSSs.

6.3 Unaccounted for water

DGGREE method stipulates to fix the unaccounted-for water at 15% throughout the project period. Taking into consideration the aging of the system, etc., the Team proposed to increase this rate incrementally with 1% per year. Consequently, it will reach 29% in the last year of the project period. Instead of taking a fixed increase of 1% per year and in order to get closer rate to the reality, we have to study the real unaccounted-for water in the existing systems.

6.4 Velocity, roughness, residual pressure

The guidelines stipulate that pipe inner velocity must be between 0.4 et 1.2 m/s. However, all the CRDAS apply 75mm and more as the minimum outside diameter of the distribution pipelines aiming at developing private connections in the future. Hence, it becomes very difficult to respect the above mentioned velocities with small water demand in the Rural WSSs.

Specifying the minimum diameter for the distribution system is a practical solution for the WSS design. However, if the applied diameter is big when comparing it with the flow carried by the pipeline, as above mentioned, the velocity could be very slow and there is the risk of deposit of suspended particles. So it is necessary to install appropriate washouts, especially at the end of the network except the case that the washout is installed very close to the end.

6.5 Design of the distribution system and service installations

The Team proposed to maintain the following points for the design of the distribution system and service installations:

(i) The transmission pipeline should be designed based on the maximum daily water supply.
(ii) The distribution pipeline should be designed based on the maximum hourly water supply.
(iii) The diameter of the service pipeline (pipeline on which the communal taps (BFs) are connected) should be determined according to the number of households to be supplied.
(iv) The flow of the service installation should be determined based on the necessary flow that has to satisfy the water demand of the population. The necessary flow depends on the maximum hourly water supply to the households with time wasted during the supply such as changing and washing tanks. The Team proposed to refer the following table:

	BP and BF		Potence
Necessary Flow	= > 0.5	< 0.5	2.0
Minimum Flow	0.5	Flow necessary	2.0
Maximum Flow	0.9	0.9	2.5

If the maximum hourly water supply exceeds the above mentioned standard flow, another communal tap (BF) should be added.

Practically, standard velocity inside the pipelines cannot be applied.

6.6 Formulas of the hydraulic simulation

Williams-Hazen formula should be applied. "C" value, the hydraulic factor related to the pipe inner surface should be 120 for the distribution and transmission pipelines and (145) for the service pipelines.

6.7 Operation hours

The operation period of a water supply system is a very important factor not only to know the maximum water supply but also to study the behavior of the network and especially that of the tank which is considered as an important facilities. The Study Team proposed to study the operation hours of the existing systems in order to have a more reliable data.

7 MODIFICATION OF SOME COMPONENTS OF THE RURAL WSS

7.1 Installation of break pressure

The Team proposed to make the following modifications for the break pressure for reducing the pressure in the distribution system:

- Construction of a water surface stabilization wall to avoid frequent open and close of the float valve
- Reduction of the applied static pressure (less than 70m is recommended)
- Installation of a hydro-bloc valve (Level regulating valve) instead of a simple float valve.

Concerning the utilization of the break pressure as a distribution tank.

It is not recommended using the break pressure as a distribution tank for the following reasons:

1) There is not any ventilating facilities

2) Light pass into the tank through the glass window. Javel (hypochlorite solution) is sensitive with the light and the temperature.

3) There is not any embankment around the break pressure. Since ambient temperature in Tunisia is rather high, the embankment seems to be necessary for keeping Javel effective.

4) There may be the risk that organic substances such as insects, etc. can easily enter inside the break pressure through the door and the window. The structure of the distribution tank is different from that of the break pressure.

7.2 Design of service installations

The confirmation of head loss caused by valves, water meters, bends etc. is necessary. These head loss should be converted to an equivalent length of the pipeline used for the service pipeline.

The examination of "C" value of Williams-Hazen Formula applied to service pipelines should take into account that high velocity inside the service pipeline can prevent the formation of deposit. The introduction of Weston Formula used for the design of service pipelines by the majority of the water supply enterprises in Japan is recommended to be considered. The result of Weston formula is almost the same as Williams-Hazen Formula when 145 is applied to "C" value.

7.3 Controlling pressure at the service installations

1) Appropriate design of the distribution system including the installation of break pressures and/or distribution tanks.
2) Adjust the length of the service pipeline to control the head loss.
3) Installing pressure reducing valves and flow control valves is the last resort because the life time of these valves is limited (2 to 3 years). The GIC is always necessary to be careful about the function of the devices. Moreover, if the working of the pressure reducing valves is deteriorated, it affects the flow of many communal taps (BF).
4) The Study Team recommends installing a butterfly valve instead of a flow control valve used diaphragm or spring, if the conditions allows.

Appendix 1: Determination of the hourly peak factor.

The average daily water supply (Vj) is calculated based on the number of the beneficiaries and the specific consumption. This volume should be increased by 15 % to take into account the unaccounted for water, i.e.: Vjm = Average consumed volume with the unaccounted for water=1,15 x (Vj)

In order to take into account the specificities of the regions, peak factors were defined for each region. The volume calculated in this way is called: maximum daily water supply volume (Vjp) = Cp x Vjm with Cp daily peak factor. The peak factor Cp is equal to 1,25 for the North and 1,5 for the centre and the South.

Moreover, during the peak day there is also a peak hour. The hourly peak factor is 1,8 according to DGGR methodology. This peak factor (1,8), which is mentioned in the specifications was not used neither for the dimensioning nor for the verification of the RWS systems. JICA Study Team thought about introducing the maximum hourly water supply in the dimensioning of the distribution networks of the RWS systems. In the absence of reliable data about this peak consumption, the Team used a peak factor based on the number of the beneficiary population and the livestock of each locality, and based on DGGR data concerning the flows of the service installations. The calculation of this hourly peak factor can be done by following the next stages:

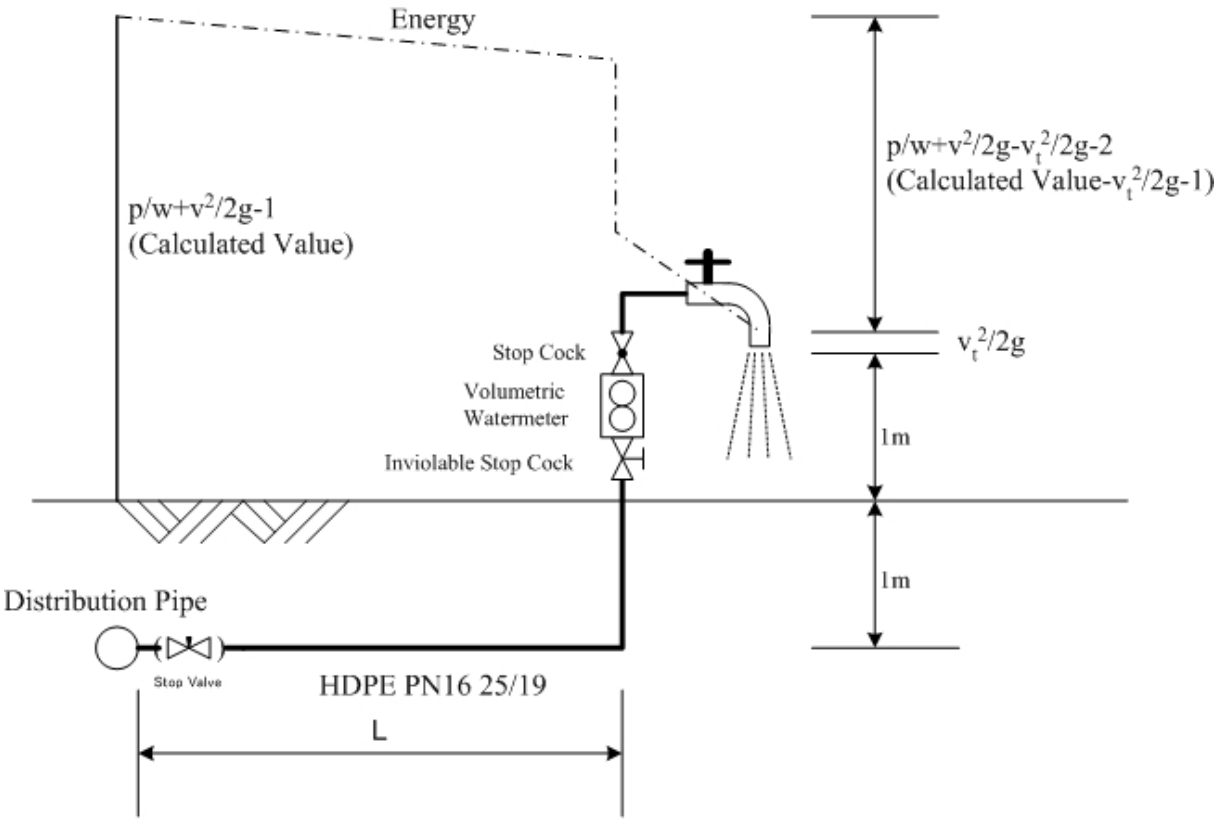
- Calculation of the daily peak water demand (or supply) (Vjp): It is evident that the dimensioning of the network should be carried out based on the peak water demand. So, our basis of calculation is the peak daily water demand (Vjp) which is defined hereafter and expressed in Liter/day.
- Determination of the average hourly water demand: always starting with Vjp we determine the average water demand per hour = (Vjp)/24 which is expressed in liter per hour.
- Calculation of the supposed continuous water demand = average hourly water demand/ 3600 expressed in liter/s.
- Definition of the hourly peak water demand: it is equal to the supposed continuous water demand multiplied by the hourly peak factor Cph.
- Definition of the capacity (or the necessary flow) of service installations: To calculate the capacity of a service installation, JICA Study Team took into consideration the time wasted during the supply i.e. when washing and changing the utensils. For that purpose, the Team estimates that there are 20 seconds over 60 that are wasted. So the capacity of a service installation = (60/40) x hourly peak water demand. As it was specified, this capacity is calculated for each locality since the number of population and livestock changes from one locality to another.

As it was above mentioned, the hourly peak factor Cph which is included in the calculation of the hourly peak water demand is unknown. To determine it and in order not to over dimension the distribution network, JICA Study Team adopted the total flow distributed by all the service installations based on DGGR norms (flow of a communal tap (BF)=0,5 l/s et flow of a potence= 2 l/s). With this solution we will have an equation with only one unknown factor which is the hourly peak factor (Cph). We can determine it by the following formula:

$$\Sigma \text{ Flow rate of a tap (DGGREE Method)} = \Sigma \text{ Average water demand} \times Cph \times 1.5$$

$$Cph = \frac{\Sigma \text{ Flow rate of a tap (DGGREE Method)}}{\Sigma \text{ Average water demand} \times 1.5}$$

Appendix 2 Equivalent Pipe Length



Equivalent pipe length to Service Installation regarding friction loss head

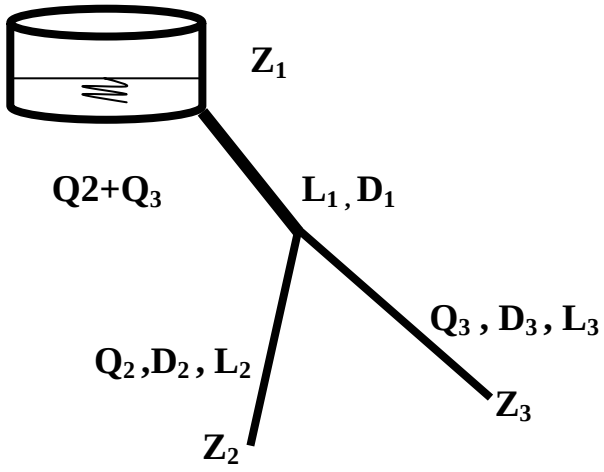
$\Delta H = 10.666\ C^{-1.85} D^{-4.87} Q^{1.85} L$

with D=19mm, C=120, Q=0.5 L/s and ΔH=10m → L=35m

with D=32mm, C=120, Q=2.0 L/s and ΔH=10m → L=35m

Appendix 3.1

1. Theoretical Determination of Flow Rate



$$\begin{cases} Z_1 + \frac{p_1}{\rho g} + \frac{v_1^2}{2g} = Z_2 + \frac{p_2}{\rho g} + \frac{v_2^2}{2g} + \Delta H_{(Q_2+Q_3, L_1, D_1)} + \Delta H_{(Q_2, L_2, D_2)} \\ Z_1 + \frac{p_1}{\rho g} + \frac{v_1^2}{2g} = Z_3 + \frac{p_3}{\rho g} + \frac{v_3^2}{2g} + \Delta H_{(Q_2+Q_3, L_1, D_1)} + \Delta H_{(Q_3, L_3, D_3)} \end{cases}$$

$$\begin{cases} Z_1 - Z_2 = \frac{v_2^2}{2g} + \Delta H_{(Q_2+Q_3, L_1, D_1)} + \Delta H_{(Q_2, L_2, D_2)} \\ Z_1 - Z_3 = \frac{v_3^2}{2g} + \Delta H_{(Q_2+Q_3, L_1, D_1)} + \Delta H_{(Q_3, L_3, D_3)} \end{cases}$$

Hazen-Williams Formula for Head Loss Computaion :

$$\Delta H = 10.666\, C^{-1.85} D^{-4.87} Q^{1.85} L$$

$$\begin{cases} Z_1 - Z_2 = \frac{Q_2^2}{2gS_2^2} + 10.666\, C^{-1.85} \left(D_1^{-4.87} (Q_2+Q_3)^{1.85} L_1 + D_2^{-4.85} Q_2^{1.85} L_2 \right) \\ Z_1 - Z_3 = \frac{Q_3^2}{2gS_3^2} + 10.666\, C^{-1.85} \left(D_1^{-4.87} (Q_2+Q_3)^{1.85} L_1 + D_3^{-4.85} Q_3^{1.85} L_3 \right) \end{cases}$$

Numerical Application :

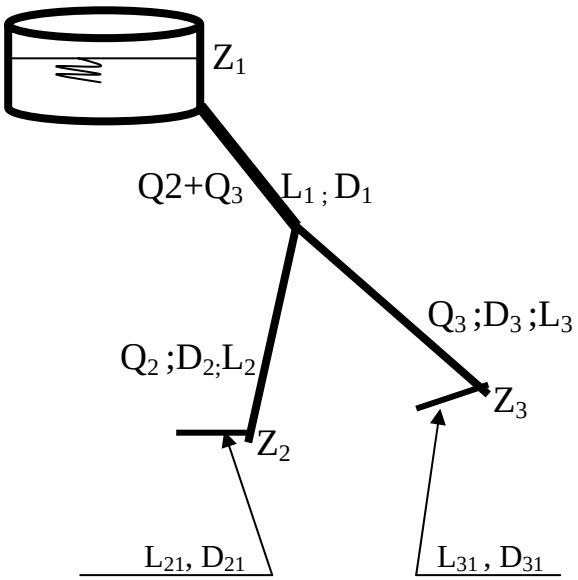
Z_1=100m ; Z_2=50m ; Z_3=70m ; L_1= L_2= L_3= 1000 m;

D_1=96.8 (110 PN 10); D_2=D_3=79.2 mm (90 PN 10)

$$\begin{cases} 50 = 2121\, Q_2^2 + 131918\, (Q_2+Q_3)^{1.85} + 354873\, Q_2^{1.85} \\ 30 = 2121\, Q_3^2 + 131918\, (Q_2+Q_3)^{1.85} + 354873\, Q_3^{1.85} \end{cases}$$

$$\Rightarrow \begin{cases} \mathbf{Q_2 = 6{,}04\ L/s} \\ \mathbf{Q_3 = 3{,}06\ L/s} \end{cases}$$

2. Case with Communal Taps



$$\begin{cases} Z_1 - Z_2 = \dfrac{Q_2^{\,2}}{2gS_2^{\,2}} + 10.666\,C^{-1.85}\left(D_1^{-4.87}(Q_2+Q_3)^{1.85}L_1 + \left(D_2^{-4.85}L_2 + D_{2.1}^{-4.85}L_{2.1}\right)Q_2^{1.85}\right) \\ Z_1 - Z_3 = \dfrac{Q_3^{\,2}}{2gS_3^{\,2}} + 10.666\,C^{-1.85}\left(D_1^{-4.87}(Q_2+Q_3)^{1.85}L_1 + \left(D_3^{-4.85}L_3 + D_{3.1}^{-4.85}L_{3.1}\right)Q_3^{1.85}\right) \end{cases}$$

Numerical Application:

Z_1=100m ; Z_2=50m ; Z_3=70m ; L_1= L_2= L_3= 1000 m
D_1=96.8 (110 PN 10); D_2=D_3=79.2 mm (90 PN 10);

$L_{2.1}$= $L_{3.1}$=35m; $D_{2.1}$= $D_{3.1}$= 19mm , Z_{21}= Z_2 =50m ; Z_{31}= Z_3=70m

$$\begin{cases} 50 = 634025\ Q_2^{\,2} + 131918\ (Q_2+Q_3)^{1.85} + 13180523\ Q_2^{1.85} \\ 30 = 634025\ Q_3^{\,2} + 131918\ (Q_2+Q_3)^{1.85} + 13180525\ Q_3^{1.85} \end{cases}$$

$$\Longrightarrow \begin{cases} Q_2 = 1{,}15\ \text{L/s} \\ Q_3 = 0{,}86\ \text{L/s} \end{cases}$$

Appendix 3.2

Flow rate from tap when it fully opens (Simulation by LOOP)

1. In case that there are not any taps at the outlets

Data

Node No	Fix	Flow Rate (L/s)	Elevation (m)
1			100
11			40
2			50
3			70

Constant pressure and unknown flow rate to node(s)

Node No	Pressure to Node
1	100.2
2	50
3	70

Result of Simulation

Pipe No	From Node	To Node	Length (m)	Dia. (mm)	HWC	Flow Rate (L/s)	Velocity (m/s)	Head Loss (m/km)	Head Loss (m)
1	1	11	1000	97	120	9.14	1.24	22.22HI	22.22
2	11	2	1000	79	120	6.06	1.24	22.22HI	22.22
3	11	3	1000	79	120	3.08	0.63	7.98	7.98

Node No	Flow Rate (L/s)	Elevation (m)	Head (m)	Pressure (m)
1R	9.136	100.00	100.20	0.20
11	0.000	40.00	77.98	37.98
2R	-6.060	50.00	50.00	0.00
3R	-3.076	70.00	70.00	0.00

2. In case that there are taps at the outlets

Data

Pipe No	From Node	To Node	Length (m)	Dia. (mm)	HWC
1	1	11	1000	96.8	120
2	11	2	1000	79	120
3	2	21	35	19	120
4	11	3	1000	79	120
5	3	31	35	19	120

Node No	FIX	DEBIT (L/s)	COTE (m)
1			100
11			40
2			50
21			50
3			70
31			70

Constant pressure and unknown flow rate to node(s)

No	Pressure
1	100.2
21	50
31	70

Results of Simulation

Pipe No	From Node	To Node	Length (m)	Dia. (mm)	HWC	Flow Rate (L/s)	Velocity (m/s)	Head Loss (m/km)	Head Loss (m)
1	1	11	1000	97	120	2.03	0.28LO	1.38	1.38
2	11	2	1000	79	120	1.16	0.24LO	1.31	1.31
3	2	21	1000	19	120	1.16	4.09	999.99HI	47.51
4	11	3	35	79	120	0.87	0.18LO	0.78	0.78
5	3	31	35	19	120	0.87	3.08	801.28HI	28.04

Node No	Flow Rate (L/s)	Elevation (m)	Head (m)	Pressure (m)
1R	2.033	100.00	100.20	0.20
11	0.000	40.00	98.82	58.82
2	0.000	50.00	97.51	47.51
21R	-1.160	50.00	50.00	0.00
3	0.000	70.00	98.04	28.04
31R	-0.873	70.00	70.00	0.00

Appendix 4 : DISTRIBUTION TANK BEHAVIOR

Governorate: BE JA Projet: GMARA 0.35

Rate of remaining volume under the minimum water leve

		Morning	Afternoon	Total
Operation Hours		2:00	2:00	4:00
Service Population (interviewed)		453	435	888
Percentage	%	51.0	49.0	100
Percentage of Consumption	%	60.0	40.0	
Operation Starting Time		8:00	17:00	
Operation Closing Time		10:00	19:00	

Distribution Tank Capacity (based on DGGREE Guideline)

Average Daily Water Demand	m^3/j	D_m	55.27		
Distribution Tank Capacity	m^3	(=0.5 D_m)	30	40	Distribution Tank Capacity to be Appl +
Peak Factor during a year			1.25		
Maximum Daily Water Demand	m^3/j	Dmax=1.25Dm	69.09		
Transmission Flow	L/s		1.5	0.8	$=D_{max}$ / (24 x 3.6)
Transmission Flow	m^3/h		5.4		+
Number of Potences			0		
Hourly Water Supply of Potence	m^3/h		5		

