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JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL INSTITUTE FOR WATER RESOURCES AND MANAGEMENT REPUBLIC OF CAPE VERDE

THE STUDY ON GROUNDWATER DEVELOPMENT IN [illegible] ISLAND IN THE REPUBLIC OF CAPE VERDE

FINAL REPORT

VOL. [illegible] MAIN REPORT

[illegible] 1999

KOKUSAI KOGYO CO., LTD., TOKYO
JAPAN TECHNO CO., LTD., TOKYO

JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL INSTITUTE FOR WATER
RESOURCES AND MANAGEMENT
REPUBLIC OF CAPE VERDE

THE STUDY ON GROUNDWATER DEVELOPMENT FOR SANTIAGO ISLAND IN THE REPUBLIC OF CAPE VERDE

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PREFACE

In response to a request from the Government of the Republic of Cape Verde, the Government of Japan decided to conduct a development study on Groundwater Development for Santiago Island in the Republic of Cape Verde and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Kunio Fujiwara of Kokusai Kogyo Co., Ltd. and consists of Kokusai Kogyo Co., Ltd. and Japan Techno Co., Ltd. to Cape Verde four times between March 1998 and September 1999.
The team held discussions with the officials concerned of the Government of Cape Verde, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Cape Verde for their close cooperation extended to the team.

September 1999

Kimio Fujita
President
Japan International Cooperation Agency

September 1999

Mr. Kimio Fujita

President,

Japan International Cooperation Agency

Tokyo, Japan

Letter of Transmittal

Dear Mr. Fujita,

We are pleased to submit to you the study report on the Groundwater Development for Santiago Island in the Republic of Cape Verde.

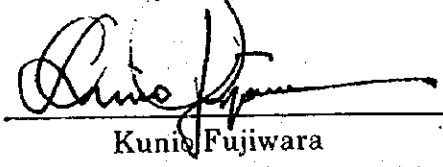
The report presents the study results on the present condition of the water supply in 205 communities in the Island and their categorization by service level as well as the groundwater development potential of the five-divided hydrogeological basins of the Island. Also addressed in the report is the plan for water supply project using groundwater as the supply source in the prioritized 34 villages.

This report consists of the hydrogeological map and four separate volumes, including the Summary, Main and Supporting Reports and Data Book. The Summary states concisely the whole study results. The Main Reports describes the results of the study and analysis including the project implementation plan for the prioritized villages and the evaluation of the project. The supporting report contains the inventory of the rural water supply facility in the Island, and methodology and analysis of the social survey. The Data Book contains the results of georesistivity survey and pumping tests, meteorological data and water source inventory.

We are confident that implementation of the proposed project would greatly contribute to improve the water supply conditions in the Santiago Island of the Republic of Cape Verde.

We wish to take this opportunity to express our sincere gratitude to your agency and the Japanese Embassy in Senegal. We also wish to express our deep appreciation to the National Institute for Water Resources and Management and other authorities concerned of the Government of the Republic of Cape Verde for the close cooperation and assistance extended to us during our activities in the study area.

Very truly yours,



Kunio Fujiwara

Team Leader,

The Study on Groundwater Development

for Santiago Island in Cape Verde


Location Map of the Villages
Capital Town of Municipality
Villages
Prioritized Villages
N
TARRAFAL
SÃO MIGUEL
SANTA CATARINA
SANTA CRUZ
PRAIA
SÃO DOMINGOS
Tarrafal
Calheta de S. Miguel
Pedra Badejo
Assomada
S.Domingos
Praia
Fazenda
Ponta Lobrão
Trás os Montes
Chão Bom
Achada Moirão
Achada Tenda
Biscainho
Milho Branco
Mato Brasil
Achada Monte
Ribeira da Prata
Achada Longueira
Mato Mendes
Ribeirão Milho
Palha Carga
Monte Pousada
Curral Velho
Achada Lagoa
Espinho Branco
Figueira Muita
Achada do Meio
Lagoa
Principal
Mato Correia
Ponta Verde
Xavá
Gongon
Pilão Cão
Figueira das Naus
Machada
Serra Malagueta
Casa Branca
Varanda
Cutelo Gomes
Ribeireta
Tagarra
Achada Laje
Achada Ponta Águas Podres
Achada Lazio
Monte Bece
Gamchemba
Achada Lém
Pedra Serrada
Pedra Barro
Saltos Abaixo
Cancelo
João Dias
Saltos Acima
Achada Bel Bel
Ribeira de Barca
Firma
Boaventura
Mato Baixo
Pingo de Chuva
Ribeirão Boi
Santa Cruz
Arribada
Mancholy
Ribeirão Isabel
Rebelo
Escrelha
Rocha Lama
Charco
Cruz Grande
Banana Semedo
Achada Fazenda
Achada Leite
Ribeirão Manuel
Achada Tome
Fontcana
Boa Entrada
Ribeirão Alpiaco
Tomba Toiro
Sedeguma
Pico Leão Preto
Mato Limão
Chã da Silva
Mato Sancho
Achada Gomes
Pata Brava
Degredo
Mato Forte
Ribeira Seca
Achada Ponta
Gil Bispo
Manhanga
Faveta
Fundura
Matinho
Boca Larga
Lirão
Chã do Tanque
Achada Galego
Pico Freire
Achada Costa
Bombardeiro
Fonte Lima
Achada Igreja
Montanha
Renque Purga
Palha Carga
Engenhos
Babosa
João Teves
Levada
São Cristovão
Chã de Lagoa
Mato Gege
Picos Acima
Pedra Molar
Monte Negro
Praia Baixo
Rincão
Leitão Grande
João Goio
Laje
Poilão Cabral
Porto Madeira
Entre Picos de Reda
Librão
Pico Antónia
Órgãos Pequenos
Banana
Mato Afonso
Achada Baleia
João Bernardo
Lohgueira
São Jorge
M. F. Rendeiro
Godim
Praia Formosa
Concelo
Mosquito Grande
F. Calval
Portal
Rui Vaz
Agua de Gato
Chaminé
Baía
Tronco
Pico Leão
Monte Branco
Lagoa
Chão Coqueiro
Dobe
Mosquito de Horta
Pau de Saco
Nora
Dacabalaio
Achada Mitra
Belém
Fontes Acima
Ribeirão Chiqueiro
Vale da Custa
Santa Ana
Veneza
Pedregal
Delgado
S Francisco
Chã Goncalves
Agostinho Alves
João Varela
Porto Mosquito
Chã de Igreja
S. Tomé
S Martinho Grande
Salineiro
S Martinho Pequeno
Gouveia
Calabaceira
Palmarejo Grande
Cidade Velha
S.Martinho Grande
Km
0
5
10

LIST OF ABBREVIATIONS

ACDI	Cooperativa para a Agrigultura e o Desenvolvimento Internacional (Cooperative for Agriculture and International Development)
AFDB	African Development Bank
AGR	Actividades Geradoras de Rendimento (Income Generating Activities)
ASAAE	Apoio aos Serviços Autónomos de Água e Energia (Support to Autonomous Services of Water and Energy)
CAAP	Comissão de Abastecimento de Água do Município da Praia (Water Supply Commission of the Municipality of Praia → replaced by EMAP)
CNAG	Concelho Nacional das Águas (National Water Council)
DEGEX	(Adult Education Program)
DGCI	Direcção Geral da Cooperação Internacional (International Cooperation Department)
DRS	Defesa e Restauração do Solo (Protection and Restauration of Soil)
EMAP	Empresa Municipal de Água da Praia (old CAAP) (Municipal Enterprise of Water of Praia)
FAIMO	Frente de Alta Intensidade de Mão-de-Obra (Front of High Intensity of Man Power)
FAO	Fundo das Nações Unidas para Agricultura e Alimentação (Food and Agriculture Organization of the United Nations)
FENU	Fundo de Equipamentos das Nações Unidas (UNEF – United Nations Equipment Fund)
ICASE	Instituto Caboverdeano de Ação Social e Escolar (Capeverdian Institute of Social and Educational Affairs)
ICF	Instituto da Condição Feminina (Institute for Women's Condition)
IEFP	Instituto de Emprego e da Formação Profissional (Institute of Employment and Professional Education)
INERF	Instituto Nacional de Engenharia Rural e Florestas (National Institute of Rural Engeneering and Forestry)
INGRH	Instituto Nacional de Gestão dos Recursos Hídricos (National Institute for Water Resources Management)
INIDA	Instituto Nacional de Investigação e Desenvolvimento Agrário

	(National Institute of Agricultural Investigation and Development)
M.A.A.A.	Ministério da Agricultura, Alimentação e Ambiente (Ministry of Agriculture, Food and Environment)
M.N.E.C.	Ministério dos Negócios Estrangeiros e das Comunidades (Ministry of Foreign Affairs and Communities)
MORABI	Associação de Apoio à Auto-Promoção da Mulher no Desenvolvimento (Cape Verdian Non-Governmental Organization of Women)
O/M	Operation and Maintenance
OMCV	Organização das Mulheres de Cabo Verde (Cape Verdian NGO of Women)
OMS	Organização Mundial da Saúde (WHO - World Health Organization)
ONG	Organização Não-Governamental (NGO - Non-Governmental Organization)
PAM	Programa Alimentar Mundial das Nações Unidas (WFP - World Food Program)
PMI	Proteção Materna-Infantil (Mother-Child Protection)
PND	Plano Nacional de Desenvolvimento (NDP = National Development Plan)
PNUD	Programa das Nações Unidas para Desenvolvimento (UNDP - United Nations Development Program)
PRA Method	Participatory Rural Appraisal Method
UNCDF	Fundo de Desenvolvimento de Capitais das Nações Unidas (United Nations Capital Development Fund)
UNICEF	Fundo das Nações Unidas para a Infância (UNICEF – United Nations International Children's Emergency Fund, now United Nations Children's Fund)
WID	Mulheres no Desenvolvimento (Women in Development)

CONTENTS

FIGURES

TABLES

1 INTRODUCTION

1.1 General

This is the Final Report on "The Study on Groundwater Development in Santiago Island in the Republic of Cape Verde" (hereinafter referred to as "the Study").

The Study has been carried out in accordance with the "Scope of Work" agreed upon in December 1997 between the National Institute for Water Resources and Management (INGRH) and the Japan International Cooperation Agency (JICA).

The Study commenced in March 1998 and has been terminated upon submission of the Final Report in September 1999. The study period was divided into 2 phases, each phase having the following contents:

First Phase:	Work in Japan	(March 1998)
	Work in Cape Verde – Stage 1	(May-December 1998)
	Work in Cape Verde – Stage 2	(January-March 1999)
Second Phase:	Work in Japan	(April-June 1999)
	Work in Cape Verde	(July 1999)
	Work in Japan	(August 1999)

1.2 Outline of the Study

1.2.1 Background of the Study

The Republic of Cape Verde is an island nation situated 600 to 750 km off the shore of West Africa. It comprises 15 volcanic islands, 9 of which are inhabited with an estimated total population of approximately 430,000 as of 1998. The 15 islands total 4,033 km^2 and belong to the dry Sahelian climatic zone where annual precipitation is very limited at less than 230mm on average. Therefore, forest is scarce, covering only 0.2% of the total area.

The study area is the Island of Santiago, the biggest island in the nation, where the capital city, Praia, is located. The island occupies about 1,005 km^2, one fourth of the total land area, and has an estimated population of approximately 228,000 (over half of the national population); the population of Praia is estimated at about 100,000, as of 1998. The population growth in this island is the largest due to the incessant influx of migrants from other islands.

Santiago Island has a mean annual precipitation of about 250mm, 95% of which is concentrated in the rainy season from August to October. There are no perennial rivers in the island because it is almost dry for most of the year (8 months). Even during the rainy season, surface water flow is observed for only a few hours in major rivers after heavy rain, as the island's steep volcanic features facilitate rapid run-off and infiltration.

Water resource development in this island is, therefore, generally very difficult, resulting in inveterate shortage in water for domestic and irrigation use. Hence, water supply service coverage in the island remains lower than 65% and the service level is poor, especially in rural areas.

In order to cope with such a situation, the Government of the Republic of Cape Verde gave emphasis to the development of water supply systems in its Third National Development Plan (1992-1995). Formulating a Water Resource Development Master Plan (1993-2005) with the assistance of UNDP, the government aims to establish self-sufficiency in water provision by the year 2005.

Three types of water resource development measures were proposed in this Master Plan for Santiago Island, that is: surface water storage through dam construction, sea water desalination, and effective groundwater development.

