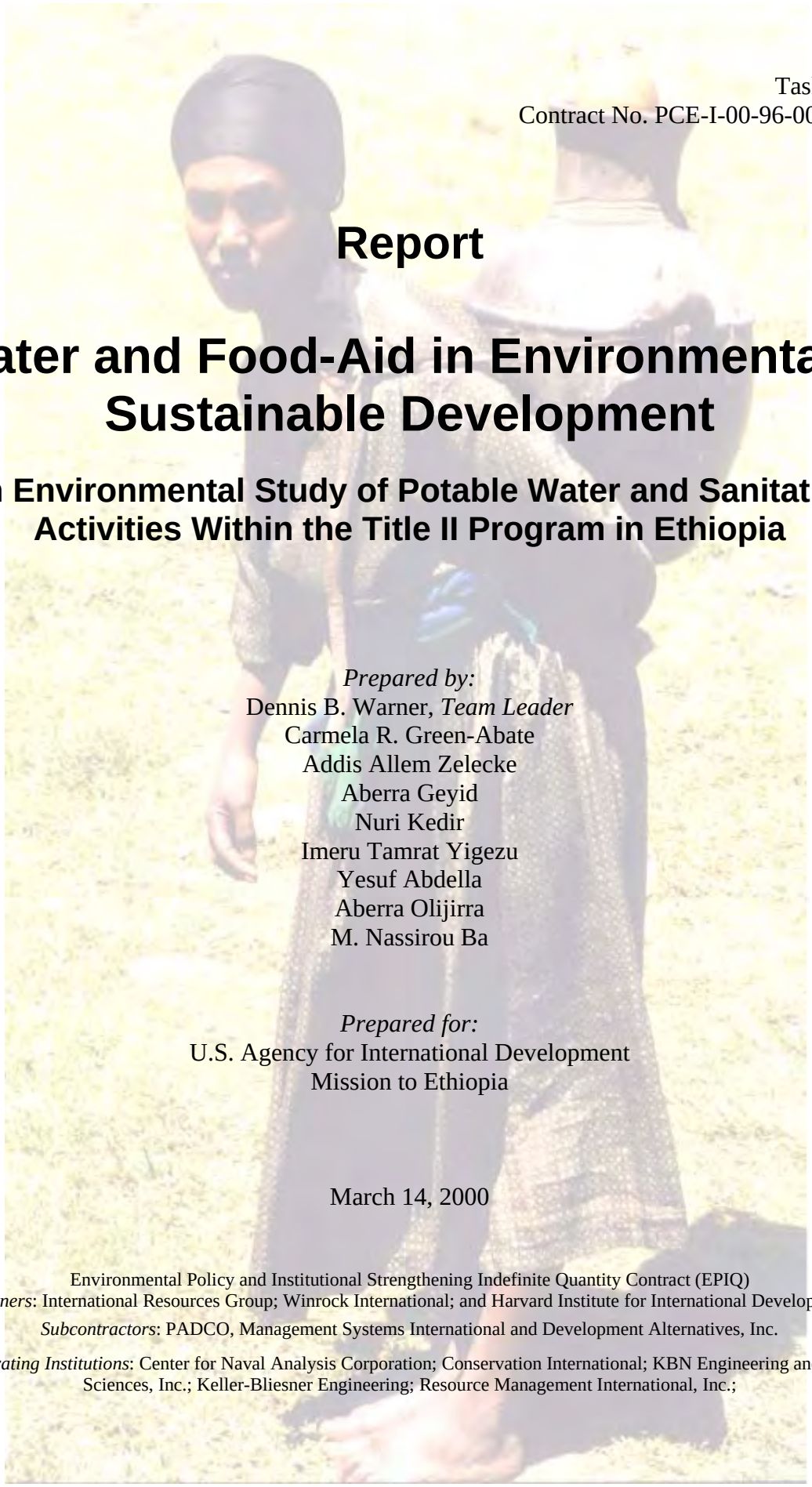
Report

WATER AND FOOD-AID IN ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT

AN ENVIRONMENTAL STUDY OF POTABLE WATER AND SANITATION ACTIVITIES WITHIN THE TITLE II PROGRAM IN ETHIOPIA

March 14, 2000



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Report

Water and Food-Aid in Environmentally Sustainable Development

An Environmental Study of Potable Water and Sanitation Activities Within the Title II Program in Ethiopia

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Table of Contents

Acronyms and Definitions

AWWA	American Water Works Association
birka	traditional ponds
birr	Ethiopian currency (US $1.00 = Eth.Birr 8.12 during Oct-Dec 1999)
CFR	Code of Federal Regulations
CRDA	Christian Relief and Development Association
CRS	Catholic Relief Service
DALY	disability adjusted life years
DAP	development activity proposal
EOC	Ethiopian Orthodox Church
EPA	Environmental Protection Authority
ESA	external support agency
ESRDF	Ethiopian Social Rehabilitation and Development Fund
FHI	Feed the Hungry International Ethiopia
IEE	initial environmental examination
IQC	indefinite quantity contract
KA	kabele adminstration
m	Meter
m^3/sec	cubic meters per second
mg/l	milligram per leter
NGO	Non-governmental organization
PRA	participatory rural appraisal
PAA	previously approved activity
PVO	private voluntary organization
REST	Relief Society of Tigray
SCF	Save the Children USA
SORDU	Southern Rangelands Development Unit
SOW	scope of work
TDS	total dissolved solids
TOR	terms of reference
WASH	Water and Sanitation for Health Project
woreda/wereda	district-level administrative area
WSC	water and sanitation committee
WVI	World Vision International Ethiopia

Acknowledgements

The commissioning and preparation of this report is due to a remarkable marriage of mutual interests and cooperation between the USAID Mission in Ethiopia, which is responsible for guiding official U.S. development assistance under the Title II Food Security Program, and eight Cooperating Sponsors (international PVOs and national NGOs), which are responsible for implementing program activities in Ethiopia. That USAID had the courage to undertake an independent review of the environmental aspects of the potable water and sanitation activities in the Title II program and that the Cooperating Sponsors had the patience and good humor to endure the inquiries and interruptions of the Study Team is very much acknowledged. Without this general concern for the effectiveness of the program and the necessary support for the study of its water and sanitation component, this report could not have been compiled.

The team wishes to acknowledge the core role of USAID/Ethiopia in initiating and funding this study. In particular, it notes the efforts of Mr. Tim Shortley, the head of the Food and Humanitarian Assistance Office (FHA), who directed the overall operation. Also involved in the work were Mr. David Eckerson, acting mission director, Mr. Dennis Panther, head of the Agricultural and Natural Resources Office (ANR) and Ms. Elisabeth Lukasavich, food security officer (FHA). The USAID Mission made a particularly valuable contribution in the form of Ato Yesuf Abdalla, water and sanitation engineer (FHA), who was seconded to the Study Team for the entire period of field operations.

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Appreciation must be given to the Cooperating Sponsors who provided the bulk of the information, technical support and logistics for this study. The Study Team was fortunate to work with organizations which care deeply about their work and ways to improve it. All Cooperating Sponsors assisted with information about their programs and provided technical and logistical support to access their field sites. A particular note of gratitude is given to SCF/USA and its country director, Mr. Jay Zimmerman, for their technical, administrative and logistical support throughout the study. SCF/USA provided a working office base for the team in Addis and, in addition, made available the services of Mr. M. Nassirou Ba to work with the team in the final days of the study. Personnel support was also given by CARE, which seconded Ato Aberra Olijirra to the team for a period of three weeks. Other major contributions to the study were

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A final acknowledgement is due to all the dedicated people working on or contributing to Title II projects. This includes the headquarters and field staff of the Cooperating Sponsors, the technical staffs of the government bureaus and offices in the field and, in particular, the people at the field sites who implement the projects – community leaders, members of water and sanitation committees, system caretakers and the many anonymous individuals who contributed their time, money and effort to build and operate the projects. The nearby communities are the beneficiaries of these Title II water and sanitation projects. But the people who make the projects possible are the planners, builders and operators working at the community level and at the field sites.

Forward

This study is part of a world-wide effort by the U.S. Government in general and USAID in particular to improve the environmental accountability of U.S.-funded relief and development activities. The philosophy behind this effort holds that people cannot truly benefit from U.S. foreign assistance if their environment is degraded in the process. The environment is the physical world in which people live. External attempts to assist people, both in the short and long-term, can be sustainable only if environmental limitations are understood and environmental resources are managed wisely.

Potable water and sanitation activities can succeed only when the developmental efforts are in harmony with environmental limitations and resources. Safe drinking water is arguably the most valuable resource the environment can provide. Without it, the choices available to poor rural communities are few and almost always involve high costs in terms of either financial outlays or human suffering, or both. Sanitation also impacts upon the environment by controlling or enhancing pollution by man-made contaminants. Whereas water is a primary measure of the health of the natural environment, sanitation is a primary measure of the protection and care given to the environment. Together, water and sanitation provide a crucial and highly fragile link between people and their environment.

In Ethiopia, there is a long history of successful cooperation between USAID and a group of international PVOs and national NGOs to address the chronic problems of hunger, food security and poverty. The Title II Food for Peace program has been a major vehicle for the delivery of innovative direct assistance to people in need. The PVO/NGO organizations participating in this effort has been at the forefront of the development of community-based activities which not only serve immediate needs for food and cash income but also for longer-term improvements in health, education and agricultural production. The Study Team acknowledges this history of successful cooperation and innovative community-based development activities.

The recent concern in the U.S. Government, and in the development community at large, for ensuring environmental protection and sustainability in foreign assistance activities provides USAID and the PVO/NGO organizations in Ethiopia an opportunity to take stock of the environmental effects of their work with rural communities in food insecure areas. A review of the impacts of potable water and sanitation activities upon the natural environment and the resulting effects upon the long-term sustainability of the activities might suggest ways to improve and strengthen future food security programs. This, indeed, is what was requested of the Study Team – to conduct an environmental study of the potable water and sanitation activities

funded by the Title II program in order to suggest ways to improve environmental protection and long-term sustainability.

To carry out this request, the Study Team gave primary attention to identifying aspects of program development and implementation that could be strengthened. In some cases, the issues identified for improvement are undoubtedly relatively minor areas of opinion, while in others they probably are constrained by resource limitations and, hence, are not easy to change. In some cases, however, serious issues of project design and implementation call for immediate attention by both USAID and the implementing PVOs/NGOs.

The work of the Study Team and this report, therefore, should be viewed as a compilation of suggestions by a group of outsiders with expertise in the matters of potable water and sanitation but not in the implementation of such projects within the context of a Title II program in Ethiopia. It is up to the organizations that fund and implement this program to decide which, if any, of the suggestions are relevant to them and their future work. It is not expected that all of the suggestions contained in this report will be implemented, but certainly some should be accepted and efforts made to change the conditions that lead to their identification by the Study Team.

The study conducted by the team is not an evaluation of program or organizational performance. Nor is it a public relations review of the work of USAID or the implementing organizations. It makes no attempt to describe the many sound and well-developed features of the program, the implementation efforts of the PVOs/NGOs or the resulting projects in the rural communities of Ethiopia. These strengths exist and were readily observed and appreciated by the Study Team, but they are not the subject of the study. To the extent, therefore, that this report reflects a heavy emphasis upon improving the program and its implementation rather than on praising the program, the Study Team accepts this judgement. The current report is intended to support and strengthen, not to diminish or discourage. Nevertheless, the Study Team believes that the nature of the report, and its emphasis, are what was requested by USAID in calling for this study.

Executive Summary

Introduction

Ethiopia, with a population of 58 million, is the second most populous country in Sub-Saharan Africa and one of the poorest, with high rates of malnutrition, infant mortality and infectious disease. Illnesses associated with poor environmental conditions account for 75% of all morbidity in the country. Diarrhea is the second greatest cause of mortality and morbidity in children under five years of age and is a factor in 46% of all childhood deaths. Access to clean water is estimated to be between 10 and 20% of the population and is accompanied by large urban – rural disparities in levels of service. Poor access to medical care and low utilization of health services is another common condition, especially in rural areas.

This report was prepared at the request of USAID/Ethiopia to review the environmental implications of potable water and sanitation activities implemented under the Title II Food for Peace program of the U.S. Government. It is part of a world-wide effort by USAID to improve the environmental soundness of foreign assistance programs supporting relief and development activities.