100 12.8 Necessary Pumping Hours

hourly consumption (% de D_{max})

Period of Time				Consommation Percentage	Consommation m^3	Inflow to Tank (m^3)	Remaining Volume in Tank (m^3)	Flow to other tanks
						0	40.00	
0:00	-	1:00	%	0	0.00	0.00	40.00	0.00
1:00	-	2:00	%	0	0.00	0.00	40.00	0.00
2:00	-	3:00	%	0	0.00	0.00	40.00	0.00
3:00	-	4:00	%	0	0.00	0.00	40.00	0.00
4:00	-	5:00	%	0	0.00	0.00	40.00	0.00
5:00	-	6:00	%	0	0.00	0.00	40.00	0.00
6:00	-	7:00	%	0	0.00	0.00	40.00	0.00
7:00	-	8:00	%	0	0.00	0.00	40.00	0.00
8:00	-	9:00	%	24	16.58	0.00	23.42	0.00
9:00	-	10:00	%	36	24.87	5.40	3.95	0.00
10:00	-	11:00	%	0	0.00	5.40	9.35	0.00
11:00	-	12:00	%	0	0.00	5.40	14.75	0.00
12:00	-	13:00	%	0	0.00	5.40	20.15	0.00
13:00	-	14:00	%	0	0.00	5.40	25.55	0.00
14:00	-	15:00	%	0	0.00	5.40	30.95	0.00
15:00	-	16:00	%	0	0.00	5.40	36.35	0.00
16:00	-	17:00	%	0	0.00	3.65	40.00	0.00
17:00	-	18:00	%	16	11.05	0.00	28.95	0.00
18:00	-	19:00	%	24	16.58	5.40	17.77	0.00
19:00	-	20:00	%	0	0.00	5.40	23.17	0.00
20:00	-	21:00	%	0	0.00	5.40	28.57	0.00
21:00	-	22:00	%	0	0.00	5.40	33.97	0.00
22:00	-	23:00	%	0	0.00	5.40	39.37	0.00
23:00	-	0:00	%	0	0.00	0.64	40.00	0.00
0:00	-	1:00	%	0	0.00	0.00	40.00	0.00
1:00	-	2:00	%	0	0.00	0.00	40.00	0.00
2:00	-	3:00	%	0	0.00	0.00	40.00	0.00
3:00	-	4:00	%	0	0.00	0.00	40.00	0.00
4:00	-	5:00	%	0	0.00	0.00	40.00	0.00
5:00	-	6:00	%	0	0.00	0.00	40.00	0.00
6:00	-	7:00	%	0	0.00	0.00	40.00	0.00
7:00	-	8:00	%	0	0.00	0.00	40.00	0.00
8:00	-	9:00	%	0	0.00	0.00	40.00	0.00
9:00	-	10:00	%	0	0.00	0.00	40.00	0.00
10:00	-	11:00	%	0	0.00	0.00	40.00	0.00
11:00	-	12:00	%	0	0.00	0.00	40.00	0.00
12:00	-	13:00	%	0	0.00	0.00	40.00	0.00

Appendix 5.1

(water charge = water cost)

FINANCIAL ANALYSIS

Cashflow and Monthly Family Flat Rate

Actual Revenue = 100 % Theoretical Revenue

Price escalation rate : 5 % per year

Family contribution growth rate : 5 % per year

Actual revenue : 100 % of theoretical revenue

Cost of 1m^3 water **0.560** DT — Family contribution to revolving fund= **23.682**

GIC membership fee **1.000** DT/Family

		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
1. TOTAL POPULATION																	
Number of inhabitants		1214	1232	1251	1269	1288	1308	1327	1347	1367	1388	1409	1430	1451	1473	1495	1518
Number of families		208	211	214	218	221	224	228	231	234	238	241	245	249	253	256	260
2. FAMILY MEMBRES																	
% of families		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
Number of familieis		125	131	137	144	150	157	164	171	178	186	193	201	209	217	226	234
3. WATER CONSUMPTION																	
- Potentical demand (m^3/day)			48.36	49.44	50.53	51.62	52.70	53.98	55.26	56.54	57.82	59.10	60.65	62.20	63.75	65.30	66.85
- Consumption (m^3/year)			10944	11550	12173	12811	13465	14186	14926	15684	16461	17257	18152	19070	20011	20974	21960
- Production (m^3/year)			12585	13283	13999	14733	15485	16314	17165	18037	18930	19845	20875	21931	23013	24121	25254
4. EXPENSES OF GIC																	
- Fixed Cost (TD/year)																	
* maintenance			2514	2640	2772	2910	3056	3209	3369	3537	3714	3900	4095	4300	4515	4741	4978
* personnel (DT/an)			1800	1890	1985	2084	2188	2297	2412	2533	2659	2792	2932	3079	3233	3394	3564
* subscription to SONEDE(1.5TT/month)			0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* subscription to STEG(0.3TD/kVA/month)			144	151.2	158.8	166.7	175.0	183.8	193.0	202.6	212.8	223.4	234.6	246.3	258.6	271.5	285.1
* management cost of GIC																	
- office supplies			50	53	55	58	61	64	67	70	74	78	81	86	90	94	99
- meeting expenses			50	53	55	58	61	64	67	70	74	78	81	86	90	94	99
- assurance			50	53	55	58	61	64	67	70	74	78	81	86	90	94	99
- contingency			40	42	44	46	49	51	54	56	59	62	65	68	72	75	79
Sub-total of Fixed Cost (TD/year)			**4648**	**4880**	**5124**	**5381**	**5650**	**5932**	**6229**	**6540**	**6867**	**7211**	**7571**	**7950**	**8347**	**8764**	**9203**
- Variable Cost (TD/year)																	
* purchase of water (0.159 TD/m^3)			2001	2218	2454	2712	2993	3311	3657	4035	4447	4895	5406	5964	6571	7232	7950
* disinfection (10 millime/m^3 produced)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
* Energy			718	795	880	972	1073	1187	1312	1447	1595	1755	1939	2139	2357	2593	2851
Sub-total of Variable Cost (TD/year)			**2719**	**3013**	**3334**	**3684**	**4066**	**4498**	**4969**	**5482**	**6042**	**6650**	**7345**	**8103**	**8928**	**9825**	**10802**
TOTAL EXPENSES OF GIC (TD/year)			**7367**	**7893**	**8458**	**9065**	**9716**	**10430**	**11198**	**12023**	**12909**	**13861**	**14916**	**16052**	**17275**	**18590**	**20004**
5. PRODUCTION COST																	
OF 1m^3 CONSUMED (TD)			0.673	0.683	0.695	0.708	0.722	0.735	0.750	0.767	0.784	0.803	0.822	0.842	0.863	0.886	0.911
6. POSSIBLE CONTRIBUTION per m^3																	
actual (TD/month). (%)	5.0		0.560	0.588	0.617	0.648	0.681	0.715	0.750	0.788	0.827	0.869	0.912	0.958	1.006	1.056	1.109
THEORETICAL REVENUE OF GIC (TD			**6128**	**6792**	**7515**	**8305**	**9166**	**10139**	**11201**	**12359**	**13619**	**14991**	**16558**	**18265**	**20125**	**22148**	**24349**
ACTUAL REVENUE OF GIC (TD/year)			**6128**	**6792**	**7515**	**8305**	**9166**	**10139**	**11201**	**12359**	**13619**	**14991**	**16558**	**18265**	**20125**	**22148**	**24349**
REVENUE OF REVOLV. FUND (TD/year)			**4001**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
REVENUE OF MEMBERSHIP FEE (TD/year)			**131**	**137**	**144**	**150**	**157**	**164**	**171**	**178**	**186**	**193**	**201**	**209**	**217**	**226**	**234**
TOTAL REVENUE (TD/year)			**10261**	**6929**	**7659**	**8455**	**9322**	**10303**	**11372**	**12537**	**13805**	**15185**	**16759**	**18474**	**20342**	**22374**	**24583**
7. YEARLY BALANCE (TD/year)			2894	-965	-799	-610	-393	-127	174	514	896	1324	1842	2422	3067	3784	4579
(REVENUE-EXPENSES)																	
% of subsidy in relation to																	
total production cost			39.3	-12.2	-9.5	-6.7	-4.0	-1.2	1.6	4.3	6.9	9.5	12.4	15.1	17.8	20.4	22.9
8. CUMULATIVE BALANCE (TD)			**2894**	**1929**	**1130**	**520**	**127**	**0**	**174**	**688**	**1584**	**2908**	**4750**	**7172**	**10239**	**14023**	**18602**
9. CUMULATIVE BALANCE OF ESCALATED																	
CASHFLOW (5%/year)	5.0		**2894**	**2074**	**1378**	**838**	**486**	**384**	**577**	**1120**	**2072**	**3499**	**5516**	**8214**	**11692**	**16060**	**21442**

Appendix 5.2

(water charge = water cost)

FINANCIAL ANALYSIS

Cashflow and Monthly Family Flat Rate

Actual Revenue = 100 % Theoretical Revenue

Price escalation rate : 5 % per year

Family contribution growth rate : 5 % per year

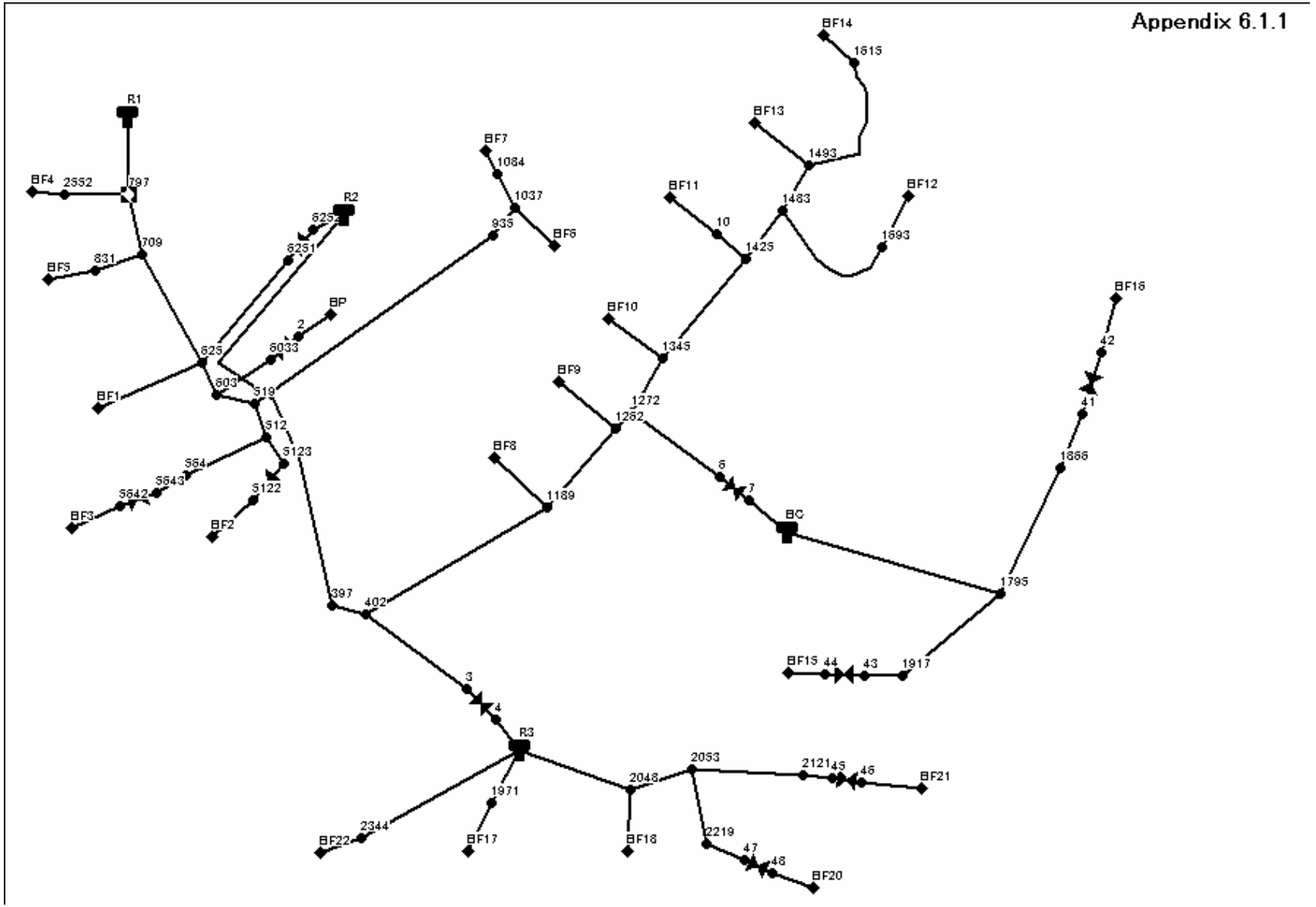
Actual revenue : 100 % of theoretical revenue

Cost of 1m^3 water **0.600** DT — Family contribution to revolving fund= **15.000**

GIC membership fee **1.000** DT/Famille

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1. TOTAL POPULATION																	
Number of inhabitants		1214	1232	1251	1269	1288	1308	1327	1347	1367	1388	1409	1430	1451	1473	1495	1518
Number of families		208	211	214	218	221	224	228	231	234	238	241	245	249	253	256	260
2. FAMILY MEMBRES																	
% of families		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
Number of familieis		125	131	137	144	150	157	164	171	178	186	193	201	209	217	226	234
3. WATER CONSUMPTION																	
- Potentical demand (m^3/day)			48.36	49.44	50.53	51.62	52.70	53.98	55.26	56.54	57.82	59.10	60.65	62.20	63.75	65.30	66.85
- Consumption (m^3/year)			10944	11550	12173	12811	13465	14186	14926	15684	16461	17257	18152	19070	20011	20974	21960
- Production (m^3/year)			12585	13283	13999	14733	15485	16314	17165	18037	18930	19845	20875	21931	23013	24121	25254
4. EXPENSES OF GIC																	
- Fixed Cost (TD/year)																	
* maintenance			2514	2640	2772	2910	3056	3209	3369	3537	3714	3900	4095	4300	4515	4741	4978
* personnel (DT/an)			1800	1890	1985	2084	2188	2297	2412	2533	2659	2792	2932	3079	3233	3394	3564
* subscription to SONEDE(1.5TT/month)			0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* subscription to STEG(0.3TD/kVA/month)			144	151.2	158.8	166.7	175.0	183.8	193.0	202.6	212.8	223.4	234.6	246.3	258.6	271.5	285.1
* management cost of GIC																	
- office supplies			50	53	55	58	61	64	67	70	74	78	81	86	90	94	99
- meeting expenses			50	53	55	58	61	64	67	70	74	78	81	86	90	94	99
- assurance			50	53	55	58	61	64	67	70	74	78	81	86	90	94	99
- contingency			40	42	44	46	49	51	54	56	59	62	65	68	72	75	79
Sub-total of Fixed Cost (TD/year)			**4648**	**4880**	**5124**	**5381**	**5650**	**5932**	**6229**	**6540**	**6867**	**7211**	**7571**	**7950**	**8347**	**8764**	**9203**
- Variable Cost (TD/year)																	
* purchase of water (0.159 TD/m^3)			2001	2218	2454	2712	2993	3311	3657	4035	4447	4895	5406	5964	6571	7232	7950
* disinfection (10 millime/m^3 produced)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
* Energy			718	795	880	972	1073	1187	1312	1447	1595	1755	1939	2139	2357	2593	2851
Sub-total of Variable Cost (TD/year)			**2719**	**3013**	**3334**	**3684**	**4066**	**4498**	**4969**	**5482**	**6042**	**6650**	**7345**	**8103**	**8928**	**9825**	**10802**
TOTAL EXPENSES OF GIC (TD/year)			**7367**	**7893**	**8458**	**9065**	**9716**	**10430**	**11198**	**12023**	**12909**	**13861**	**14916**	**16052**	**17275**	**18590**	**20004**
5. PRODUCTION COST OF 1m^3 CONSUMED (TD)			0.673	0.683	0.695	0.708	0.722	0.735	0.750	0.767	0.784	0.803	0.822	0.842	0.863	0.886	0.911
6. POSSIBLE CONTRIBUTION per m^3 actual (TD/month). (%)	5.0		0.600	0.630	0.662	0.695	0.729	0.766	0.804	0.844	0.886	0.931	0.977	1.026	1.078	1.131	1.188
THEORETICAL REVENUE OF GIC (			**6566**	**7277**	**8052**	**8898**	**9820**	**10863**	**12001**	**13241**	**14592**	**16062**	**17741**	**19570**	**21562**	**23730**	**26088**
ACTUAL REVENUE OF GIC (TD/yea			**6566**	**7277**	**8052**	**8898**	**9820**	**10863**	**12001**	**13241**	**14592**	**16062**	**17741**	**19570**	**21562**	**23730**	**26088**
REVENUE OF REVOLV. FUND (TD/year)			**2534**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
REVENUE OF MEMBERSHIP FEE (TD/year)			**131**	**137**	**144**	**150**	**157**	**164**	**171**	**178**	**186**	**193**	**201**	**209**	**217**	**226**	**234**
TOTAL REVENUE (TD/year)			**9231**	**7414**	**8196**	**9048**	**9977**	**11027**	**12172**	**13419**	**14778**	**16255**	**17942**	**19779**	**21779**	**23956**	**26322**
7. YEARLY BALANCE (TD/year) (REVENUE-EXPENSES)			1865	-479	-263	-16	261	597	974	1397	1869	2394	3025	3726	4504	5366	6318
% of subsidy in relation to total production cost			25.3	-6.1	-3.1	-0.2	2.7	5.7	8.7	11.6	14.5	17.3	20.3	23.2	26.1	28.9	31.6
8. CUMULATIVE BALANCE (TD)			**1865**	**1385**	**1123**	**1106**	**1368**	**1965**	**2939**	**4336**	**6205**	**8599**	**11624**	**15351**	**19855**	**25221**	**31539**
9. CUMULATIVE BALANCE OF ESCALATED CASHFLOW (5%/year)	5.0		**1865**	**1479**	**1290**	**1338**	**1666**	**2347**	**3438**	**5007**	**7126**	**9877**	**13396**	**17792**	**23186**	**29712**	**37515**

AIN DAM (Initial Design)



Appendix 6.1.1

AIN DAM (Proposition by Resident Consultant)

19/11/2005 13:02:59

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*************************************************************************
*                            E P A N E T                                *
*                    Hydraulic and Water Quality                        *
*                    Analysis for Pipe Networks                         *
*                          Version 2.0                                  *
*************************************************************************