As part of a number of undertakings to accelerate groundwater development, the Government strove to construct deep wells and rehabilitate existing water supply facilities. With this background, the Government of the Republic of Cape Verde requested grant aid from the Government of Japan in 1994, for the procurement of pumping equipment and other materials for groundwater development in Santiago Island. However, the request was rejected due to inadequate data and information regarding the project. Consequently, the Government of Cape Verde requested the conduct of a development study in order to clarify the situation and establish the development plan for water supply in Santiago Island. In response to this request, JICA dispatched a Preparatory Study Team in December 1997 and formulated the Scope of Work for the development study.

1.2.2 Objectives of the Study

The objectives of the Study are:

To establish a system that would realize the effective use of groundwater survey results through the systematic arrangement of existing data and the execution of necessary hydrogeological surveys.

To evaluate the potential of groundwater development in Santiago Island, by area, and to formulate a suitable development plan and a water supply plan.

To formulate a development and/or a rehabilitation plan for existing water supply facilities in Santiago Island that require improvement or rehabilitation.

To transfer relevant skills and techniques to the counterpart personnel during the course of the Study.

1.2.3 Study Area

The Study covers the entire island of Santiago in terms of groundwater development potential. The Study also covers water supply in all the villages and towns in the island, except the urban area of Praia.

1.3 Study Description

1.3.1 Study Components and Sequence

The major purpose of the Study is to establish the plans for water resource development and water supply service improvement in the rural areas of Santiago Island. Due to a remarkable shortage of water sources and the dispersed village

structure in steep mountainous regions, public water supply is inadequate and the services cover a limited area.

The poor service level is caused mainly by a shortage in budget for development, although the weak management system is also be one of the reasons why the sector remains underdeveloped. Strengthening the water management system could, therefore, contribute to service level improvement.

Taking these matters into consideration, the Study consists of two major components. One component pertains to water resource development, mainly groundwater development. The other component pertains to matters related to water supply, and includes the following sub-components: 1) basic understanding of existing water supply conditions in the area, 2) establishment of a water supply plan along with a facility design proposal for prioritized villages, and 3) formulation of the project implementation plan as well as the operation and maintenance plan.

The water resource development component entails the conduct of various hydrological and hydrogeological surveys and their analyses, to evaluate groundwater development potential in the hydrogeological basins of Santiago Island, and prepare the hydrogeological map of the Island.

The water supply component entails the following:

1) Understanding the conditions of existing water supply facilities and water use, to prioritize the villages for the detailed survey, through:
   - Field reconnaissance in every village
   - Interviews with the villagers on water use and desired facility type
   - Socioeconomic survey in some of the representative villages to understand important social factors in each municipality
   - Interviews with water supply managing staff of each municipality to confirm service level
2) Establishment of a sound water supply plan and facility design for the prioritized villages by conducting:
   - Field survey on facility design in the concerned villages
   - Socioeconomic survey by interviews with key informants in some representative villages in each municipality, and in-depth social and WID surveys by PRA method in relation to operation and maintenance system improvement
3) Formulation of the project implementation plan and operation and maintenance plan through:
   - Survey on financial conditions and construction material availability
   - Discussions with managing organizations at the national and local levels

Besides the above two major components, the Study also entails GIS/database installation. Based on INGRH's request, JICA has procured a set of hardware and software for the construction of various databases. Equipment procurement and the transfer into the GIS system of all geographic information featured on the 1:50,000-scale map (No. 58 Praia) were done in Japan. The test operation, including the

transfer of technology in GIS operation, was done in Cape Verde during Stage 1 of the First Phase.

The detailed work items and the Study sequence are shown in Figs. 1-1 and 1-2, as well as in the Scope of Work detailed in the following Section.

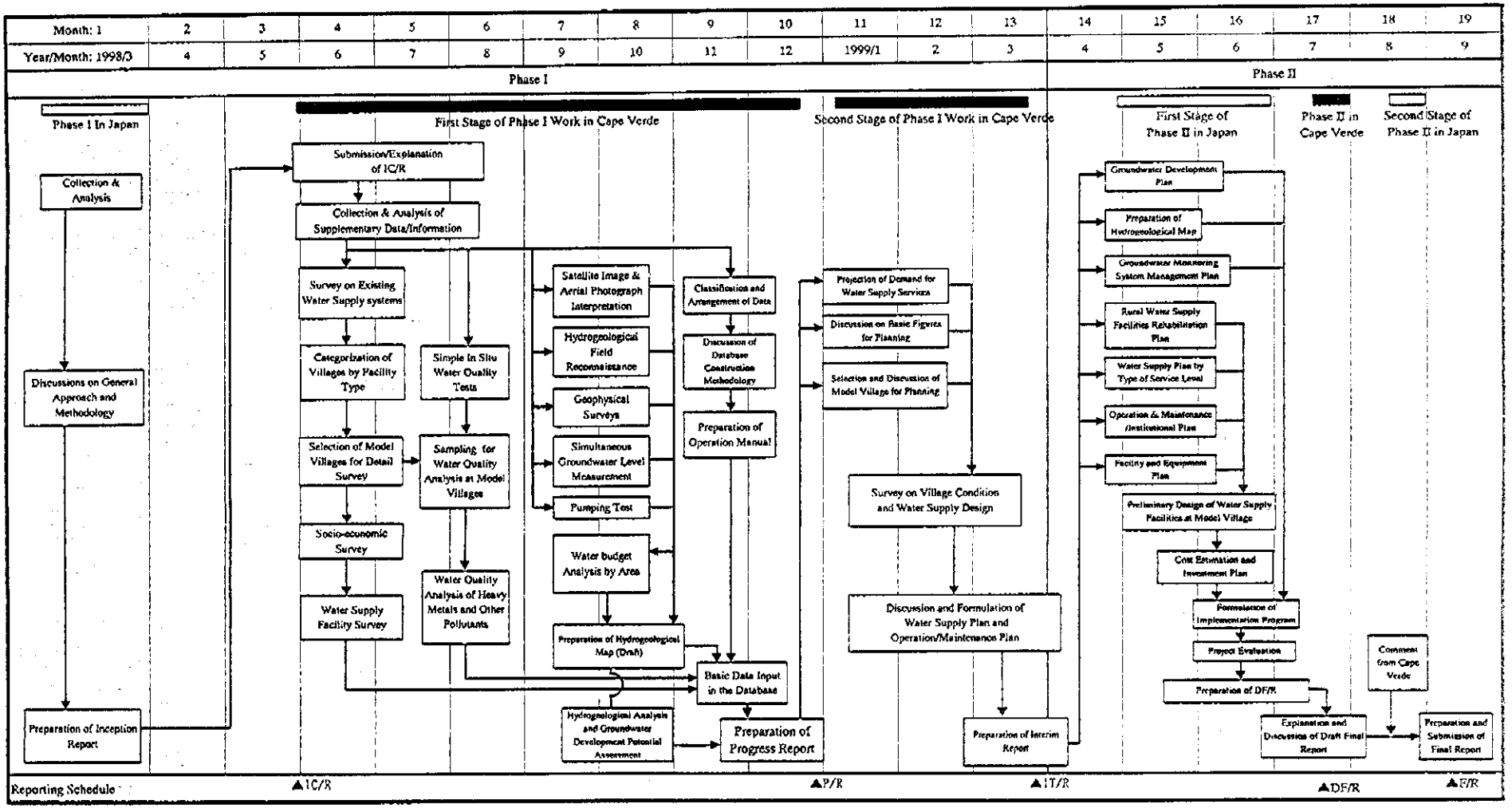


Figure 1-1 Study Operation Flow Chart

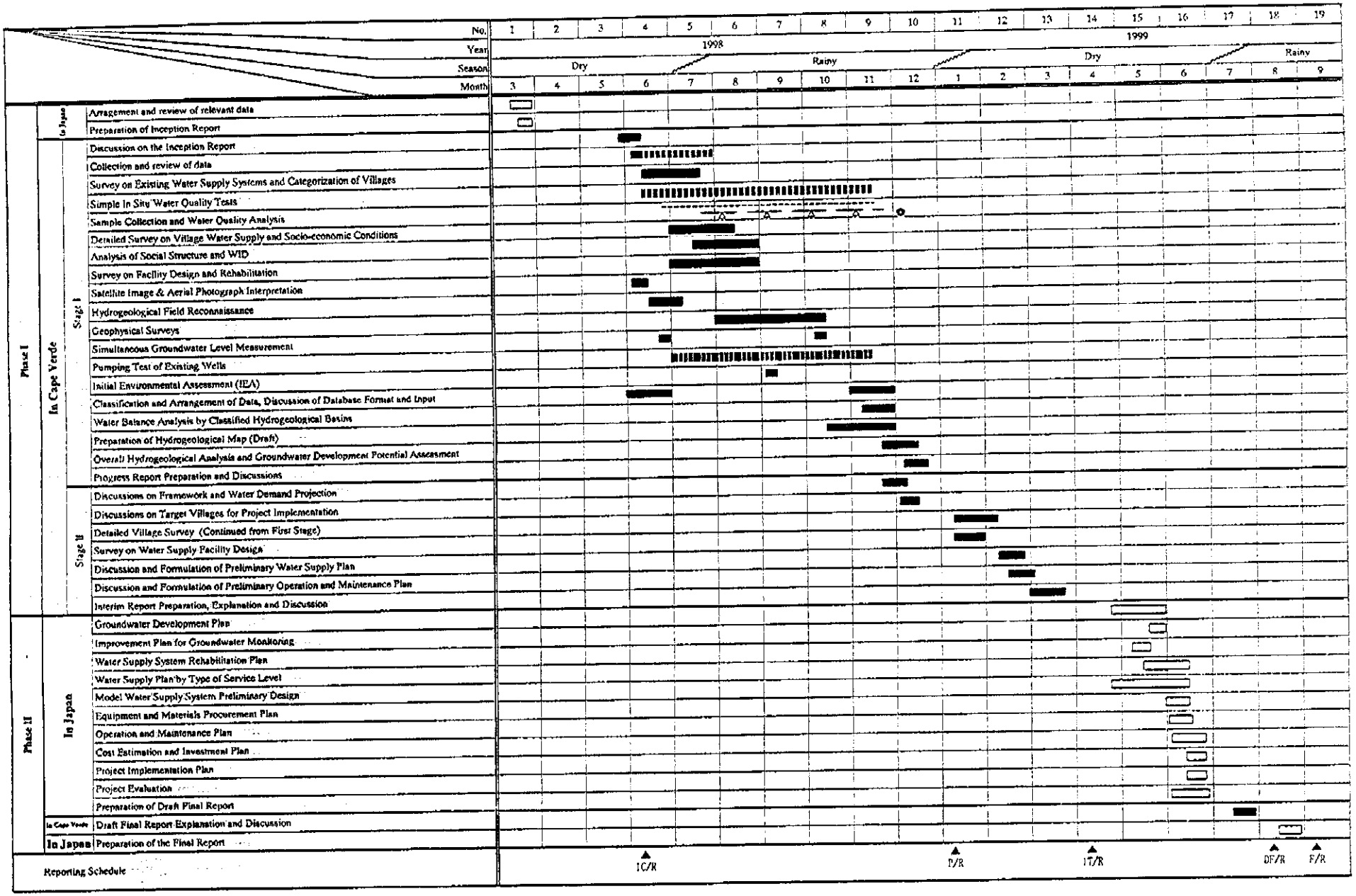


Figure 1-2 Work Schedule

1.3.2 Scope of Work

The Scope of Work of the Study is detailed below by phase and stage.

1.3.2.1 Phase I

A1. Stage I

1) Preparatory Work in Japan and Cape Verde

Collection, review, analysis and compilation of relevant data and information.

a. Socioeconomy

- Latest socioeconomic statistics
- Central and local government organizations
- Local industries, livelihood, standard of living
- Village structure (population, population density, infrastructure, social structure)
- Sanitary and health conditions (prevailing diseases such as water-borne diseases, solid waste and excreta disposal systems, awareness of the importance of hygiene)
- Present policies related to Women in Development (WID)
- Industrial pollution, e.g. chromium levels in effluents from leather industry
- Other relevant data and information

b. Water supply

- Existing well data and water supply services (well inventory, spring yields, water tariffs, access to water, community participation, etc.)
- Relevant on-going and planned projects
- Laws, regulations and policies on water resource development and water supply services
- Existing water supply operation and maintenance
- Water facility design standards and water quality standards
- Availability of materials for facility construction
- Progress of surface water reservoir project
- Progress of seawater desalination program
- Other relevant data and information

c. Natural conditions

- Maps (topography, geology, hydrogeology, land use, etc.)
- Satellite images and aerial photographs
- Reports and materials on geological and hydrogeological surveys

- Well construction records
- Meteorological data and river flow records
- Records on particular disasters, e.g. flooding, drought
- Format of previous database system on water resources
- Other relevant data and information

2) Database Construction
   a. Classification and arrangement of data
   b. Discussion on database construction methodology
   c. Selection of hardware and software
   d. Preparation of operation manual
3) Field Survey

a. Natural conditions
- Topographic and geological reconnaissance
- Ecological, hydrological, and hydrogeological reconnaissance
- Study on spring flow mechanism
- Survey on existing wells
- Geophysical survey (electric resistivity)
- Simultaneous groundwater level measurement
- Pumping test of existing wells
- Water quality analysis

b. Village survey
- Survey on existing water supply facilities
- Socioeconomic survey (site observation and questionnaire survey)
- Survey on sanitary conditions
- Discussions with villagers concerning hygiene, WID, community participation, facility maintenance, operation of water association, etc.