In promoting relief and development in Ethiopia, USAID for many years has actively used the Title II program to support a broad range of community-based activities. Cooperation between USAID and a group of international PVOs and national NGOs, which implements the Title II program, has been close and has contributed in Ethiopia to the development of one of the largest and strongest Title II country programs in the world. It is this close cooperation between USAID and the implementing organizations and their mutual concern for the Title II program which has led to the current study – a review of the environmental effects of potable water and sanitation activities in Ethiopia.

The environmental regulations affecting U.S. foreign assistance programs are contained in 22 CFR 216, which requires that USAID make threshold decisions regarding the potential environmental impacts of proposed actions, including water and sanitation activities. To better understand the issues of compliance and to improve overall program effectiveness, it was jointly agreed by USAID and the eight Cooperating Sponsors (PVOs and NGOs) participating in the Title II program in Ethiopia to carry out a formal environmental assessment of small-scale irrigation activities and a subsequent, but less formal, environmental study of the Title II water and sanitation activities, which is the subject of this report.

Objectives

The overall objective of the study is to improve the long-term sustainability and environmental protection of potable water and sanitation activities in Ethiopia. Specific objectives are concerned with improving project effectiveness in serving the needs of the people, providing technical advice to the Cooperating Sponsors and developing a training module for developing sustainable and environmentally sound water and sanitation activities.

Development Frameworks

Several basic frameworks in the areas of policies, legislation and institutions define the water and sanitation sector in Ethiopia. Currently, these frameworks are in great flux as the Government of Ethiopia strives to establish a legal and organizational structure suited to the country's needs. The federal government has adopted comprehensive policies for water resources, which includes water supply and sanitation, and for the environment which call for the protection of natural resources and the promotion of the well being of people. In legislation, however, the legal instruments for these sectors remain in provisional or draft form at present. There are draft proclamations for water resources, environment and public health awaiting final revisions and adoption by the Council of Ministers and eventually Parliament.

Regarding water supply, the draft water resources proclamation gives domestic use of water priority over all other water uses, but requires a permit for the construction of waterworks but not for small-scale activities normally found in Title II water projects. The draft environmental proclamation calls for environmental impact assessments of all development projects, both public and private. And finally, the draft public health proclamation has provisions requiring the monitoring and protection of drinking water quality. As stated above, all of these proclamations are in various draft stages and require further refinement and approval before they become binding.

The environmental regulations affecting USAID are contained in 22 CFR 216, which sets out conditions for application of Initial Environmental Examinations (IEE), Environmental Assessments (EA) and Environmental Impact Statements (EIA). Small-scale potable water and sanitation projects are specifically exempted from this process, but there are no criteria for defining small-scale from large-scale projects. In general, both the draft Ethiopian environmental procedures and the USAID regulations lack detailed technical guidance to enable the Cooperating Sponsors to incorporate the required environmental factors into water and sanitation projects.

Institutionally, water and sanitation projects are implemented by regional, or state, governmental organizations in Ethiopia with the federal government responsible for setting policies and strategies, conducting studies and setting standards. The regional bureaus for water

and for health have primary responsibility for overall development, but project implementation is also carried out by the Ethiopian Social Rehabilitation and Development Fund (ESRDF) as well as other national or regional institutions.

Study Format

Title II-supported water and sanitation projects in Ethiopia include ponds, springs, hand dug wells, boreholes, roof rainwater catchments, ground rainwater catchments, latrines, showers, clothes washing basins and cattle troughs. Seven of the Cooperating Sponsors (CARE, CRS, EOC, FHI, REST, SCF and WVI) have water and sanitation activities in their current Development Assistance Proposals (DAP), which are multi-year programs varying from 3 to 6 years. Overall, these DAP programs encompass hundreds of small water and sanitation activities over the period 1997-2003.

This report was prepared by a Study Team, composed of nine experts in different development specialities (institutional, hydrogeology, engineering, health, water quality, community participation), which included representatives from private consulting, USAID and the Cooperating Sponsors. The study was conducted under the USAID Environmental Policy and Institutional Strengthening (EPIQ) IQC contract and was managed by Winrock International, EPIQ subcontractor to International Resources Group.

The study was designed to be interactive and participatory. Information was obtained from USAID, the Cooperating Sponsors, government agencies and development organizations. In the course of the study, the team visited 38 field sites drawn from all seven of the Cooperating Sponsors implementing water and sanitation projects. Review meetings were held throughout the period of the study to outline current efforts and progress to date. The provisional findings and recommendations of the study were reviewed in meetings with USAID and the Cooperating Sponsors in both Addis Ababa and Washington DC.

Findings

The Study Team was impressed with the cooperation, dedication and enthusiasm of the staff of the Cooperating Sponsors. The field sites in the Title II program in general are located in remote areas with few amenities to support development operations or, indeed, the efforts of project staff. Despite these difficulties, the team found that all projects visited in the field were highly appreciated by the people in the adjacent communities. Many sites had few visible signs of recent development other than what had been implemented with the help of the Cooperating Sponsors. Because of the obvious importance of these water and sanitation projects to the targeted communities, the Study Team believes it worthwhile to further strengthen and improve them on the basis of the following findings.

Although Ethiopia has considerable untapped water resources, many areas of the country have chronic water shortages and some have poor groundwater quality, especially in the Rift Valley where the concentration of fluoride in the water can be high. Surface waters often have poor bacteriological quality as a result of inadequate sanitary measures to control human and animal excreta. The full extent of the problem is unknown because of a lack of water quality monitoring and testing in the Title II program.

A variety of simple technologies are used to collect and delivery water to the consumers. Innovative methods of spring protection, rainwater harvesting and shallow well construction can be seen in the field, but too often errors in the choice of technology or in technical design limit the effectiveness of the projects. In the better cases, people have access to protected and safe drinking water with easily accessible facilities for clothes washing, bathing and cattle watering nearby. In the poorer cases, people are forced to draw water from unsafe sources and of doubtful quality with no access to other water-related facilities. Some projects have constructed latrines, but the overall promotion and use of them is insufficient for the needs of the communities. Sanitation in the form of drainage and source protection is sometimes poor. Only minor efforts are made to improve water quality through system design or treatment processes. To a great extent, the Cooperating Sponsors appear to work in isolation from each other and do not adequately exchange information on successful technologies and projects.

Health is a primary area of impact in water and sanitation projects, even when it is not a primary objective. Some Cooperating Sponsors have attempted to enhance health benefits by promoting latrines, constructing bathing shelters and providing hygiene education to project communities. In most instances seen in the field, water projects did not include associated sanitation facilities or health promotion through training or improved domestic hygiene. Other factors which limited the achievement of health benefits were the occasional use of unsafe drinking water sources and the more common situation of insufficient water available to meet basic needs.

As indicated above, water quality of both surface and groundwater sources in Ethiopia can be highly variable. Contaminants affecting health can include chemical constituents, such as fluorides and nitrates, while biologic organisms can be bacteria, protozoa, trematodes and helminths. The main pathogenic organisms, such as intestinal coliforms, protozoa, worms and leeches, are related to poor sanitation, especially unsanitary excreta disposal. In the Title II projects, most water facilities provide reasonable protection from external pollution, but some have serious problems of human and animal contamination. Little attention is given to water quality because there is very little water quality monitoring or testing by the Cooperating Sponsors. This is related to the general lack of water quality testing laboratories in Ethiopia and the difficulty of transporting water samples over long distances.

The crucial issue in project sustainability is whether the community uses and cares for the facility. All of the Cooperating Sponsors have long experience in working with rural communities. The Study Team found that when a Sponsor gave special attention to sensitizing and preparing communities for water and sanitation activities, community support during the subsequent implementation and operation of the project remained high. This often involved working with communities from 6 to 12 months in advance of project construction. The water and sanitation committee is the key element in project sustainability. Where committees had access to technical training, spare parts and follow on technical support from the Cooperating Sponsors, project facilities were well maintained. When projects appeared to be weak, they often were associated with inadequate community preparation, insufficient training of committees and insufficient involvement of women.

Conclusions and Recommendations

Although small-scale rural water and sanitation projects may appear to be simple activities, in actuality they are among the most sophisticated of developmental efforts because to succeed they must fully engage the targeted communities in terms of understanding, participation and behavioral changes. These are no small requirements for projects that must also protect the environment and employ a minimum of outside resources. That the Title II program in Ethiopia through the close cooperation of USAID and the Cooperating Sponsors has achieved as much as it has in the area of potable water supply and to some extent in sanitation is due to the dedication and hard work of all involved. The following are suggestions of the Study Team intended to assist this difficult task by strengthening some of the weaker areas of the program.

- Sanitation improvements should always be linked with water supply activities in order to maximize health benefits.
- USAID should establish technical guidelines for the development of water and sanitation projects.
- Water quality monitoring should be required for all potable water systems.
- Water and sanitation projects should be concentrated with other Title II activities in specific areas.
- Project communities should have effective water and sanitation committees.
- Project water sources should be protected from pollution.
- Health education materials should be developed and used in the projects.
- Information and experiences should be shared among the Cooperating Sponsors.

In addition to the above, the Study Team suggests that USAID clarify some of the ambiguities between the relief and development roles of the Title II program. Although the program formally acknowledges both roles, in practice it is planned and implemented primarily in a relief mode.

Training Workshop

A final output of this study is the outline for a one-week training workshop on potable water and sanitation development for senior technical and program staff of the Cooperating Sponsors. The workshop is designed on a modular basis to serve differing training needs. A total of 23 stand-alone modules on various issues of planning, technical design, organizational development, health and community involvement are outlined, along with a one-day field trip to observe practical applications of successful projects.

Section 1: Introduction

Ethiopia is one of Africa's poorest countries, with high rates of malnutrition, infant mortality and infectious diseases. Burdened with high population growth, low employment, inefficient agricultural and industrial sectors and poor social and physical infrastructure, Ethiopia cannot feed itself and requires a massive transformation of all major sectors if it is to reverse the declining trends of the past 25 years.

With an estimated population of 58 million, of which 52% are below the age of 18, Ethiopia is the second most populous country in sub-Saharan Africa. It is a country of great diversity with over 85 ethnic groups and several agro-ecological zones. Most of the population lives in the rural areas with only 16% living in the cities. Poverty, high levels of malnutrition and food insecurity, crippling debts (accumulated at both national and household levels), severe environmental degradation, rates of population growth exceeding real economic growth, war and lack of infrastructure have resulted in some of the worst economic and health conditions in the world.

In 1998, the per capita gross national product (GNP) was estimated at $110 per year with annual economic growth at 2%.[1] National statistics indicate an under 5 mortality rate of 175/1,000 live births[2], a total adult literacy rate of 39% and primary school enrolment at about 30%[3]. Access to potable water in Ethiopia is estimated at about 15%[4] and to sanitation at 19%[5], but with wide urban-rural disparities. Results from the National Nutritional Survey of 1992 showed a worsening nutritional status compared to a similar survey carried out in 1983. Stunting (low height-for-age) was observed in 64% of children between the ages of 6–59 months, one of the highest rates in Africa. High incidences of diarrheal disease and heavy parasitic loads contribute towards this grim nutritional scenario.

Following the fall of the Marxist *Dergue* regime in 1991, government policies have favored market liberalization, a dismantling of parastatal organizations and the disengagement of the public sector from economic management. In 1993, a decentralized federal system of governance was adopted. Subsequently, a series of new policies were promulgated (Health Policy, 1993; Environmental Policy, 1997; Water Resources Policy, 1998) which incorporate

[1] World Bank (1999). **World Development Report 1998/99.**

[2] UNICEF (1999). **The Progress of Nations**. New York: UNICEF.

[3] Ethiopia (1998). **Education Sector Development Program, Action Plan**.

[4] Ministry of Water Resources (1998). **Federal Water Resources Policy**. Addis Ababa.

[5] UNICEF (1998). **State of the World's Children**. New York: UNICEF.

principles of democratization and decentralization. In 1996 the government announced five-year development programs for three key sectors–roads, health and education.