Input File: AIN DAM BE.NET
```

Link - Node Table:

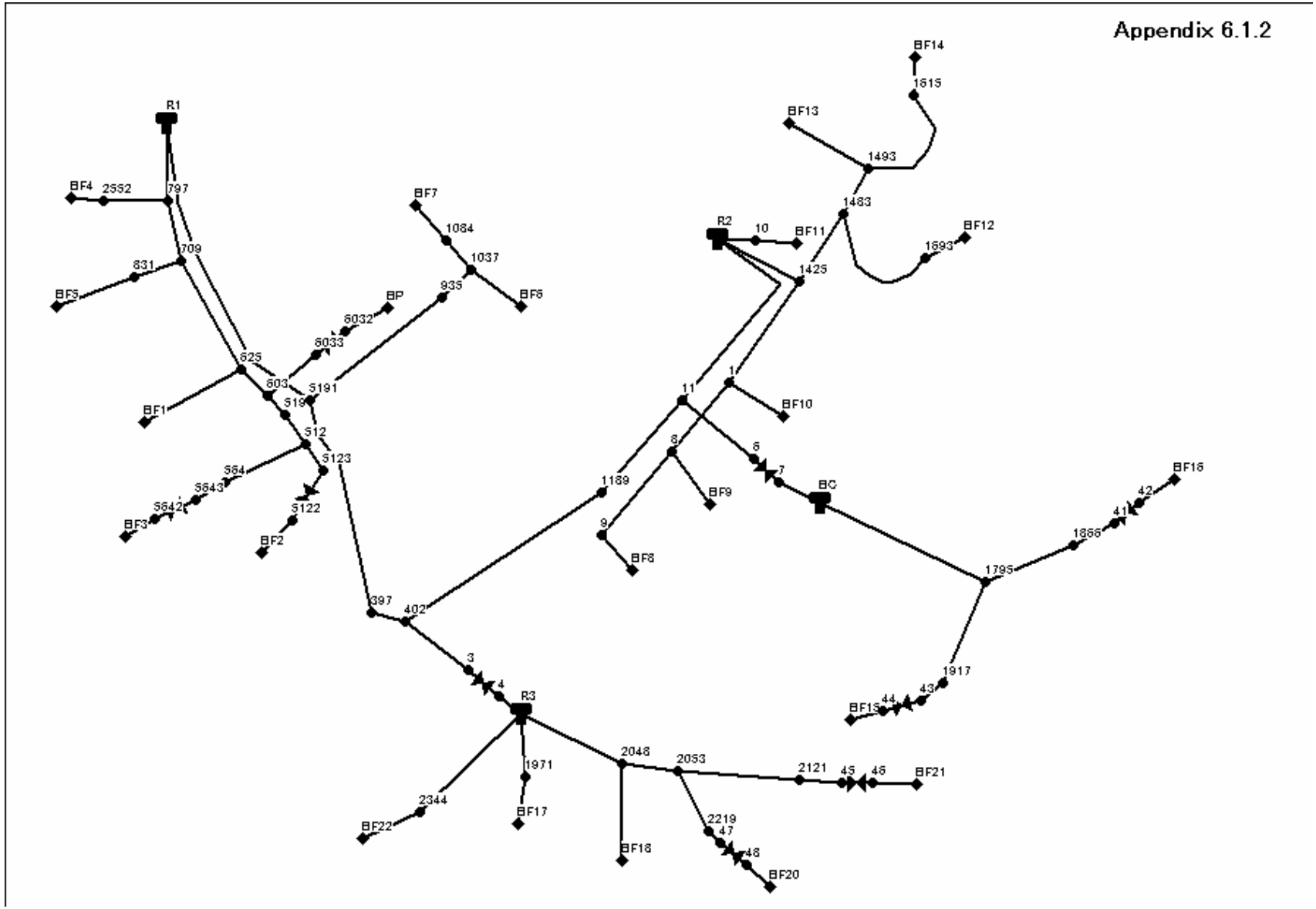
Link ID	Start Node	End Node	Length m	Diameter mm
1	R1	797	254,48	96,8
2	797	2552	92,09	66
3	2552	BF4	35	19
4	797	709	386,24	96,8
5	709	831	386,24	66
6	831	BF5	35	19
7	709	625	128,97	79,2
9	625	603	42,20	79,2
10	603	519	85,53	79,20
11	519	512	86,23	66
15	519	935	183,33	66
16	935	1037	436,98	66
18	1037	1084	83,25	66
21	625	6251	130	54
20	6252	R2	1	66
22	512	564	130,31	66
31	R2	397	808,07	96,8
32	397	402	20,08	96,8
33	402	3	382,07	54
34	4	R3	1	66
36	1272	1345	293,01	97
37	1345	1425	410,89	97
38	1425	1483	81,52	66
39	1483	1693	247,38	66
40	1483	1493	48,83	66
47	1425	10	48,47	66
48	402	1189	460,47	96,8
49	1189	1262	291,91	96,8
50	1262	1272	11,16	96,8
53	1272	6	205,8	54
54	7	BC	1	66
55	R3	1971	137,81	66
56	R3	2344	594,82	66
59	R3	2048	307,88	66
61	2048	2053	71,01	66
62	2053	2219	163,56	66
64	2053	2121	285,94	66
66	BC	1795	535,59	66
67	1795	1917	317,96	66
69	1795	1866	210,68	66
41	1493	1615	405,19	66

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
797	0,00	230,74	31,85	0,00
2552	0,00	230,60	23,79	0,00
BF4	**0,80**	**207,22**	**0,41**	**0,00**
709	0,00	225,36	45,69	0,00
831	0,00	224,21	45,73	0,00
BF5	**1,14**	**179,30**	**0,82**	**0,00**
625	0,00	221,89	46,51	0,00
603	0,00	221,39	46,83	0,00
519	0,00	220,67	49,56	0,00
512	0,00	220,23	57,86	0,00
BF2	**0,68**	**162,67**	**0,30**	**0,00**
564	0,00	220,00	66,54	0,00
BF3	**0,85**	**153,92**	**0,46**	**0,00**
1037	0,00	216,87	36,36	0,00
935	0,00	219,55	26,30	0,00
BF6	**1,00**	**181,15**	**0,64**	**0,00**
1084	0,00	216,78	17,33	0,00
BF7	**0,67**	**199,74**	**0,29**	**0,00**
BP	**0,66**	**174,84**	**0,28**	**0,00**
6251	0,00	221,08	20,05	0,00
6252	0,00	203,03	2,00	0,00
5123	0,00	205,18	42,81	0,00
5122	0,00	165,18	2,81	0,00
5643	0,00	197,64	44,18	0,00
5642	0,00	157,64	4,18	0,00
6033	0,00	207,21	32,65	0,00
2	0,00	177,21	2,65	0,00
BF1	**1,15**	**176,21**	**0,83**	**0,00**
397	0,00	187,86	67,71	0,00
402	0,00	187,48	65,22	0,00
3	0,00	185,09	50,66	0,00
4	0,00	134,63	0,20	0,00
1272	0,00	177,34	38,87	0,00
6	0,00	174,34	64,95	0,00
7	0,00	109,60	0,21	0,00
1345	0,00	176,16	22,49	0,00
1425	0,00	175,09	14,26	0,00
10	0,00	175,06	10,86	0,00
1483	0,00	174,13	9,93	0,00
1693	0,00	173,47	41,54	0,00
1615	0,00	173,50	16,75	0,00
BF12	**1,08**	**132,67**	**0,74**	**0,00**
BF14	**0,66**	**157,03**	**0,28**	**0,00**
BF11	**0,52**	**164,37**	**0,17**	**0,00**
BF13	**0,64**	**158,34**	**0,26**	**0,00**
BF10	**0,77**	**154,05**	**0,38**	**0,00**
1493	0,00	173,95	15,87	0,00
1189	0,00	180,64	43,38	0,00
BF8	**1,10**	**138,03**	**0,77**	**0,00**
1262	0,00	177,43	38,99	0,00
BF9	**1,04**	**139,13**	**0,69**	**0,00**
1971	0,00	134,54	10,41	0,00
2344	0,00	133,15	38,09	0,00
2048	0,00	129,77	51,89	0,00
BF18	**1,22**	**78,82**	**0,94**	**0,00**

2053	0,00	129,38	66,13	0,00	
2121	0,00	128,95	70,35	0,00	
2219	0,00	129,14	84,11	0,00	
BF21	**0,79**	**59,00**	**0,40**	**0,00**	
BF20	**0,79**	**45,43**	**0,40**	**0,00**	
BF22	**1,03**	**95,73**	**0,67**	**0,00**	
1795	0,00	106,66	68,77	0,00	
1917	0,00	106,17	67,95	0,00	
BF15	**0,79**	**38,62**	**0,40**	**0,00**	
1866	0,00	106,34	61,16	0,00	
BF16	**0,79**	**45,58**	**0,40**	**0,00**	
BF17	**0,51**	**124,30**	**0,17**	**0,00**	
41	0,00	103,07	57,89	0,00	
42	0,00	65,18	20,00	0,00	
43	0,00	102,91	64,69	0,00	
44	0,00	58,22	20,00	0,00	
45	0,00	125,68	67,08	0,00	
46	0,00	78,60	20,00	0,00	
47	0,00	125,87	80,84	0,00	
48	0,00	65,03	20,00	0,00	
R1	-7,95	235,05	0,30	0,00	Réservoir
R2	-7,41	203,03	2,00	0,00	Réservoir
R3	-3,34	134,63	0,20	0,00	Réservoir
BC	0,00	109,59	0,20	0,00	Réservoir

AIN DAM (Proposition by the JICA Study Team)



Appendix 6.1.2

AIN DAM (Proposition by The Study Team)

19/11/2005 13:02:15

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*********************************************************************
*                          E P A N E T                              *
*                  Hydraulic and Water Quality                      *
*                  Analysis for Pipe Networks                       *
*                        Version 2.0                                *
*********************************************************************
Input File: AIN DAM Equip.NET
```

Link – Noe Table:

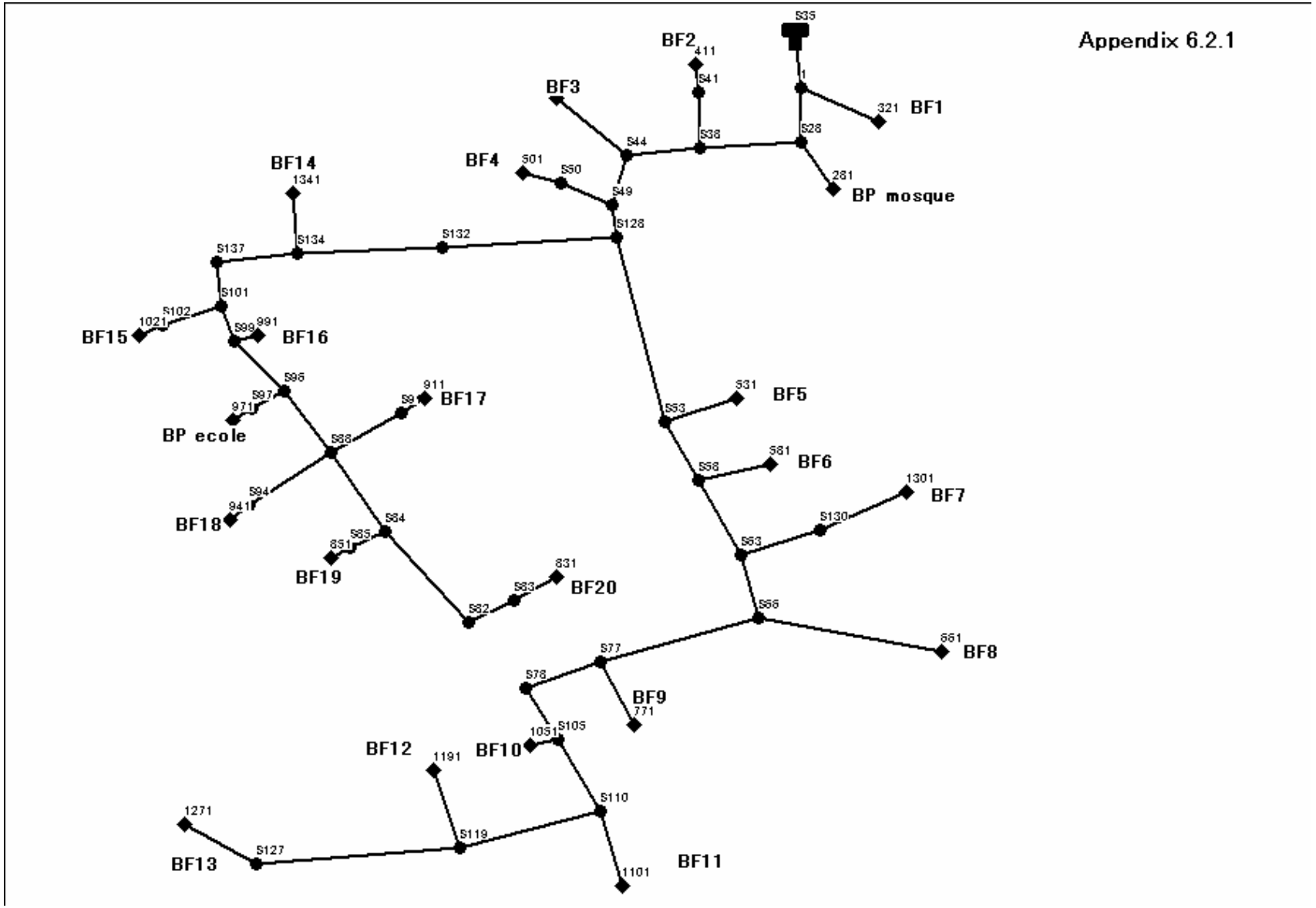
Link ID	Start Node	End Node	Length m	Diameter mm
1	R1	797	254,48	96,8
2	797	2552	92,09	66
3	2552	BF4	35	19
4	797	709	386,24	96,8
5	709	831	386,24	66
7	709	625	128,97	79,2
9	625	603	42,20	79,20
10	603	519	85,53	79,20
11	519	512	86,23	66
15	5191	935	183,33	66
16	935	1037	436,98	66
18	1037	1084	83,25	66
22	512	564	130,31	66
32	397	402	20,08	73,6
33	402	3	382,07	51,4
34	4	R3	1	66
38	1425	1483	81,52	79,2
39	1483	1693	247,38	66
40	1483	1493	48,83	66
48	402	1189	460,47	51,4
53	11	6	205,8	51,4
54	7	BC	1	66
55	R3	1971	137,81	66
56	R3	2344	594,82	66
59	R3	2048	307,88	66
61	2048	2053	71,01	66
62	2053	2219	163,56	66
64	2053	2121	285,94	66
66	BC	1795	535,59	66
67	1795	1917	317,96	66
69	1795	1866	210,68	66
65	R2	1425	100	79,2
68	R2	10	50	66
70	R1	5191	897,62	79,2
83	5191	397	550,34	73,6
8	1425	1	410,89	79,2
31	8	9	291,91	66
52	1189	11	303,07	54
63	11	R2	803,09	54
84	1	8	304,17	66
20	1493	1615	405,19	66

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
797	0,00	232,62	33,73	0,00
2552	0,00	232,47	25,66	0,00
BF4	**0,83**	**207,25**	**0,44**	**0,00**
709	0,00	229,85	50,18	0,00
831	0,00	228,59	50,11	0,00
BF5	**1,19**	**179,38**	**0,90**	**0,00**
625	0,00	228,37	52,99	0,00
603	0,00	228,13	53,57	0,00
519	0,00	227,89	56,78	0,00
512	0,00	227,30	64,93	0,00
BF2	0,82	162,80	0,43	0,00
564	0,00	227,02	73,56	0,00
BF3	**0,96**	**154,05**	**0,59**	**0,00**
1037	0,00	214,01	33,50	0,00
935	0,00	216,39	23,14	0,00
BF6	**0,96**	**181,10**	**0,59**	**0,00**
1084	0,00	213,93	14,48	0,00
BF7	**0,61**	**199,69**	**0,24**	**0,00**
BP	**0,79**	**174,96**	**0,40**	**0,00**
5123	0,00	206,30	43,93	0,00
5122	0,00	166,30	3,93	0,00
5643	0,00	198,76	45,30	0,00
5642	0,00	158,76	5,30	0,00
6033	0,00	208,27	33,71	0,00
6032	0,00	178,27	3,71	0,00
BF1	**1,23**	**176,34**	**0,96**	**0,00**
397	0,00	209,57	89,42	0,00
402	0,00	209,29	87,03	0,00
3	0,00	206,25	71,82	0,00
4	0,00	134,63	0,20	0,00
6	0,00	174,82	65,43	0,00
7	0,00	109,60	0,21	0,00
1425	0,00	172,47	11,64	0,00
10	0,00	174,17	9,97	0,00
1483	0,00	172,12	7,92	0,00
1693	0,00	171,48	39,55	0,00
1615	0,00	171,56	14,81	0,00
BF12	**1,05**	**132,63**	**0,70**	**0,00**
BF14	**0,62**	**156,99**	**0,24**	**0,00**
BF11	**0,50**	**164,36**	**0,16**	**0,00**
BF13	**0,60**	**158,31**	**0,23**	**0,00**
BF10	**0,66**	**153,95**	**0,28**	**0,00**
1493	0,00	171,95	13,87	0,00
1189	0,00	189,09	51,83	0,00
BF8	**0,91**	**137,79**	**0,53**	**0,00**
BF9	**0,90**	**138,96**	**0,52**	**0,00**
1971	0,00	134,54	10,41	0,00
2344	0,00	133,15	38,09	0,00
2048	0,00	129,77	51,89	0,00
BF18	**1,22**	**78,82**	**0,94**	**0,00**
2053	0,00	129,38	66,13	0,00
2121	0,00	128,95	70,35	0,00
2219	0,00	129,14	84,11	0,00
BF21	**0,79**	**59,00**	**0,40**	**0,00**
BF20	**0,79**	**45,43**	**0,40**	**0,00**

BF22	**1,03**	**95,73**	**0,67**	**0,00**	
1795	0,00	106,66	68,77	0,00	
1917	0,00	106,17	67,95	0,00	
BF15	**0,79**	**38,62**	**0,40**	**0,00**	
1866	0,00	106,34	61,16	0,00	
BF16	**0,79**	**45,58**	**0,40**	**0,00**	
BF17	**0,51**	**124,30**	**0,17**	**0,00**	
41	0,00	103,07	57,89	0,00	
42	0,00	65,18	20,00	0,00	
43	0,00	102,91	64,69	0,00	
44	0,00	58,22	20,00	0,00	
45	0,00	125,68	67,08	0,00	
46	0,00	78,60	20,00	0,00	
47	0,00	125,87	80,84	0,00	
48	0,00	65,03	20,00	0,00	
5191	0,00	217,38	217,38	0,00	
1	0,00	170,35	16,68	0,00	
8	0,00	168,20	29,76	0,00	
9	0,00	167,62	30,36	0,00	
11	0,00	178,63	40,16	0,00	
R1	-10,92	235,05	0,30	0,00	Réservoir
R3	-3,34	134,63	0,20	0,00	Réservoir
BC	0,00	109,59	0,20	0,00	Réservoir
R2	-4,30	174,20	0,20	0,00	Réservoir

SLATNIA (Branched Distribution)



Appendix 6.2.1

SLATNIA (Branched Distribution)

18/11/2005 17:05:02

```
*****************************************************************
*                           E P A N E T                         *
*                  Hydraulic and Water Quality                  *
*                  Analysis for Pipe Networks                   *
*                        Version 2.0                            *
*****************************************************************

Input File: Slatnia  reseau ramifie.net
```

Link – Noe Table:

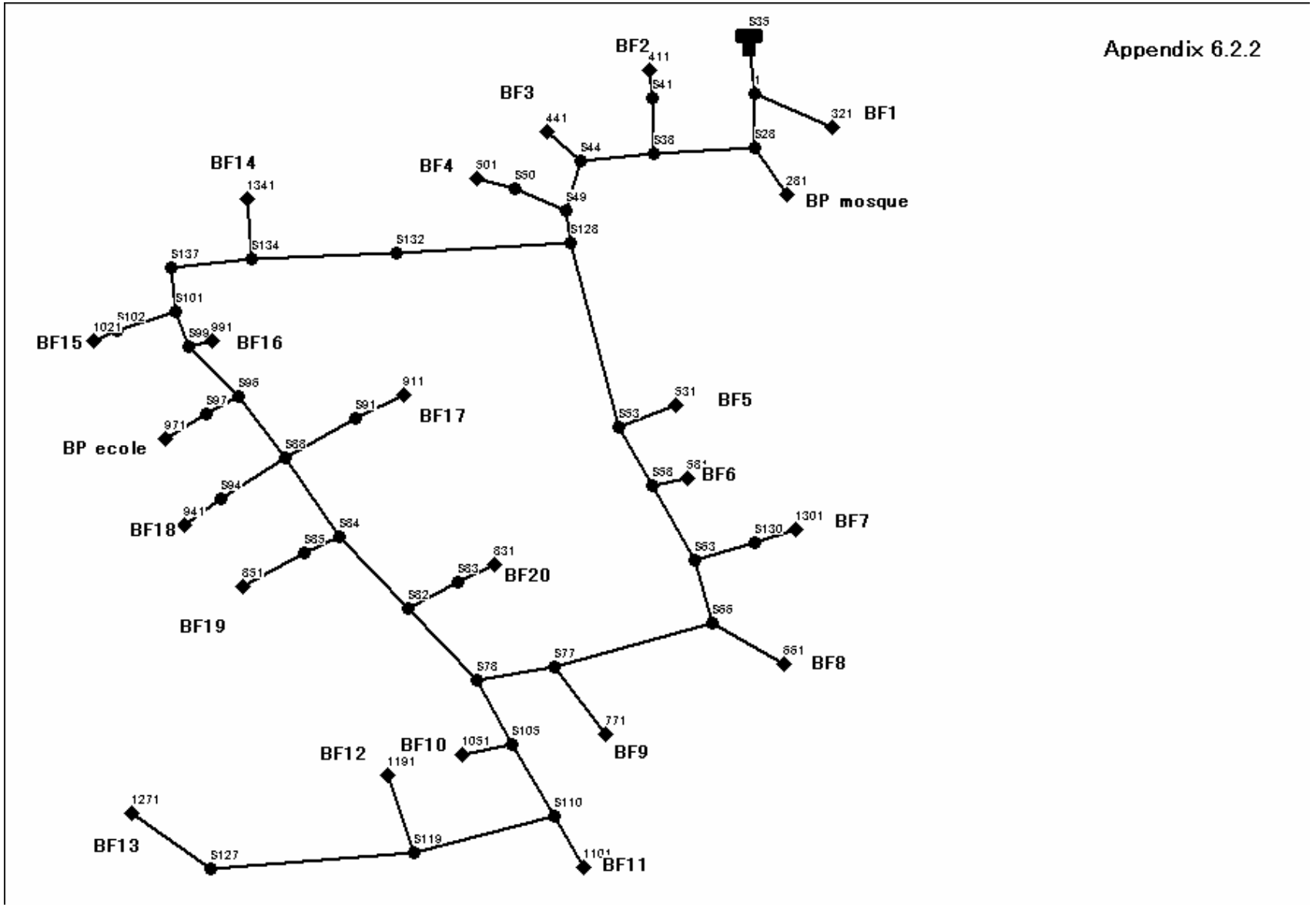
Link ID	Start Node	End Node	Length m	Diameter mm
2	S28	S38	521,61	141
3	S38	S41	117,10	66
4	S38	S44	198,92	141
5	S44	S49	471,13	141
6	S49	S50	10,8	66
9	S53	S58	518	96,8
10	S58	S63	857,54	96,8
11	S63	S130	521,34	66
12	S63	S66	494,72	96,8
13	S66	S77	1036,01	79,2
14	S77	S78	38,86	79,2
16	S82	S83	126,5	66
17	S82	S84	154,86	66
18	S84	S85	15,76	66
19	S84	S88	345,63	66
20	S88	S91	378,04	66
21	S88	S94	463,30	66
22	S88	S96	609,06	66
23	S96	S97	36,36	66
24	S96	S99	265,17	79,2
26	S78	S105	254,98	79,2
27	S105	S110	854,42	66
28	S110	S119	1527,89	66
30	S127	S119	1367,07	66
8	S128	S53	203,92	96,8
7	S49	S128	50,09	141
57	S128	S132	517,66	141
33	S134	S137	222,37	96,8
34	S101	S102	149,07	66
35	S137	S101	179,19	96,8
36	S101	S99	245,37	79,2
56	S132	S134	575,03	110,2
1	S35	1	673,81	176,2
42	1	S28	467,76	176,2