4) Analysis and Evaluation
   a. Hydrogeological analysis
   b. Preparation of hydrogeological map (draft)
   c. Water balance analysis
   d. Assessment of groundwater development potential
   e. Water quality analysis
   f. Preparation of tentative groundwater development plan
5) Preparation of Progress Report

A2. Stage 2

1) Field Survey
   a. Site survey for water supply facility design

b. Village survey continued from stage I (A1-3)-b.)

2) Establishment of Policy for Various Development Plans Through Discussions
   a. Planning framework
   b. Water demand projection
   c. Tentative water supply plan
   d. Tentative groundwater development plan
   e. Tentative water supply facility plan
   f. Tentative operation and maintenance plan
3) Preparation of Interim Report

1.3.2.2 Phase II

1) Preparation of Hydrogeological Map
2) Plan Formulation
   a. Groundwater development plan
   b. Water supply plan
   c. Water supply facility plan
   d. Operation and maintenance plan
   e. Groundwater monitoring plan
   f. Project implementation plan and cost estimate
3) Preliminary Design of Water Supply Facilities
4) Environmental Impact Assessment
5) Project Evaluation
   a. Financial evaluation
   b. Economic evaluation
   c. Institutional evaluation
   d. Technical evaluation
   e. Social evaluation
6) Preparation of Draft Final Report
7) DF/R Explanation and Discussion
8) Preparation and Submission of Final Report

1.3.3 Reports

The study reports prepared by the JICA Study Team during the course of the Study and submitted to the Government of Cape Verde are as follows:

1)	Inception Report	20 copies in English	June 1998
2)	Progress Report	20 copies in English	December 1998
3)	Interim Report	20 copies in English	March 1999
4)	Draft Final Report		July 1999

The Draft Final Report consists of the following four volumes:

• Summary Report (Volume 1)	20 copies in English 20 copies in Portuguese
• Main Report (Volume 2)	20 copies in English 20 copies in Portuguese
• Supporting Report (Volume 3)	20 copies in English
• Data Book (Volume 4)	20 copies in English

5) Final Report

The Final Report was prepared within 30 days after the Government of Cape Verde makes comments on the Draft Final Report. The Final Report prepared and submitted to JICA consists of the same volumes as the Draft Final Report. The JICA headquarters will send the Final Report to the Government of Cape Verde through diplomatic channels as soon as possible.

2 SOCIOECONOMY

2.1 Socioeconomic Situation of the Republic

2.1.1 Land and Population

The Republic of Cape Verde consists of ten major islands and five islets located 600 to 750 kilometers off the coast of Senegal, with a land area of about 4,033m^2. With an annual growth rate of 1.45% between 1980 and 1990, nine of the islands are populated with a total of 341,491 people (1990). Assuming that the population increased at the same rate after this period, the country is estimated to have a total population of about 430,000 as of 1999.

Praia, the national capital, is located in Santiago Island where nearly one fourth of the population lives. Other major islands are Santo Antão, São Vicente and Sal. Santo Antão has the most rainfall and is, therefore, the most forested island. It also holds the second largest population nationwide. São Vicente has the country's major harbor and the second largest city, Mindelo. The international airport is located in Sal; the construction of a new international airport in Praia started in 1998.

Only one tenth of the country's land base is arable, which implies a high population density (808 persons) per square kilometer of arable land. The Sahelian climate, with its prolonged periods of drought, marked shortage of fresh water sources, i.e. rivers, springs, and a high natural population growth rate of 2.7%, inflict intolerable pressure on the country's fragile agricultural base. Even in years when rainfall is abundant, the country can produce only 50 to 60% of its total food requirements.

The poor natural resource base, particularly with respect to fresh water, and the absence of a mineral resource base have led to high rates of emigration. As a result, twice as many Cape Verdeans live abroad.

2.1.2 Local Administration

At the time of the 1990 Census, Cape Verde was administratively divided into 14 municipalities (*concelhos*) which were further sub-divided into 31 parishes (*freguesias*), although parishes are not part of the administrative division. Each municipality consists of local communities (*zonas*).

In Santiago Island, two *freguesias* were elevated to the municipal category in 1994 and 1997: *Freguesia* de N. Sra. da Luz in Praia became the Municipality (*Concelho*) of São Domingos in 1994, and *Freguesia* de São Miguel of Tarrafal became the Municipality (*Concelho*) of São Miguel in 1997. Thus, Santiago now consists of six municipalities.

Table 2-1 presents the names of the municipalities (*concelhos*) and parishes (*freguesias*).

Table 2-1 Administrative Divisions in Cape Verde as of 1998

Island	Municipality	*Freguesias*
Boa Vista	Boa Vista	Santa Isabel and S. João Baptista
Brava	Brava	S. João Baptista and N. Sra. do Monte
Fogo	Fogo	N. Sra. da Conceição, N. Sra da Ajuda, S. Lourenço and Santa Catarina
Maio	Maio	N. Sra. da Luz
Sal	Sal	N. Sra. das Dores
Santiago	Praia	N. Sra. da Graça, S. Nome de Jesus and S. João Baptista
	São Domingos	N. Sra. da Luz and S. Nicolau Tolentino
	Santa Catarina	Santa Catarina and S. Salvador do Mundo
	Santa Cruz	S. Lourenço dos Órgãos and S. Tiago Maior
	São Miguel	S. Miguel Arcanjo
	Tarrafal	S. Amaro Abade
Santo Antão	Paul	S. Antão das Pombas
	Porto Novo	S. João Baptista and S. André
	Ribeira Grande	N. Sra. do Livramento, N. Sra. do Rosário, S. Crucifixo, and S. Pedro Apóstolo
São Nicolau	São Nicolau	N. Sra. do Rosário and N. Sra. da Lapa
São Vicente	São Vicente	N. Sra. da Luz

2.1.3 Economic Situation

1) Economic Performance

In spite of the country's many handicaps, the economy has grown fairly and steadily since its independence (5 July 1975), as a result of continued efforts of the population, influx of official foreign aid, and substantial remittances from emigrants.

Based on the data supplied by IMF, the *Banco de Cabo Verde* estimates that the Gross Domestic Product (GDP) in Cape Verde grew 3 to 4.7% per year in real terms between 1993 and 1997, exceeding the population growth rate. From US$959 in 1994, the per capita GDP increased to US$1,126 in 1997.

Consumer price inflation was low at 3.4% in 1994, but rose to 8.4% in 1995 and 8.6% in 1997. Consumer prices are mostly dependent on import prices due to the country's inability to be self-sufficient in food production and lack of raw materials.

Unemployment remains one of the greatest economic problems, with an estimated 26% of the labor force unable to find any formal work in 1996 (EIU, 1997). Although public investment in infrastructure development and private-sector investment in exportation are seen to increase, it is difficult to generate adequate employment to absorb the surplus labor force. Cape Verdeans, especially young ones, are likely to continue to emigrate in search of employment.

2) Economic Structure

Cape Verde's economy has been traditionally based on services. The service sector accounted for 76% of the GDP in 1994, employing about 41% of the active population. Commerce, transport and public services accounted for 47% of the GDP.

Tourism occupies only about 3% of the GDP, but has been identified as a major area for economic growth as a result of recent foreign investments.

Although services account for the largest share of the GDP, the economy of Cape Verde remains oriented towards agriculture and fishing. While agriculture only accounted for 7.8% of the GDP in 1994, it absorbed approximately 53% of the country's workforce. Aside from services, the majority of the country's exports consist of agricultural products and processed items such as bananas, lobsters, and fresh, frozen and canned fish.

The manufacturing industry is small but has some development potential. It accounted for about 16% of the GDP in 1994, but employed only 5% of the total workforce.

3) Inflation Rate

The consumer price index (CPI) decreased from 8.1% to 3.5% in 1994, before increasing again in 1995. Low inflation in 1994 is the result of the favorable influence of a set of internal and external variables. Among the internal variables were: a) trade liberalization, increase in domestic supply and exports; b) price control on certain basic food products (i.e. rice, wheat, corn, vegetable oil); and c) exchange rate policy based on the stability of domestic prices. Among the external variables, imports played a significant role.

4) Trade Balance

Cape Verde relies heavily on imports for all but its primary requirements and has suffered from a large and persistent merchandise trade deficit since its independence. It is characterized by a constant trade deficit, with exports equaling only 2 to 8% of total imports. In 1997, merchandise exports amounted to US$13.9 million, while merchandise imports amounted to US$211.1 million, with a trade deficit of US$197.2 million.

Imports consist of food, manufactured goods, fuel, and other essentials. Exports are mainly bananas, canned tuna, fresh and frozen fish, lobsters, salt, shoes and clothes. Import values and volumes have tended to increase steadily over time. Between 1985 and 1990 for example, imports of both fuel and commodities increased 27%, and intermediate and capital goods increased 32%. In contrast, export volumes and values have tended to fluctuate from year to year. Only exports of seafood products and bananas remain relatively stable. Cape Verde's main trading partners over the past few years have been countries of the European Community (France, Germany, the Netherlands, Portugal, Spain, and Sweden).

5) Public Finance

The fiscal year of Cape Verde starts from 1 January and ends on 31 December.

Total revenues including budgetary revenues, grants, transfers and privatization revenues in 1995 and 1996 amounted to CV Esc.15.7 billion and CV Esc.16.5 billion, respectively. Total expenditures in the same years amounted to CV Esc.19.0 billion and CV Esc.19.4 billion, respectively. As a result, in 1996, global deficit decreased to CV Esc.2.9 billion as compared to CV Esc.3.3 billion in 1995. The current balance, though negative, has improved as a result of favorable developments in revenues and expenses, thanks largely to taxes on income, profits and import tariffs.

2.1.4 National Development Plan

1) Development Policy

The National Development Plan for 1997-2000 (hereinafter referred to as the "1997-2000 NDP") considers the human being as the focus of development, given that the Cape Verdeans are the main resources of their country. For the development of social policies, the overall objectives of the 1997-2000 NDP are as follows: a) complete development of Cape Verde through its people, b) development of human resources based on current job market conditions, c) gradual preparation of the labor force so that the country can maximize the benefits its integration into the world economy will produce, taking direct advantage of the globalization process.

2) National Development Programs

In order to achieve the objectives as mentioned above, the 1997-2000 NDP dedicates a set of 12 Major Programs directed at human and social development, covering the following areas: diet and food stability; environment; development of the education system; culture; employment; vocational training; health promotion; development and protection of natural habitats; promotion of the welfare of the family, women, children and youth; media; eradication of poverty and satisfaction of basic needs.

3) Satisfaction of Basic Needs

The 1997-2000 NDP considers food, drinking water, housing, health, employment, literacy, communication and information as main basic needs, and sanitation, electricity, telecommunication, vocational training, secondary education, culture (including leisure and sports) as complementary basic needs.

The objectives for this sector are to: a) ensure national coverage of programs to satisfy the main basic needs of each region; and b) satisfy the complementary basic needs of each community.

4) Basic Sanitation Program

The basic sanitation program is one of the 12 major programs of the 1997-2000 NDP. The program aims to improve water quality and collection and treatment services (waste and effluents). In order to support the activities, it is considered imperative to involve local authorities in the management and operation of these systems and activities. The program consists of the following: a) development of basic sanitation infrastructure in main and secondary urban centers; b) development of a water quality control system; c) treatment of effluents for reutilization for agricultural and industrial purposes; d) collection and treatment of urban solid wastes; e) institutional development; and f) enhance awareness of the importance of public health and sanitary education.

5) Public Investment Program

In order to achieve the development goals of the 1997-2000 NDP, the Public Investment Program for 1998-2000 was prepared. For 1998, 1999 and 2000, a total investment of 37.4 billion CV. Esc. is required. Of the total amount, 20.1% will be appropriated for the development of basic sanitation, 16.3% for the development of the agrarian sector, 9.9% for the development of the transportation system, and 8.5% for health care development.