The USAID Food Security Program under P.L. 480 Title II is used in Ethiopia to address food security issues affecting highly vulnerable households. Food-assisted programs are directed at marginal communities to strengthen their economic and social base and to move them from dependence on external food resources to food security and, increasingly, to sustainable development activities. These programs provide not only food but also improve rural infrastructure through the provision of health facilities, drinking water sources, latrines, agricultural training, credit and other needed services.

Through a network of eight non-governmental organizations, termed Cooperating Sponsors, USAID channels Title II resources to rural areas where food security issues are major challenges, both for the present and the future. A common problem in these areas is environmental degradation and its effect on the productive capacity of agricultural communities to feed themselves. The promotion of long-term sustainable development is dependent upon a supportive environment and the role of development activities in protecting and enhancing it.

The environmental procedures specified in 22 CFR Part 216 apply to all USAID projects and require the Agency to make threshold decisions concerning the significance of environmental impacts that various types of actions, including water and sanitation activities, may have[6]. In addition to this regulatory role, USAID also is concerned about the affects of adverse environmental consequences upon the sustainability of development activities. By applying the concepts of environmental science and lessons from past experience, USAID seeks to go beyond regulatory requirements and enhance project sustainability.

The Title II Program in Ethiopia incorporates a variety of potable water and sanitation activities, including the construction of ponds, wells, springs, latrines and other small-scale rural facilities. These activities are subject to an environmental review, typically under an Initial Environmental Examination (IEE), which usually results in a finding that they do not have significant effects on the environment and hence a formal Environmental Assessment is not required. Despite such a finding, water and sanitation activities function within the natural environment and cumulatively may have significant effects upon it and upon the welfare of the people they serve. Two areas of concern are common to all Title II activities: the protection of the environment and the sustainability of projects to perform as intended. USAID and its Cooperating Sponsors in Ethiopia have called for a comprehensive study of the environmental issues surrounding the potable water and sanitation activities supported by Title II. The purpose

[6] U.S. Government (n.d.). "Agency Environmental Procedures, 22 CFR 216." **Code of Federal Regulations**.

of this study is to provide assistance in the development of sustainable and environmentally sensitive potable water and sanitation projects.

The current document has been prepared by a team of development specialists composed of international and national consultants and representatives from USAID and the Cooperating Sponsors. Winrock International of Arlington, Virginia (USA) acted as subcontractor for USAID/Ethiopia through International Resources Group. A detailed scope of work for the study was prepared by the Team Leader during a visit to Ethiopia 28 August-9 September 1999. He returned to Ethiopia over the period 9 October-2 December 1999 and with the assistance of a team of seven specialists carried out a series of interviews, reviews and field visits related to water and sanitation activities in the Title II program. The conclusions and recommendations of this study were presented in meetings with USAID/Ethiopia, the Cooperating Sponsors and AID/Washington. Final review and revisions of the study report were completed over December 1999–February 2000.

Section 2: Background to the Study

2.1 Title II Food Security Program in Ethiopia

The USAID Food Security Program under P.L. 480 Title II is being used in Ethiopia to address food security issues affecting highly vulnerable households. Food-assisted programs are directed at marginal communities to strengthen their economic and social base and to move them from dependence on external food resources to food security and, increasingly, to sustainable development activities. These programs provide not only food but also improve rural infrastructure through the provision of health facilities, drinking water sources, latrines, agricultural training, credit and other needed services.

Resources under Title II, which are primarily food commodities, are distributed through several channels, including the United Nations World Food Program, and are used and managed by non-governmental cooperating sponsors, both U.S.-based private voluntary organizations (PVOs) and indigenous local non-governmental organizations (NGOs). These Cooperating Sponsors use the food to support activities in maternal and child health, agricultural production, natural resource management and various forms of infrastructure development, including roads, bridges, latrines, wells and small-scale irrigation systems. Worldwide, a total of $821 million of Title II funding was allocated in FY1997, of which $309 million was provided to Cooperating Sponsors. The global Title II budget for FY2000 totals $904 million.

In Ethiopia, USAID has been providing Title II resources since the mid-1980s for both relief and development purposes. Over the years, Ethiopia has become one of the six countries in the world (along with Haiti, India, Bolivia, Peru and Ghana) which receive half of all Title II resources; in recent years, Ethiopia has been the largest recipient in Africa. Through 1994, the Title II program in Ethiopia provided over 175,000 metric tons of food valued at over $150 million. Since then, Title II support has continued to increase and currently is budgeted to provide 97,000 metric tons of food with a value of $44 million in FY2000 (see Table 2.1).

Table 2.1: Title II Commodity Support to Ethiopia

Fiscal Year	Quantity (1000 metric tons)	Total Value (million dollars)
FY98	64	26
FY99	83	36
FY00	97	44

Source: USAID data.

The food commodities provided by Title II include wheat, rice, lentils, vegetable oil and a corn and soy bean mix. Upon arrival in country, most of the commodities are monetized, that is sold on the open market, to raise funds for targeted programs of relief and development.

Through a network of eight non-governmental organizations, termed Cooperating Sponsors, USAID channels Title II resources to rural areas where food security issues are major challenges, both for the present and the future. A common problem in these areas is environmental degradation and its effect on the productive capacity of agricultural communities to feed themselves. The promotion of long-term sustainable development is dependent upon a supportive environment and the role of development activities in protecting and enhancing it.

Over the past 5 to 7 years, there has been a shift in emphasis in the Title II program in Ethiopia from one stressing relief to one that is increasingly stressing sustainable development. Several Cooperating Sponsors recently undertook re-assessments of their Title II programs to better support this shift. The current Development Activity Proposals (DAP) of the Cooperating Sponsors are beginning to reflect the new emphasis.

Title II support in Ethiopia is directed at food security issues affecting highly vulnerable households. In addition, food-assisted programs in Ethiopia are designed to strengthen economic frameworks and encourage sustainable development in marginal communities. Such programs provide not only food but also support improved rural infrastructure and health facilities, drinking water and sanitation facilities, agricultural training, small-scale irrigation, natural resource management activities, credit and other services.

Current Title II support to the eight Cooperating Sponsors is $163 million for multi-year programs ranging from 3 to 6 years. The largest program recipients of Title II commodities are CRS and REST, while the smallest are Africare and FHI. The proportion of these funds used for potable water and sanitation activities is not known but probably amounts to about 10% of the total.

USAID is required to observe the environmental procedures specified in 22 CFR Part 216, which apply to all USAID projects and require the Agency to make threshold decisions concerning the significance of environmental impacts that various types of actions, including water and sanitation activities, may have. In addition to this regulatory role, USAID also is concerned about the affects of adverse environmental consequences upon the sustainability of development activities. By applying the concepts of environmental science and lessons from past experience, USAID seeks to go beyond regulatory requirements and enhance project sustainability.

The Title II Program in Ethiopia incorporates a variety of potable water and sanitation activities, including the construction of ponds, wells, springs, latrines and other small-scale rural

facilities. These activities are subjected to review, typically under an Initial Environmental Examination (IEE), that usually results in a finding that they do not have significant effects on the environment and hence a formal Environmental Assessment is not generally required. Nevertheless, they function within the natural environment and cumulatively may have significant effects upon it and upon the welfare of the people they serve. Underlying this study are concerns for the environment and the sustainability and health impacts of small potable water and sanitation facilities. USAID and its Cooperating Sponsors in Ethiopia have called for a comprehensive study of the environmental issues surrounding the potable water and sanitation activities supported by Title II. The purpose of this study is to provide assistance in the development of sustainable and environmentally sensitive potable water and sanitation projects.

2.2 USAID Policies and Regulations

The USAID Strategic Plan for Ethiopia (USAID, 1998) is focused on problems of drought and food shortages, and as a result includes a Special Objective (SPO 1): Enhanced Household Food Security in Target Areas. The SPO identifies five critical intermediate results:

IR 1 – Increased agricultural production

IR 2 – Increased household income

IR 3 – Improved health status

IR 4 – Maintaining the natural resources base

IR 5 – Maintaining emergency response capacity.

Programs formulated under this SPO, therefore, are assessed in terms of their contributions to the above desired results.

Environmental regulations affecting USAID programs are contained within the Code of Federal Regulations (22 CFR 216). In 1996, USAID made the decision to apply the Agency's environmental regulations more consistently than had previously been the case to P.L. 480 (Food for Peace) Title II food aid assistance. Title II programs increasingly were being used to fund activities that were development projects and were not confined to disaster or emergency food relief.

USAID environmental procedures, known as Reg. 216, are intended to ensure that environmental factors and values are integrated into the USAID decision-making process. The regulation sets out a series of procedures to make threshold decisions concerning the significance of environmental impacts, i.e., judging the applicability of different levels of environmental analysis. For example, Section 216.2 provides criteria concerning which activities are to be

exempted from the procedures, which are to be categorically excluded, and which normally have a significant effect on the environment and, therefore, require an Environmental Assessment or an Environmental Impact Statement. In general, water development projects fall into the last category requiring further assessment, e.g., river basin development, water management such as dams or irrigation, drainage, and "potable water and sewerage projects other than those that are small-scale." Thus, large-scale potable water and sanitation projects require further environmental examination, while small-scale schemes do not. The regulation gives no additional information for distinguishing between large-scale and small-scale projects.

In Ethiopia, USAID and the Title II Cooperating Sponsors reviewed the procedures for responding to Reg. 216 at a workshop in Mekelle in February 1997. It was clearly recognized that well-designed development activities that took into account relevant environmental issues would be more beneficial to the users and less likely to lead to adverse environmental impacts. It was not clear, however, how to incorporate environmental design and implementation concepts into Title II-sponsored potable water and sanitation activities in a way that would satisfy the regulation and enhance environmental sustainability.

Over the period August to December 1998, USAID and the Cooperating Sponsors carried out a Programmatic Environmental Assessment (PEA) of the Title II funded small-scale irrigation activities in Ethiopia.[7] Completed in early 1999 and approved in July 1999, the PEA identified the key environmental issues in small-scale irrigation, assessed their importance and recommended ways to mitigate and monitor them. In late 1997 and early 1998, at about the same time that the need for a PEA concerning small-scale irrigation had been identified, USAID/Ethiopia and the REDSO Regional Environmental Officer also identified the need for mitigation and monitoring of water and sanitation projects. This need was further intensified in light of cable 98 State 108651 concerning the requirements for testing of potable water. As the process of a programmatic approach leading to improved methods of design and implementation of small-scale irrigation projects was seen to be equally useful to other types of small-scale projects, USAID and the Cooperating Sponsors agreed to carry out an environmental study of the Title II potable water and sanitation activities. After several delays, the scope of work was developed in early September 1999[8] and the study was carried out in Ethiopia over October and November 1999. The results of this study are presented in the current document.

Because water quality testing has become so critical to the application of Reg. 216, it is useful to detail the current concerns and requirements relevant to potable water projects. Cable 98 State 108651, dated 16 June 1998, called attention to recent revelations that drinking water

[7] Catterson, T. et al (1999). **Programmatic Environmental Assessment of Small-Scale Irrigation in Ethiopia**. CRS-USCC/USAID Bureau for Africa.

[8] Warner, D.B. (1999). **Scope of Work for an Environmental Study of Title II-Supported Potable Water and Sanitation Activities in Ethiopia**. Winrock International/USAID Ethiopia. 10 October 1999.

systems in a number of countries were delivering dangerously high levels of arsenic originating in groundwaters of natural origin and causing arsenicosis in the recipient populations. The problem was particularly acute in Bangladesh and West Bengal, India, where shallow tube wells were drawing water from sedimentary deposits, as well as in Mexico, Romania, Argentina, Inner Mongolia, China and Taiwan. Arsenic concentrations can be found in several geological situations, including hydrothermal mineral deposits, geothermal waters affected by active vulcanism, coal deposits and erosion sediments from the Himalayan Mountains.

USAID concern over arsenic was heightened by the fact that up to that time arsenic had not generally been considered a problem in drinking water and, consequently, water supplies had rarely been tested for it. Because of these new findings, however, cable 98 State 108651 considered it prudent "that environmental reviews carried out in accordance with 22 CFR 216 should include testing for arsenic in addition to the usual testing for coliform bacteria and nitrite/nitrate." Moreover, testing for additional contaminants was also advised when a nearby pollution source (e.g., industry, mining, heavy pesticide or fertilizer use) was suspected. The overall consequence of the this heightened USAID concern over arsenic and other potential contaminants of drinking water has been to highlight the importance of water quality testing.