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
S28	0,00	307,62	25,37	0,00	
S38	0,00	303,36	15,55	0,00	
S41	0,00	303,27	12,44	0,00	
S44	0,00	301,85	11,63	0,00	
S49	0,00	298,54	16,65	0,00	
S50	0,00	298,52	16,52	0,00	
S53	0,00	295,30	19,37	0,00	
S58	0,00	289,18	23,62	0,00	
S63	0,00	281,21	31,94	0,00	
S130	0,00	280,18	30,39	0,00	
S66	0,00	277,87	34,63	0,00	
S77	0,00	265,64	23,70	0,00	
S78	0,00	265,34	23,55	0,00	
S82	0,00	273,99	24,45	0,00	
S83	0,00	273,80	23,29	0,00	
S84	0,00	274,23	22,35	0,00	
S85	0,00	274,21	22,42	0,00	
S88	0,00	276,09	17,64	0,00	
S91	0,00	275,68	16,59	0,00	
S94	0,00	275,59	16,58	0,00	
S96	0,00	286,24	17,22	0,00	
S97	0,00	286,19	17,77	0,00	
S99	0,00	288,93	16,01	0,00	
S102	0,00	292,19	14,01	0,00	
S105	0,00	263,38	25,68	0,00	
S110	0,00	254,51	27,98	0,00	
S119	0,00	248,17	21,37	0,00	
S127	0,00	246,90	14,20	0,00	
S128	0,00	298,21	17,38	0,00	
S137	0,00	293,52	12,75	0,00	
S134	0,00	295,00	13,49	0,00	
S101	0,00	292,33	14,43	0,00	
321	0,68	291,46	0,30	0,00	
281	0,83	282,68	0,43	0,00	
411	0,56	291,03	0,20	0,00	
441	0,54	290,41	0,19	0,00	
501	0,66	282,27	0,27	0,00	
531	0,71	276,25	0,32	0,00	
581	0,80	265,96	0,40	0,00	
1301	0,91	250,32	0,53	0,00	
661	0,98	243,85	0,61	0,00	
771	0,80	242,34	0,40	0,00	
1051	0,83	238,14	0,44	0,00	
1101	0,87	227,01	0,48	0,00	
1191	0,75	227,16	0,36	0,00	
1271	0,60	232,93	0,23	0,00	
1341	0,59	281,73	0,22	0,00	
1021	0,60	278,41	0,23	0,00	
991	0,65	273,18	0,26	0,00	
971	0,68	268,72	0,30	0,00	
911	0,66	259,36	0,27	0,00	
941	0,66	259,28	0,27	0,00	
851	0,77	252,17	0,38	0,00	
831	0,79	250,91	0,40	0,00	
S132	0,00	297,53	14,66	0,00	
1	0,00	309,05	17,89	0,00	
S35	-15,93	311,28	0,00	0,00	Réservoir

SLATNIA (Looped Distribution)

Appendix 6.2.2



Appendix 6.2.2

SLATNIA (Looped Distribution)

18/11/2005 17:04:35

```
******************************************************************
*                          E P A N E T                           *
*                  Hydraulic and Water Quality                   *
*                  Analysis for Pipe Networks                    *
*                        Version 2.0                             *
******************************************************************

Input File: Slatnia reseau maille.NET
```

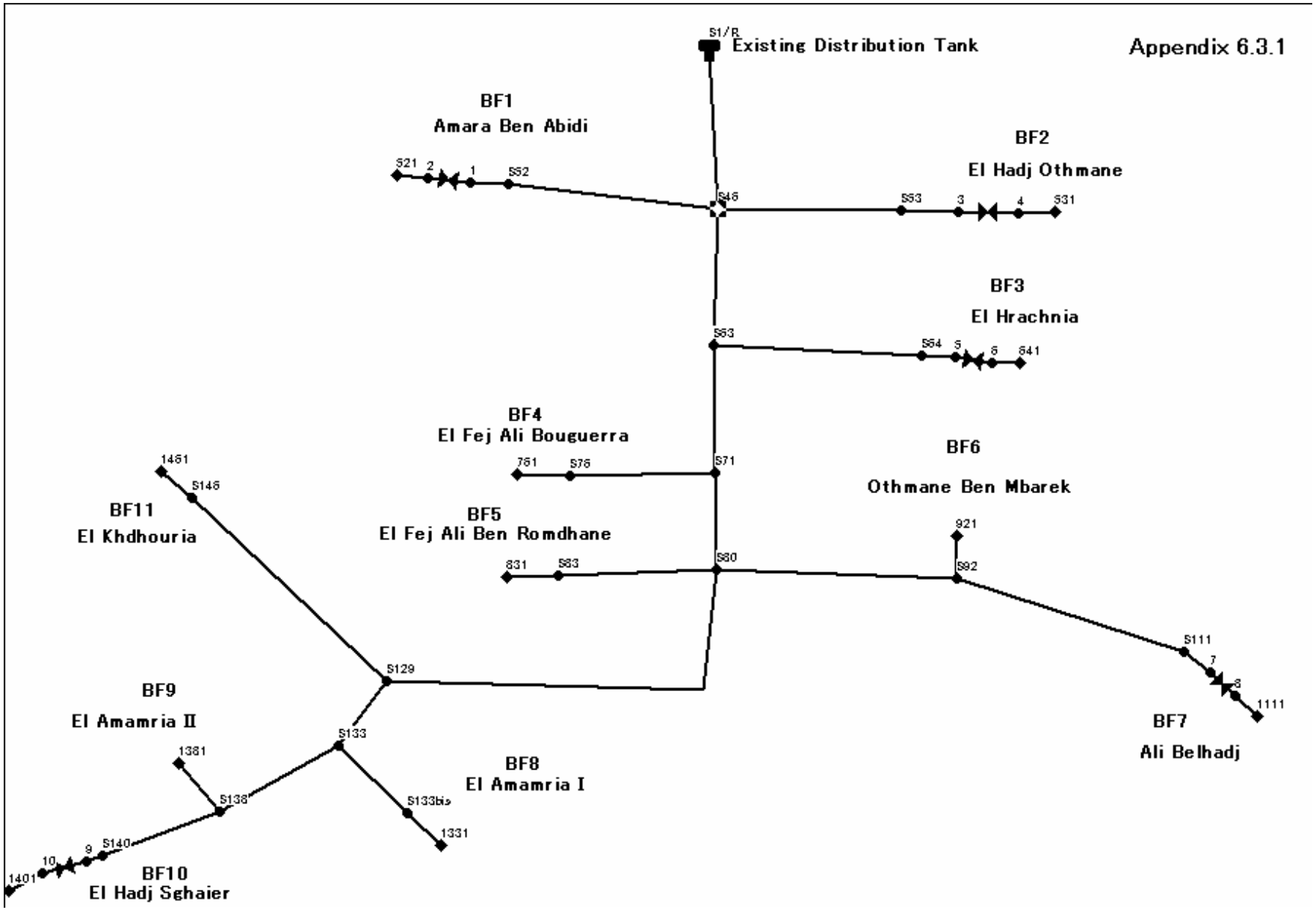
Link – Noe Table:

Link ID	Start Node	End Node	Length m	Diameter mm
2	S28	S38	521,61	141
3	S38	S41	117,10	66
4	S38	S44	198,92	141
5	S44	S49	471,13	141
6	S49	S50	10,8	66
9	S53	S58	518	79,2
10	S58	S63	857,54	79,2
11	S63	S130	521,34	66
12	S63	S66	494,72	79,2
13	S66	S77	1036,01	79,2
14	S77	S78	38,86	66
16	S82	S83	126,5	66
17	S82	S84	154,86	66
18	S84	S85	15,76	66
19	S84	S88	345,63	79,2
20	S88	S91	378,04	66
21	S88	S94	463,30	66
22	S88	S96	609,06	79,2
23	S96	S97	36,36	66
24	S96	S99	265,17	96,8
26	S78	S105	254,98	79,2
27	S105	S110	854,42	66
28	S110	S119	1527,89	66
8	S128	S53	203,92	79,2
7	S49	S128	50,09	141
57	S128	S132	517,66	141
33	S134	S137	222,37	110,2
34	S101	S102	149,07	66
35	S137	S101	179,19	110,2
36	S101	S99	245,37	96,8
56	S132	S134	575,03	141
15	S82	S78	460,97	66
1	S35	1	673,81	176,2
42	1	S28	467,76	176,2
30	S119	S127	1367,07	66

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
S28	0,00	307,62	25,37	0,00	
S38	0,00	303,37	15,56	0,00	
S41	0,00	303,27	12,44	0,00	
S44	0,00	301,86	11,64	0,00	
S49	0,00	298,55	16,66	0,00	
S50	0,00	298,53	16,53	0,00	
S53	0,00	293,99	18,06	0,00	
S58	0,00	285,71	20,15	0,00	
S63	0,00	275,79	26,52	0,00	
S130	0,00	274,94	25,15	0,00	
S66	0,00	272,15	28,91	0,00	
S77	0,00	268,16	26,22	0,00	
S78	0,00	268,02	26,23	0,00	
S82	0,00	271,68	22,14	0,00	
S83	0,00	271,50	20,99	0,00	
S84	0,00	273,93	22,05	0,00	
S85	0,00	273,90	22,11	0,00	
S88	0,00	277,23	18,78	0,00	
S91	0,00	276,79	17,70	0,00	
S94	0,00	276,69	17,68	0,00	
S96	0,00	288,01	18,99	0,00	
S97	0,00	287,96	19,54	0,00	
S99	0,00	290,29	17,37	0,00	
S102	0,00	292,77	14,59	0,00	
S105	0,00	265,90	28,20	0,00	
S110	0,00	256,38	29,85	0,00	
S119	0,00	249,56	22,76	0,00	
S127	0,00	248,18	15,48	0,00	
S128	0,00	298,22	17,39	0,00	
S137	0,00	294,12	13,35	0,00	
S134	0,00	295,62	14,11	0,00	
S101	0,00	292,91	15,01	0,00	
321	**0,68**	291,46	0,30	0,00	
281	**0,83**	282,68	0,43	0,00	
411	**0,56**	291,03	0,20	0,00	
441	**0,54**	290,41	0,19	0,00	
501	**0,66**	282,27	0,27	0,00	
531	**0,69**	276,23	0,30	0,00	
581	**0,73**	265,90	0,34	0,00	
1301	**0,82**	250,22	0,43	0,00	
661	**0,89**	243,74	0,50	0,00	
771	**0,84**	242,39	0,45	0,00	
1051	**0,88**	238,19	0,49	0,00	
1101	**0,90**	227,05	0,52	0,00	
1191	**0,78**	227,19	0,39	0,00	
1271	**0,63**	232,95	0,25	0,00	
1341	**0,60**	281,74	0,23	0,00	
1021	**0,61**	278,42	0,24	0,00	
991	**0,67**	273,21	0,29	0,00	
971	**0,72**	268,75	0,33	0,00	
911	**0,68**	259,38	0,29	0,00	
941	**0,68**	259,30	0,29	0,00	
851	**0,77**	252,16	0,37	0,00	
831	**0,75**	250,86	0,35	0,00	
S132	0,00	296,99	14,12	0,00	
1	0,00	309,05	17,89	0,00	
S35	-15,92	311,28	0,00	0,00	Réservoir

OULED MOUSSA (One Service Area with One Distribution Tank)



Appendix 6.3.1

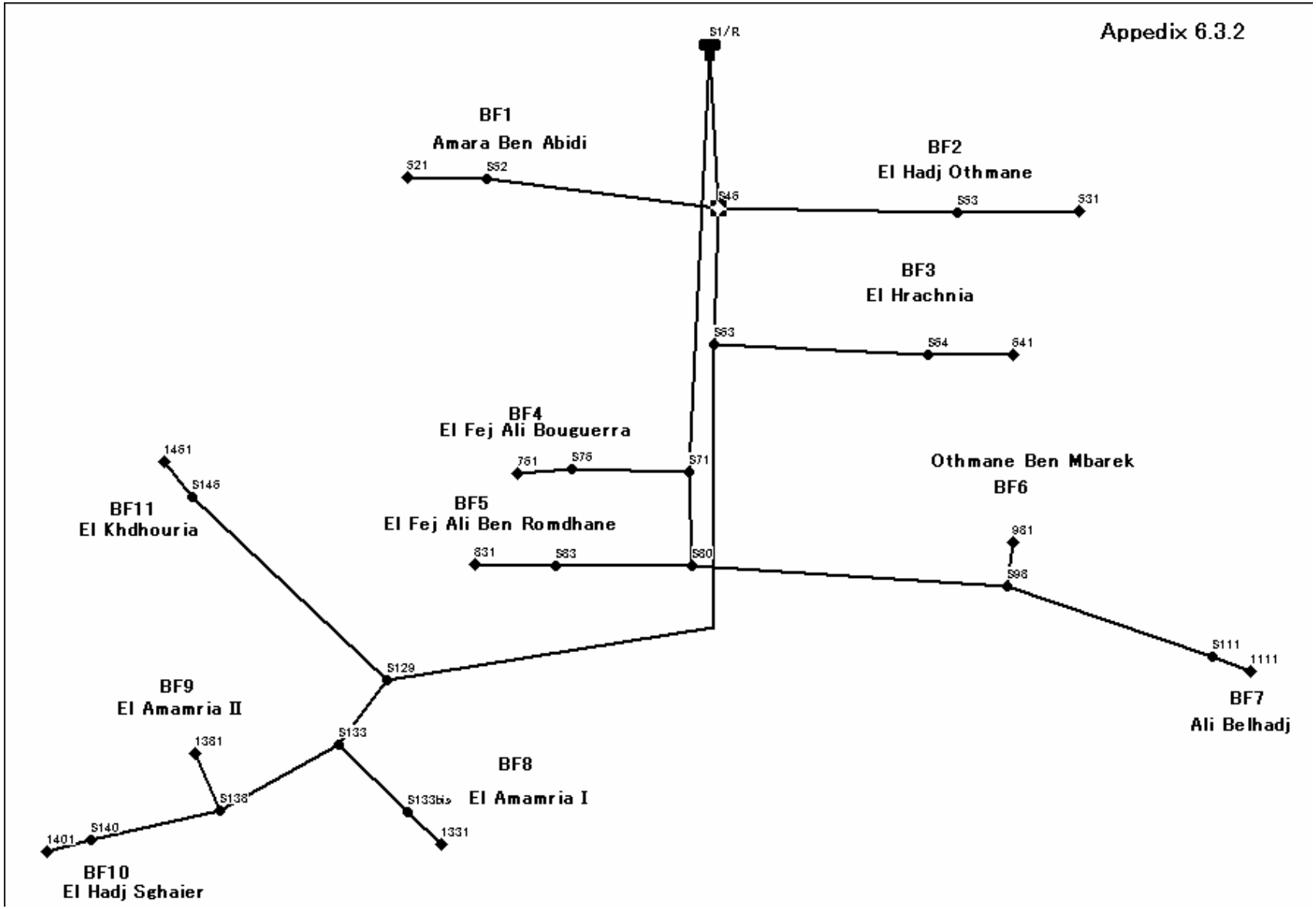
OULED MOUSSA
(One stage service area with one distribution tank)

```
                                                  16/11/2005 22:12:13
******************************************************************************
*                             E P A N E T                                    *
*                  Analyse Hydraulique et Qualitative                        *
*                    pour les Réseaux sous Pression                          *
*                           Version 2.0                                      *
******************************************************************************

Input File: Ouled Moussa ecoulement a charge libre P.NET


Link – Noe Table:
------------------------------------------------------------------------------
Link            Start           End                    Length     Diameter
ID              Node            Node                        m           mm
------------------------------------------------------------------------------
1               S1/R            S46                   4192,04          141
2               S46             S52                    601,11           66
3               S46             S53                    144,95           66
4               S46             S63                    929,27          141
5               S63             S64                    215,37           66
6               S63             S71                    388,05          141
7               S71             S76                    387,22           66
8               S71             S80                    547,99        110,2
9               S80             S83                    224,30           66
10              S80             S92                    603,91         79,2
11              S92             S111                   1405,9           66
12              S80             S129                  1991,96         79,2
13              S129            S133                   205,68         79,2
14              S133            S133bis                 22,55           66
15              S133            S138                   232,07           66
16              S138            S140                    383,2           66
17              S129            S146                   874,44           66
```

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
S46	0,00	458,94	55,02	0,00	
S53	0,00	458,72	52,82	0,00	
S52	0,00	458,02	42,44	0,00	
S63	0,00	456,74	52,49	0,00	
S64	0,00	456,41	52,93	0,00	
S71	0,00	456,00	42,90	0,00	
S76	0,00	455,34	25,95	0,00	
S80	0,00	453,28	32,38	0,00	
S83	0,00	452,92	24,59	0,00	
S92	0,00	452,08	18,17	0,00	
S111	0,00	449,94	31,39	0,00	
S129	0,00	434,05	31,75	0,00	
S146	0,00	432,62	25,09	0,00	
S133	0,00	432,84	30,43	0,00	
S133bis	0,00	432,80	29,50	0,00	
S138	0,00	431,31	33,15	0,00	
S140	0,00	430,73	35,49	0,00	
521	**0,79**	**415,98**	**0,40**	**0,00**	
531	**0,79**	**406,30**	**0,40**	**0,00**	
641	**0,79**	**403,88**	**0,40**	**0,00**	
761	**0,84**	**429,83**	**0,44**	**0,00**	
831	**0,81**	**428,75**	**0,42**	**0,00**	
921	**0,69**	**434,21**	**0,30**	**0,00**	
1111	**0,79**	**418,95**	**0,40**	**0,00**	
1331	**0,90**	**403,81**	**0,51**	**0,00**	
1381	**0,96**	**398,74**	**0,58**	**0,00**	
1401	**0,79**	**395,64**	**0,40**	**0,00**	
1461	**0,82**	**407,96**	**0,43**	**0,00**	
1	0,00	454,76	39,18	0,00	
2	0,00	435,58	20,00	0,00	
3	0,00	455,45	49,55	0,00	
4	0,00	425,90	20,00	0,00	
5	0,00	453,15	49,67	0,00	
6	0,00	423,48	20,00	0,00	
7	0,00	446,68	28,13	0,00	
8	0,00	438,55	20,00	0,00	
9	0,00	427,46	32,22	0,00	
10	0,00	415,24	20,00	0,00	
S1/R	-8,96	473,12	0,15	0,00	Réservoir

OULED MOUSSA (Two Stages Service Area with One Distribution Tank)



Appendix 6.3.2

OULED MOUSSA
(Two stage service areas with one distribution tank)