2.2 Socioeconomic Situation in Santiago Island

2.2.1 Administrative Divisions and Population

1) Area and Population

Santiago is the largest island in the country as it covers about 1,005km^2, 25% of the national territory. At the time of the 1990 Census, Santiago comprised of four municipalities, i.e. Praia, Santa Catarina, Santa Cruz, and Tarrafal, and a total population of 175,691. The municipality of Tarrafal and Praia were divided into 2 municipalities each in 1994 and 1997, thus the island consists of 6 municipalities, with an estimated population of 228,482 as of 1998. The area coverage of and population distribution in each municipality are shown below.

Table 2-2 Area and Population in Santiago (1990 and as of 1998)

Municipality	Area (km^2)	Population ('90)	Est. Population ('98)
Tarrafal	123	11,627	14,613
São Miguel	76	13,786	15,985
Santa Catarina	274	41,584	47,949
Santa Cruz	146	25,892	35,832
São Domingos	142	11,526	13,784
Praia	244	71,276	100,319
Total	1,005	175,691	228,482

2) Population Trend

Population in Santiago Island has increased from 145,957 in 1980 to 175,691 in 1990 at an annual growth rate of 1.9% on average. Of its six municipalities, Praia shows the highest growth rate, with an annual average of 3.7%, followed by Sta. Cruz with an annual average of 1.2%. Praia's high population growth rate is attributed to population growth in Praia City, which increased at an annual growth rate of 4.6% between 1980 and 1990. Praia's rural area has shown the lowest growth rate: only 1.4% during the same period.

Table 2-3 Population Trend in Santiago (1980-1990)

Municipality	1980	1990	'80-'90 Annual Growth Rate
Tarrafal	11,853	11,627	-0.19%
São Miguel	12,349	13,786	1.11%
Santa Catarina	41,012	41,584	0.14%
Sta. Cruz	22,995	25,892	1.19%
São Domingos	11,117	11,526	0.36%
Praia City	39,411	61,644	4.57%
Praia Rural	18,337	21,158	1.44%
City + Rural	57,748	82,802	3.67%
Total	157,074	175,691	1.87%

Source: The 1980 and 1990 Census Reports

2.2.2 Urban and Rural Population

With a total population of 61,644 (1990), Praia City, the national capital and also the capital of the Municipality of Praia, holds 18% of the national population and 35% of the total population of Santiago Island (1990). Assuming an annual population growth rate of 4.6%, the population of the city (approximately 88,300 as of 1998) is estimated to exceed 100,000 in 2001.

The second largest town in the island is Pedra Badejo in the Municipality of Santa Cruz, with a population of 5,302, followed by the towns of Tarrafal (3,626) in the Municipality of Tarrafal and Assomada (3,414) in the Municipality of Santa Catarina. Calheta de S. Miguel, in the new Municipality of São Miguel, had a population of 2,599 and Várzea da Igreja (São Domingos), in the new Municipality of S. Domingos, a population of 1,860 in 1990.

Table 2-4 presents the population of each municipality in urban and rural areas. The urban population in 1990 averaged 44.6% in Santiago. The highest percentage of urban population was recorded in Praia Municipality, at 86.4%, followed by Sta. Cruz at 20.4%.

Table 2-4 Urban and Rural Population in Santiago (1990)

Municipality	Urban		Rural		Total	
	Population	%	Population	%	Population	%
Tarrafal	3,626	31.1	8,001	68.9	11,627	100
São Miguel	2,599	18.8	11,187	81.2	13,786	100
Sta. Catarina	3,414	8.2	38,170	91.8	41,584	100
Sta. Cruz	5,302	20.4	20,590	79.6	25,892	100
São Domingos	1,860	16.1	9,666	83.9	11,526	100
Praia	61,644	86.4	9,632	13.6	71,276	100
Total	78,445	44.6	97,246	55.4	175,691	100

Source: 1990 Census

2.2.3 Economic Base

1) Economic Activities and Employment Status

The 1990 economically active population or labor force in Santiago Island totaled 65,300. Of the total labor force, 20,455 (31%) were engaged in agriculture, including livestock and fishery, 14,108 (22%) in the service industry, and 9,720 (15%) in construction. It is evident from these figures that agriculture, including livestock and fishery, is the most important industry in Santiago Island.

Of the six municipalities in Santiago, the economically active population employed in the agricultural sector in 1990 totaled 4,576 in the Municipality of S. Miguel (67% of its labor force), 6,846 (44%) in the Municipality of Sta. Catarina, 4,110 (44%) in the Municipality of Sta. Cruz, and only 2,308 (9%) in the Municipality of Praia.

The economically active population in the construction sector amounted to 1,078 (28%) in the Municipality of Tarrafal and 901 (22%) in S. Domingos. Only 12 to 15% of the labor force of other municipalities are employed in the same sector.

In the service sector, the Municipality of Praia has 10,317 (40% of its labor force), while other municipalities have only 5 to 13% of their labor force in this sector.

In the commerce sector, the municipalities of Praia and Sta. Catarina have 15% of their labor force in this sector, while other municipalities have 4 to 10%.

Table 2-5 Employment Status in Santiago (1990)

	Tarrafal	São Miguel	Sta. Catarina	Sta. Cruz	São Domingos	Praia	Average
Agriculture	33%	67%	44%	44%	33%	9%	31%
Manufacturing	3%	2%	4%	4%	2%	6%	4%
Construction	28%	13%	13%	12%	22%	14%	15%
Commerce	10%	4%	15%	9%	7%	15%	12%
Services	13%	5%	9%	10%	14%	40%	22%
Others	13%	9%	14%	21%	22%	15%	15%

Source: 1990 Census (modified)

Notes: (1) Agriculture includes livestock and fishery.
(2) Manufacturing includes mining.

2) Agricultural Population and Production

The Agricultural Census 1988 (1988 Census) indicated that the Cape Verde population in the agricultural sector totaled 32,193, of which 17,922 (56%) were in Santiago. Based on the 1988 Census, it has been estimated that the population in the agricultural sector in 1995 was 103,273 (about 51%) of the total population. The agricultural population in 1985 consisted of 46,456 males and 56,817 females. Females accounted for 55% of the total agricultural population.

Table 2-6 Population in the Agricultural Sector (1988 and 1995)

	1988			1995		
	Male	Female	Total	Male	Female	Total
Tarrafal	10,064	13,256	23,320	11,210	15,348	26,558
Sta. Catarina	14,984	19,260	34,244	16,256	20,085	36,341
Sta. Cruz	8,962	10,084	19,046	8,959	10,416	19,375
Praia	9,108	9,674	18,782	10,031	10,968	20,999
Total	43,118	52,274	95,392	46,456	56,817	103,273

Source: Estatísticas Agrícolas, Ministry of Agriculture, Food and Environment –1997

Arable land in Santiago is estimated at about 21,600 ha in 1988, of which about 20,900 ha (nearly 97%) are rain-fed. The majority of the farmers mainly cultivate maize and *feijão* beans. The Municipality of Santa Cruz ranked the first in the production of maize, while the Municipality of Tarrafal ranked the first in the production of *feijão*. Food production in Santiago tends to decrease year by year.

Table 2-7 Food Production in Santiago (1990 and 1995)

		Maize		Feijão beans	
		1990	1995	1990	1995
Tarrafal	Area (ha)	5,322	4,844	5,297	4,814
	Production (ton)	2,033	1,424	446	510
Sta. Catarina	Area (ha)	7,561	6,527	7,537	6,483
	Production (ton)	2,671	2,214	703	405
Sta. Cruz	Area (ha)	4,439	3,028	4,417	2,970
	Production (ton)	885	551	99	118
Praia	Area (ha)	3,061	2,967	3,041	2,927
	Production (ton)	543	906	251	198
Total (Santiago)	Area (ha)	20,383	17,366	20,292	17,194
	Production (ton)	6,132	5,095	1,499	1,231

Source: Estatísticas Agrícolas, Ministry of Agriculture, Food and Environment –1997

2.3 Social and WID Aspects in Rural Area

2.3.1 National Framework

1) Situation of Women

Women represent more than half of the national human resources of Cape Verde where immigration has been prominent since the eighteenth century. Women in Cape Verde have a very important role in the family as well as the workplace. They manifest great potentiality in sustainable and balanced development. Notwithstanding, illiteracy, unemployment, concentration of women in least important jobs, and reduced participation in decision-making at the local as well as the national level, block the integration of women into the development process.

The situation of women, however, has improved significantly since the country's independence in 1975, particularly in recent years. In 1979, Cape Verde joined the

UN Convention on the elimination of all forms of discrimination against women (CEDM). The new Constitution guarantees equality to women in every aspect. Women's literacy rate has dramatically increased from 38% in 1980 to 64% in 1995, although still lagging far behind that of men (men's literacy rate is 81% in 1995 up from 64% in 1980). The total fertility rate is 3.7 in 1996, down from 7.0 in 1960. (UNICEF World Children's Report, 1998)

Despite such advances in the fields of education and health, traditional as well as cultural discrimination against women still prevail. At home, women are mainly assigned domestic activities, especially in rural areas where traditional values are slow to change.

Women in Cape Verde are traditionally engaged in informal sector activities, e.g. production and trade of goods and services, agriculture, livestock raising, etc. However, in a country where women head 41% of the total households, women assume most responsibilities at the household level, allowing them little time to effectively participate in social activities. Moreover, gender-related inequalities put women at a disadvantage when it comes to their active participation in the economy, as they often lack easy access to land and credit. Although 46% of those working in the high intensity labor schemes known as FAIMO are women, their salary is substantially less than their male counterparts due to limited training opportunities and skills.

The integration of women into the economic fabric requires capacity building, provision of additional spare time, and assurance of proper gender relationships. Recognizing the situation and importance of improving women's status, the National Development Plan (NDP) for 1997~2000 suggests to promote and create an equal partnership between men and women at home as well as at the work place. The NDP 1997~2000 sets the following objectives to improve women's status:

- Ensure enhanced participation of women in the development process and ensure women's rights
- Guarantee creation of an environment that would provide equal opportunities to women in fields of education, access to professional training, health, and public activities.
- Reinforce legal measures against discrimination and the abuse of women
- Promote women's economic independence through improved access to employment and credit

The Government created ICF (Institute for Women's Condition) in 1995 to support various sectors in establishing systems that would facilitate the integration of gender issues and networking with international organizations.

The NDP 1997~2000 also stipulates the role of non-governmental organizations (NGOs) and private entities in social development. The NDP suggests that social programs should be implemented with the cooperation of the state, the private sector, and civil/social organizations, to ensure public participation and social growth and development. Hence, the NDP provides a framework that encourages the integrated intervention of the various relevant public institutions, to coordinate the policies related to social development, including the development of women's status.

There is a growing number of NGOs currently involved in development programs for women. Most prominent are MORABI (Association for the Support and Self-Promotion of Women in Development), OMCV (Organization of the Women of Cape Verde), VERDIFAM (Association of Cape Verdean Family) and AMESV. AMESV particularly focuses on education, technical training, income generation, consciousness enhancement, and mostly targets women from vulnerable social strata. An increasing number of NGOs are promoting a micro-credit programme for income generation activities. OASIS, a local NGO, provides civil/community organizations/associations with technical training in agriculture and integrated rural development, and helps these associations find jobs.

2) Poverty

According to the World Bank, 30% of the population of Cape Verde are poor, and 14% live under extreme poverty. Poverty in Cape Verde is directly attributed to the fragility of the agricultural sector as well as other economic factors. In the rural areas, the weak state of the agricultural industry is traceable to drought and environmental degradation, factors that compel most of the rural population to find off-farm jobs for survival. Most of the off-farm jobs are offered by FAIMO. Although FAIMO is a commendable way of reaching the poor, some of its intrinsic characteristics nurture a perverse dependency that subsequently suffocates private initiatives. In such a context, FAIMO does not offer a way out of poverty, although it contributes to the reduction of impoverished conditions in the long run.

In view of the large number of women, especially those heading a household, in poverty, the Government's National Poverty Alleviation Programme (NPAP) endeavors to strategically integrate women in every industrial sector activity. More specifically, the programme adopts the following measures:

- Promote the involvement of poor women in the economic activities of the informal sector, as well as in agriculture and livestock production, through training, information dissemination, and guaranteed access to credit.
- Creation of an environment that would facilitate and ensure the increased participation of women, by implementing measures that would provide women with spare time and ensure equality in relationships (i.e. marriage).
- Capacity building through education and professional training, to improve literacy and increase access to employment and self-employment.
- Reinforce health-oriented education programs to protect mother and child health and welfare.

3) Health and sanitation

A major challenge of the health sector in Cape Verde is to improve the access to health care and the quality of public health care services.

Health care services are provided at two national hospitals: one in Praia, Santiago and the other in Mindelo, St. Vincent; three regional hospitals in Assomada, Santiago, S. Filipe, Fogo, and Ribeira Grande, S. Antao; 15 health centers, 23 sanitation posts, and 79 sanitation units. One regional hospital is currently being constructed in Pedra Badejo, Santiago. Since 1977, MCH/FP (mother and child health/family planning) services are made available at 15 of its centers nationwide, including two regional

centers. 81% of the population have access to health care services within one hour's walk. Since 1993, free health care services are provided to those working in FAIMO, the impoverished and the unemployed.