2.3 Objectives of the Study

As indicated above, this study of the environmental aspects of potable water and sanitation activities supported by the Title II program is intended to provide recommendations for the development of sustainable and environmentally sensitive projects. This guide is directed primarily at the Cooperating Sponsors but is also intended for use by USAID and other development agencies in the formulation and implementation of small-scale potable water and sanitation projects in marginal communities. The overall objective of this study is:

> *To improve the long-term sustainability and environmental protection of potable water and sanitation activities in Ethiopia.*

With reference to the Title II program, there are several specific objectives:

- To improve the effectiveness of potable water and sanitation activities in serving the needs of people in the program areas;
- To provide technical advice to the Cooperating Sponsors and other organizations concerned with potable water and sanitation activities; and
- To develop a training module to assist Cooperating Sponsors in developing sustainable and environmentally sound potable water and sanitation activities.

It should be noted that this study is not being undertaken in response to a regulatory requirement. Rather, it is a response to a perceived need on the part of the Cooperating Sponsors and USAID for better methodological tools for planning, implementing and operating potable water and sanitation activities. In effect, this study is intended to support the philosophy of going beyond compliance to incorporate sound environmental planning into activity designs to ensure the Title II-supported activities not only "do no harm" but actually improve the long-term sustainability of the natural resource base upon which food security depends.

Section 3: Policy, Legislative and Institutional Frameworks for Water Supply and Sanitation in Ethiopia

3.1 Background

Until very recently, the water resources sector of Ethiopia did not have any articulated policy or legal documents for the appropriate management of water resources except for some fragmented ministerial directives and day-to-day practices within the relevant government administration. In 1976 an attempt was made to prepare a National Water Code, while the implementing regulations were prepared in 1985/86. The government, however, never approved these laws although they provided a holistic and comprehensive approach for the management of water resources of the country.

In the past two decades, the institutions responsible for the management of the water resources of the country have undergone frequent changes with new ministries and authorities being established, reorganised and dissolved. In September 1995, the Ministry of Water Resources was established. This ministry was established at a time when fundamental changes were taking place in terms of the regional structure of the country. The change to a federal system of government meant the decentralisation of water resources management with federal and regional governments having specific responsibilities for water resources management and consequent institutional reorganisation for water resources management at the federal and regional levels.

With respect to the environmental management and protection of the country, the responsibility had, until very recently, rested with the various government sectoral agencies responsible for different areas of the natural and human environment. This led to the fragmentation of environmental management and protection activities and consequently to serious deterioration and damage to the environment. It is due to the realisation of these problems that the Government established the Environmental Protection Authority (EPA) at the federal level with regulatory, coordinating, monitoring and enforcement functions with respect to the environment. At the regional level, however, there are no independent bodies for the management and protection of the environment.

3.2 Policy Framework

3.2.1 The Constitution

As the supreme law of Ethiopia, the Constitution provides the framework for all national policies, laws and institutional systems of the country. The Constitution of the Federal Democratic Republic of Ethiopia, contained in Proclamation 1/1995, has several provisions which have direct policy, legal and institutional relevance for the management of the water resources of the country.

The Constitution provides that the Government recognises the right to a clean and healthy environment as an objective and basic right of the Ethiopian people. It recognises that the design and implementation of development programmes and projects should not damage or destroy the environment. The right of the public and the community, including women, to full consultations and participation in the planning and implementation of policies and development projects that affects them is also provided as well as the right to compensation for displacement of the local population as a result of state programmes.

The current land tenure system is essentially unchanged from that of the previous regime. Art. 40(3) of the Constitution provides for the public ownership of both rural and urban land as well as all natural resources. Thus, private ownership of land and other natural resources including water resources is excluded. In the Ethiopian context, the recent past attested to the fact that public ownership of land meant increasing insecurity of tenure among the peasants. Redistribution of land usually meant losing part of one's allotment or being relocated elsewhere. Despite this fact, the Government has taken some steps aimed at creating and strengthening a sense of security among users of land.

The government has taken various legislative and institutional measures aimed at creating and strengthening a sense of security among the users of land. The Constitution itself addresses this issue to some extent when it guarantees Ethiopian peasants the protection against eviction from their possessory rights (Art. 40(4)). Moreover, the recently enacted Rural Land Administration Proclamation No. 89/1997 has the objective of restoring confidence in the peasantry by vesting them with a stable holding right. Be that as it may, one can fairly conclude that many small-holder farmers in the country still do not seem to feel security with respect to their land holding with all its implications on agricultural productivity, social organisation and environmental protection.

With regard to the management of water resources and the protection of the environment, the responsibilities of the federal government and the regional states are distinctly provided in the Constitution. The federal government is vested with the responsibility of formulating the policies, strategies and plans as well as the enactment of laws for the utilisation and conservation

of land and natural resources. Regional states are given the responsibility of administering land and other natural resources in accordance with the policies and laws issued by the federal government {Arts 51(2) (5) and Arts. 52(2c and 2d)}.

As regards the management of water resources, the Constitution has a specific provision which provides that the federal government shall determine and administer the utilisation of the waters or rivers or lakes linking two or more States or crossing the boundaries of the national territorial jurisdiction (Art. 51(11)). This means that the allocation and administration of the water resources of the country will largely rest with the federal government since almost all water resources in the country are shared by two or more regional States. However, groundwater resources, which are in most cases confined within a region, will mainly be under the jurisdiction of regional states.

3.2.2 Federal Water Resources Policy

The federal water resources policy was recently adopted by the Council of Ministers and is currently considered to be the basic framework policy for the management of the water resources of the country. The policy addresses both cross-sectoral and sectoral issues of water resources management and is very comprehensive and detailed in nature covering most aspects of water resources management. It incorporates several relevant policy provisions regarding potable water and sanitation and has a separate section dealing solely with water supply and sanitation (WSS).

The overall objective of the WSS policy is the promotion of the well being of the people and enhancement of public health through the provision of water supply systems of acceptable quality and quantity, appropriate sanitation facilities and mechanisms for water resources protection.

In the part discussing the general water resources policies and in the cross-cutting issues on water allocation, there is an express recognition that water supply and sanitation (WSS), especially for domestic purposes shall be given priority over all other water uses except for multi-purpose uses that include WSS. It also provides for the need to promote and enhance traditional and localised water harvesting techniques which include rainwater harvesting through cisterns, dykes, shallow wells, springs, birkas and the like due to the perceived advantages that such schemes involve local resources and indigenous skills.

With regard to environmental protection of water resources, the policy stipulates the need to establish and institutionalise environmental conservation and protection requirements as integral parts of water resources planning and project development. More importantly, it declares the need to ensure that all water resources schemes and projects have environmental impact assessment and evaluation components as part of the development process. This section also

contains several relevant policy elements for watershed management, water resources protection (both in terms of quality and quantity) and conservation.

In the area of operation and maintenance and funding of water resources schemes and projects, there are provisions which require that future studies, projects and undertakings by ESAs, NGOs, the Government and the private sector should incorporate adequate resources and satisfactory plans for the sustainable operation and maintenance of systems. It also calls for the involvement of communities in the operation and maintenance of water systems. Policies for the formulation of standards, guidelines and criteria for the design, installation, operation and maintenance and monitoring of water systems as well as for water quality management are also covered.

3.2.3 Environmental Policy

The Environmental Policy of Ethiopia was approved by the Council of Ministers on 2 April1997. The policy contains ten sectoral and ten cross-sectoral policies and also has provisions required for the appropriate implementation of the policy itself.

The policy on water resources, although it does not specifically mention water supply and sanitation as an issue, has several provisions requiring the recognition of watershed protection as fundamental to the maintenance of water quality and quantity. It also provides for the involvement of water users, particularly women and animal herders in the planning, design, implementation and follow up in their localities of water policies, programmes and projects as well as subjecting all water related projects to the EIA process. The policy elements regarding sanitation aspects of water resources are urban biased and do not directly address policy issues on sanitation in the rural context. Overall, the environmental policy on WSS issues seems to be lacking a rural perspective especially in a country where the majority of the population live in rural areas and have critical problems in getting access to adequate sanitation services.

Of more importance to the context of WSS are the policy provisions on environmental impact assessment (EIA) which provide the basic policy framework and form the basis for the subsequent issuance of laws, regulations and guidelines. The policy elements are as follows:

- to ensure that environmental impact assessments consider not only physical and biological impacts but also address social, socio-economic, political and cultural conditions:

- to ensure that public and private sector development programmes and projects recognise any environmental impacts early and incorporate their containment into the development design process;

- to recognise that public consultation is an integral part of EIA and ensure that EIA procedures make provision for both an independent review and public comment before consideration of decision makers;

- to ensure that an environmental impact statement always includes mitigation plans for environmental management problems and contingency plans in case of accidents;

- to ensure that, at specified intervals during the project implementation, environmental audits regarding monitoring, inspection and record keeping take place for activities where these have been required by the Environmental Impact Statement;

- to ensure that preliminary and full EIAs are undertaken by the relevant sectoral ministries or departments, if in the public sector, and by the developer, if in the private sector;

- to create by law an EIA process which requires appropriate environmental impact statements and environmental audits for private and state development projects;

- to establish the necessary institutional framework and determine the linkages of its parts for undertaking, coordinating and approving EIAs and the subsequent system of environmental audits required to ensure compliance with conditionalities;

- to develop detailed sectoral technical guidelines in EIAs and environmental audits;

- to ensure that social, socio-economic, political and cultural conditions are considered in environmental impact assessment procedures and included in sectoral guidelines; and

- to develop EIA and environmental audit capacity and capability in the Environmental Protection Authority, sectoral ministries and agencies as well as in the regions.

The above discussions on the existing policy framework for water resource and environmental management and protection, reveal that much has been covered, at least at the policy level, for sustainable management and environment protection of water supply and sanitation projects. What remains to be seen is that whether these policy provisions are or will be translated into appropriate legislative and institutional frameworks at all levels so as to achieve the intended objectives of sustainability and environmental protection of WSS activities particularly at the community level where the USAID Title II-supported WSS activities are directed.

The federal water resources policy seems to comprehensively and in a detailed manner address the concerns from both the technical and environmental perspective the policy issues that

need to be dealt with in WSS activities at both federal and regional levels and going down to the community level.

The environmental policy, on the other hand, while not adequately covering the main policy elements that need to be focussed in dealing with sustainability and environmental protection issues particularly at the rural and community level, has adequate policy provisions regarding the conduct and requirements that need to be addressed in the process of environmental impact assessment.

3.3 Legislative Framework

3.3.1 The Draft Water Resources Management Proclamation of Ethiopia

In 1994, a proclamation was issued which for the first time directly dealt with water resources management of the country. Titled the Water Resources Utilisation Proclamation No. 92/1994, this proclamation is the main legal instrument regarding water resources management in Ethiopia even though no attempt to date has been made to implement it. The proclamation includes some aspects of the earlier draft code in that it stipulates that certain water users require permits and allows for water charges to be levied by the appropriate government authority. It exempts permit requirements for the use of water by peasants, artisanal miners, traditional fishermen and persons rendering traditional water transport services. The proclamation outlines the obligations of the permit holder and the basis for the revocation of permits. It also provides for the payment of fees and water charges in accordance with directives to be issued by the appropriate authority.

Recently, a new draft water resources proclamation has been submitted to the Council of Ministers for adoption and will later be submitted to parliament for final approval and issuance as law. The stated purpose of the proclamation is “to ensure that the water resources of the country are protected and deployed for the highest social and economic benefits of the people of Ethiopia; to follow up and supervise that they are duly conserved; to ensure that harmful effects of water are prevented; and that the management of water resources are carried out properly.”

As regards ownership of water resources of the country, the draft proclamation states that water resources are the collective property of the Ethiopian people. Actually, what this implies is that the State will have a major role in the management and protection of the water resources of the country.

There is a clear recognition in the draft proclamation that domestic use of water shall have priority over all other water uses. Domestic use is defined as the use of water for drinking, cooking, sanitation, or for other domestic purposes. The latter provisions are in line with the water resources policy which specifically mentions that water supply and sanitation projects,

particularly for domestic purposes, shall be given priority over all other uses. These provisions are of direct relevance to Title II supported potable water and sanitation activities which are given explicit recognition in both water resources policy and law as having priority of use because these are directed towards domestic purposes.