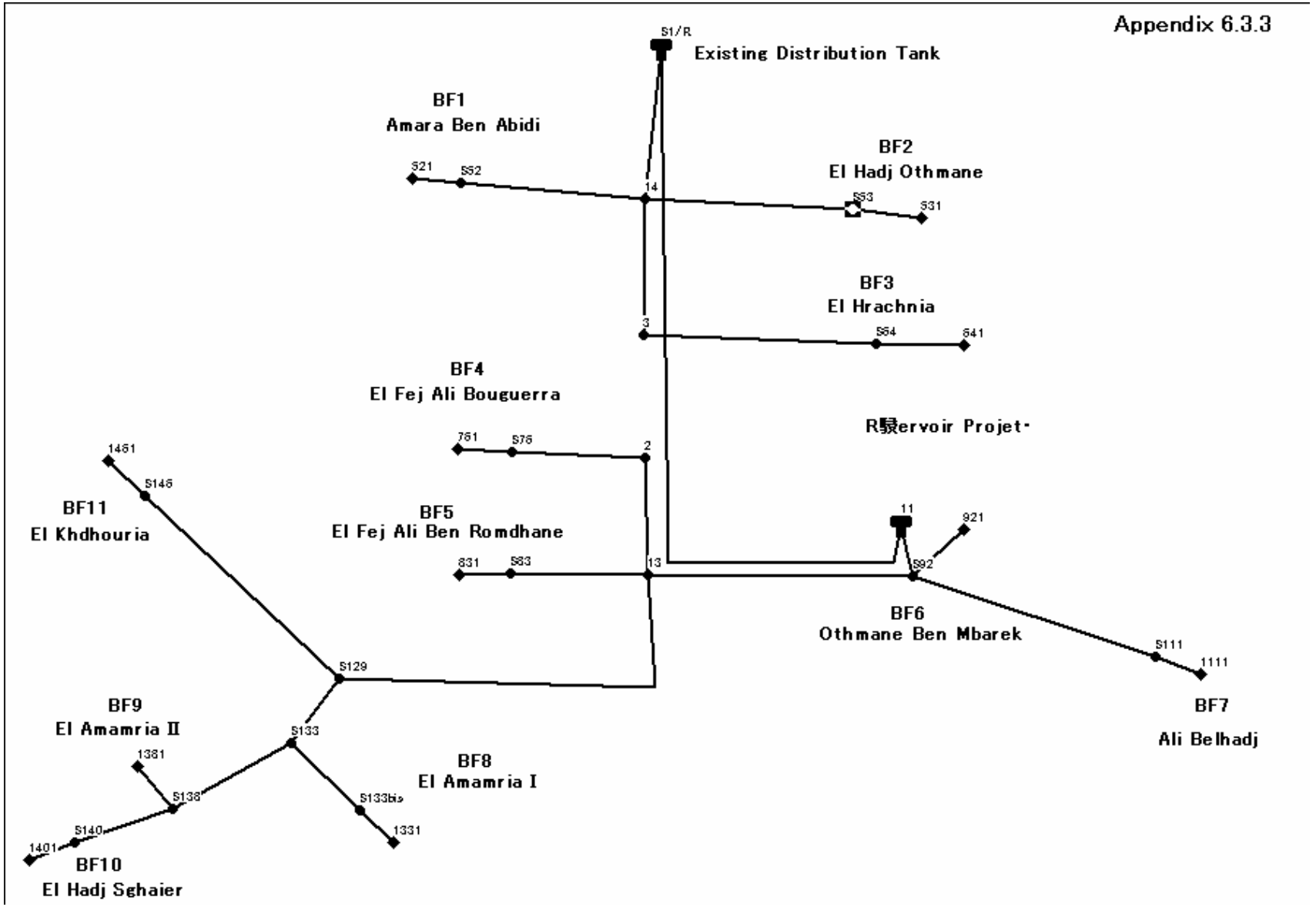
```
                                                  18/11/2005 08:18:41
******************************************************************
*                           E P A N E T                          *
*                   Hydraulic and Water Quality                  *
*                   Analysis for Pipe Networks                   *
*                         Version 2.0                            *
******************************************************************

Input File: Ouled Moussa ecoulement a charge libre Def.NET


Link – Noe Table:
```

Link ID	Start Node	End Node	Length m	Diameter mm
1	S1/R	S46	4192,04	96,8
2	S46	S52	601,11	66
3	S46	S53	144,95	66
4	S46	S63	929,27	96,8
5	S63	S64	215,37	66
7	S71	S76	387,22	66
9	S80	S83	224,30	66
13	S129	S133	205,68	79,2
14	S133	S133bis	22,55	66
15	S133	S138	232,07	66
16	S138	S140	383,2	66
17	S129	S146	874,44	66
12	S63	S129	2928	96,8
6	S1/R	S71	5509,36	96,8
8	S71	S80	547,99	96,8
11bis	S98	S111	1040,47	66
10	S80	S98	603,91	79,2

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
S46	0,00	436,74	32,82	0,00	
S53	0,00	436,45	30,55	0,00	
S52	0,00	435,94	20,36	0,00	
S63	0,00	432,55	28,30	0,00	
S64	0,00	432,14	28,66	0,00	
S71	0,00	455,02	41,92	0,00	
S76	0,00	454,39	25,00	0,00	
S80	0,00	453,97	33,07	0,00	
S83	0,00	453,60	25,27	0,00	
S111	0,00	450,36	31,81	0,00	
S129	0,00	424,34	22,04	0,00	
S146	0,00	423,43	15,90	0,00	
S133	0,00	423,36	20,95	0,00	
S133bis	0,00	423,33	20,03	0,00	
S138	0,00	421,99	23,83	0,00	
S140	0,00	421,34	26,10	0,00	
521	**0,73**	415,92	0,34	0,00	
531	**0,91**	406,43	0,53	0,00	
641	**0,88**	403,98	0,50	0,00	
761	**0,82**	429,82	0,43	0,00	
831	**0,83**	428,76	0,43	0,00	
1111	**0,93**	419,10	0,55	0,00	
1331	**0,73**	403,64	0,34	0,00	
1381	**0,80**	398,57	0,41	0,00	
1401	**0,84**	395,69	0,45	0,00	
1461	**0,64**	407,79	0,26	0,00	
981	**0,70**	434,22	0,31	0,00	
S98	0,00	452,52	18,61	0,00	
S1/R	-8,82	473,12	0,15	0,00	Réservoir

OULED MOUSSA (Two Distribution Tanks)



Appendix 6.3.3

OULED MOUSSA
(One stage service area with two distribution tanks)

17/11/2005 15:45:26

```
**********************************************************************
*                            E P A N E T                             *
*                   Hydraulic and Water Quality                      *
*                   Analysis for Pipe Networks                       *
*                         Version 2.0                                *
**********************************************************************

Input File: Ouled Moussa ecoulement a charge libre P mod Equip 2.2.NET
```

Link – Noe Table:

Link ID	Start Node	End Node	Length m	Diameter mm
2	14	S52	601,11	66
3	14	S53	144,95	66
5	3	S64	215,37	66
7	2	S76	387,22	66
9	13	S83	224,30	66
11	S92	S111	1405,9	66
12	13	S129	1991,96	79,2
13	S129	S133	205,68	79,2
14	S133	S133bis	22,55	66
15	S133	S138	232,07	66
16	S138	S140	383,2	66
17	S129	S146	874,44	66
20	11	S92	10	66
27	S92	13	603,91	96,8
38	S1/R	14	4192,04	66
18	13	2	547,99	66
29	14	3	929,27	66
1	S1/R	11	6661	66

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
S53	0,00	429,85	23,95	0,00	
S52	0,00	429,53	13,95	0,00	
S64	0,00	428,23	24,75	0,00	
S76	0,00	443,99	14,60	0,00	
S83	0,00	444,64	16,31	0,00	
S92	0,00	448,46	14,55	0,00	
S111	0,00	445,95	27,40	0,00	
S129	0,00	427,80	25,50	0,00	
S146	0,00	426,70	19,17	0,00	
S133	0,00	426,68	24,27	0,00	
S133bis	0,00	426,64	23,34	0,00	
S138	0,00	425,15	26,99	0,00	
S140	0,00	424,42	29,18	0,00	
521	**0,60**	**415,81**	**0,23**	**0,00**	
531	**0,80**	**406,31**	**0,41**	**0,00**	
641	**0,82**	**403,90**	**0,42**	**0,00**	
761	**0,61**	**429,63**	**0,24**	**0,00**	
831	**0,65**	**428,60**	**0,27**	**0,00**	
921	**0,61**	**434,15**	**0,24**	**0,00**	
1111	**0,86**	**419,02**	**0,47**	**0,00**	
1331	**0,79**	**403,70**	**0,40**	**0,00**	
1381	**0,85**	**398,62**	**0,46**	**0,00**	
1401	**0,89**	**395,74**	**0,50**	**0,00**	
1461	**0,71**	**407,85**	**0,32**	**0,00**	
13	0,00	444,88	23,88	0,00	
14	0,00	430,07	26,15	0,00	
2	0,00	444,36	31,26	0,00	
3	0,00	428,57	24,32	0,00	
S1/R	-3,48	473,12	0,15	0,00	Réservoir
11	-4,73	449,11	0,20	0,00	Réservoir

APPENDIX E

QUESTIONNAIRE FOR SOCIO-ECONOMIC SURVEY

The Rural Water Supply Project (Phase II)

Questionnaire of the Household Survey

Ref: ☐

Name of the Interviewer: _____
Governorate _____
Delegation: _____
Project Name _____
Locality Name _____

SECTION 1. Information about the interviewee

1.1 Sex: 1. M ☐ 2. F ☐

1.2 Age:
1. 20-29 years ☐
2. 30-39 years ☐
3. 40-49 years ☐
4. 50-59 years ☐
5. 60-69 years ☐
6. 70 years: ☐

1.3 Position 1. Husband ☐ 2. Wife ☐ 3. Son ☐ 4. Daughter ☐
5. Other _____

1.4 Educational Level 1. Illetrate: ☐ 2. Religious education ☐ 3. Primary ☐
1. Secondary: ☐ 5. Academic ☐

1.5 Principal Activities of the household head ***(It is possible to give many answers)***

1.Worker ☐ 2. Farmer ☐ 3. Breeder ☐
4.Civil servant ☐ 5.Merchant ☐ 6. Other ☐
7. Nothing ☐

SECTION 2. Information about the household

2.1 Total number of members living together : *Mention the number :*

Male adults ☐ Children (3–18years) ☐
Female adults ☐ Babies ☐

2.2 Number of rooms ☐

Tick the corresponding answer

2.3 Is there any kitchen (s) in your house? 1. Yes ☐ 2. No ☐
2.4 Is there any shower (s) in your house? 1. Yes ☐ 2. No ☐
2.5 Is there any bathroom (s) in your house? 1. Yes ☐ 2. No ☐

2.4 Available commodities

Tick the corresponding answer

Is your house equipped with:

2.4.1 TV	1. Yes ☐	2. No ☐
2.4.2 Refrigirator	1. Yes ☐	2. No ☐
2.4.3 Washing Machine	1. Yes ☐	2. No ☐
2.4.3 Car	1. Yes ☐	2. No ☐
2.4.5 Fixed telephone	1. Yes ☐	2. No ☐
2.4.6 GSM	1.Yes ☐	2. No ☐

SECTION 3. Water

(First answer the questions 3.1-3.10 of the attached sheet about the types of the water sources that your are using)

3.11 How do you judge the security (continuity) of water supply?

Season	1. Suffisiant (continuous)	2. Insuffisiant (intermittent)
3.11.1 Summer		
3.11.2 Winter		

3.12 Which member of your family supplies you with water? (it is p answers are possible)

1. Adult man ☐ 2. Adult woman ☐ 3. Girl ☐
4. Boy ☐ 5. Carrier ☐ 6. Other (specify) _____

3.13 How much water do you get everyday or everyweek <u>in summer</u>?

Week ☐ Day ☐

_____ Cans of 20L Total: _____ L/Week

_____ Water tank of _____ L Total: _____ **L/Day** (Divide the total quantity of the week by 7)

3.14 How much water do you get everyday or everyweek <u>in winter</u>?

Week ☐ Day ☐

_____ Cans of 20L Total: _____ L/Week

_____ Water can of _____ L Total: _____ L/Day (Divide the total quantity of the week by 7)

3.15 Where do you store water? (It is possible to give many answers)

1. Cans ☐ 3. Tanks for rain water ☐
2. Metal tanks ☐ 4. Other (specify) _____

3.16 How do you use water? (It is possible to give many answers)

1. Drinking ☐ 2. Washing ☐ 3. Watering Animals ☐
4. Secondary irrigation ☐ 5. Watering ☐ 6. Industrial use ☐
7. Other _____

3.17 How do you pay water?

1. By m3 ☐ 2. Monthly flat rate ☐ 3. by water tank ☐
4. Annual flat rate ☐ 5. Other _____

3.18 What is the average cost of m3 of water? ☐ DT

(When the interviewee does not know about the price of 1m3, ask for the price of 20L or the quantity that he (she) usually bu

	DT	(for 20L)
	DT	(for ____m3)

3.19 What are the disadvantages of the present situation of water supply? (It is possible to give many answers)

1. Quality (taste, odor) ☐ 2. Distance (far, tiresome) ☐ 3. Price (expensive) ☐
4. Quantity (intermittent) ☐ 5. Other _____

3.20 What payment method do you prefer?

1. Periodical flat rate ☐ 2. Proportional (m^3) ☐
3. Mixed ☐ 4. Other _____

Mention the reasons of your preference: _____

_____

3.21 Which price do you judge reasonable for one cubic meter of water (m3)? ____ DT

3.22 If the price of water exceeds 1DT, are you going to adhere to the GIC? 1. Yes ____ 2. No ____

3.23 Are you ready to sign the contract of adhesion to the GIC? 1. Yes ____ 2. No ____

3.24 Would you like to become a member of the Boards of Directors of the G 1. Yes ____ 2. No ____

3.25 If it is necessary to implement a pipeline in your land do you accept that?

1. Accepting without compensation ____ 2. Refuse ____
3. Accepting while asking for indemnification ____ 4. Hesitant/undecided ____

SECTION 4. Economy

4.1 How much do you spend for water in your family? ____ DT

4.2 How much is the annual income of your family? ____ DT

SECTION 5. Health and hygiene

5.1 According to you does the water you consume have a bad impact on the health?

1. Yes ____ 2. No ____

5.2 According to you, in what way does the water you are using affect the health?

1.Diarrhoea	2. Hepatitis	3. Polio	4. Itch	5. Trachoma	6. Kidney	7. Stomach	8. Skin irritation	Other
إسهال	بوصفير	شلل	جرب	رمد				

5.3 How do you find the access to medical care?

1. Easy ____ 2. Average ____ 5. Difficult ____

5.4 Availability of latrines: 1.Yes ____ 2. No ____ (If you choose the answer number 1, answer the following question)

5.5 Where are the toilets located in your house?

1. Outside the fence of the house ____
2. At the fence of the house ____
3. Inside the house ____

5.6 Discharge system

1. Pit ____
2. In the nature ____
3. Other (specify) _____

SECTION 6: Exploitation and Maintenance of the Water Supply System (In case a GIC exists)

6.1 Have you ever heard about GIC? 1.Yes ☐ 2. No ☐

6.2 Are satisfied with the services of this GIC? 1.Yes ☐ 2. No ☐

6.3 What are the reasons of your dissatisfaction?

_____

_____

_____

6.4 Are the officials of the GIC competent ?

1. They are all competent ☐ 2. Some of them are competent ☐
3. All of them are not competent ☐

SECTION 7: Gender

7.1 Do you think that women's participation in the sensitization meetings of the Drinking Water Supply Prject is necessary?

1.Yes ☐ 2. No ☐

Justify your answer:

_____

_____

_____

7.2 Do you agree that a woman will be a tap keeper in your locality?

1.Yes ☐ 2. No ☐

Justify your answer:

_____

_____

_____

7.3 Do you agree that a woman would be a memeber of the Board of Directors of the GIC and represent your locality?

1.Yes ☐ 2. No ☐

Justify your answer:

_____

_____

_____

7.4 Do you think that women can repair the Public Taps?

1.Yes ☐ 2. No ☐

Justify your answer:

_____

_____

_____

3. Water Subject: Information about the water sources that are being used

Type of the water sources	3.1 Order of Frequency (first 2) ***1**	3.2 Period of usage 1 : all seasons 2 : summer only 3 : winter only	3.3 Distance (km) (go to water source)	3.4 Means of transportation 1. Humans Efforts 2. Horses 3. Animal traction 4. Mechanical traction	3.5 Time needed (min.) (go to water source)	3.6 Time needed (min.) (go and return to water source including waiting time)	3.7 Frequency ***2** /day /week	3.8 Price of water DT/m^3 ***3**	3.9 Perceived taste 1. Soft 2. Salty 3. Bitter 4. Other (specify)	3.10 Quality 1. Acceptable 2. More or less 3. Bad (If the interviewees choose the answer No 3, it is necessary to cite their reasons below)
Natural Spring				S : W :		S : W :	S : W :			
Shallow wells				S : W :		S : W :	S : W :			
BF (of neighboring GIC or SONEDE)				S : W :		S : W :	S : W :			
Potence (of neighboring GIC or SONEDE)				S : W :		S : W :	S : W :			
Private connections in the neighborhood				S : W :		S : W :	S : W :			
Majel (Rain water)				S : W :		S : W :	S : W :			
Water Venders				S : W :		S : W :	S : W :			
Water tank				S : W :		S : W :	S : W :			
Other ( )				S : W :		S : W :	S : W :			

Remarks: 1) First, select the two sources of water that are used the most together with their order of frequency. Ask the remaining questions about the two water sources.

2) Mention the frequency whether it is daily (/day), weekly (/week), compared with the used sources

3) If the interviewees give the price of the water can of 20L, convert the cost to m3.

S: Summer, W: Winter

APPENDIX F

MANAGEMENT MODEL FOR GIC

MANAGEMENT MODEL FOR GIC

Proposed management system of GIC

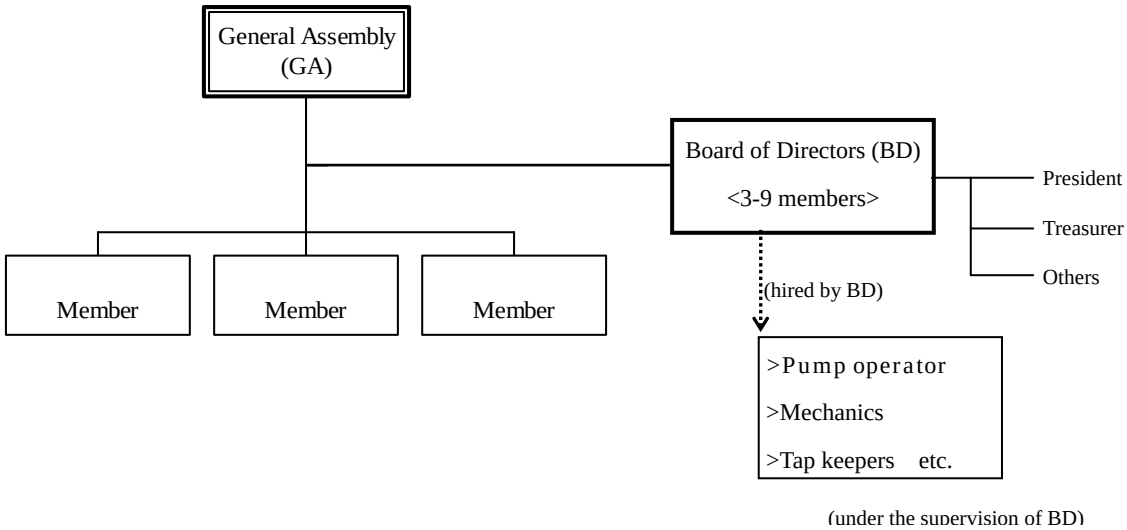
1. Organization of GIC 1
1.1 Organization 1
1.2 Board of Directors 1
1.3 Treasurer 2
1.4 Pump operator 2
1.5 Tap Keeper 3
2. Materials for Management 3
3. Management facilities recommended to be introduced 4
4. Training to be implemented 4

Proposed management system of GIC

1. Organization of GIC

1.1 Organization

Based on the Decree, the organization of GIC should in principle be as shown in the following figure:



1.2 Board of Directors

Considering the prospective total number of GIC members, the number of the Board of Directors is recommended to be (figure) and disposition of directors in each locality can be considered as shown in the following table.

Localities	Number of Families	Recommended number of directors
A	20	2
B	3	1
C	5	
D	18	2
E	9	1
*****		1
H		1
*****		

Tasks of the Board of Directors are as follows:

1) To hold meeting as required and at least once every quarter in a year.
2) Election of the president of GIC among the directors.
3) Designation of the treasurer.
4) Hiring pump operators, network keepers and tap keepers, if necessary.
5) Taking responsibility for the year end balance sheet to be audited by fiscal receiver in the regional office of the Ministry of Finance.