Although women's health and nutrition have generally improved since 1975, anaemia still prevails due mainly to many childbirth in a short span and inadequate nutrition. Mortality is usually caused by infectious diseases, respiratory infections, malnutrition and parasites, with diarrhoea, acute respiratory infections, and malnutrition being the most predominant causes of death among children under 5. Poor hygienic conditions and lack of sanitary and potable water lead to the prevalence of diarrhoea. The cholera outbreak in 1994/95 affected 13,177 people and caused 253 deaths. The intensive health education campaign organized at the time of the outbreak resulted in the bleaching of drinking water by the majority of population. Recently, however, many villages do not carry this disinfection procedure as frequently as they should.

The population with access to safe drinking water is 34% in the rural area and 70% in the urban area (1990~96). The population with adequate sanitation facilities is 10% in the rural area and 40% in urban areas (1990~96) (UNICEF World Children's Report, 1998).

4) Education

Since 1994, the education system in Cape Verde consists of six years of free and compulsory primary education, five years of high school, and one year of pre-university education. (According to the "Reform" in progress, compulsory education will be extended to a total of 9 years by 2001, and pre-university education to three years.) The net primary school enrollment was 97.8% in 1996 with no significant gender inequality. Major constraints in the sector are outdated curriculum, lack of teaching materials and facilities, and ineffective teachers; 61.3% of the teachers at the primary level are without professional training.

In Cape Verde, women represent 64% of the illiterate population. This condition for women over 35 years of age is mainly attributed to the colonial regime when women had very limited access to education. Women's level of education is reflected in their attitudes, practices, behaviors, survival and development, and continues to be a major barrier in their active participation in social as well as political fields.

In 1979, the government implemented a three-level adult literacy programme: basic reading, writing and arithmetic being the first level; advanced reading, writing and arithmetic the second level; and training in general skills constituting the third level.

2.3.2 Social Characteristics of Six Municipalities in Santiago Island

Under the decentralization system, municipalities are autonomous bodies, hence each municipality has a different administrative system. Since the decentralization started in 1991 the municipal administrative system is not well established yet.

A municipality is the smallest administrative unit. It consists of a municipal council and an administrative body called *camara* municipal. A municipality normally consists of at least one *freguesia*. A *freguesia* does not carry any administrative function, but the municipality or the central government may establish a representative agency within the area. A *freguesia* consists of villages (*zona*). Many of the *zona* have what is called a commission made up of several residents appointed by the municipality or nominated by the *zona* population. The commission

voluntarily undertakes activities such as the identification of FAIMO workers and other vulnerable population as well as identification of village needs. It also maintains liaison with the municipality. In villages without a commission, the village chief assumes the same responsibilities. A *zona* consists of at least one *lugar*, or locality.

Although a *zona* does not have any administrative function, the municipality often uses it as a basic unit for programme intervention, in the absence of other alternatives.

1) Tarrafal

Migration from Tarrafal, mostly to Portugal, is very strong. The percentage of unemployment for those living in Tarrafal in the ages between 15~64 was 13% in 1990 (17% for men and 8% for women). Unemployment conditions mostly affects the young: 19% for ages between 15~29, 5~6% for ages between 30~64.

60% of the population between 15~64 are economically active: 89% for men and 44% for women. Major economic activities are intensive agriculture, forestry, livestock, hunting, fishing, and construction. Majority of Tarrafal's population depends on FAIMO, which pays a monthly wage of 9,000 ECV for non-skilled labour, far below 16,000 ECV, the wage of those defined within the poverty level. Women are often engaged in small scale trading, e.g. selling fish, firewood, sand, among others as a means of survival.

The population of Tarrafal is served by a health center located in the town of Tarrafal. The center also services the population of Sao Miguel. Of the total number of households, 86% has no toilets or latrine.

2) Sao Miguel

The percentage of unemployment for the residents of Sao Miguel between 15~64 years of age was 10% in 1990 (15% for men and 7% for women). Unemployment conditions mostly affect the young: 15% for ages between 15~29, 4~5% for ages between 30~64.

Ninety (90) percent of the population between 15~64 years of age are economically active: 93% for men and 88% for women. Major economic activities are intensive agriculture, forestry, livestock, hunting, fishing, and construction. Majority of the population is engaged in FAIMO while women are often engaged in small scale trading.

Sao Miguel is a fairly new municipality established in 1996. It does not have a health center and the population is served by the health center in the town of Tarrafal. According to the study made by the World Bank, the municipality has the highest prevalence of malnutrition. Most households (94%) have no toilets or latrines.

3) Santa Catarina

Unemployment is high at 30% of the population. Of those employed, 33% are engaged in agriculture, fishing and forestry. Major sources of income in this municipality are intensive agriculture, livestock and fishing. Many are engaged in the activities of FAIMO, 60% of which are women.

The population is served by a regional hospital at Assomada, in the town of Santa Catarina. There are also two health centers and 8 sanitation units in the municipality.

4) Santa Cruz

The major sources of income are intensive agriculture, forestry, hunting, and fishing. The municipality has the largest cultivated land of banana and vegetable in the country. FAIMO is important to the majority of the population as an indirect source of income.

The population is served by a health center located in the town of Pedra Badejo. One regional hospital is under construction in this town since 1998. Most households (96%) do not have toilets or latrines.

5) Sao Domingos

Unemployment rate is 35%. Most of the population (91%) is engaged in agriculture. Other sources of livelihood are livestock and fishing. Handicraft is one of the well-established trades in the municipality.

The health needs of the population are met by one health center in the municipality which is still under the supervision of Praia, and four sanitation posts. Only 5% of the total households have toilets or latrines.

6) Praia

Praia, being the most important migratory destination of the country, shows a high population growth rate of 3.7%. Urban migration is a big concern particularly in Praia City where illegal settlements with all the social consequences are already a familiar phenomenon.

There is a national hospital in Praia City. Tuberculosis remains a major problem in the city along with water borne diseases. Over half (69%) of the total households have no toilets or latrines. The significant absence of household sanitation facilities poses a serious health threat in the city of Praia.

2.3.3 Community Participation in Water Supply O/M

1) Survey sample and methodology

Six (6) to eight (8) *zonas* (villages) each were picked from six municipalities to study rural social characteristics, especially pertaining to gender issue and general domestic water supply conditions. The survey was carried out in 43 villages, basically targeting village leaders, sanitation agents, teachers, water vendors, and others, as shown in the Supporting Report.

614 individuals (312 male and 302 female) representing the household category have been interviewed.

Key informant interviews as well as group interviews were also conducted with the help of an interpreter and research assistants, using both structured and semi-structured questionnaires. The results of the interviews, particularly quantifiable information, are given in the Supporting Report.

The results did not indicate any distinctive features in each of the six municipalities. No significant behavioural differences were observed even in the villages where the FENU phase II project is planned. Water supply conditions, however, were observed to differ according to the type of system.

2) Water Supply O&M System

The villagers are not involved in water supply O&M. They buy water from water vendors who sell water produced by public faucets. Of the 23 water vendors interviewed, 14 were male and 9 were female, demonstrating little gender discrimination. The major responsibilities of the water vendor are collection of water fee and cleaning, although some indicated repair and water quality control as added responsibilities. They are remunerated for provision of such services. Of 23 water vendors interviewed, only 40% received technical training on repair or maintenance. Nonetheless, only a few were actually engaged in repair work, and mostly the municipality, in response to requests made by the water vendor, undertook repair/maintenance work.

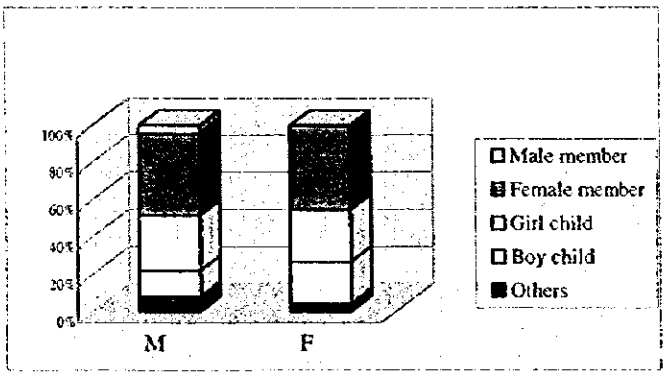
3) Satisfaction/dissatisfaction with current water supply

Majority of the population is not satisfied with the current water supply. In the village where households are connected to the water supply system and/or spring water is plentiful, the population more or less indicated satisfaction. The major reasons for dissatisfaction are found in quantity, quality, accessibility, cost of water, and unreliability in terms of frequency of water-tank lorry supply and the seasonal variations in the water level of springs and dug wells. Although the primary reason for dissatisfaction varies according to *zona*, water shortage is the most predominant factor.

4) Women and water

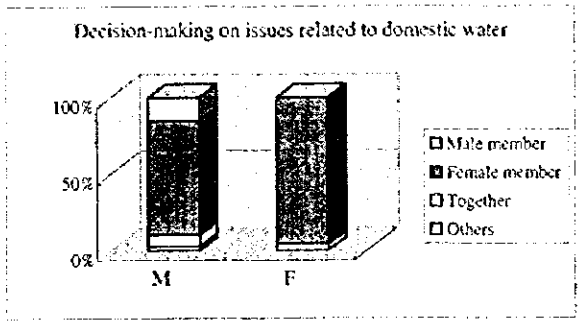
Women are responsible for the collection of water for domestic use (i.e., drinking, food preparation, bathing, washing, and gardening when applicable), whereas men are responsible for agriculture water. Women collect domestic water with the help of children but more often by girls. Women also help each other in cases of pregnancy and illness, evidencing the "joint hand" mentality, a traditional concept of mutual help. (Refer to the following chart showing the results of interviews with community men and women on the collection of domestic water)

Figure 2-1 Responsibility for domestic water collection



When it comes to deciding when and who to collect water and how much water to collect, women usually make the decision, particularly so in female-headed households, a common phenomena in Cape Verde. Nevertheless, even in the cases of married women or women living with partners, women make the decisions, although it is observed that men, in some cases, have the final say. It is therefore safe to conclude that domestic water issues are the women's responsibility. (Refer to the following chart showing the results of the interviews with community men and women on decision-making on domestic water issues.)

Figure 2-2 Decision-making on issues related to domestic water



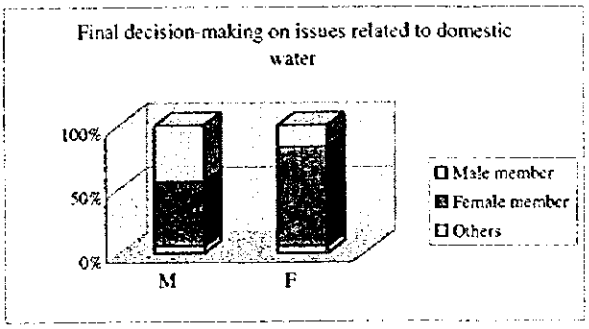


Table 2-8 below was developed on the basis of the interview results and shows gender differences in access and control over water and household economic issues. The table shows that women have more access and control over domestic water issues than men. On the other hand, men have better access and control over irrigation water issues than women. However, the current water situation does not permit use of water for irrigation purposes. Few of those who have done some repair or maintenance work on the water facilities were men, indicating that maintenance work is usually the responsibility of men. Women are found to be in charge of the household economy.

Table 2-8 Access and control over water and household economic issues

	Access/Control		Remarks
	Male	Female	
1. Resources			
1.1 Water use			
a. Domestic water	△	○	
b. Irrigation water	N/A	N/A	Not normally collected
1.2 Equipment			
a. Equipment for maintenance	△	×	Only men are engaged in maintenance
1.3 Skills/training	×	×	
a. Water system maintenance			
1.4 Labor support for water collection	△	○	Mostly supported by children
1.5 Credit for water fee	×	×	
1.6 Household economy	△	○	
2. Benefits			
2.1 Water	○	○	

○ = have good access/control
△ = have some access/control
× = have no access/control

5) Community interest in improved water supply

Majority of the population indicated that they are not satisfied with the current water supply system. They also showed interest in having better water supply conditions and voiced the willingness to participate in O&M if improved water facilities are installed.

The population, in general, indicated a desire for increased water supply through the installation of new facilities, rehabilitation of existing ones, or even through increased water supply by the lorry. Although the ability of the population to buy more water was not verified by the interviews, the need for increased water supply quantity and at least a willingness to buy more water were confirmed. The reservation about having to pay for water supply indicated by the population with free access to water can not be denied however, although they indicated the willingness to compromise if water becomes scarce.