The draft proclamation allocates responsibilities for the planning, management, utilisation and protection of the water resources of the country between the federal government and regional states. Rivers that flow across more than one region, transboundary rivers and water resources which lie between regions including their tributaries, are defined as being central/federal water resources. The mandate for administering central/federal water resources is given to the Ministry of Water Resources, defined as the "Supervising Body."

On the other hand, water resources found in any regional state or the Addis Ababa City Government or the Dire Dawa Administration are defined as "water existing in a region." The "Supervising Body" for water resources existing in regions is the respective regional bureau responsible for administering water resources in each regional state.

The above provisions relating to federal and regional mandates over the administration of the water resources of the country have certain implications. Essentially, the federal Ministry of Water Resources will centrally administer almost all of the water resources of the country because most of the water resources including their tributaries are shared between two or more regional states. However, with respect to groundwater resources, which are in most cases localised within a region, the regional bureaux responsible for water resources in the respective regions will have the main responsibility for administering the use of such water resources. It thus means that most of the Title II supported WSS activities which utilise groundwater and are localised in nature will be regulated by the regional States ("the Supervising Body") in which these activities are found.

The supervising body has broad regulatory powers which include the issuance of permits for water resources use and construction; allocation of water resources; establishing required standards for the design and construction of waterworks and monitor same; issue guidelines and directives for the prevention of pollution of water resources as well as water quality and health standards in consultation with other concerned public authorities.

A major aspect of the draft water resources proclamation is that most water resource uses and activities are to be based on a permit system (Art. 11). However, there are certain water uses and activities which are exempt from this rule. These are:

- hand-dug wells or use of water from hand-dug wells; and
- use of water for domestic purposes, traditional irrigation, artisanal mining and for traditional animal rearing as well as for water mills.

Since all WSS activities currently undertaken under Title II are utilised for domestic purposes, such water uses will thus be exempt from water use permits. However, with the exception of hand-dug wells, the construction of waterworks requires permits (Art. 11). "Waterworks" is defined in the draft proclamation as any man-made work constructed or to be constructed for the purpose of putting water to beneficial use, and includes diversion, construction, drilling, cleaning, investigation, regulation, purification, measurements, transportation, transmission, desalination, flood control, prevention of soil erosion and other related and similar works.

What can be understood from the above is that any kind of waterworks involving construction for the diversion, collection, or abstraction of water for different water uses will require permits. As such, it means that most of the activities under Title II supported WSS are to be subject to waterworks permits.

The draft proclamation has several provisions regarding application, issuance, duration, suspension and revocation of permits. It also provides for the payment of fees and water charges to the supervising body to be specified in subsequent regulations. Water users associations are also recognised in the proclamation. It stipulates that water users associations may be voluntarily established or may be encouraged by the supervisory body and relevant public authorities.

The draft proclamation also provides that detailed regulations will be issued by the Council of Ministers at the federal level for central/federal water resources and by the regional states with respect to water resources existing in the regional states. When eventually approved, the draft proclamation will repeal the Water Resources Utilisation Proclamation No. 92/1994.

The draft Water Resources Management Proclamation has laid down the basic legislative framework for the management, utilisation and protection of the water resources of the country. In most cases, Title II-supported WSS activities will fall under the jurisdiction of the respective regional states because the nature of the activities utilise water resources confined within regions. They will thus be subject to the regulations expected to be issued by the regional states based on the federal water resources law.

3.3.2 The Draft Environmental Proclamation

The draft environmental proclamation has gone through a series of workshop discussions involving stakeholders from government agencies at the federal and regional levels, the private sector and local as well as international NGOs. The draft is now in its final stage and is expected to be submitted to Parliament for approval early next year.

The draft proclamation is a framework law and sets down the administrative and regulatory framework, basic rules and principles, and environmental management tools to be

followed at all levels and by different sections of society for the appropriate management and protection of the natural resources and environment of the country.

One of the basic environmental management tools that is required in the draft proclamation is an environmental impact assessment (EIA) of development projects carried out by both private and public institutions (termed "proponents"). Any person, natural or legal, will henceforth be required to undertake an EIA before implementing a development project.

All project proponents will be required to conduct a preliminary environmental impact assessment and submit the results to the responsible government body. If the project is determined to result in a significant environmental impact, it will be subject to a full environmental impact assessment. Otherwise, the project will be given the go ahead with or without conditions. When so required, the proponent is required to undertake a full environmental impact assessment and submit an environmental impact statement (EIS) for review. The responsible government body will then review the EIS and either permit the project to be carried out with or without conditions, or prohibit the implementation of the project. The responsible government body is also responsible to periodically monitor the project to ensure that it is carried out with the conditions set out in the environmental impact statement.

The mandate for the review of environmental impact statements is given to both the federal and regional government bodies responsible for regulating the management of the environment and depends on the type of project to be undertaken. At the federal level, the Environmental Protection Authority (EPA) will be responsible for the review of environmental impact assessment of all projects financed or licensed by the federal government. Moreover, EPA will also be responsible for the review of environmental impact statements of projects to be undertaken in regions that are likely to have trans-regional environmental impacts. In all other cases, the competent agencies in each regional State will be responsible for the review of environmental impact statements of projects to be undertaken in the concerned regions.

Since Title II-supported WSS activities are undertaken in different regions or independent city administrations but are unlikely to have any trans-regional environmental impacts, the review of environmental impact assessments and monitoring of such activities should be undertaken by the responsible regional bodies.

The establishment of environmental quality standards and criteria as well as monitoring their implementation is also given to the Environmental Protection Authority. It will set up these standards and criteria in consultation with the appropriate government agencies. This implies that regional states can not set up their own environmental quality standards but should comply with those set at the federal level unless they wish to establish more stringent standards than that set at the federal level.

The draft proclamation contains several provisions stipulating basic rules for environmental management of land and other natural resources; the control of pollution and management of wastes and hazardous materials. It also provides for the designation of environmental inspectors by the EPA and regional environmental agencies to follow up and supervise the implementation of the environmental requirements issued under the proclamation and subsequent environmental regulations.

As a framework law, the draft environmental proclamation needs several detailed and specific regulations to further translate the basic environmental rules provided in the proclamation. To date, some efforts have been made to prepare specific regulations and guidelines particularly with respect to environmental impact assessment of development projects and activities. But much remains to be done in providing appropriate environmental quality standards for different sectors including water quality standards.

3.3.3 The Draft Health Proclamation

The draft Health Proclamation is still in its early draft stage and is currently being reviewed by the Ministry of Public Health in order to come up with a more coherent and succinct version. In its current draft form, it appears to apply primarily to urban areas.

The draft proclamation contains some provisions relating to water quality which is of relevance to this study. The provisions relating to drinking water supply are stipulated in the form of prohibitions, which include:

- no person or organisation shall develop or operate a water supply, either ground or surface waters, for human consumption other than a site specified by regulations;
- no person or organisation shall construct collection dams for surface water/rain water near waste disposal areas or on the slopes of cities and towns other than a site specified by regulations;
- no new community water supply system shall operate and provide services prior to a bacteriological and chemical laboratory test;
- no development projects, infrastructures, buildings, institutions or other activities that would affect the quality and/or quantity of water should be carried out around the vicinity of a water source;
- no person or organisation shall distribute water from a well/spring to the public, unless it is adequately protected from any type of pollutants;

- no person or organisation shall develop water supply to the public from any source other than from an approved source;

- no person or organisation shall develop/operate rain water harvesting from contaminated roof catchments; and

- no person or organisation shall supply domestic water to the public immediately following maintenance work before providing chlorination or some other disinfection process.

3.3.4 Ethiopian Regulations and Guidelines and USAID Environmental Procedures

The Environmental Protection Authority has prepared a more or less comprehensive environmental impact assessment system to ensure that any development projects and activities integrate environmental considerations in the planning process as a prerequisite for their approval. To date, EIA regulations, procedural and sectoral guidelines have been prepared. However, these documents are still in a draft stage and have to be submitted to government for approval and subsequent implementation at both the federal and regional levels. One of the main reasons why the EIA regulations and guidelines are still pending is that the Environmental Proclamation, which is the basic law for subsequent issuance of the regulations and guidelines, has not yet been finalised and approved by government.

The Ethiopian EIA regulations and procedural guidelines do not differ substantially from USAID Environmental Procedures as given in 22 CFR 216 (Reg. 216) regarding the requirements and criteria to determine which category of development projects and activities should be subject to more stringent environmental assessment and which should be subject to a less stringent one. In both cases, projects which normally can be considered to cause a significant effect on the environment are to be subject to a detailed study (Environmental Assessment/Environmental Impact Statement) in order to enable the concerned decision-making body to determine the appropriate actions to be taken. On the other hand, where a proposed activity is normally considered not to have a significant effect on the environment, the requirement is for a less rigorous review of the potential environmental effects of the proposed activity (Initial Environmental Examination/Preliminary EIA) in order to determine whether or not there is a need to undertake an Environmental Assessment/Environmental Impact Statement.

With respect to potable water and sanitation activities, USAID Reg. 216 provides that “potable water and sanitation projects other than those that are small-scale” normally have a significant effect on the environment and therefore require an Environmental Assessment or an Environmental Impact Statement. Therefore, except for small-scale WSS projects, all other potable water and sewerage projects are normally subject to a detailed environmental assessment

(section 216.2(d)). Small-scale WSS activities are subject to an initial environmental examination but only when there is a finding that the proposed activity may have a significant effect (positive threshold decision) that a further Environmental Assessment will be required. However, there is no defined criteria in Reg. 216 to distinguish between large-scale and small-scale WSS projects. The Ethiopian EIA regulations and guidelines do not specifically mention WSS activities or categorise them by type or scale for EIA purposes. From a reading of the procedural guidelines which categorises projects in other sectors (agriculture, industry transport and mining) according to the scale of activities for EIA purposes, however, one can assume that small-scale projects, including relevant water and sanitation activities, require only an initial environmental examination as they are normally presumed not to cause significant environmental effects.

Since the potable water and sanitation activities carried out by cooperating sponsors in Ethiopia under the Title II program are small-scale in nature, they are subject to an Initial Environmental Examination according to USAID Reg. 216 as well as the draft Ethiopian EIA regulations and procedural guidelines.

What is lacking in both the USAID environmental procedures and the Ethiopian regulations are detailed technical guidelines and checklists to enable the Cooperating Sponsors to incorporate the required environmental factors in the design and implementation process of WSS activities.

Similar to what is provided in the draft environmental proclamation, the review and evaluation of EIAs of small-scale WSS projects is under the jurisdiction of regional states. Therefore, it is the relevant government agency at regional and lower levels (wereda, zone, etc.) which will be responsible for the review and approval for activities requiring an EIA.

It is clear from the above that Ethiopia has yet to put in place the necessary environmental impact assessment requirements. The regulations and guidelines are still in draft form although they address more or less comprehensively the EIA requirements for development activities. This means that the environmental impacts of Title II-supported WSS activities will primarily be subject to the requirements set out in Reg. 216.

As the implementation of the Ethiopian EIA regulations and guidelines may take some time to take hold, it is the regional and, more particularly, community levels which are affected by the environmental impacts of WSS projects. Reg. 216, therefore, will remain for some time the main instrument to regulate the environmental impacts of WSS activities.

3.3.5 Other Regulations

The Ethiopian Standards Regulations No. 12/1990, which set up quality standards for drinking water, was issued September 1990 by the Standards Authority. The regulation establishes desirable and permissible levels for the physical and chemical properties of drinking water as well as the testing methods to be used.

When defining the scope of the regulation in Article 1, however, Regulation No. 12/1990 limits its application to *piped drinking water supplies*. Thus, the standards do not apply to the supply of drinking water by other means (boreholes, hand-dug wells, ponds, etc). Moreover, the regulation also imposes the standards only when the consumer population exceeds 10,000 persons. Taking into account both conditions stated in the regulations for the application of the water quality standards, it is clear that the WSS activities carried out under the Title II program are excluded from the ambit of the regulations because they do not include piped drinking water supply and they serve less than 10,000 persons. Therefore, it can be stated that *there are no national drinking water quality standards yet for small-scale water supply and sanitation activities*.