1.3 Treasurer

Tasks of Treasurer shall be as follows:

1) Annual budgeting of GIC
2) Preparation of GIC members list
3) Registering income and issuing a receipt (Number printed cash voucher book distributed by the CRDA should be used)
4) Payment of authorized amount by the GIC board of directors
5) Registration of income and expenditure in the accounting book
6) Keeping the receipts of income and expenditure
7) Preparation of a GIC financial report
8) Presenting the financial report to the board of directors and the GIC general meeting
9) Submission of the GIC financial report with all corroborative data to a Regional Taxation Bureau or the concerned department of the Minitry of Finance

1.4 Pump operator

Tasks of a pump operator shall be as follows:

1) Securing enough quantity of water that users demand
2) Management and maintenance of hydraulic equipment, measuring devices, system protection installation, etc.
3) Management and maintenance of pipe network with ancillary facilities
4) To start and to stop a pump according to the water level of a distribution tank
5) To read and write down the indicator figure of water meter before and after the pump operation
6) Operation of disinfection facilities and contral of Javel water (hypochlorite)
7) Cleaning of pipeline by using drains
8) To check functions of various devices and apparatuses such as valves, service facilities, a pump starter panel, etc.
9) Small repair works assisted by mechanics, laborers, etc. if needed

10) Recording the daily operation and keeping the operation record book
11) Keeping devices, tools and documents in the pumping station
12) Guarding the pumping station and hydraulic equipment
13) Reporting to the President of GIC on the technical conditions of equipment, apparatuses and devices of water supply system
14) In case the tap keepers are not assigned, to open and close the communal taps and potencies at designated time.
15) Playing a role of liaison of troubles/accident of the system found by population.

1.5 Tap Keeper

Tasks of tap keepers shall be as follows:

1) To supply the necessary quantity of water to consumers, receive the water charge for the supplied water and issue a receipt to the consumers.
2) Keeping the credit notebooks for the credit sales of water
3) To check and take care of the hydraulic equipment, the protection and measurement devices that exist in and around the service facilities.
4) To control the consumers for the good use of the service facilities.
5) Keeping the hydraulic equipment and the civil engineering works of the service facilities in good conditions
6) Coordinate with the person responsible for water analysis (the president of GIC or another person appointed by the Board of Directors to coordinate with the regional hygiene service) and take samples for the analysis, if required
7) To inform the pump operator of the president of GIC of the conditions and functioning of the service facilities and any other problematic observation
8) Execution of small repairs
9) Playing a role of liaison of troubles/accident of the system found by population.

2. Materials for Management

Following materials should be furnished in the GIC office, the pumping station or so:

1) Operation record book
2) Accounting book
3) Cash voucher book
4) Completion drawing
5) Network diagram
6) Technical instruction and information on constructed facilities

3. Management facilities recommended to be introduced

Following management facilities are recommended to introduce for effective and efficient management of GIC. However, the introduction should be considered the balance between cost and benefit.

1) Management contract with CRDA
2) Technical Director
3) Private operator for the maintenance
4) Outsourcing of accounting data processing

4. Training to be implemented

Staff of GIC should have one or more of following training courses in order to fulfill its tasks.

1) Technical knowledge on the water supply system for a pump operator
2) Service facilities maintenance for tap keepers
3) Basic accounting for tap keepers
4) Keeping operation records for a pump operator
5) Keeping accounting book for a treasurer
6) Budgeting for the president of GIC and a treasurer

APPENDIX G

SYNTHESIS REPORT
ON
THE SITUATION OF THE WATER USERS GROUPS FOR DRINKING WATER SUPPLY (GIC/AEP)
FOR THE YEAR 2003

REPUBLIC OF TUNISIA

MINISTRY OF AGRICULTURE, ENVIRONMENT AND HYDRAULIC RESOURCES

SYNTHESIS REPORT ON THE SITUATION OF THE WATER USERS GROUPS FOR DRINKING WATER SUPPLY (GIC/AEP) FOR THE YEAR 2003

GENERAL DIRECTORATE FOR THE RURAL ENGINEERING AND WATER EXPLOITATION

NOVEMBER 2004

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Introduction

Thanks to the efforts made by the Government in the field of drinking water in the rural areas, the rural drinking water rate of supply reached 83.5%.

This allowed the number of the GICs, created to insure the operation and the maintenance of water systems, to increase from 100 GICs in 1987 to 2675 GICs in 2002 (1591 GICs of Rural WSS, 982 GICs of irrigation and 102 mixed GICs).

During the year 2003, 108 GICs were certified (50 GICs of Rural WSS, 45 GICs of irrigation and 13 mixed GICs) and 71 GICs were dissolved or integrated with other GICs (60 GICs of Rural WSS, 9 GICs of irrigation and 2 mixed GICs). At the end of the year 2003, the total number of GICs reached 2717 including 1581 GICs of Rural WSS, 1022 GICs of irrigation and 114 mixed GICs. The repartition of these GICs according to the regions shows that 1078 GICs, i.e. 39.5% are mainly found in the North, 1028 GICs, i.e. 38% are in the centre and 611 GICs, i.e. are in the southern part of the country.

Among the 1581 GICs/RWS certified at the end of 2003, 770 GICs were the subjects of this valuation i.e. 49%.

This report proposes to recapitulate the results of the operation of the GIC/RWS for the year 2003. It includes three major chapters:

I- Technical analysis of operation of the Rural WSS,

II- Financial analysis of Rural WSS/GIC,

III- Administrative and social organization of the GICs.

CHAPTER I - TECHNICAL ANALYSIS OF THE OPERATION OF THE RURAL WSS

I - 1 - Number of the supplied families

The total number of the families supplied by the 770 GICs, subject of this evaluation, amounts to 108353, i.e. an average of 141 families per Rural WSS (705 inhabitant).

The families supplied by the Rural WSS are mainly found in Kairouan (25088 i.e. %) and in Kasserine (19291 i.e. %).

The number of families per collective service installation amounts to 19 families or 95 inhabitants.

Appendix 1 shows the repartition of the number of families supplied by region.

I - 2 - Service points:

The total number of the service points amounts to 18674 distributed as follows:

Table I: Repartition of the service points

Type of service point	Number	%
Communal tap	4862	26%
Potence	812	4.5%
Connections for public institutions	994	5.5%
Private connections	12006	64%
Total	**18674**	**100%**

- The total number of the service points amounts to 18674 including 12006 individual connections, 4862 communal taps, 812 Potences and 994 connections for public institutions.
- The number of individual connections is 12006 i.e. 64% of the service points. Individual connections are the most abundant in the majority of the governorates but more clearly in the regions of Kairouan (3388 individual connections i.e. 28.2%), Jendouba (2760 individual connections i.e. 23%) and Kasserine (2066 individual connections i.e. 17%). Appendix 2 indicates the repartition of the service points by region.

I - 3 - Water production and counting by GICs:

In 2003, the total volume of water planned to be produced by the 770 GICs amounts to 9.306 million m^3 and the volume really achieved amounts to 9.05 million m^3 i.e. representing an achievement rate of 97%. It should be noted that 59% of the production was achieved by

three governorates i.e. Kairouan (2.8 million m^3 i.e.31%), Béja (1.4 million m^3 i.e. 15%) and Kasserine (1.2 million m^3 i.e. 13%).

The average production by GICs is about 11760 m^3/GIC; it varies from 5000 m^3/ GICs in Medenine to 23 000 m^3/GICs in Kairouan.

The average counting rate (ratio between the production estimated by the counting and the total production) is about 71%. The highest counting rates were registered in:

- Mahdia and Sousse (100%),
- Sfax (94%),
- Gafsa and Jendouba (91%).

The lowest counting rates were registered in Zaghouan (37%) and in Béja (49%).

It should be signaled that the number of GICs that do not have flow meters amounts to 206 (i.e. 27% of GICs). These GICs are mainly found in the governorate of Kairouan 49 GICs (i.e. 24%), in Kasserine 33 GICs (16%), in Siliana 32 GICs (i.e. 15.5%) and in Bizerte 27 GICs (13%).

I - 4 - Average consumption per inhabitant and per day (liter/ inhabitant/day)

In 2003, the total production of water was 9.05 million m^3. The volume of water distributed is estimated to be 6.602 million m^3, the number of the beneficiary families was 108353 i.e. 541765 inhabitant. The average production per inhabitant and per day is estimated to be 46L/inhabitant/day. According to the volume of water distributed, the specific consumption is estimated to be 33L/inhabitant/day.

According to Appendix 3, the production of water per inhabitant and per day varies from 17L/inhabitant/day in Mahdia to 88L/inhabitant/day in Béja. The highest production per inhabitant was registered in:

- Béja 88L/inhabitant/day
- Gafsa 70L/inhabitant/day
- Zaghouan 62L/inhabitant/day
- And Kairouan 61L/inhabitant/day

The lowest average production per inhabitant was registered in:

- Mahdia 17 L/inhabitant/day
- Medenine 25 L/inhabitant/day

I - 5 -Disinfection of the production (chlorination):

The repartition of GICs, of the beneficiary families as well as the quantities of water produced according to the practice of disinfection is presented as follows:

Table 2: Repartition of GICs, beneficiary families and the quantities of water produced according to the disinfection

Chlorination	Regular	Irregular	Unpracticed	No information	Total
Number of GICs	453	184	35	98	770
%	59%	24%	5%	13%	100%
Water quantity per m^3	6.2	1.6	0.22	1.05	9.05
%	68%	18%	2%	12%	100%
Number of families	69898	21819	4035	12601	108353
%	65%	20%	4%	12%	100%

See appendix 7.

We notice that:

- 229 GICs i.e. 29% do not undertake a steady disinfection or do not practice it at all. These GICs are mainly found in Kasserine 63 GICs i.e.27.5% and in Bizerte 41 GICs i.e. 18%.
- 1.82 million m^3 i.e. 20% of the water production was distributed to the users without a steady disinfection, 60% of this quantity is produced in Kasserine 0.63 million of m^3, 0.318 million m^3 in Gafsa and 0.149 million m^3 in Siliana.
- 24% of the beneficiary families consumed water that is not steadily chlorinated or not treated at all.

I - 6 Efficiency of the Rural WSS (Technical losses):

The number of the Rural WSS that possess a counting of the production and the

distribution amounts to 566 Rural WSS (i.e. 73.5%). At the level of these Rural WSS, the volume of water produced amounts to 7.707 million m^3. Whereas, the volume of water distributed was 5.313 million m^3 i.e. an average global efficiency of 69%.

The efficiency of the weakest network was registered in Béja and Jendouba. Whereas, the highest efficiency was registered in Mahdia (94%), Zaghouan (89%) and Sfax (88%) (See Appendix 5).

The repartition of Rural WSS/GICs according to the rate of water losses is presented as follows:

Table 3: Repartition of GICs according to the rate of water losses

Loss rate	<15%	15%-30%	>=30%	Total
Number of GICs	221	191	154	566
%	39%	34%	27%	100%

Appendix 16 shows that the percentage of GICs that have a loss rate less than 15% are found in Mahdia (94% of GICs), in Medenine (80% of GICs), in Sfax (69% of GICs) and in Sousse (60% of GICs); whereas, the GICs having a water loss rate that exceeds 30% are found in Béja (74% of GICs), in Gafsa (58% of GICs), and in Jendouba (40% of GICs).

I - 7 - Availability of technical documents at the level of GICs:

(Completion drawing, network diagram and technical cards)

I - 7 - 1 Completion drawing:

The number of GICs that possess completion drawings amounts to 336 GICs i.e. 44% of the analyzed GICs. These GICs are mainly found in Mahdia (100% of GICs), in Zaghouan (89% of GICs) and in Medenine (66% of GICs) (see appendix 8).

I - 7 - 2 Network scheme:

The number of GICs that possess network schemes amounts to 560 GICs i.e. 73% of the analyzed GICs. These GICs are mainly found in Mahdia (100% of GICs), in Zaghouan and Bizerte (97% of GICs) in Kairouan (95% of GICs) and in Gafsa (94% of GICs) (see annex 8).

I - 7 - 3 Technical cards:

The number of GICs that possess technical cards of the installed equipment amounts to 360 GICs i.e. 47% of the analyzed GICs. These GICs are mainly found in Mahdia (100% of GICs), in Béja (88% of GICs) and in Medenine (82% of GICs) (see appendix 8).

CHAPTER II - FINANCIAL ANALYSIS OF THE RURAL WSS OPERATION:

II – 1 - Estimated O/M costs of the Rural WSS:

The global amount of the budget of the 770 GICs - subject of the evaluation- amounts to 4.11 million TD. The budget amount per GICs varies from 2.835 TD to 8.506 thousand TD / GIC. The average is 5.341 thousand TD / GIC (see appendix 9).

Water volume planned to be produced by the 770 GICs amounts to 3.9 million m^3. This volume varies from 4961m^3 to 22371 m^3 per GIC. The average is 12087 m^3/ GIC.

The average cost of the O/M of the Rural WSS amounts to 0.510 TD/m^3. The repartition of GICs according to the costs is presented as follows:

- 270 GICs i.e. 35% have costs inferior or equal to 0.450TD/m^3.
- 415 GICs i.e.54% have costs comprised between 0.450TD and 0.9TD /m^3.
- 85 GICs i.e.11% have costs more than 0.9TD/m^3.

Annex 10 presents the repartition of GICs according to the O/M costs of the Rural WSS.

The lowest O/M costs were registered in:

- Bizerte 0.431TD/m^3,
- Mahdia 0.459TD/m^3,
- Kairouan 0.463TD/m^3,
- Zaghouan 0.486TD/m^3.

The highest operation costs were registered in:

- Jendouba 0.640TD/m^3.
- Sousse 0.854TD/m^3.

In case of Sousse, this can be explained by the high percentage of GICs having a connection on SONEDE network. For Jendouba, this can be explained by the high percentage of the independent systems and the low consumption.

At the regional level, the highest rates of the GICs having costs less than 0.45TD/m^3 are found in Mahdia 69% of GICs, in Bizerte 51% of GICs, in Kairouan and Kasserine 45% of GICs. Whereas, the biggest proportion of the GICs the cost of which is judged high (>0.900DT/m^3) are found in Sousse 44% and in Sfax 15%. However, the GICs having a cost between 0.450 and 0.900TD/m^3 are predominant in Jendouba 81% of GICs, in Sfax 71% of GICs, in Gafsa 62% of GICs, and in Medenine 61% of GICs.

II - 1 - 1 - Repartition of GICs according to the recovery methods:

Among the 770 analyzed GICs, 755 GICs have information about the adopted recovery method i.e. 98%. The repartition of the GICs according to the recovery methods is presented as follows:

Table 4: Interaction between the operation cost and the recovery method

Recovery Method	Number of GICs	%
Flat Rate	190	25%
Commodity Charge	430	56%
Mixed Method	135	18%
No information	15	2%
Total	770	100%

The repartition of GICs according to the recovery method is presented in appendix 11.

II - 1 - 2 - Application of the estimated costs and flat rates:

Among the 190 GICs adopting flat rate as a recovery method, 119 GICs (63%) apply to the minimum the amounts of the flat rates that were estimated by the budget. While, among the 430 GICs that exclusively practice the commodity charge, 310 GICs i.e. 72% apply to the minimum the costs calculated in the budgets.

The highest percentage of GICs that apply the calculated amounts of the flat rate was registered in Kairouan (91%), in Béja (88%) and in Bizerte (67%); whereas, the lowest percentage was registered in Jendouba (9%), in Zaghouan and Kasserine (29%).

The highest percentage of the GICs applying to the minimum the calculated costs was registered in Mahdia (97%), in Béja and Gafsa (91%); whereas, the lowest percentage was registered in Kasserine (42%), in Bizerte (50%) and in Zaghouan (50%).

Appendix 12 indicates the repartition of the GICs that apply their budgets according to the recovery methods.

II - 2 - Real O/M costs:

For the 770 analyzed GICs, the total revenues achieved during the year 2003, amount to 3.57 million TD. However, the revenues related to the operation of the water system amount to 2.58 million TD i.e. 72% of the total revenues. Whereas, the total expenses during the same financial year amount to 2.5 million TD; and the expenses related to O/M of the water system were 2.3 million TD.

The global recovery rate of all the expenses (O/M and other expenses) is 140%.

The average revenues per m^3 amount to 0.392 TD/m^3. Whereas, the average expenses per m^3 are 0.351 TD/m^3 i.e. representing a recovery rate of the O/M of 112%.

The analysis of GICs balance sheet shows that:

- The expenses of the personnel represent 39% of the amount of the total expenses. This relatively high rate should be brought to a more reasonable one. Due to this fact, the GICs are requested to reduce the wage bill.
- Energy expenses represent 28% of the total expenses.
- The expenses of buying water represent 19% of the total expenses.
- **And maintenance expenses represent only 13% of the total expenses**.
- GICs expenses on aids and donations were estimated 120.154 thousand TD which represents 67% of the expenses apart from the operation and the maintenance of the Rural WSS and they also represent 41% of the maintenance expenses of the GICs during the same year.

II - 2 - 1 Collection rate of the flat rate:

The repartition of the GICs according to the collection rate of the flat rate is presented as follows:

- 65 GICs representing 34% have collection rates that are inferior or equal to 50%.
- 64 GICs representing 34% have collection rates between 50 and 80%.
- 34 GICs representing 18% have collection rates from 80 to 90%.
- 27 GICs representing 14% have collection rates that are more than 100%.

In case we group together the third and the fourth category, we notice that only 42% of the GICs that practice flat rate as a recovery method have collection rates which are 80% or more.

Appendix 13 indicates that the highest percentages of the GICs having a collection rate of flat rates which is lower than 50% are found in Kasserine (57%), in Kairouan and Bizerte (41%). Whereas, the highest percentages of the GICs having a collection rate which is 100% or more are found in Zaghouan (57%) and in Béja (19%).

II - 3 - Financial analysis of the Rural WSS operation:

The financial analysis concerns the 770 GICs retained for the valuation representing 49% of the certified GICs throughout the country. These GICs have all the information concerning the expectations and the achievements of water production, the revenues, the expenses and the number of beneficiary families.

II - 3 - 1 Connection of Forecast / achievement of the GICs:

Concerning the 770 analyzed GICs, the planned total volume of water amounts to 9.3 million m^3. While, the actually produced volume reached 9.05 million m^3, representing an achievement rate of 97%.

Table 5: The difference between the planned water volume and the water volume produced according to the recovery method

	Underestimation		Overestimation		Good forecast		Total	
	Number of GICs	%	Number of GICs	%	Number of GICs	%	Number of GICs	%
Recovery method	173	22	338	44	259	34	770	100
Commodity charge	101	24	197	46	132	30	430	56
Flat rate	30	16	78	41	82	43	190	25

See appendix 14.

We note that:

- 34% of GICs make good anticipations of the water volumes.
- 44% of GICs were accused of overestimation of the water volumes to produce.
- 22% of GICs were accused of underestimation of the water volumes to produce.

This allows us to conclude that an improvement of the quality of the GICs budgets is necessary. Moreover, a steady follow up of budgets execution allows the connection between the anticipations and the achievements. This follow up should be done for every GIC at the end of every term in order to intervene at the right time and to do the necessary corrections.

II - 3 - 2 Recovery of the expenses:

The recovery rate of the expenses is the ratio between the revenues and the expenses of O/M executed during the same financial year. At a national level, the average recovery rate of the expenditure amounts to 112%. It varies from 92% in Jendouba to 119% in Kasserine. The repartition of the GICs according to the expenditures' recovery rate is presented as follows:

Table 6: Repartition of the GICs according to the expenditures' recovery rate

	<50%	50-80%	80-100%	>=100%
Number of GICs	35	64	145	526
%	5%	8%	19%	68%

We notice that 68% of GICs registered expenditures' recovery rates that are 100% or more. Whereas, only 5% of GICs registered recovery rates that are less than 50%. This is basically due to the following facts:

- The GICs insures only the direct expenses (energy, workforce, and buying water).
- The GICs do not make any separation between the revenues of the ongoing financial year and those of the previous financial years and they do not insure a particular follow up of the debts of the previous years.

Appendix 15 shows the repartition of GICs according to the expenditures' recovery rate.

II - 3 - 3 Coverage of the O/M expenses:

The coverage of the O/M expenses is the ratio between the achieved average revenues per m^3 and the O/M cost initially calculated in the budget. This rate expresses the degree of GICs financial autonomy. The repartition of GICs according to the coverage of the O/M expenses is presented as follows:

- 141 GICs representing 18% of GICs have coverage less than 50%. These are mainly found in Zaghouan (46% of GICs), Kairouan (32% of GICs) and Kasserine (24% of GICs),
- 177 GICs representing 23% of GICs have coverage from 50 to 80%. These are mainly found in Jendouba (33% of GICs), Siliana (32% of GICs) and Bizerte (30% of GICs),
- 131 GICs representing 17% of GICs have coverage from 80 to 99%. These are mainly found in Sousse (36% of GICs) and Gafsa (30% of GICs),
- 321 GICs representing 42% of GICs have 100% or more coverage. These are mainly found Mahdia (69% of GICs), Sfax (63% of GICs) and Medenine (48% of GICs).

At the regional level, the average covering rate of the O/M expenses is 77%; it varies from 56% in Zaghouan to 109% in Mahdia.

Appendix 16 shows the repartition of GICs according to the coverage the O/M expenses.