6) Willingness to participate in water supply O/M

The residents showed their desire to contribute to water supply O/M by their willingness to pay a water fee, form a water users committee, and assuming responsibility for facility maintenance. In the interview, the residents indicated the need for support and training in proper facility maintenance to effectively carry out water supply system maintenance. Although most people welcome the idea of forming a water users committee, some prefer the appointment of one person to assume all the responsibility. Some of those who showed willingness, however, expect to be remunerated for their services.

When asked about who should provide the land for the installation and/or maintenance of the facilities, the majority were willing to offer a section of their

property for this purpose. There were a few who indicated that the municipality in reality must provide the land, as most people own land only enough for housing.

7) Health and sanitation

Diarrhoea and skin diseases are among the most common diseases affecting children and adults, and this may be attributed to inadequate water supply and unsanitary conditions.

Nonetheless, the population is generally aware of the importance of health and personal hygiene, safe drinking water supply, as well as the correlation between contaminated water and water-borne diseases, e.g. diarrhoea, cholera. Although health education is organized by health facilities (e.g. sanitation units and posts), it is not regularly carried out. The school curriculum also includes health and sanitation. The cholera epidemic in 1994/95 compelled authorities to stringently educate the people on proper health and sanitary practices, a policy that raised the awareness of the importance of having safe water. The residents also learned that water must be treated. During the cholera epidemic, many treated their water supply by chlorination.

With general understanding of the importance of personal hygiene and sanitation, the residents are quite frustrated with the water supply conditions. Ironically, however, the garbage disposal habits -- waste is disposed just about anywhere -- of the residents do not help much in improving sanitary conditions in these villages. None of the residents have taken the initiative to dig a community garbage pit, expecting the municipality or somebody else to take provide such necessity.

Only few households have toilets, with the majority using open fields. Although inconvenient, many prefer the open fields to an indoor latrine, which is considered dirty. People's acceptance of the toilet but not the latrine proves the importance placed on the former as a status symbol.

Of the 20 teachers interviewed, 9 said that the school had toilets, but all except one are not used either because the facility is broken or due to the lack of water.

8) Impacts of improved water

In the interviews, the population gave top priority to economic needs along with the need for domestic water, although family health and education are also considered of importance. This prioritization is largely influenced by the fact that scarce rainfall conditions have badly affected the economic conditions of the residents, who are predominantly reliant on rain-fed cultivation. Abnormalities in the climate since the last decade have affected groundwater availability, which was easily accessible to the population through springs and dug wells in the past. Water shortage stagnated not only economic activities but social as well as cultural activities in Santiago Island.

In view of these conditions, improved water supply conditions are expected to have tremendous positive impacts on the community. In particular, such conditions would render the women better equipped to promote family health and hygiene.

At present, 1~3 hours are spent in collecting water. Improved water supply conditions would reduce this time and consequently give women more time to attend to personal, social and economic activities. Most women, however, are more interested in having more time for housework and childcare if given more free time.

Aside from this, women place a lot of importance in carrying out income generating activities, to help the household economy, if presented with more spare time.

2.4 In-depth study on community participation in water supply O&M

2.4.1 Study sites

Two villages were selected for the in-depth study: Fazenda, in the municipality of Tarrafal, and Achada Costa in the municipality of Santa Cruz. The reasons for selecting these two villages are:

- In Fazenda, people have free access to water, as opposed to those in Achada Costa who buy water from a water-tank lorry. These contrasting conditions present two distinct cases in terms of payment for water use.
- Although remotely located, Fazenda has been exposed to development activities in the past, while Achada Costa, despite relatively good communication links with other areas, remains underdeveloped.
- While the means of livelihood in Fazenda is a mixture of agriculture and fishing, the residents of Achada Costa are only into agriculture, thereby presenting different lifestyles.

The intention of selecting two villages with distinctive characteristics was to recommend priority issues to consider for enhanced community participation in O&M.

2.4.2 Study methodology

The in-depth study was conducted in collaboration with MORABI, a women's NGO in Cape Verde. Initial visits were made to Fazenda and Achada Costa to explain to the communities the objectives of the in-depth study and to request for the collaboration of the target population. At this time, key persons such as administrative leader, etc., to be interviewed were identified. In the meantime, background information and data concerning the two villages were collected from relevant municipal offices. In the next visit, the first community meeting was held in each village, which commenced with the introduction of the objectives of the in-depth study to the whole community, followed by discussions on current water issues. Unstructured, individual interviews were simultaneously conducted in each village. The second community meeting was held to continue the discussions held earlier and develop community resource maps as well as daily routine by gender. These exercises were organized in order to enhance the awareness of the population regarding the fact that water problems are a community issue and, therefore, to enhance the sense of "ownership" and "participation" in water supply facility O&M.

2.4.3 Study results in Fazenda

1) Characteristics of Fazenda

Fazenda is located near the northern end of Santiago Island, in the Municipality of Tarrafal. It has a population of 141, 57 men and 84 women, a total of 33 families in

30 houses. Approximately 42% of the total number of families receive either financial or food assistance from the municipality.

The major economic activities in Fazenda are rain-fed agriculture, fishery, and livestock raising. People also exploit the forest for sales of firewood.

The community has a one-room elementary school where the first four years of primary education is provided. Children have to go to other areas for further education. There is no health unit in the village.

There is a local Agricultural and Livestock Association established in 1997. The Association, registered in December 1997, is currently under contract with OASIS, a national non-governmental organization promoting self-sufficiency of local communities through formation of cooperatives and associations. The Association mobilizes the villagers to voluntarily participate in community activities such as construction of roads, felling for pasture and building of a community center.

Apart from the existing Association, the sense of community is very strong, which is manifested in the form of the "joint hand" mentality, a traditional concept of mutual help exercised at the time of farm work, funeral as well as matrimony, and even in house building activities.

The community traditionally celebrates a big festivity called "Festa de Vela Cruz", but due to deteriorating village economic conditions resulting from drought, celebration is not as grandiose as before. Football, a famous sports among the youth, is also no longer played because there is no water to wash after the game.

2) Water Use Conditions

The people of Fazenda take water from two sources:

- An open dug well located in the center of the village
- A spring located 2 km from the center of a village near the coast

Although easily accessible, the dug well produces water not suitable for drinking. Besides, it takes hours to collect 25 liters of water. The spring provides the population with drinking water, although access is extremely difficult and even dangerous. Women usually get up as early as 4 o'clock in the morning to fetch water from the spring as shown below:

Table 2-9 Daily routine in Fazenda by gender

Time	Women	Men
4:00 AM	Wake up Collect water	
6:00 AM		Wake up
7:00 AM	FAIMO	FAIMO
12:00 PM	Collect firewood House cleaning	Return home Rest
1:00 PM	Prepare lunch	
2:00 PM	Serve lunch Wash dishes Prepare corn	Lunch Rest
3:00 PM	Start dinner preparations	Go fishing
5:00 PM	Look after animals	Return home
6:00 PM	Wash up	Wash up
7:00 PM	Serve dinner Wash dishes	Eat dinner
8:00 PM	Pray Go to sleep	Pray Go to sleep

People have acknowledged that improved water supply conditions would bring them the following benefits:

- Better health and hygiene for individuals and the community
- More spare time for women and girls
- More food
- Opportunities for income generation activities such as horticulture and cattle breeding

3) Community participation in O&M

The community agrees to form a water management committee responsible for the water supply facility O&M. Although people in Fazenda are currently not paying for water, the benefits of an improved water supply clearly surpass the burden people have to bear, e.g. payment of a water fee, the wages of the committee members, cost of fuel and tools required for O&M, personnel training, among others.

The major responsibilities of the water management committee are: general supervision, establishment of condition for the use of the water supply for the community, maintenance of the facilities, and record keeping. The committee, which should include one sales person, one machine operator, and one president, will be elected in a community meeting and given a trial period. An evaluation will be undertaken on the performance of the committee. The qualifications for members of the committee are:

- Literate
- Possession of an ID card

- Experienced and knowledgeable on the field (in case of machine operator)
- With socially acceptable moral standards
- Credible, honest and responsible

2.4.4 Study results in Achada Costa

1) Characteristics of Achada Costa

Achada Costa is relatively easy to access from Pedra Bedejo, the town of Santa Cruz. It has a population of 186 with 31 households.

The major economic activities are presently limited to those offered by FAIMO, dry land agriculture, sales of firewood as well as handicraft by women. The municipality considers the village among the "special villages for Poverty Alleviation Programme."

The village has neither a school (except a kindergarten) nor sanitation unit. Accordingly, the level of education in the village is very low; there is also no adult education programme. Children attend the school in the neighboring village Levada.

People recognize that their village is underdeveloped and expressed the following: "nobody knows that we are here, or nobody even cares". There has never been any outside intervention for the development of the village, nor is there any community organization/association.

2) Water Supply Conditions

There is a community reservoir with a capacity of $22m^3$, which is supplied with water twice a week by a tank lorry. The only water source (dug well) of the community dried up in 1995.

Water is sold at 3 CVE per 20 liters, and the average consumption ranges from 15 to 20 liters per capita per week.

When the lorry does not come to the village, people have to go to Pedra Badejo and Joao Teves to buy water, which implies extra cost for transportation.

The last cholera epidemic (1995) clearly changed the attitude of the population in terms of safe water. Consequently, the community expressed the desire not only for an increased amount of water supply but also information/training sessions on health and hygiene. The benefits of good water supply are described as improved health, economic activities such as agriculture, horticulture, and livestock, and moreover, happiness of the community.

3) Community participation in O&M

People in Achada Costa also agree to form a water management committee with one president, one sales person, one machine operator and one secretary. The prime responsibilities of the water management committee are to ensure good distribution of water and maintenance of the facilities.

The water management committee should be trained in all aspects related to water supply such as water quality and control, family and community hygiene, facility

operation and maintenance, and management training. The members of the committee must have the following qualities:

- Respect water safety rules
- Educated and/or literate
- Skilled in public relations
- Credible, honest and responsible

2.4.5 General recommendations for enhanced community participation in O&M

Both communities demonstrated their willingness to participate in O&M of the improved water facilities, as they clearly see that such facilities offer more advantages than hardships. Despite the economic difficulties they are going through, they are obviously prepared to do everything possible to maintain the water facilities. Nevertheless, there are several strategic issues, as shown below, that must be taken into account in order to enhance community participation for sustainable O&M.

① Priority

A study should be carried out to determine if the population gives highest priority to water supply. The willingness of the population to buy water not only depends on their existing economic capacity but on the seriousness of water problems they confront daily. If an improved water facility has been constructed in an area where the population gives highest priority to water, the population will highly likely find the means to maintain the facility.

② Community involvement in all phases of the project

The population should be involved in all phases of the project, i.e., problem identification, project planning, implementation, and evaluation. This will help the community fully identify with the project.

③ Participation of women

- **Women's preference:**
  The ideas and desires of the population, especially women, concerning water supply facilities should be taken into account. Women's participation in the water supply project is not a controversial issue in Cape Verde, as women are recognized as the main users of water, especially domestic water. Therefore, consulting women and taking their opinions seriously is highly recommended.

- **Gender sensitivity:**
  While the project provides a good opportunity for capacity building of women and enhances positive gender relationships over time, it does not focus on women alone. Nor does it deny existing gender relationships or threatens the status of men in the family and in the community. It is, therefore, important to consider the sentiments of men to avoid opposition from male members of the community.

④ **Water management by the community**

Formulate a water management committee responsible for water supply related issues, i.e., water quality control, cleaning of the facilities, accounting, leadership and community participation. Respect the cohesiveness and sentiments of the population in creating a water management committee.

⑤ **Capacity building of the community**

As much information as possible should be provided to the community to foster a sense of participation. Selected training courses should be provided and be made available to any resident interested, as a means of fostering a sense of responsibility among the population.

⑥ **Community-based organization**

The project should utilize as much as possible existing community human and material resources. Coordination with an existing community organization/association, e.g. developmental and religious organization/association, will be useful in the mobilization of the community. Fazenda, for example, has an agricultural cooperative, which has been effective in mobilizing the population for community work. However, the absence of such organizations/associations does not imply that the project will be ineffective in such a locality. The exploitation of the "joint hand" mentality, a traditional concept of mutual help that still strongly exists in many places and fosters the spirit of community, would be significant to the project's advantage. If mobilized to the fullest, this mentality can be an effective vehicle to gain dynamic community participation.

⑦ **Enhance awareness of improved sanitation and hygiene practices**

Although the level of knowledge on sanitation and hygiene is rather high among the population, there is still a need for further development in the form of trial and error. Health and hygiene education and improved water supply conditions would greatly motivate the population to carry out hygienic practices.