To a large extent, the water quality standards incorporated in the regulations are based on the international standards set by WHO and do not reflect the particular conditions of Ethiopia. Moreover, the standards were devised to apply to the larger towns where piped drinking water supply may be available to significant numbers of people. To date, it is doubtful whether the provisions of the regulations have been enforced, even in urban areas, although it is declared in the regulations that the standards are obligatory.

Directive WD1 on the Drilling, Construction and Rehabilitation of Water Wells, issued in October 1999 by the then National Water Resources Commission, requires that a permit be obtained before a water well (excepting hand-dug wells) can be drilled by any person or organisation. This regulation has been issued to control and monitor groundwater abstraction. The directive has several provisions laying down the necessary requirements and standards that have to be met before a permit can be given for the drilling, construction and rehabilitation of water wells. In the past, certain efforts were made to implement the directives. However, after decentralisation and the establishment of the federal system of government, the Ministry of Water Resources has stopped accepting applications for water well drilling permits because it felt that is the regional states are now responsible for this.

For the Addis Ababa metropolitan area, Proclamation 10/1995 and the Addis Ababa Water and Sanitation Authority (AAWSA) Regulation No. 5/1995 give the AAWSA responsibility for determining if underground water may be abstracted and to issue permits to drill water wells in the Addis Ababa area. The owners of water wells presently in use must now

register with the authority. The AAWSA may take legal action against anyone who fails to register or obtain a permit.

3.4 Institutional Framework

The change to a federal system of government in Ethiopia after 1991 led to the decentralisation of responsibility for the administration and management of the country's natural resources and the environment to the regional states. The major functions of the executive organs of government are policy and lawmaking on the basis of which regional states manage and administer their resources.

3.4.1 Water Resources Sector

At the federal level, the Ministry of Water Resources is responsible for regulating the management and development of the water resources of the country. With respect to water supply and sanitation, the ministry is responsible for devising policies and strategies for the development and management of WSS activities; undertaking studies, particularly for the development of large and medium water supply schemes and developing water quality standards in consultations with other appropriate bodies. Currently, the ministry is developing a water resources development strategy based on the policy adopted by the government which includes a strategy for water supply and sanitation. The ministry also has a Water Supply and Sanitation Department which is involved in developing such policies and strategies, giving support and training to regions and devising appropriate water quality standards in consultation with other relevant government agencies.

Regional states play the major role particularly in the regulation, development and management of small-scale water supply and sanitation schemes. The responsible bureaux for water resources in regions are organised as the regional states deem fit (e.g. Water, Mines and Energy, Natural Resources etc). In some regions there is still ongoing reorganisation of bureaux. For instance, the Oromia Bureau of Water, Mines and Energy has recently been reorganised into two bureaux, namely Irrigation, Water and Mines and Energy.

The Title II-supported water supply and sanitation projects are undertaken by the Cooperating Sponsors in different regions at the community level. Thus, the line departments in the regions, in collaboration with the Cooperating Sponsors, have a major role to play in ensuring that the WSS activities are sustainably managed during the project design, operation and maintenance phases as well as periodic evaluation of the projects.

At present, there are no legal requirements or standards in place on which the responsible line departments at different levels in the regions and the cooperating sponsors themselves can

base their decisions when carrying out WSS projects in the targeted communities except for the standard professional design and construction practices that the project proponents follow.

3.4.2 Environment Sector

With respect to the environment, the Environmental Protection Authority is the responsible regulatory body at the federal level. Its main responsibilities include:

- to prepare environmental policies and laws and when approved follow up their implementation;
- to prepare a system for environmental impact assessment of programmes and projects and supervise their implementation;
- to prepare required standards for the protection of soil, water and air as well as the biological systems they support and follow up their implementation; and
- to render advice and technical support to regions on environmental protection.

As discussed earlier, it is only the environmental policy that has been prepared and adopted by government to date. The framework environmental law and the EIA regulations and guidelines are still at a draft stage and there are no standards that have been prepared yet.

The EPA also has an Environmental Council to ensure inter-sectoral coordination among the relevant sectoral ministries that have a major concern in environmental protection. The council is composed of the Minister of Agriculture, Minister of Trade and Industry, Minister of Health, Minister of Mines and Energy, Minister of Water Resources, Commissioner of the Science and Technology Commission and General Manager of the Environmental Protection Authority. Currently, the council is chaired by the Minister of Agriculture. The responsibilities of the council are to make recommendations on policy matters concerning environmental protection and to evaluate and approve directives and standards issued by the EPA.

The draft environmental proclamation has incorporated provisions for the reestablishment of the EPA with additional powers and duties and has also broadened the composition of the environmental council to include other government agencies, regions, the private sector and local environmental NGOs. It also requires that other sectoral Ministries and agencies establish environmental units to see that environmental concerns and monitoring programs are incorporated in their development programmes.

At the regional level, there are no independent environmental agencies established as yet except in the Addis Ababa Administration. Currently, specific sectors have been given responsibilities for environmental protection, but this varies from region to region. For instance,

in the Amhara regional state, it is the Agricultural Bureau which is responsible for the environment. In the Tigray region, it is the Planning Bureau. Because environmental issues are cross-sectoral in nature, there is a need to establish an independent regulatory body responsible for the environment in regions. The present institutional structures in the regions are not conducive to addressing environmental concerns. They are narrowly focussed on specific sectors (e.g. agriculture, water, etc) and are found in sectors which have conflicting objectives, namely, development and environmental protection.

Most regions have realised this drawback and are intending to establish an independent environmental agency in their respective regions. Currently, all regions as well as the Dire Dawa and Addis Ababa City Administrations have established Regional Environmental Coordinating Committees chaired by the Vice- President of the Regional Council. All the regional states with the exception of Gambella have prepared environmental conservation strategies with the participation of stakeholders up to the community level. The conservation strategies incorporate several environmental programmes to be implemented in the regions and have provisions for the establishment of an EIA system based on the federal EIA regulations. There is also the intention to establish environmental coordinating bodies at the zonal, wereda and community levels composed of relevant line governments, communities and NGOs to be responsible for environmental protection at all levels.

Although various steps are currently being undertaken at both the federal and regional levels to put in place the appropriate policy, legislative and institutional frameworks for environmental protection, this study clearly shows that there is still much left to do, particularly in the establishment of environmental regulations, standards and institutions to effectively address environmental issues at all levels including the community level.

Thus, until such environmental regulations, standards and institutions are in place, the WSS activities currently undertaken under the USAID Title II program will have to rely on the minimal guidance provided in Reg. 216. Further technical guidance for the environmental protection of WSS activities needs to be developed.

3.4.3 Health Sector

There is a global realization that the focus of preventive health care must reside at the community level. In Ethiopia, this is reflected in the recent Health Policy and Health Sector Development Program (HSDP). Access to health services nationwide, defined as being within 10 km from a health facility, is about 48.5%[9] but real service access is very much lower than this. Since the change in government in 1991 and decentralization in 1993, the health sector has moved from highly centralized services, which were delivered in a fragmented way with reliance

[9] Ministry of Health (1998). **Program Action Plan for the Health Sector Development Program (HSDP).**

on vertical programs, to providing basic primary health care emphasizing prevention, promotion and basic curative services through a decentralized system of governance. Under the new health policy, the health care delivery system has been reorganized into four tiers. Primary health care units, each with five satellite community health clinics, provide comprehensive primary care service. Each satellite unit is planned to cover a population of 5,000. The other three health care levels are district, zonal and specialized hospitals.

As in many other countries, responsibility for the provision of potable water and sanitation in Ethiopia is split between water development services, which are under the purview of the Ministry of Water Resources, and sanitation services, which fall within the activities of the Ministry of Health. The goals and implementation of the sector investment plans are ambitious. They entail health facility expansion, improved service quality, restructured health sector management, improved financial sustainability, an increased role for private sector health care and an improved drug supply.

In order to achieve the goals set out in the HSDP, there is a need for further reorientation of the health sector as well as many more trained health personnel. In the interim, service access, quality and utilization remain low. Despite a commitment to the social sector by the current government, per capita health expenditure in 1996 remained low at about $1.20. This is significantly less than the sub-Saharan African average health expenditure of $10 per capita.

Health service quality has been compromised by inadequate and poorly maintained infrastructure and equipment, scarcity of trained health personnel, drugs and pharmaceutical supplies. There are an estimated 20,000 health care workers providing service, the vast majority in the public sector. The ratio of one health worker to 2,850 people is one of the lowest in the world. In addition, a combination of inadequate working conditions, under-utilization, low salaries and lack of career development opportunities have contributed to widespread job dissatisfaction and significant personnel turnover and attrition. A combination of limited access and low utilization of public health services contributes towards consistently poor health statistics.

The ambitious goals set by the HSDP cannot be achieved unless there is community participation. The government sees this participation taking place in different forms, ranging from increasing service coverage, encouraging the use of available health services, particularly by women and children, and involving the community in preventive health measures. Community participation, if properly managed, can be a powerful tool for changing attitudes towards health care services and mobilizing communities to support health service delivery. A further level of community health agents and traditional birth attendants is foreseen to be established below the community health units, but outside the formal government system and based on a system of community compensation. Ethiopia has a long history of community-level

heath agents, with over 60,000 having been trained during the period of the *Dergue*. Few of these community-level health agents, however, are functioning at present.

3.5 Conclusions and Issues to be Addressed

This study shows that apart from policies being put in place at the federal level, the legal and institutional frameworks in Ethiopia are not yet sufficiently developed for appropriate water resources management and environmental protection in the country. Most of the legislative requirements are still in a draft stage and even if adopted will take some time to be adequately integrated and implemented at the regional, and particularly, at the local and community level where Title II-supported WSS activities are operational. Similarly, institutional capacity to deal with the sustainability and environmental protection issues at the community level leaves much to be desired. What this implies is that USAID has an increasing role to play, at least in the short to medium term, in ensuring that the WSS projects carried out by the Cooperating Sponsors are sustainable and environmentally sensitive so as to achieve a better livelihood to the communities they are intended to serve.

Accordingly, it is felt that the following issues need to be addressed in order to ensure that WSS projects will be sustainable and environmentally viable in the future:

- There is still no legislative framework that has been approved by government for the sustainable management and regulation of water resources and the protection of the environment. Thus, it is necessary for USAID to consider the development of appropriate technical guidelines in order to strengthen the sustainability and proper integration of environmental concerns in the WSS activities undertaken by the Cooperating Sponsors.

- Water quality standards are non-existent for small-scale WSS projects at the national level. It is therefore appropriate to consider whether or not to use international guidelines or, alternatively, develop other appropriate guidance for water quality measurements of small-scale WSS projects.

- Most government line departments at the local level do not have adequate capacity or the regulatory instruments for effective management and monitoring of WSS activities. It is important, therefore, to develop an appropriate mechanism to effectively integrate government line departments into project design, implementation and monitoring activities of WSS projects to ensure long term sustainability of such projects.

- The community-based water and sanitation committees may need to be strengthened to ensure that they adequately take on the responsibilities of operation and maintenance of WSS systems. In this respect, “best practices” of effective water committees in other

(non-Title II) WSS projects in Ethiopia may serve as models for developing appropriate guidelines to strengthen Title II project committees.

Section 4: Potable Water and Sanitation Activities Supported By Title II

4.1 Typology of Water Supply and Sanitation Activities

The following is a brief description of the potable water and sanitation activities currently being developed by the Cooperating Sponsors.

4.1.1 Ponds

Ponds are small man-made water reservoirs, which are constructed by digging a shallow pit and using the excavated soil to build up an embankment on the periphery of the pit. Ponds in Ethiopia are usually round in design and typically have a diameter of 20 to 40 meters, a depth of up to 2 meters and a water capacity of up to 1,000,000 liters. In some cases, large ponds may have twice this capacity. Rainfall is collected on the adjacent higher land (catchment area) and channeled to the pit where it is stored for use by animals and people. A spillway is needed at some point on the embankment to allow excess water to safely flow out of the pond. In addition, fencing is used to keep animals out of the pond. Ponds sometimes have outlet pipes allowing water to flow to cattle troughs or drinking water wells. Most ponds in Ethiopia fill during the rainy season but become empty during the dry season because of a combination of water withdrawals, seepage and evaporation. No cost data are available.