II - 3 - 3 - 1 - 1 Analysis of the covering rate of the O/M expenses

II - 3 - 3 - 1 - 1 According to the recovery method

The repartition of GICs according to the recovery method and the covering rate for the O/M expenses is presented as follows:

Table 7: Interaction between the TCFEE and the recovery method

	Commodity charge			Flat rate			Mixed method		
TCFEE	<50%	50-80%	>=80%	<50%	50-80%	>=80%	<50%	50-80%	>=80%
Number of GICs	60	86	284	41	56	93	37	24	177
%	14%	20%	66%	22%	29%	49%	27%	24%	49%

See appendix 17.

We notice that:

- 66% of the GICs that practice commodity charge as a recovery method insured a TCFEE >= 80%.
- 49% of the GICs that practice commodity charge-flat rate as a recovery method insured a TCFEE >= 80%.
- 49% of the GICs that practice flat as a recovery method insured a TCFEE >= 80%.

II- 3 -3 -1- 2 According to the application of the budget:

The repartition of GICs according to the expenditures' recovery rate and the application of the budget is presented as follows:

Table 8: Interaction between the TCFEE and the application of the budget (GICs that practice commodity charge)

	GICs that stick to their budget			GICs that do not stick to their budget		
TCFEE	<50%	50-80%	>=80%	<50%	50-80%	>=80%
Number of GICs	33	55	222	27	31	62
%	11%	17%	72%	23%	26%	52%

We notice that:

- 72% of the GICs that stick to their budget can cover at least 80% of the expenses of the O/M of their water systems.
- Only 52% that do not stick to their budget can cover at least 80% of the O/M expenses (See appendix 18).

Table 9: Interaction between the TCFEE and the application of the budget (GICs that practice flat rate)

	GICs that stick to their budget			GICs that do not stick to their budget		
TCFEE	<50%	50-80%	>=80%	<50%	50-80%	>=80%
Number of GICs	24	30	65	17	26	28
%	20%	25%	54%	24%	37%	39%

See appendix 19.

We notice that:

- 54% of the GICs that stick to their budget can cover at least 80% of the expenses of the O/M of their water systems.
- Only 39% that do not stick to their budget can cover at least 80% of the O/M expenses.

II - 3 - 4 O/M expenses taken in charge by the GICs:

Taking in charge energy expenses:

For all the 770 GICs, subject of this valuation, energy total expenses amounted to 661356TD i.e. 28% of the operation total expenses for the year 2003. These expenses were 100% borne by GICs.

Taking in charge the expenses of the personnel:

For all the 770 GICs, subject of this valuation, the total expenses of the personnel amounted to 909642TD i.e. 39% of the operation total expenses for the year 2003. These

expenses were 100% borne by GICs.

Taking in charge maintenance costs:

For all the 770 GICs, subject of this valuation, the total expenses achieved in matters of maintenance of the Rural WSS, amounted to 290484TD i.e. 13% of the operation total expenses for the year 2003. These expenses represent only 33% of the maintenance cost included in the budget of the same year.

In order to enable the GICs to bear the expenses of maintenance of the Rural WSS, we added to the maintenance costs achieved during the year 2003 the balance of the GICs for the same year (Operation revenues 2003 - O/M expenses) while admitting that the balance of GICs must be allocated to the fund reserved for the maintenance of the Rural WSS. This balance was 267615TD. So GICs capacity to take in charge the maintenance costs can be calculated by the ratio between the total maintenance costs achieved plus GICs balance and the maintenance costs included in the budget for the same year.

GICs' capacity to take in charge maintenance costs = 56%.

CHAPTER III - ADMINISTRATIVE AND SOCIAL MANAGEMENT

III – 1 - Adhesion of the population:

During the year 2003, the average adhesion rate was 19%. It varies from 0% in Mahdia and Sousse to 43% in Béja. (See appendix 20).

The amount of money paid for adhesion varies from 0.5 to 5DT. The actual revenues of adhesion amount to 35273TD i.e. 1.4% of GICs total revenues.

III - 2 - Holding of the General assemblies:

The general assembly is an opportunity to gather the beneficiaries every year in order to inform them, sensitize them and to report to them the management results and to elect the members of the board of directors.

The prolonged delay in the organization of these meetings accentuates the gap between the beneficiaries and their GICs, weakens their associative behavior and can be the cause of some dissatisfaction towards the members of the board of directors.

In principle, each GIC is responsible for the annual organization of its own general assembly in conformity with the regulation. Yet, taking into account the present context where the members of the board of directors did not adequately assimilate the procedures and the fact that the population did not get used to these meetings or did not understand their advantages, the GICs found themselves obliged to make considerable efforts in order to organize these assemblies. However these efforts are still insufficient because of the lack of human and material means.

During the year 2003, the number of GICs having information about the holding of the general assembly amounts to 742 GICs i.e. 96% of the analyzed GICs. At the level of these GICs, the situation of the general assembly organization can be summarized as follows:

- 131 GICs i.e. 18% have no delay,
- 186 GICs i.e. 25% have 1 year delay,
- 158 GICs i.e. 21% have 2 years delay,
- 267 GICs i.e. 37% have 3 years delay.

If we add the 3rd category to the 4th one, we can say that 58% of GICs are inactive in matters of general assembly holding.

Appendix 21 presents the repartition of GICs according to the holding of general assemblies.

III - 3 - The making up of the GICs' board of directors:

During the year 2003, the number of the GICs that have information about the making up of their board of directors amounts to 758 i.e. 98% of the analyzed GICs.

The total number of the members of the board of directors amounts to 4014 members. Among them 1835 are active members i.e. 46%. Whereas, 54% of the members of the board of directors are inactive, i.e. the average is 2 active members per GIC.

We notice that 45% of the board of directors of GICs is composed of 6 members.

Appendix 22 indicates that 712 members (18%) are illiterate, representing an average of 1 member per board of director.

III - 4 - Management contract:

Management contract is the contract document that settles the responsibilities of both parties i.e. the CRDA and the GIC in matters of O/M of the water system. The number of GICs that have concluded a management contract with the CRDA amounts to 222 GIC i.e. 38%.

Based on appendix 24, the most advanced governorates in this field are Sfax (60 GICs), Kairouan (34 GICs), Bizerte (29 GICs), Siliana (22 GICs) and Jendouba (16 GICs).

III – 5 - Water standing charge contract:

Water standing charge contract is the document that settles the relationship between the GICs and its members. The number of GICs that apply the standing charge contract amounts to 231 GICs i.e. 30% of the analyzed GICs. The percentage of the beneficiaries that signed the standing charge contract amounts to 73%.

The most advanced governorates in this field are Kairouan (42 GICs), Gafsa (29 GICs), Sfax (29 GICs) Zaghouan (28 GICs) Bizerte (27 GICs) and Jendouba (25 GICs) (See appendix 25).

III - 6 - Holding of the operation record book and the follow up of the operation data

During the year 2003, 655 had marks concerning the holding of the operation record book and the follow up of the operation data. The repartition of these GICs appears as follow:

- 267 GICs i.e. 41% had a mark 7/10 or more (a good holding of the operation record book).
- 258 GICs i.e.39% had a mark between 5 and 7/10 (operation record book moderately well held).
- 130 GICs i.e. 20% had a mark less than 5/10 (operation record book badly held).

This data indicates that around 60% of GICs need training and/or supervision in matters of holding the operation record book and the follow up of the operation data; in addition to, the sensitization of the members of the board of directors about the advantage and the importance of the follow up of the Rural WSS operation data. These GIC are mainly found in Kairouan (68 GICs), Sfax and Siliana (15 GICs).

III - 7 - Holding of the accounting document and the follow up of the financial management:

During the year 2003, 655 had marks concerning the holding of the accounting document and the follow up of the financial management. The repartition of these GICs appears as follow:

- 386 GICs i.e. 59% had a mark 7/10 or more (Those were the GICs that insured a good holding of their accounting documents and follow their financial management).
- 155 GICs i.e. 24% had a mark between 5 and 7/10 (Those were the GICs whose accounting documents were moderately well held and insured an average follow of their financial management).
- 114 GICs i.e. 17% had a mark less than 5/10 (GICs with a badly held accounting document and they do no not follow their financial management).

This data indicates that around 41% of GICs need training and/or supervision in matters of holding the accounting document and the follow up of the financial management. This situation can be improved either by recruiting operation agents having an educational level that allows them to hold the accounting documents and the follow up of the financial management; or by subcontracting this task to private accountants. (See appendix 27).

III - 8 - Valuation of the GICs functionality:

The number of GICs having all the information necessary for the valuation of the functionality amounts to 655 GICs. The result of analysis of the GICs sample indicates that:

- 113 GICs i.e. 17% are considered functional.
- 366 GICs i.e. 56% are considered as average GICs.
- 175 GICs i.e. 27% are considered as weak GICs.

We notice that the highest percentage of the well functioning GICs is found in Mahdia (87%); whereas, the highest percentage of the named weak GICs is found in Gafsa (47%), and in Bizerte and Kairouan (45%). (See appendix 28).

Table 1

Number of Beneficiary Families				
Governorate	Number of GIC	Number of Beneficiary Families	Number of Beneficiary Families / Number of GIC	Rank
Beja	65	8,549	132	4
Bizerte	74	8,404	114	5
Gafsa	53	5,655	107	9
Jendouba	42	6,789	162	6
Kairouan	122	25,088	206	1
Kasserine	113	19,291	171	2
Mahdia	32	6,570	205	7
Medenine	44	4,903	111	10
Sfax	87	12,103	139	3
Siliana	78	6,367	82	8
Sousse	25	1,711	68	12
Zaghouan	35	2,923	84	11
Total	770	108,353	141	

Table 2

Service Installations								
Governorate	Number of GIC	Number of Beneficiary Families	Communal Tap (BF)	Potence	Particular Connection to Public Institutions	Private Connection	Total of Service Installations	Private Connections / Total of Service Installations
Beja	65	8,549	346	4	67	824	1,241	66%
Bizerte	74	8,404	554	1	83	481	1,119	43%
Gafsa	53	5,655	127	171	89	575	962	60%
Jendouba	42	6,789	375	0	100	2,760	3,235	85%
Kairouan	122	25,088	1,269	98	199	3,388	4,954	68%
Kasserine	113	19,291	969	247	180	2,066	3,462	60%
Mahdia	32	6,570	243	14	8	36	301	12%
Medenine	44	4,903	177	38	49	171	435	39%
Sfax	87	12,103	241	199	108	1,274	1,822	70%
Siliana	78	6,367	313	13	67	34	427	8%
Sousse	25	1,711	77	3	13	37	130	28%
Zaghouan	35	2,923	171	24	31	360	586	61%
Total	770	108,353	4,862	812	994	12,006	18,674	64%

Table 3

Water Production Estimated and Metered									
Governorate	Number of GIC	Number of Beneficiary Families	Water Metered	Water Estimated	Total of Water Produced	Metered Rate	lpcd	GIC without Metering	Rate of GIC without Metering
Beja	65	8,549	676,317	690,223	1,366,540	49%	88	2	3%
Bizerte	74	8,404	292,926	146,461	439,387	67%	29	27	36%
Gafsa	53	5,655	658,182	66,560	724,742	91%	70	8	15%
Jendouba	42	6,789	503,895	47,355	551,250	91%	44	6	14%
Kairouan	122	25,088	2,029,256	746,543	2,775,799	73%	61	49	40%
Kasserine	113	19,291	753,311	416,479	1,169,790	64%	33	33	29%
Mahdia	32	6,570	205,113		205,113	100%	17	0	0%
Medenine	44	4,903	170,518	49,550	220,068	77%	25	11	25%
Sfax	87	12,103	614,025	38,063	652,088	94%	30	15	17%
Siliana	78	6,367	303,526	176,467	479,993	63%	41	32	41%
Sousse	25	1,711	140,010	0	140,010	100%	45	0	0%
Zaghouan	35	2,923	123,081	207,600	330,681	37%	62	23	66%
Total	770	108,353	6,470,160	2,585,301	9,055,461	71%	46	206	27%

lpcd: liter per capita per day

Table 4

Per Capita Per Day Consumption (lpcd)							
Governorate	Number of GIC	Number of Beneficiary Families	Water Metered	Water Estimated	Total of Water Produced	Water Distributed	lpcd
Beja	65	8,549	676,317	690,223	1,366,540	613,581	39
Bizerte	74	8,404	292,926	146,461	439,387	373,479	24
Gafsa	53	5,655	658,182	66,560	724,742	631,595	61
Jendouba	42	6,789	503,895	47,355	551,250	294,885	24
Kairouan	122	25,088	2,029,256	746,543	2,775,799	1,959,260	43
Kasserine	113	19,291	753,311	416,479	1,169,790	983,269	28
Mahdia	32	6,570	205,113		205,113	192,553	16
Medenine	44	4,903	170,518	49,550	220,068	197,014	22
Sfax	87	12,103	614,025	38,063	652,088	576,283	26
Siliana	78	6,367	303,526	176,467	479,993	407,994	35
Sousse	25	1,711	140,010	0	140,010	90,996	29
Zaghouan	35	2,923	123,081	207,600	330,681	281,904	53
Total	770	108,353	6,470,160	2,585,301	9,055,461	6,602,813	33

lpcd: liter per capita per day

Table 5

Efficiency of Water Supply System						
Governorate	Number of GIC	Water Metered	Water Estimated	Total of Water Produced	Water Distributed	Efficiency
Beja	65	676,317	690,223	1,366,540	613,581	45%
Gafsa	53	658,182	66,560	724,742	492,950	68%
Jendouba	42	503,895	47,355	551,250	294,885	53%
Kairouan	122	2,029,256	746,543	2,775,799	1,959,260	71%
Kasserine	113	753,311	416,479	1,169,790	983,269	84%
Mahdia	32	205,113		205,113	192,553	94%
Medenine	25	89,240	9,350	98,590	88,858	90%
Sfax	87	614,025	38,063	652,088	576,283	88%
Sousse	25	140,010	0	140,010	90,996	65%
Zaghouan	2	23,500	0	23,500	20,800	89%
Total	566	5,692,849	2,014,573	7,707,422	5,313,435	69%

Table 6

Distribution of GIC according to UFW (Unaccounted-for Water) Rate

Governorate	Number of GIC	<15%	%	15-30%	%	>=30%	%
		Number		Numbeer		Number	
Beja	65	16	25%	1	2%	48	74%
Gafsa	53	6	11%	16	30%	31	58%
Jendouba	42	11	26%	14	33%	17	40%
Kairouan	122	27	22%	47	39%	48	39%
Kasserine	113	35	31%	78	69%	0	0%
Mahdia	32	30	94%	1	3%	1	3%
Medenine	25	20	80%	4	16%	1	4%
Sfax	87	60	69%	27	31%	0	0%
Sousse	25	15	60%	2	8%	8	32%
Zaghouan	2	1	50%	1	50%	0	0%
Total	566	221	39%	191	34%	154	27%

Table 7

Disinfection

Governorate	Number of GIC	Number of Beneficiary Families	Total of Water Produced	Regular Disinfection						Intermittent Disinfection						Non-Disinfection					
				Volume		No. of Families		GIC		Volume		No. of Families		GIC		Volume		No. of Families		GIC	
				m3	%	No.	%	No.	%	m3	%	No.	%	No.	%	m3	%	No.	%	No.	%
Beja	65	8,549	1,366,540	1,235,394	90	7,451	87	56	86	55,780	4	487	6	5	8	75,366	6	611	7	4	6
Bizerte	74	8,404	439,387	222,845	51	3,787	45	33	45	86,195	20	1,777	21	15	20	0	0	0	0	0	0
Gafsa	53	5,655	724,742	385,817	53	3,505	62	30	57	318,497	44	1,940	34	19	36	0	0	0	0	0	0
Jendouba	42	6,789	551,250	439,287	80	5,001	74	30	71	38,023	7	803	12	7	17	0	0	0	0	0	0
Kairouan	122	25,088	2,775,799	1,950,647	70	16,846	67	63	52	0	0	0	0	0	0	825,152	30	8,242	33	59	48
Kasserine	113	19,291	1,169,790	533,573	46	9,128	47	50	44	636,217	54	10,163	53	63	56	0	0	0	0	0	0
Mahdia	32	6,570	205,113	197,410	96	6,025	92	30	94	7,703	4	545	8	2	6	0	0	0	0	0	0
Medenine	44	4,903	220,068	33,805	15	679	14	4	9	42,855	19	614	13	6	14	143,408	65	3,610	74	34	77
Sfax	87	12,103	652,088	577,528	89	10,713	89	69	79	74,560	11	1,390	11	18	21	0	0	0	0	0	0
Siliana	78	6,367	479,993	318,047	66	4,014	63	48	62	149,070	31	2,215	35	29	37	12,876	3	138	2	1	1
Sousse	25	1,711	140,010	133,515	95	1,426	83	23	92	6,495	5	285	17	2	8	0	0	0	0	0	0
Zaghouan	35	2,923	330,681	154,581	47	1,323	45	17	49	176,100	53	1,600	55	18	51	0	0	0	0	0	0
Total	770	108,353	9,055,461	6,182,449	68	69,898	65	453	59	1,591,495	18	21,819	20	184	24	1,056,802	12	12,601	12	98	13

Table 8

Situation of GIC on the Preparation of Necessary Documents							
Governorate	Number of GIC	Completion Drawings (of Construction Works)		Pipeline System Plan		Technical Documents	
		Number	%	Number	%	Number	%
Beja	65	38	58%	58	89%	57	88%
Bizerte	74	23	31%	72	97%	14	19%
Gafsa	53	9	17%	50	94%	29	55%
Jendouba	42	6	14%	36	86%	9	21%
Kairouan	122	68	56%	116	95%	75	61%
Kasserine	113	38	34%	19	17%	18	16%
Mahdia	32	32	100%	32	100%	32	100%
Medenine	44	29	66%	30	68%	36	82%
Sfax	87	33	38%	58	67%	43	49%
Siliana	78	20	26%	43	55%	27	35%
Sousse	25	9	36%	12	48%	2	8%
Zaghouan	35	31	89%	34	97%	18	51%
Total	770	336	44%	560	73%	360	47%

Table 9

Budget and Resuto on Operaion, Maintenance and Management (OM/M) Cost of Drinking Water GICs during 2003

Governorate	Number of GIC	Planned Water Production	Planned Water Distribution	OM/M Budget	Actual Water Production	Actual Water Distribtuion	Actual OM/M Cost	Reveneu for OM/M Cost	Applied Water Charge / m3 (DT)	Actual Revenue /m3 (DT)	Actual Cost /m3 (DT)	Ratio of Revenue and Cost	Ratio of Water Charge and OM/M Cost
Beja	65	831,021	738,085	361,002	1,366,540	613,581	250,223	251,459	0.489	0.410	0.408	100%	84%
Bizerte	74	589,449	542,328	233,928	439,387	373,479	108,895	143,380	0.431	0.384	0.292	132%	89%
Gafsa	53	676,758	591,760	297,452	724,742	631,595	167,707	261,462	0.503	0.414	0.266	156%	82%
Jendouba	42	457,750	389,088	248,910	551,250	294,885	149,388	137,128	0.640	0.465	0.507	92%	73%
Kairouan	122	2,729,225	2,239,854	1,037,767	2,775,799	1,959,260	543,274	564,763	0.463	0.288	0.277	104%	62%
Kasserine	113	1,453,390	1,274,553	663,130	1,169,790	983,269	327,018	387,806	0.520	0.394	0.333	118%	76%
Mahdia	32	346,600	346,600	159,260	205,113	192,553	88,223	96,026	0.459	0.499	0.458	109%	109%
Medenine	44	320,678	274,872	168,923	220,068	197,014	87,430	96,813	0.615	0.491	0.444	111%	80%
Sfax	87	952,077	838,718	488,197	652,088	576,283	310,898	349,131	0.582	0.606	0.539	112%	104%
Siliana	78	493,693	430,193	221,095	479,993	407,994	142,123	156,709	0.514	0.384	0.348	110%	75%
Sousse	25	124,020	111,958	95,584	140,010	90,996	64,639	67,633	0.854	0.743	0.710	105%	87%
Zaghouan	35	332,000	282,200	137,245	330,681	282,924	76,776	77,585	0.486	0.274	0.271	101%	56%
Total	770	9,306,661	8,060,209	4,112,493	9,055,461	6,603,833	2,316,594	2,589,895	0.510	0.392	0.351	112%	77%

Table 10

Distribtuion of GIC according to OM/M Cost of Water Supply System

Governorate	Number of GIC	<=0.450	%	0.450-0.900	%	>0.900	%
Beja	65	25	738,085	361,002	1,366,540	613,581	250,223
Bizerte	74	38	542,328	233,928	439,387	373,479	108,895
Gafsa	53	14	591,760	297,452	724,742	631,595	167,707
Jendouba	42	8	389,088	248,910	551,250	294,885	149,388
Kairouan	122	55	2,239,854	1,037,767	2,775,799	1,959,260	543,274
Kasserine	113	51	1,274,553	663,130	1,169,790	983,269	327,018
Mahdia	32	22	346,600	159,260	205,113	192,553	88,223
Medenine	44	13	274,872	168,923	220,068	197,014	87,430
Sfax	87	8	838,718	488,197	652,088	576,283	310,898
Siliana	78	20	430,193	221,095	479,993	407,994	142,123
Sousse	25	2	111,958	95,584	140,010	90,996	64,639
Zaghouan	35	14	282,200	137,245	330,681	282,924	76,776
Total	770	270	8,060,209	4,112,493	9,055,461	6,603,833	2,316,594