⑧ **Monitoring and supervision**

- **Continuous support of the community:**
  The water management committee should be monitored for a certain period by extending continuous support in the practical application of knowledge and skills they have acquired during the training sessions.

- **Collaboration with local NGO**
  Even if the community demonstrates willingness to participate actively in facility O&M, it is crucial to keep a close and continuous contact with the community before, during and after the construction of the water facility. This will help encourage community participation and ensure the sustainable use of the facility. Under the circumstances, collaboration with a local NGO is assumed to help encourage and make the community enthusiastic about participating in the activities.

2.5 Participation of Rural Communities in the FENU Water Supply

2.5.1 Public Awareness

FENU is currently undertaking a project on rural water supply in Santiago Island. The first phase has started in 19 sites in six municipalities. The project, along with the construction of water facilities, underscores community participation in all phases to ensure:

- Sustainable use of water supply facilities
- Reduced O&M costs
- Systematic water supply control
- Improved attitude regarding water supply and sanitation

The enhancement of public awareness is a vital part of the project for it aims to establish a relationship between the project and the recipient population. Community participation depends greatly on motivating factors. When the community acknowledges its necessities and feels that they can be fulfilled, it will be remarkably motivated to participate in the project. To ensure this, therefore, relevant activities, i.e., education programs, will be implemented prior to, during, and after the facilities are constructed.

2.5.2 Community participation in O&M

The project philosophy concerns the creation of a water management committee in each site to ensure the effective management, maintenance and operation of water supply facilities. The specific responsibilities of the committee are: management of the sale of water, promotion of hygiene and health education, hold monthly meetings to inform the community of planned activities and discuss water problems, money collection for operation and maintenance, among others. The committee should have its own rules and regulations. The creation of the committee is also aimed to stimulate voluntary community participation.

The committee will consist of the following:

- President
- Representative of the municipality
- Treasurer or secretary represented by the school teacher or church
- Female resident member responsible for hygiene and health
- Male resident member (plumber or mason) in charge of minor repairs
- Resident member (farmer, mason or carpenter)
- Female resident living near the facility, to act as caretaker

2.5.3 Maintenance system

The municipal services will entail periodic technical control and maintenance of the facilities. The water management committee in turn will establish a fund for the maintenance of the equipment and treatment of water.

The municipality, the study team, and the water management committee will work jointly for the successful implementation of the project.

2.5.4 Training and education

The members of the water management committee will be trained in accounting, management, and preparation of reports. In addition, depending on the nature of responsibilities of each member, training will be given on maintenance skills, water quality control, among others.

All users will be trained in the proper use of the facilities and the norms concerning water transportation and storage, and in keeping the surroundings of the facilities clean.

3 WATER SUPPLY

3.1 National Policy on Water Supply

According to the Water Code of the Republic of Cape Verde (adopted in 1984, and its principal decrees for application promulgated in 1985 and 1987), water in all its form is a national asset, which should be developed and managed by a central administrative unit.

The National Water Council (CNAG), an inter-ministerial institution presided by the Minister of Agriculture, Food and Environment (MAAA) and comprising representatives from three other ministries, is responsible for the management of water resources in the country.

CNAG's executive organ used to be Junta dos Recursos Hidricos (JRH), which dealt with a whole range of activities related to water resource development. JRH's functions have been transferred to the new National Institute for Water Resource Management (INGRH) and to the municipalities since 1993. The execution of construction works is contracted to agencies specializing in this area and private enterprises.

The Master Plan for Water Resources (1993-2005) of the Republic of Cape Verde, prepared in 1993, stipulates that the Government's objectives for the sector of drinking water supply are **to provide safe and stable drinking water and increase national coverage to 100% of the population by 2005** (from approximately 65% as of 1990: 62% in Santiago), as well as **to rehabilitate infrastructures and improve the technical and financial aspects of the water supply system.**

With regard to the unit supply amount, the Master plan targets the following amounts: **50 liters per capita per day (l/c/d)** for households with connections, and **20 l/c/d** for public faucets. The actual consumption rates vary from place to place, but are generally lower than the target units. Distribution points should not be further than 1,000 meters from the houses.

In order to attain the objectives, the government is actively implementing projects with special emphasis on drinking water supply and sanitation in urbanized areas (Praia and secondary centers), and drinking water supply in rural areas, utilizing financial assistance from multilateral institutions (UNDP, AFDP, EU, UNICEF, etc.) and bilateral foreign aid from Germany, Saudi Arabia, Spain, U.S.A, France, Italy, Norway, the Netherlands, Portugal, and Switzerland.

Since water resources are very limited in every island of the nation, the development of investigations are carried out on the development of all possible resources and water supply alternatives e.g. seawater desalination, surface water storage through the construction of dams, rainwater collection and storage, groundwater exploitation by shallow and deep wells, spring water development by 'galeria' and condensed humidity fog.

Also, to optimize scarce existing water resources, the introduction of modern and sound irrigation techniques is a high priority, in order to increase the quantity of water available for drinking and other essential purposes.

3.2 Organizations Related to Water Supply

The organizations in the sector of water supply in the Republic and their functions are as follows:

1) CNAG

The National Water Council (CNAG) is the top national administration for water resource development and management. It is composed of representatives of four ministries and presided by the Minister of MAAA.

2) INGRH

The National Institute for Water Resource Management (INGRH) is the executive organ of the CNAG. It is in charge of conducting research and reconnaissance studies, planning and managing water resources, and promoting the development of the sector.

Concretely, INGRH's main tasks are as follows:

- Assess the availability of water resources
- Reasonable exploitation of water resources, taking into consideration the optimum use of the resources for the benefit of the people
- Improve urban and rural water supply conditions
- Review the tariff policy
- Promote the relationship between domestic and irrigation water use
- Support autonomous services related to water supply and energy in each municipality.

INGRH has its headquarters in Praia City and three branch offices in Santa Catarina, São Nicolau and Santo Antão. The INGRH HQ consists of 4 Departments: (i) Planning Department, (ii) Water Supply Department, (iii) Hydrological Department and (iv) Administration and Finance Department.

The total number of staff and employees are 199, of which 14% are technicians, 2% administrative staff, 17% maintenance staff, 24% office employees (cleaners, office messengers, etc.), 3% servants, 3% trainees and 37% other employees such as motor operators, water vendors etc.

3) INERF

The National Institute for Rural Engineering and Forestry (INERF) is directly under the MAAA, and constructs water supply facilities, wells, etc., on a contract basis with INGRH or MAAA. It is foreseen that INERF will become a private enterprise under the privatization program of MAAA.

4) EMAP

The Municipal Enterprise for Water of Praia (EMAP) is a public corporation which supplies potable water and manages solid waste and the sewerage system of the Municipality of Praia.

5) Local Governments

Each municipality in Santiago Island has a Department of Water and Energy, which supplies water to the population, except in the Municipality of Praia where the water supply services are undertaken by the above mentioned EMAP.

In the 4 Municipalities of Tarrafal, São Miguel, Santa Cruz and São Domingos, the water supply service section is responsible for the distribution of water for domestic and irrigation use to both urban and rural areas. Groundwater exploited by INGRH is supplied through public grids, public faucets, and delivery by tank lorries. In the case of the Municipality of Santa Catarina, however, the municipal water supply office section only services the town of Assomada and its surroundings, while the INGRH branch office supplies water to the population in rural areas and water for agricultural use.

Each municipality pays a water tax to the State: 15 CV Esc per m^3 for domestic use, 8 CV Esc per m^3 for agricultural use. In September 1998, INGRH raised its unit water rates from 5 to 15 CV Esc per m^3 for domestic use, and from 2 to 8 CV Esc per m^3 for irrigation use.

3.3 Present Rural Water Supply Conditions in Santiago Island

3.3.1 Existing Water Sources for Domestic Use

Four types of water sources are used in rural areas, i.e. shallow wells (dug wells: pumped up for irrigation use and dipped for domestic use), deep wells (boreholes equipped with motorized pumps for irrigation and domestic use), springs (for irrigation and domestic use) and rainwater.

Boreholes for domestic use are predominantly used (140 villages: all public wells), followed by springs (60 villages, 8 of which have been developed and equipped with some facilities), shallow wells (29 villages, mostly dug and developed privately) and rainwater (4 community systems and a number of private storage systems).

Since rainwater and water from shallow wells are not stable, the villages dependent on such sources usually get their supply from tank lorries that deliver water taken from boreholes, especially during dry season. The percentage of water source type differs by area as shown in the table below.

Table 3-1 Number of villages using boreholes, springs and shallow wells as water supply source by Municipality

Municipality and Number of Villages		Type of Water Sources and Number (%) of Villages		
		Boreholes	Springs	Shallow Well
Tarrafal	(20)	17 (85%)	2 (10%)	1 (5%)
São Miguel	(22)	11 (50%)	7 (32%)	4 (18%)
Santa Catarina	(70)	41 (59%)	24 (34%)	5 (7%)
Santa Cruz	(37)	31 (84%)	4 (11%)	2 (5%)
São Domingos	(28)	24 (86%)	3 (11%)	1 (3%)
Praia	(28)	18 (64%)	10 (36%)	0 (0%)
Total	(205)	142 (69.3%)	50 (24.4%)	13 (6.3%)

As of 1998, there are 102 boreholes in Santiago Island, 38 of which are used only for irrigation, 22 for irrigation and domestic use, and 42 exclusively for domestic use.

The production of these wells varies by month and year in accordance with the condition of each well and the seasonal variation in needs especially for irrigation.

About 76 % of the total production from the wells is used for irrigation; the remaining 24% is used for water supply (domestic purposes) in each of the 5 municipalities, except in Praia where nearly 90 % of the total production is used for water supply (see Table 3-2).

Table 3-2 Number of Boreholes Wells and Their Average Daily Production by Municipality (1997)

Municipalities	No. of Wells	Average Daily Production (m^3/day)	Use and Approximate Percentage	
			Irrigation (m^3/day, %)	Domestic (m^3/day, %)
Tarrafal	12	1,463	1,057 (72.2)	406 (27.8)
São Miguel	7	433	266 (61.4)	167 (38.6)
Santa Catarina	17	416	30 (7.2)	386 (92.7)
Santa Crus	32	4,050	3,494 (86.3)	556 (13.7)
São Domingos	17	651	511 (78.5)	140 (21.5)
Praia	17	2,506	340 (13.6)	2,166 (86.4)
Total	102	9,519	5,698 (59.9)	3,821 (40.1)
Total of 5 municipalities, except Praia	85	7,013	5,358 (76.4)	1,655 (23.6)

Spring water is commonly utilized for domestic use and irrigation in Santiago Island, especially in the municipalities of Santa Catarina and Praia where springs are abundant.

The number of springs and their yields have decreased in the past 20 years as influenced by the decrease in rainfall in the Island. The total estimated yield of springs in 1998 is shown in Table 3-3. Since many of the springs are situated very far from the houses or in places with elevations lower than that of the residential areas, only a limited amount of the spring yield is practically utilized for domestic use: from 0.7% in Santa Cruz to 6.1% in Sao Miguel, averaging 1.4% in the whole island.

Table 3-3 Estimated Total Yield of Springs and Domestic Water Consumption by Municipality

Municipality	Number and Total Daily Yield of Springs				Estimated Domestic Water Consumption and Percentage (m^3/day, %)
	1991 (from database)		Estimation in 1998		
	No.	Total Yield (m^3/day)	No.	Total Yield (m^3/day)	
Tarrafal	59	604	20	447	10 (2.2)
São Miguel	119	1,257	95	1,027	62 (6.1)
Santa Catarina	547	15,695	457	13,189	194 (1.5)
Santa Crus	174	7,448	162	6,310	42 (0.7)
São Domingos	99	2,623	88	2,210	28 (1.3)
Praia	152	8,490	145	7,204	79 (1.1)
	1,150	36,117	967	30,387	415 (1.4)

Assumptions for estimation : ①

① Springs with yield smaller than 2m^3/day have all dried up

② Yield of other springs have gone 15% down

3.3.2 Existing Water Supply Systems/Facilities and Services

The water supply facilities in rural areas of Santiago Island comprise of the following:

- Household connections (sources: boreholes and springs)
- Public faucets (sources: boreholes and springs)
- Public faucets (water from wells transported by tank lorries)
- No public facility; water is delivered by tank lorry
- Rainwater collection/storage systems
- No public facilities or public supply services

The number of the above mentioned facility/service types are tabulated in the Table 3-4 by municipality, and the facilities by village are given in Table 3-6 and in the Supporting Report.