4.1.2 Springs

Springs are natural water sources where underground water flows to the surface. They normally occur only in hilly or mountainous areas. Springs are improved by cleaning out the "eye" where the water comes to the surface, capturing the immediate flow in small collection box and then piping the water downhill to a storage tank, cattle trough or other facility. The purpose of improving a spring is to capture as much of the flow as possible and to protect the water from contamination. Springs used in the Title II program generally have a flow rate of less than 1.0 liter per second and some even stop flowing during prolonged dry seasons. The cost of protecting springs is highly variable depending upon conditions, but the cost in the Title II program ranges from under 10,000 birr to over 40,000 birr for full distribution systems.

4.1.3 Hand-dug wells

These are shallow wells dug by hand, averaging one to two meters in width and with a maximum depth of 20 to 25 meters. They are used in areas where the groundwater table is near enough to the surface to be intercepted by a dug well. In consolidated soils, hand-dug wells may

be unlined, but more often the sides of the wells are reinforced with concrete well rings or stone masonry to prevent collapse of the walls and inflow of surface water. Dug wells may be left uncovered at the top, in which case a rope and bucket is used to draw water, or closed with a concrete cover, in which case a handpump, generally an Afridev or India Mark II model pump, is installed to lift the water. A hand-dug well with a handpump will cost 15,000 to 30,000 birr.

4.1.4 Boreholes

Boreholes are wells drilled by mechanical drilling rigs, with an average width of 15 to 20 cm and a maximum depth of up to 200 meters. Boreholes with depths of 50 meters or less are termed shallow wells and may be fitted with handpumps, but for greater depths, termed deep wells, diesel-powered electrical generators and submersible electrical pumps are required. When a borehole is fitted with a motor-powered pump, it usually is connected to a storage tank to hold water, a piped distribution system and a tap stand where people fill their water containers. The operation and maintenance of deep boreholes is demanding and requires daily attention by a trained operator with access to fuel, tools and spare parts. Boreholes with simple handpumps cost around 80,000 birr while deep boreholes with motorized pumps will cost 300,000 birr and up.

4.1.5 Roof rainwater catchments

These systems utilize the impervious nature of corrugated iron roofs to collect rainwater and channel it through roof gutters into a nearby cistern. Rooftop catchments are particularly suited to schools, clinics and other large public buildings but can equally be constructed for individual households as long as the roofing material is impervious and easy to keep clean. Cisterns are storage tanks that can be constructed of sheet metal, ferrocement, concrete blocks or stone masonry and may have a capacity ranging from a small one cubic meter ferrocement jar to a large communal storage tank of 10 to 20 cubic meters. In some cases, tanks as large as 85 cubic meters have been constructed. Water is drawn from the cistern by means of a tap on the side of the tank or through an opening on the top. Because of lengthy dry seasons in most of Ethiopia, rooftop catchments do not provide an assured supply of water thoughout the year. The availability of the water supply is dependent upon the area of the roof catchment, the rainfall patterns, the size of the cistern and the use of water. Costs depend on the size of the storage tank and may vary from 15,000 to 35,000 birr.

4.1.6 Ground rainwater catchments

A ground rainwater catchment is a system in which rainfall is harvested from an area of paved stone and channeled to a storage tank located at the downstream side of the catchment. The area of the paved catchment is 400 to 450 square meters for lowland areas receiving about 700 mm annual rainfall. Low retaining walls are erected on the periphery of the catchment which is also fenced to keep out livestock. The storage tank is usually circular, of stone masonry

construction, with a capacity of 100 to 150 cubic meters. It is connected to the catchment area by two screened inlet pipes. Water is drawn from the reservoir by means of a short outlet pipe leading to a gate valve and a tap controlled by an operator. Under careful control, the above reservoir will supply 30 to 40 households with water for up to four months into the dry season. The cost of the system is around 25,000 birr.

4.1.7 Latrines

Latrines are shallow pits excavated into the soil for the deposition of human excreta. Most pits for single latrines are a meter in diameter and between two and three meters deep. Pits for communal or public latrines, containing four to ten individual compartments with dropholes, are correspondingly larger and often contain some provision for mechanical evacuation of the accumulated excreta. The pit is usually covered with a concrete slab which forms the floor of the latrine and the associated drophole. Individual household latrines usually have a floor constructed of logs and packed earth. Cleaning of latrine floors and dropholes, however, is easier when they have a smooth, waterproof surface. For privacy and, sometimes, personal security, latrines are normally covered by a superstructure of straw, mud, wood, brick, stone or concrete. A vent pipe is usually provided in communal latrines and those built for schools and clinics, and is found in some individual household latrines. Although water supply is needed for handwashing and personal hygiene at latrines, it is not found at facilities financed by Title II in Ethiopia. No cost data are available.

4.1.8 Showers

The term “showers” is used to describe bathing compartments into which the users carry water for bathing. In a few instances, piped water from overhead taps is used. The greywater from the shower compartment usually drains through the floor into a soakaway or surface drainage channel. The compartment superstructure is constructed of concrete block or stone masonry. No cost data are available.

4.1.9 Clothes washing basins

These are small sinks, or even simple slabs, of concrete or stone masonry on which clothes can be manually washed. Water is generally available from a nearby tap or spring, and the greywater from the basins is directed to an underground soakaway or drainage channel. No cost data are available.

4.1.10 Cattle troughs

Cattle troughs are concrete or stone masonry basins into which water from a nearby well, spring, pond or borehole is piped or, more likely, manually carried. Typical troughs are a meter wide, five meters long and 0.4 meters deep. Cattle and other domestic animals are allowed to

drink from these troughs. In severe water-shortage areas, improved water sources are often reserved for human consumption with livestock required to travel to distant alternative water sources. Cattle troughs may cost up to 5,000 birr.

4.1.11 Medical waste disposal pits

These pits should be used by clinics and health centers for the disposal of used syringes, drugs, dressings and other infectious wastes. In actuality, there is little attention given to medical waste disposal pits in Title II projects. A few rural health facilities dispose of their medical wastes in ordinary pit latrines, and one rural health center is building an incinerator for medical wastes.

4.1.12 Operation and maintenance training

Training in the operation and maintenance of potable water and sanitation facilities is provided to the water and sanitation committees by the Cooperating Sponsors with, in some cases, the assistance of the zonal or woreda water department. This training depends upon the type of facility (handpump vs. protected spring vs. pond), the organization of the committee and the capacity of the Cooperating Sponsor. In some cases, training involves several days of formal instruction, while in others no significant training occurs either during construction or after handing over of the facility to the committee.

4.1.13 Sanitation and hygiene education

Training in health education, with specific emphasis on personal and household hygiene education and the promotion of sanitation, is occasionally provided to the water and sanitation committees as well as the general community by the Cooperating Sponsors and the zonal or woreda health department. In practice, however, such training is rarely provided as an integral part of the potable water and sanitation activities in Title II.

4.2 Implementation to Date

There are eight PVO/NGOs serving as Cooperating Sponsors in the Title II food security program: Africare, CARE International, Catholic Relief Service (CRS), Ethiopian Orthodox Church (EOC), Food for the Hungry International (FHI), Relief Society of Tigray (REST), Save the Children/USA (SCF) and World Vision International (WVI). With the exception of Africare, all have potable water and sanitation activities within their programs which support the USAID Special Objective of enhanced household food security in target areas.

The potable water and sanitation activities implemented to date by the Cooperating Sponsors are generally low cost, small-scale and labor intensive. They include the construction of ponds, springs, hand-dug wells, boreholes, roof rainwater catchments, ground rainwater

catchments, latrines, showers, clothes washing basins and cattle troughs. In addition, training is sometimes provided for the operation and maintenance of the above facilities and for the promotion of sanitation and hygiene education. These activities are not stand-alone projects; rather, they are intended to be an integral component of a larger food security program that may contain irrigation activities, livestock and poultry production, health center construction, etc. Table 4.1 lists the types of potable water and sanitation activities undertaken by the Cooperating Sponsors under the Title II program.

Table 4.1: Potable Water and Sanitation Activities of Cooperating Sponsors

Activities	Africare	CARE	CRS	EOC	FHI	REST	SCF	WVI
Facilities Development								
Ponds			●	●	●		●	●
Springs		●	●	●	●	●		●
Hand-dug wells		●	●	●	●	●	●	
Boreholes						●		●
Roof rainwater catchments		●	●		●			●
Ground rainwater catchments		●					●	
Latrines		●		●	●			●
Showers					●			
Clothes washing basins				●	●			
Cattle troughs				●	●	●	●	
Medical waste disposal pits		●		●	●			
Training								
Operation and maintenance		●		●	●	●		
Sanitation and hygiene education		●		●	●	●		

The geographical locations of the Title II supported projects are distributed throughout Ethiopia. Although the overall Title II program serves both urban and rural areas, the potable water and sanitation activities of the program are found almost entirely in rural areas. For example, CARE and CRS are implementing spring protection activities in Hararge Region; CARE is also building rainwater collection systems in Showa Region and communal latrines in Addis Ababa; EOC builds ponds and develops springs in Amhara Region; FHI is carrying out spring development and hand-dug wells in South Gondor Region; REST develops springs, hand dug wells and boreholes in Tigray Region and SCF renovates ponds and hand dug wells in

Borena Region. This list is not complete, but it serves to illustrate the wide distribution of the Title II activities.

At present, all of the Cooperating Sponsors are operating under individual multi-year programs supported by Title II. These programs are based on a Development Activity Proposal (DAP) which each Cooperating Sponsor submits to USAID for approval and funding support. The current DAP programs range from 3 to 6 years in duration and occur over the period 1997 to 2003. Prior to the current DAP programs, most of the Cooperating Sponsors carried out similar relief and development activities for USAID under a Multi-Year Operational Program (MYOP). The status of water and sanitation activities implemented within the current DAP programs is shown in Table 4.2. It should be noted that most of the Cooperating Sponsors were still in the first half of their DAP program in late 1999, the point at which this study was carried out.

Table 4.2: Implementation of Title II Projects in Current DAPs

Activities	CARE 1995-2003 P/A	CRS 1997-2001 P/A	EOC 1998-2003 P/A	FHI 1999-2001 P/A	REST 1999-2001 P/A	SCF 1999-2003 P/A	WVI 1998-2002 P/A
Ponds	33/11	57/25	59/3 (combined)		No Data Provided	24/2	34/9
Springs	107/37	49/19		36/13			5/2
Hand-dug wells	34/6	71/24		24/8		19/5	
Boreholes							40/9
Roof rainwater catchments	17/4	4/4					
Ground rainwater catchments	60/30 (cisterns)						
Latrines	1247/182			16/5			35/1
Showers				7/3			
Clothes washing basins				18/2			
Cattle troughs				18/8		43/7	
Operation and maintenance	56/30 (groups)		318/112 (households)	439/128 (individuals)			
Sanitation and hygiene education	325/650 (households)		318/112 (households)				

P = Planned; A = Achieved
Source: Data provided by Cooperating Sponsors.

In general, the planning and implementation of Title II activities occur over six sequential phases, starting with the preparation of a DAP and concluding with on going maintenance and repair of systems. Each phase has a different, but distinct, impact upon the environment and upon the sustainability of the resulting projects. For potable water and sanitation activities, the phases assist in identifying the points at which the impacts are most significant. The six phases are:

Phase 1: Program planning (preparation of the DAP)

Phase 2: Project planning (preparation of an overall plan for one or more projects)

Phase 3: Project design (preparation of a specific technical plan and specifications for a single project)

Phase 4: Project construction/implementation (building or otherwise carrying out the design in the field)

Phase 5: Project operation (running the project according to its plan and design)

Phase 6: Project maintenance (performing preventive servicing and repair works to keep the project operating)

These phases are used in Table 6.1 (Chapter 6: Conclusions) to identify particular deficiences in the Title II program.

4.3 Review of Water and Sanitation Activities

A team of nine experts carried out this study for USAID and the Cooperating Sponsors. Seven of them participated full-time while two were available only part of the time. The list of names with biosketches of the Study Team members is found in Annex C.