Table 11

Repartition of GIC according to the recovery method

Governorates	Number of GIC	Commodity charge	%	Flat rate	%	Commodity charge-flat rate	%	No information	%
Beja	65	35	54%	16	25%	14	22%	0	0%
Bizerte	74	8	11%	66	89%	0	0%	0	0%
Gafsa	53	53	100%	0	0%	0	0%	0	0%
Jendouba	42	31	74%	11	26%	0	0%	0	0%
Kairouan	122	68	56%	34	28%	20	16%	0	0%
Kasserine	113	73	65%	14	12%	26	23%	0	0%
Mahdia	32	31	97%	0	0%	0	0%	1	3%
Medenine	44	32	73%	0	0%	0	0%	12	27%
Sfax	87	64	74%	0	0%	23	26%	0	0%
Siliana	78	8	10%	35	45%	33	42%	2	3%
Sousse	25	25	100%	0	0%	0	0%	0	0%
Zaghouan	35	2	6%	14	40%	19	54%	0	0%
Total	770	430	56%	190	25%	135	18%	15	2%

Table 12

Repartition of GICs according to the application of the projected costs and flat rates

Governorates	Nber GIC	GICs that practice commodity charge					GICs that practice flate rate				
		Nber GIC	GIC that apply	%	GIC that donot apply	%	Nber GIC	GIC that apply	%	GIC that donot apply	%
Beja	65	35	32	91%	3	9%	16	14	88%	2	13%
Bizerte	74	8	4	50%	4	50%	66	44	67%	22	33%
Gafsa	53	53	48	91%	5	9%					
Jendouba	42	31	23	74%	8	26%	11	1	9%	10	91%
Kairouan	122	68	47	69%	21	31%	34	31	91%	3	9%
Kasserine	113	73	31	42%	42	58%	14	4	29%	10	71%
Mahdia	32	31	30	97%	1	3%					
Medenine	44	32	19	59%	13	41%					
Sfax	87	64	48	75%	16	25%					
Siliana	78	8	7	88%	1	13%	35	21	60%	14	40%
Sousse	25	25	20	80%	5	20%					
Zaghouan	35	2	1	50%	1	50%	14	4	29%	10	71%
Total	770	430	310	72%	120	28%	190	119	63%	71	37%

Table 13

Repartition of GIC according to the collection rate of flat rate

Governorates	Flat rate	<=50%		50%-80%		80%-100%		>100%	
		Nber GIC	%	Nber GIC	%	Nber GIC	%	Nber GIC	%
Beja	16	5	31%	4	25%	4	25%	3	19%
Bizerte	66	27	41%	26	39%	7	11%	6	9%
Gafsa	0								
Jendouba	11	4	36%	5	45%	2	18%	0	0%
Kairouan	34	14	41%	13	38%	3	9%	4	12%
Kasserine	14	8	57%	1	7%	4	29%	1	7%
Mahdia	0								
Medenine	0								
Sfax	0								
Siliana	35	5	14%	14	40%	11	31%	5	14%
Sousse	0								
Zaghouan	14	2	14%	1	7%	3	21%	8	57%
Total	190	65	34%	64	34%	34	18%	27	14%

Table 14

Quality of GIC forecast for the year 2003

Governorates	Nber GIC	GIC that were accused of an over estimation		GIC that were accused of an under estimation		GIC that made a good forecat	
		Nbre	%	Nbre	%	Nbre	%
Beja	65	4	6%	48	74%	13	20%
Bizerte	74	37	50%	0	0%	37	50%
Gafsa	53	22	42%	14	26%	17	32%
Jendouba	42	17	40%	12	29%	13	31%
Kairouan	122	56	46%	33	27%	33	27%
Kasserine	113	61	54%	17	15%	35	31%
Mahdia	32	22	69%	0	0%	10	31%
Medenine	44	29	66%	7	16%	8	18%
Sfax	87	54	62%	6	7%	27	31%
Siliana	78	20	26%	20	26%	38	49%
Sousse	25	8	32%	7	28%	10	40%
Zaghouan	35	8	23%	9	26%	18	51%
Total	**770**	338	44%	173	22%	259	34%
Repartition according to the recovery method adgoted		197 commodity charge	46%	101 commodity charge	23%	132 commodity charge	31%
		78 cot	41%	30 cot	16%	82 cot	43%

Table 15

Repartition of GIC according to the expenses recovery rate

Governorates	Nber GIC	<=50%		50%-80%		80%-100%		>100%	
		Nber GIC	%	Nber GIC	%	Nber GIC	%	Nber GIC	%
Beja	65	5	8%	4	6%	9	14%	47	72%
Bizerte	74	0	0%	0	0%	0	0%	74	100%
Gafsa	53	0	0%	4	8%	7	13%	42	79%
Jendouba	42	1	2%	4	10%	16	38%	21	50%
Kairouan	122	1	1%	13	11%	39	32%	69	57%
Kasserine	113	24	21%	17	15%	8	7%	64	57%
Mahdia	32	0	0%	5	16%	4	13%	23	72%
Medenine	44	3	7%	4	9%	6	14%	31	70%
Sfax	87	1	1%	9	10%	23	26%	54	62%
Siliana	78	0	0%	4	5%	20	26%	54	69%
Sousse	25	0	0%	0	0%	5	20%	20	80%
Zaghouan	35	0	0%	0	0%	8	23%	27	77%
Total	770	35	5%	64	8%	145	19%	526	68%

Table 16

Repartition of GIC according to the coverage rateof the operation and maintenance costs

Governorates	Nber GIC	<=50%		50%-80%		80%-100%		>100%	
		Nber GIC	%	Nber GIC	%	Nber GIC	%	Nber GIC	%
Beja	65	15	23%	15	23%	9	14%	26	40%
Bizerte	74	2	3%	22	30%	17	23%	33	45%
Gafsa	53	6	11%	9	17%	16	30%	22	42%
Jendouba	42	6	14%	14	33%	9	21%	13	31%
Kairouan	122	39	32%	21	17%	19	16%	43	35%
Kasserine	113	27	24%	27	24%	8	7%	51	45%
Mahdia	32	1	3%	4	13%	5	16%	22	69%
Medenine	44	8	1%	10	23%	5	11%	21	48%
Sfax	87	1	8%	17	20%	14	16%	55	63%
Siliana	78	17	1%	25	32%	14	18%	22	28%
Sousse	25	3	22%	4	16%	9	36%	9	36%
Zaghouan	35	16	46%	9	26%	6	17%	4	11%
Total	770	141	18%	177	23%	131	17%	321	42%

Table 17

Interaction between the recovery method and the coverage rate of the operation

Governorates	Commodity charge									Flat rate									Commodity charge -Flat rate								
	<50%		50%-80%		80%-100%		>=100%		s/ total	< 50%		50%-80%		80%-100%		>=100%		s/ total	< 50%		50%-80%		80%-100%		>=100%		s/ total
	Nbre	%	Nbre	%	Nbre	%	Nbre	%		Nbre	%	Nbre	%	Nbre	%	Nbre	%		Nbre	%	Nbre	%	Nbre	%	Nbre	%	
Beja	8	23%	7	20%	6	17%	14	40%	35	2	13%	5	31%	2	13%	7	44%	16	5	36%	3	21%	1	7%	5	36%	14
Bizerte	0	0%	1	13%	1	13%	6	75%	8	2	3%	21	32%	16	24%	27	41%	66									
Gafsa	6	11%	9	17%	16	30%	22	42%	53																		
Jendouba	2	6%	9	29%	8	26%	12	39%	31	4	36%	5	45%	1	9%	1	9%	11									
Kairouan	13	19%	14	21%	11	16%	30	44%	68	17	50%	5	15%	4	12%	8	24%	34	9	45%	2	10%	4	20%	5	25%	20
Kasserine	17	23%	15	21%	5	7%	36	49%	73	4	29%	4	29%	1	7%	5	36%	14	6	23%	8	31%	2	8%	10	38%	26
Mahdia	1	3%	4	13%	4	13%	22	71%	31																		
Mednine	6	19%	8	25%	2	6%	16	50%	32																		
Sfax	0	0%	11	17%	10	16%	43	67%	64										1	4%	6	26%	4	17%	12	52%	23
Siliana	2	25%	4	50%	0	0%	2	25%	8	7	20%	12	34%	5	14%	11	31%	35	7	21%	8	24%	9	27%	9	27%	33
Sousse	3	12%	4	16%	9	36%	9	36%	25																		
Zaghouan	2	100%	0	0%	0	0%	0	0%	2	5	36%	4	29%	2	14%	3	21%	14	9	47%	5	26%	4	21%	1	5%	19
Total	60	14%	86	20%	72	17%	212	49%	430	41	22%	56	29%	31	16%	62	33%	190	37	27%	32	24%	24	18%	42	31%	135

Table 18

Impact of the application of the budget on the TCFEE 1 (Coverage rate of the operation and maintenance costs)

Governorates	Commodity charge and GIC that stick to their budgets									Commodity charge and GIC that do not stick to their budgets								
	<50%		50%-80%		80%-100%		>=100%		S/Total	<50%		50%-80%		80%-100%		>=100%		S/Total
	Nbre	%	Nbre	%	Nbre	%	Nbre	%		Nbre	%	Nbre	%	Nbre	%	Nbre	%	
Beja	7	22%	5	16%	6	19%	14	44%	32	1	33%	2	67%	0	0%	0	0%	3
Bizerte	0	0%	0	0%	1	25%	3	75%	4	0	0%	1	25%	0	0%	3	75%	4
Gafsa	4	8%	8	17%	16	33%	20	42%	48	2	40%	1	20%	0	0%	2	40%	5
Jendouba	2	9%	8	35%	5	22%	8	35%	23	0	0%	1	13%	3	38%	4	50%	8
Kairouan	9	19%	8	17%	9	19%	21	45%	47	4	19%	6	29%	2	10%	9	43%	21
Kasserine	5	16%	8	26%	3	10%	15	48%	31	12	29%	7	17%	2	5%	21	50%	42
Mahdia	0	0%	4	13%	4	13%	22	73%	30	1	100%	0	0%	0	0%	0	0%	1
Medenine	3	0%	5	26%	3	16%	8	42%	19	3	23%	3	23%	0	0%	7	54%	13
Sfax	0	0%	4	8%	4	8%	40	83%	48	0	0%	7	44%	6	38%	3	19%	16
Siliana	1	0%	4	57%	0	0%	2	29%	7	1	100%	0	0%	0	0%	0	0%	1
Sousse	1	0%	1	5%	9	45%	9	45%	20	2	40%	3	60%	0	0%	0	0%	5
Zaghouan	1	25%	0	0%	0	0%	0	0%	1	1	100%	0	0%	0	0%	0	0%	1
Total	33	20%	55	18%	60	19%	162	52%	310	27	23%	31	26%	13	11%	49	41%	120

Table 19

Impact of the application of the budget on the TCFEE2																	
Governorates	Flate rate and GIC that stick to their budgets									Flate rate and GIC that do not stick to their budgets									
	<50%		50%-80%		80%-100%		>=100%		S/Total	<50%		50%-80%		80%-100%		>=100%		S/Total
	Nbre	%	Nbre	%	Nbre	%	Nbre	%		Nbre	%	Nbre	%	Nbre	%	Nbre	%	
Beja	1	7%	4	29%	2	14%	7	50%	14	1	50%	1	50%	0	0%	0	0%	2
Bizerte	1	2%	13	30%	11	25%	19	43%	44	1	5%	8	36%	5	23%	8	36%	22
Gafsa																		
Jendouba	0	0%	0	0%	1	100%	0	0%	1	4	40%	5	50%	0	0%	1	10%	10
Kairouan	15	48%	4	13%	4	13%	8	26%	31	2	67%	1	33%	0	0%	0	0%	3
Kasserine	1	25%	1	25%	1	25%	1	25%	4	3	30%	3	30%	0	0%	4	40%	10
Mahdia																		
Medenine																		
Sfax																		
Siliana	5	24%	7	33%	3	14%	6	29%	21	2	14%	5	36%	2	14%	5	36%	14
Sousse																		
Zaghouan	1	25%	1	25%	1	25%	1	25%	4	4	40%	3	30%	1	10%	2	20%	10
Total	24	20%	30	25%	23	19%	42	35%	119	17	24%	26	37%	8	11%	20	28%	71

Table 20

Adhesion of thepopulation							
Governorates	Number of GIC	Number of GIC/adhesion	%	Real/ beneficiaries	Real/members	%	Revenues/adhesion
Beja	65	38	58%	8549	3661	43%	7686
Bizerte	74	66	89%	8404	2733	33%	4095
Gafsa	53	32	60%	5655	1604	28%	2815
Jendouba	42	2	5%	6789	223	3%	1205
Kairouan	122	22	18%	25088	2351	9%	2256
Kasserine	113	84	74%	19291	6870	36%	13413,8
Mahdia	32	0	0%	6570	0	0%	0
Medenine	44	11	25%	4903	319	7%	602
Sfax	87	11	13%	12103	1450	12%	847,5
Siliana	78	25	32%	6367	1438	23%	2015
Sousse	25	0	0%	1711	0	0%	0
Zaghouan	35	5	14%	2923	277	9%	338
Total	770	296	38%	108353	20926	19%	3527,3

Table 21

Organization of general assemblies

Governorates	GIC that have information		GIC withant delay		GIC having one year delay		GIC having 2 years delay		GIC having 3 years delay	
	Nbre	%	Nbre	%	Nbre	%	Nbre	%	Nbre	%
Beja	65	100%	2	3%	0	0%	31	48%	32	49%
Bizerte	74	100%	20	27%	0	0%	12	16%	42	57%
Gafsa	53	100%	1	2%	49	92%	2	4%	1	2%
Jendouba	42	100%	27	64%	0	0%	8	19%	7	17%
Kairouan	122	100%	38	31%	1	1%	37	30%	46	38%
Kasserine	112	99%	0	0%	63	56%	25	22%	24	21%
Mahdia	32	100%	25	78%	7	22%	0	0%	0	0%
Medenine	43	98%	18	42%	25	58%	0	0%	0	0%
Sfax	87	100%	0	0%	12	14%	17	20%	58	67%
Siliana	68	87%	0	0%	0	0%	12	18%	56	82%
Sousse	25	100%	0	0%	10	40%	14	56%	1	4%
Zaghouan	19	54%	0	0%	19	100%	0	0%	0	0%
Total	742	96%	131	18%	186	25%	158	21%	267	36%

Table 22

Number of the GIC 's member of the board of directors

Governorates	Nbre of GIC	Numbre of the member of the boards of directors	Active members	%	Illiterate members	%
Beja	64	324	125	39%	29	9%
Bizerte	72	465	262	56%	129	28%
Gafsa	53	276	152	55%	76	28%
Jendouba	42	225	76	34%	30	13%
Kairouan	122	705	297	42%	136	19%
Kasserine	113	665	323	49%		0%
Mahdia	28	154	41	27%	55	36%
Medenine	40	171	90	53%	31	18%
Sfax	87	384	172	45%	60	16%
Siliana	77	414	148	36%	107	26%
Sousse	25	75	54	72%	24	32%
Zaghouan	35	156	95	61%	35	22%
Total	758	4014	1835	46%	712	18%

Table 23

Repartition of GIC according to the number of the member of the board of directors

Governorates	Nbre of GIC	Board of directors composed of 3 members	%	Board of directors composed of 6 members	%	Board of directors composed of 9 members	%
Beja	64	26	41%	32	50%	6	9%
Bizerte	72	10	14%	41	57%	21	29%
Gafsa	53	17	32%	33	62%	3	6%
Jendouba	42	18	43%	15	36%	9	21%
Kairouan	122	36	30%	59	48%	27	22%
Kasserine	113	25	22%	68	60%	20	18%
Mahdia	28	10	36%	12	43%	6	21%
Medenine	40	27	68%	9	23%	4	10%
Sfax	87	57	66%	19	22%	11	13%
Siliana	77	27	35%	39	510%	11	14%
Sousse	25	25	100%	0	0%	0	0%
Zaghouan	35	19	54%	15	43%	1	3%
Total	758	297	39%	342	45%	119	16%

Table 24

Signing the management contract

Governorates	Nbr of GIC that have information	Nbr ofGIC that have a management contract	%
Beja	49	17	35%
Bizerte	71	29	41%
Gafsa	53	8	15%
Jendouba	42	16	38%
Kairouan	34	34	100%
Kasserine	113	10	9%
Mahdia	31	6	19%
Medenine	25	2	8%
Sfax	60	60	100%
Siliana	75	22	29%
Sousse	25	14	56%
Zaghouan	4	4	100%
Total	582	222	38%

Table 25

Aplication of member ship contract

Governorates	Nbr of GIC	Total beneficiary nbr	beneficiary have a nbr ship contract	%
Beja	17	2481	1164	47%
Bizerte	27	3740	3730	100%
Gafsa	29	2883	511	18%
Jendouba	25	4802	2474	52%
Kairouan	42	14015	14012	100%
Medenine	10	1015	219	22%
Sfax	29	3555	1811	51%
Siliana	19	1978	1600	81%
Sousse	5	377	166	44%
Zaghouan	28	2588	1483	57%
Total	231	37434	27170	73%

Table 26

Holding of the operation record book and the follow up of the operation data

Governorates	Weak		Average		Good		Nbre GIC
	Nbre	%	Nbre	%	Nbre	%	
Beja	0	0%	12	18%	53	82%	65
Bizerte	0	0%	66	89%	8	11%	74
Gafsa	0	0%	53	100%	0	0%	53
Jendouba	8	19%	14	33%	20	48%	42
Kairouan	68	56%	44	36%	10	8%	122
Kasserine	1	100%	0	0%	0	0%	1
Mahdia	3	10%	0	0%	28	90%	31
Medenine	7	16%	19	44%	17	40%	43
Sfax	15	17%	0	0%	72	83%	87
Siliana	15	19%	36	46%	27	35%	78
Sousse	0	0%	1	4%	24	96%	25
Zaghouan	13	38%	13	38%	8	24%	34
Total	130	20%	258	39%	267	41%	655

Table 27

Holding of the accounting document and the follow up of the financial management

Governorates	Weak		Average		Good		Nbre GIC
	Nbre	%	Nbre	%	Nbre	%	
Beja	1	2%	15	23%	49	75%	65
Bizerte	40	54%	0	0%	34	46%	74
Gafsa	12	23%	0	0%	40	75%	53
Jendouba	2	5%	18	43%	22	52%	42
Kairouan	46	38%	67	55%	9	7%	122
Kasserine	1	100%	0	0%	0	0%	1
Mahdia	3	10%	0	0%	28	90%	31
Medenine	2	5%	21	49%	20	47%	43
Sfax	0	0%	0	0%	87	100%	87
Siliana	2	3%	21	27%	55	71%	78
Sousse	0	0%	1	4%	24	96%	25
Zaghouan	5	15%	12	35%	18	53%	34
Total	114	17%	155	24%	386	59%	655

Table 28

Repartition of GIC according to the degree of frinctionality

Governorates	Weak GIC		Average GIC		Good GIC		Nbre GIC
	Nbre	%	Nbre	%	Nbre	%	
Beja	4	6%	32	49%	29	45%	65
Bizerte	33	45%	36	49%	5	7%	74
Gafsa	25	47%	28	53%	0	0%	53
Jendouba	16	38%	25	60%	1	2%	42
Kairouan	55	45%	64	52%	3	2%	122
Kasserine	1	100%	0	0%	0	0%	1
Mahdia	2	6%	1	3%	27	87%	31
Medenine	14	33%	26	60%	3	7%	43
Sfax	4	5%	55	63%	28	32%	87
Siliana	12	15%	53	68%	13	17%	78
Sousse	1	4%	20	80%	4	16%	25
Zaghouan	9	26%	26	76%	0	0%	34
Total	176	27%	366	56%	113	17%	655

Table 29

GIC Salaried employees

Governorates	Numbre of GIC that have information	Number of salaried employees	Salaried employees affiliated of CNSS	%	Technical director
Beja	64	82	1	1%	28
Bizerte	59	45	0	0%	0
Gafsa	53	55	3	5%	0
Jendouba	42	26	3	12%	16
Kairouan	99	141	2	1%	15
Kasserine	113	110	1	1%	0
Mahdia	29	182		0%	3
Medenine	34	32	0	0%	1
Sfax	87	103	12	12%	6
Siliana	75	63	0	0%	0
Sousse	25	52	1	2%	0
Zaghouan	24	24	11	46%	
Total	704	915	34	4%	69