Each of the above supply facilities/systems and service conditions are described below:

Table 3-4 Number of Villages by Water Supply Facility and by Municipality

Type of Water Supply System/ Facility in the Village	Number of Villages (5 towns and 200 villages in total)						
	Tarrafal	São Miguel	Santa Catarina	Santa Cruz	São Domingos	Praia	Sub-total
(a) Household connections with deep well(s) as a source accompanied by (c)	2	2	5	5	1	1	16
(b) Household connections with spring as source	0	0	0	0	0	1	1
(c) Public faucets and reservoir tank connected to a well (some are accompanied by (d) or others)	9	4	10	7	5	14	49
(d) Public faucets, reservoir tank and water transportation services by tank lorry	4	5	25	19	17	5	75
(e) Public faucets, reservoir tank and spring as a source	0	0	2	0	1	1	4
(f) Public faucets, and rainwater collection/storage system (served by (d) when rainwater is not available)	2	0	1	0	1	0	4
(g) No facilities; water is delivered by tank lorry	0	1	0	0	0	0	1
(h) No public supply services (water is taken from springs or dug wells, or purchased from a private water vendor)	3	10	27	6	3	6	55
	20	22	70	37	28	28	205

1) Public faucets

Public faucets are the most common in the rural areas of Santiago Island. Villages equipped with public faucets number 149 (73% of 201 villages/towns, including 5 towns and 17 villages with household connections); this system uses the following sources: wells (140), springs (5), and rainwater collection systems (4). Each of these villages are equipped with one or several reservoir tanks and 1 or 2 sets of public

faucets, i.e. *chafariz* (usually 3 taps each), *fontenario* (2 taps each) and two taps directly attached to the reservoir tank.

However, the reservoir tanks linked to their respective water sources by transmission pipes only number 66, and this includes those in 5 towns and 17 villages with household connections. On the other hand, reservoirs in the remaining 81 villages are filled with water transported by tank lorries. Table 3-5 and Figure 3-1 show the number of reservoirs and public faucets by municipality.

Table 3-5 Number of Reservoir Tank for Public Faucets (Number of Villages Equipped with Reservoir Tank)

	Reservoir Tank Linked to Source	Reservoir Tank Fed by Tank lorry	Total
Tarrafal	11 (11)	6 (6)	17 (17)
São Miguel	8 (7)	7 (7)	15 (14)
Santa Catarina	19 (17)	28 (27)	47 (44)
Santa Cruz	14 (13)	22 (20)	36 (33)
São Domingos	7 (7)	20 (18)	27 (25)
Praia	16 (17)	5 (5)	21 (21)
Total	70 (66)	86 (81)	156 (147)

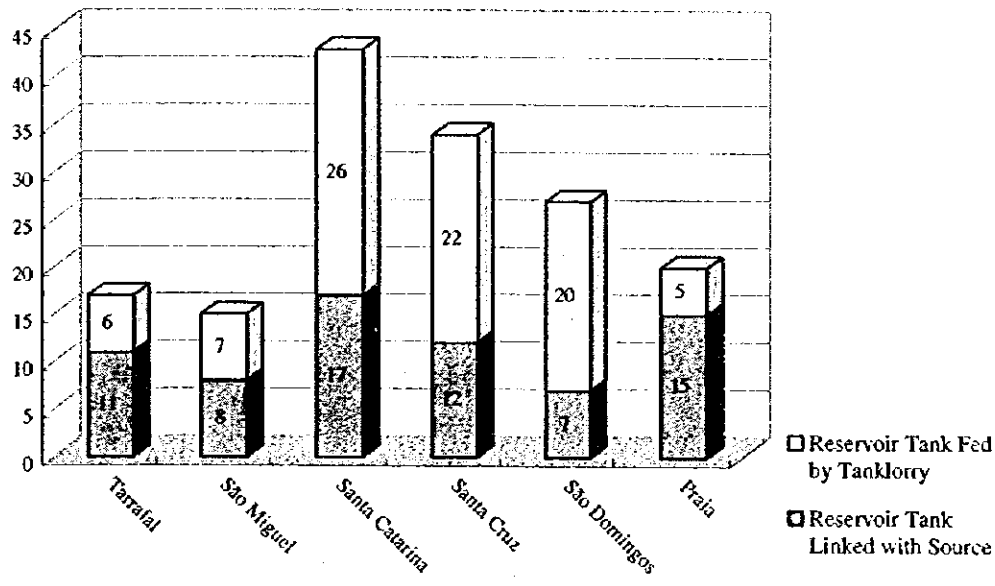


Figure 3-1 Number of Reservoir Tank for Public Faucets

Water transported by tank lorries comes from a well or a nearby reservoir tank and is directly conveyed to the tank lorry using valves. It takes 1 to 3 trips to transport water

faucets, i.e. *chafariz* (usually 3 taps each), *fontenario* (2 taps each) and two taps directly attached to the reservoir tank.

However, the reservoir tanks linked to their respective water sources by transmission pipes only number 66, and this includes those in 5 towns and 17 villages with household connections. On the other hand, reservoirs in the remaining 81 villages are filled with water transported by tank lorries. Table 3-5 and Figure 3-1 show the number of reservoirs and public faucets by municipality.

Table 3-5 Number of Reservoir Tank for Public Faucets (Number of Villages Equipped with Reservoir Tank)

	Reservoir Tank Linked to Source	Reservoir Tank Fed by Tank lorry	Total
Tarrafal	11 (11)	6 (6)	17 (17)
São Miguel	8 (7)	7 (7)	15 (14)
Santa Catarina	19 (17)	28 (27)	47 (44)
Santa Cruz	14 (13)	22 (20)	36 (33)
São Domingos	7 (7)	20 (18)	27 (25)
Praia	16 (17)	5 (5)	21 (21)
Total	70 (66)	86 (81)	156 (147)

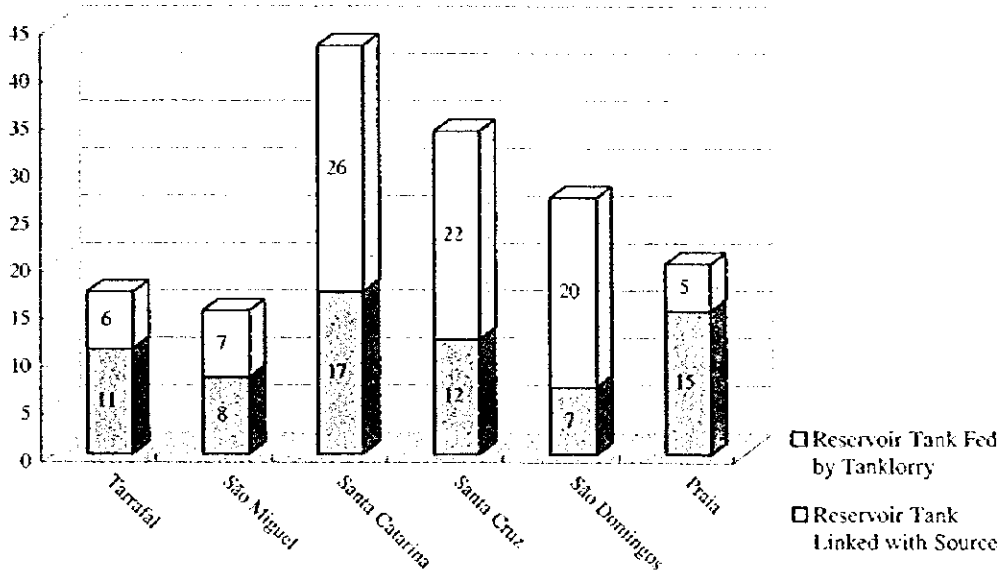


Figure 3-1 Number of Reservoir Tank for Public Faucets

Water transported by tank lorries comes from a well or a nearby reservoir tank and is directly conveyed to the tank lorry using valves. It takes 1 to 3 trips to transport water

to fill the tanks of the respective villages within the same day; this is usually carried out 1 to 3 times a week. The weekly frequency of the transportation service depends on the tank capacity, service population, or tank lorry availability, i.e. number of municipal tank lorries and number of villages to be covered. As a result, the amount of water reaching the residents varies from place to place: between 7 to 20 liters/capita/day, with the majority getting only 8 to 15 liters/c/d (11 liters/c/d on average).

Most of the villages (*zonas*) have only one reservoir tank for the public faucets, regardless of whether the tank is linked to a source or fed by a lorry. The reservoir tank capacity ranges from 8 to 60 m^3 (the majority ranges from 20 to 40m^3), even though the villages are spread out over a wide area, including a number of detached clusters called *lugares*.

The residents of *lugares* with no reservoir or public faucets must go to the center of the village to fetch water, spending 20 minutes to over an hour each way.

Water is usually supplied twice a day for a total of 2 to 8 hours: 1 to 5 hours both in the morning and afternoon. However, longer service hours do not necessarily mean better service, as the limited number of taps result in long queues waiting to use the public faucets. The water consumption rate, therefore, varies even within the same village.

People in detached *lugares* can physically fetch water 1 to 3 times a day, resulting in a unit consumption rate of 3 to 10 liters/c/d. People living close to the public faucets are likely to come and fetch water at any time during service hours, and their daily consumption rate ranges from 8 to 16 liters, some exceeding 20 liters.

The low water consumption rate is mainly due, of course, to shortage of water production points and amount, shortage of service trucks for water transportation in each municipality, and the long distance between the houses and the public faucets.

However, it should be noted that the existing water charge collection system contributes much to the limited use of water. Since the residents have to pay the water vendors to use the public faucets under the "cash on delivery" system, consumption is inevitably lower than their actual needs for economic reasons, especially since the fee is expensive in relation to the average household income.

As of 1998, the charges imposed for the use of the public faucets are as follows:

Water from a reservoir tank linked to a spring source:	Free or 2 CVE/20 liters
Water from a reservoir tank linked to a borehole:	2 to 3 CVE/20 liters
Water from a reservoir tank filled by tank lorry:	3 to 8 CVE/20 liters

A family of 5, each consuming 20 liters per day, must pay a daily fee of 10 to 40 CVE, that is 300 to 1200 CVE per month.

The water vendor at the public faucets is generally a resident of the concerned village, appointed by the villagers and hired by the municipal water supply office as temporary staff. He or she is responsible not only for the water fee collection, but also for the following operation/maintenance work:

- Inspecting the facility condition and reporting to the municipal office

- Disinfecting water using disinfectant supplied by the municipal office
- Keeping the facility and its surroundings clean and easy to use

2) Household connections

There are 16 villages (8%), in addition to 5 towns, with household connections. Neither of these villages are entirely dependent on this system, however, due to the availability of public faucets.

These villages use boreholes as supply sources, except for 1 village (Cidade Velha) in Praia Municipality which uses spring water. The distribution tank is located at a higher elevation than the area, and water is conveyed to the houses by natural flow through a service main and branch pipes, without using feed pumps.

As with the use of the public faucets, water is supplied in the morning and the afternoon for a total of 6 to 8 hours a day. The valve operation and disinfecting procedures are manually undertaken by the pump attendants and technicians of the municipal water supply offices.

Water charge varies by municipality, but the charge system is similar in a sense that the unit cost increases in accordance with the household monthly consumption as shown below:

Monthly consumption per household Unit cost CVE/m^3 (CVE/20 liters)

Under 10 m^3 100 to 130 (2.0 to 2.6)

Between 10 and 20 m^3 180 to 200 (3.6 to 4.0) for over 10 m^3

Over 20 m^3 250 to 280 (5.0 to 5.6) for over 20 m^3

The staff of the municipal water supply office read the water meters attached to the houses and inform the households of the amount they have to pay. The users pay at the municipal office or the collector who goes door to door.

3) Direct delivery service by tank lorry

Water delivery services by municipal tank lorries are extended to the following villages:

- Villages without any public supply facility and without other available water source for domestic use: some of the private reservoirs are fed periodically for joint use (2 villages).
- Villages where existing facilities are out of order or under repair: water is supplied to private reservoirs or drum cans placed along designated transportation routes. This is a temporary measure that disturbs the rotation schedule of the tank lorries (2 to 6 villages).
- Villages with rainwater collection/storage systems, but without water during the dry season (4 villages).
- Villages with only one type of water source (shallow dug well) that usually dries up in the dry season (1 to 3 villages).

The water charge varies by municipality and occasionally in accordance with the delivery distance: between 3 and 10 Esc/20 liters. As with the use of public faucets, the water charge is paid on a "cash on delivery" basis.

3) No public water supply service

There are 55 villages (about 27%), corresponding to an estimated population of about 25 thousand, with no public water supply services.

The residents of these villages fetch water mostly from springs (40 villages with about 18 thousand people), but also from private dug wells and public faucets in adjacent villages. Residents in some villages where springs do not exist or are remotely located, purchase water from private water transporters/vendors at extremely high prices: from 8 to 80 Esc/20 liters, mostly between 10 and 20 Esc/20 liters.