The study was designed to be interactive and participatory, as described in Annex D. The main elements of the study methodology were as follows:

- **Meetings and discussions with representatives of the Cooperating Sponsors, USAID, Government of Ethiopia and international agencies**. The team leader presented the proposed outline of the study at two meetings of the Cooperating Sponsors. Additional meetings and discussions were held by members of the team with officials who were either involved in the Title II program or knowledgeable about water and sanitation development in Ethiopia. The list of officials interviewed is given in Annex B.

- **Reviews of documents and reports**. The team reviewed documentation directly related to the Title II program (DAPs, PAAs, IEEs, project plans, mid-term evaluations and official correspondence) provided by the Cooperating Sponsors and USAID as well as background documentation (policy papers, legislation, technical guidelines) provided by Government of Ethiopia and international sources. The documents and references used in the study are shown in Annex A.

- **Field visits to project sites of the Cooperating Sponsors**. Visits were made by the team to one or more field sites of all Cooperating Sponsors (with the exception of

Africare which had no water and sanitation projects at the time). These visits were arranged in consultation with the Cooperating Sponsors. The team identified general areas (zones or woredas) it wished to visit, while the relevant Cooperating Sponsor selected the specific project sites. Overall, the team visited 38 field sites and made detailed inspections of the following number of projects: ponds (4), springs (10), hand dug wells (10), boreholes (2), roof rainwater catchments (3), ground rainwater catchments (3), latrines (10), showers (2), clothes washing basins (3) and cattle troughs (9). The main activities and field visits of the team are shown in Annexes E and F.

- **Internal team review of each site visit**. After each day in the field, the team met to review the positive and negative aspects of each project and to identify potential mitigations. These discussions formed the basis of team consensus on program issues, impacts, conclusions and recommendations.

- **Follow up discussions with the Cooperating Sponsors**. Upon return from the field, the team leader met informally with each Cooperating Sponsor (one exception: a telephone call with REST) to discuss the field visit and to give an assessment of the projects seen by the team. These discussions were a frank description of the team's conclusions regarding the strong and weak points of the projects.

- **Progress review meetings with the Cooperating Sponsors**. At the completion of the field visits, the team held a progress meeting with the Cooperating Sponsors (1 December 1999) to review provisional conclusions and recommendations. The team leader held a similar meeting for representatives of PVOs and USAID in Washington DC (10 December 1999). Comments received at these meetings were used in the preparation of the final report.

- **Progress review meetings with USAID**. Three review meetings were held with USAID. In Addis Ababa, a mid-study review was held on 10 November 1999 and a final debriefing review on 24 November. Representatives of AID/Washington were also present at the PVO meeting in Washington on 10 December. In addition to these formal presentations, the team leader had several informal meetings with USAID officials in Addis Ababa, and again later in Washington, to discuss progress of the study and the emerging conclusions.

Section 5: Characteristics of Potable Water and Sanitation Development in Ethiopia

5.1 Hydrogeology and Water Resources

5.1.1 Basic Principles

Water Resources Potential of Ethiopia

Ethiopia has good potential for the development of surface and groundwater resources for domestic, agricultural and industrial purposes. There are thirteen major river basins in the country, among which eight have large perennial rivers with average flows of 30 to 500 m^3/sec. In addition, eight natural lakes are found in the highlands and in the Rift Valley. Most of the freshwater in Ethiopia has total dissolved solids (TDS) less than 1500 mg/l, which is an upper limit of acceptability on the basis of taste, although there are some areas with saline and even brine waters.

A number of classification systems have been used to describe the hydrogeological and climatic conditions of Ethiopia. Considerable groundwater potential occurs in aquifers, which can be classified as having high, moderate or low productivity. The Rift Valley and adjacent areas have some of the most productive aquifers as a result of a high degree of faulting and fracturing of the volcanic rocks and the occurrence of relatively permeable, unconsolidated sediments. On the other hand, the older volcanic formations in the highlands, which have relatively less fracturing and higher amounts of clay, are moderate to low productivity aquifers.

The above classification of productivity groups was developed by Tesfaye Chernet, the compiler of the hydrogeologic map of Ethiopia, on the basis of data obtained from 237 boreholes located throughout the country (see Table 5.1). He also reported that there are more than 3000 boreholes in Ethiopia.

Table 5.1: Productivity of Groundwater Aquifers in Ethiopia

Productivity of Aquifers	Number of Boreholes with Data	Specific Capacity (liters/sec.)				Estimated Optimum Yield (liters/sec) (20 m drawdown)		
		Range (all known values)	Range (80% of values)	Mean	Median	Range (80% of values)	Mean	Median
High	106	0.03–40.5+	0.2 – 7.6	3.3	2	1.8 – 68.4	29.7	18
Moderate	116	0.02 -13.5	0.05–1.1	0.53	0.13	0.45 – 9.9	4.8	1.2
Low	15	0.001–3.4	0.006–0.5	0.1	0.04	0.05 – 4.5	0.9	0.4
Source: T Chernet (1988). Hydrogeological Map of Ethiopia. Ministry of Mines, Energy and Water Resources.								

All available water sources in Ethiopia, both surface and groundwater, are derived from rainfall. Generally, the wet season (Kiremt) in Ethiopia occurs from July to September with the source of moisture originating in the Gulf of Guinea. Another rainy period is March and April, especially in the southeastern part of the country, which receives moisture from the Indian Ocean. Depending on the nature of rainfall distribution and features such as wind, temperature, radiation and altitude, up to five distinct rainfall and evaporation zones can be recognized in Ethiopia.

In addition, five major water resource regions can be identified on the basis of their surface and groundwaters and the corresponding water quality. These are:

Highland 1: Widespread and moderate to large quantities of surface water and/or groundwater. Good chemical quality (TDS of 0–1500 mg/l). Most streams are perennial and cold springs are common. Depth to groundwater is 0-100 m and is exploitable in low relief areas.

Highland 2: Widespread and moderate to low quantities of surface water and/or groundwater. Good to fair chemical quality (TDS of 0 -3000 mg/l). Some streams are perennial and some intermittent. Depth to groundwater is 0–100 m and exploitable in low relief areas.

Lowland 1: Widespread and moderate to large quantities of surface water and/or groundwater. Variable chemical quality (TDS of 500–3000 mg/l). Most streams are perennial, with depth to groundwater of 0–150 m.

Lowland 2: Localized and moderate to large quantities of groundwater, especially along valleys. Fair to poor chemical quality (TDS of 1000–3000 mg/l). Most streams are intermittent, but some are perennial. Depth to groundwater is 0–270m.

Lowland 3: Localized and limited quantity of groundwater. Fair to poor chemical quality (TDS of 1000–3000 mg/l). All streams are intermittent. Depth to groundwater is 0–300 m.

Problem areas: Areas with any of the following: high salinity of natural waters (greater than 3000 mg/l), high fluoride concentration (greater than 1.5 mg/l), great depth to groundwater (greater than 100 m), possibility of striking thermal groundwater and/or very low recharge to groundwater.

Hydrogeology and Ground Water Resources

In terms of hydrogeological considerations, the geological formations found in Ethiopia are the following:

Igneous intrusions and metamorphic aquifers

These are the oldest rocks in Ethiopia (Precambrian). The major igneous intrusions are the granitoids, granites, gabbros, diorites, doloritic dyke sills and diabase intrusions. These rocks are generally impermeable but when fractured and weathered can produce significant amounts of groundwater. Shallow groundwaters can be developed in the upper zones using hand dug wells and shallow boreholes. Granites, when highly weathered and disintegrated, form loose sandy deposits which can produce reasonably good groundwater at shallower depths. In areas where there are fault features, igneous intrusions can produce significant ground water even at deeper zones.

The metamorphic rocks are generally impermeable unless subjected to fracturing and weathering. Major groundwater occurrence is associated with fracture zones, while shallow groundwater occurs in the upper weathered zones.

Sedimentary rock aquifers

Sedimentary rocks formed during the Paleozoic and Cenozoic (younger than Precambrian) geologic periods include sandstones, limestones, shales, marles and evaporites. Among these deposits, sandstones and limestones are generally good aquifers with very high groundwater potential, particularly when fractured or with developed karstic features. Groundwater can be found at any depth depending upon the water table and location of aquifer.

Volcanic rock aquifers

The earliest and most extensive group of volcanic rocks are the trap series which erupted from fissures during the early and middle Tertiary period. Trap series volcanic rocks consist of the Ashangi group and Shield groups, which consist mainly of basaltic rocks. Most of the central highland of Ethiopia is covered by the trap series basalts. Other volcanic formations are found in the Rift Valley and on the adjoining plateau. These formations are predominantly acidic and include tuffs, ignimbrites, rhyolites and trachytes.

Aquifer zones in the trap volcanic series are associated with fault fractures, joint systems, lava flows, inter-volcanic flow weathered zones and sediments, vesicles and pore spaces between different lava flows. Significant groundwater can be developed in these rocks. The yield from these rocks can be increased by drilling deeper through several aquifers.

Groundwater potential in volcanic rocks associated with the rift system is very high as these rocks have been subjected to intensive fracturing as a result of faulting processes in the Rift Valley. Acidic flows normally develop explosive pyroclastic deposits such as tuffs, pumice, ash, scoria and braccias that have high porosity and permeability and can be productive aquifers. Furthermore, inter-volcanic flow weathered zones and sedimentary deposits form good aquifers.

Alluvial aquifers

In this class are included unconsolidated to semi-consolidated alluvial, aeolin and lacustrine sediments. They form highly productive aquifers with large intergranular porosity except for the fine-grained sediments. Shallow as well as deep groundwater can be developed depending on the water table, depth and aquifer thickness.

Hydrogeology and Groundwater Quality of Ethiopia

In terms of groundwater quality the geologic regions of Ethiopia can be categorized as the Rift Valley region, metamorphic and igneous rock region and Mesozoic and Cenozoic sedimentary rock regions excluding the Rift Valley.

Rift Valley Region: In the rift valley, fluoride is a major problem, often making the ground water unsuitable for drinking. The WHO guidelines for the maximum allowable concentration of fluoride in drinking water 1.5 mg/l. Fluoride in the Rift Valley is associated with acidic products such as pumice, ignimbrite, obsidian and rhyolite, which are the products of post-techtonic volcanic activities. Groundwaters in the Rift Valley also have high TDS contents, usually above 1500 mg/l.

Metamorphic and igneous rock regions: The ground water quality in these rocks is variable but generally good, except in some gypsiferous metamorphic rocks where water quality can be very poor.

The Mesozoic and Cenozoic sedimentary rock region (except the Rift Valley): The ground water quality in such rocks is generally poor. TDS values are generally above 1500 mg/l, except in adigrat sandstone which has a TDS value less than 1500 mg/l. The poor groundwater quality is a result of dissolution of rock-forming minerals, such as calcite, magnesite, gypsum, etc.

Hydrogeology and Chemical Groundwater Quality of Title II Project Areas

The general chemical quality of groundwater in the project areas can be described by three distinct examples:

- Groundwater in Tigray Region is hard with high TDS values.

- Hand dug wells in Garamuleta and in Lay Gaynt are sunk in basalt-derived soils where major problems are not anticipated.

- Shallow wells around Dire Dawa are sunk in alluviums and the groundwater in these alluvium deposits is usually of good chemical quality. Some of the wells, however, are too shallow and can easily be contaminated bacteriologically.

- Groundwater quality in the Rift Valley is more problematic because of high fluoride content, even though good groundwater potential exists.

Groundwater Resources Development

As described earlier, the groundwater potential of Ethiopia varies from region to region according to hydrogeological conditions (geology, hydrogeology, climate, vegetation, etc.). Hydrogeological studies, supported by borehole data, confirm that there is considerable potential for groundwater development in Ethiopia. Groundwater depth and chemical quality varies from region to region. Regional hydrogeological studies suggest that except in limited places, such as the Rift Valley, the groundwater is of generally good chemical quality.

The level of groundwater development in Ethiopia to date is very low but constitutes the major source of water for both urban and rural communities. Data collected by the Ministry of Water Resources and analyzed by Ernst & Young in association with Tropics Consulting Engineers in 1997 indicated that 88% of the 561 urban water supply sources in the survey used groundwater. Half of these 561 sources were developed with boreholes while another 30% were based on springs. The same survey showed that water sources for 182 rural settlements were dived as follows: boreholes 29%, hand dug wells 33% and springs 38%.

Despite its high cost, ground water is the most reliable source of water for rural communities in terms of both quality and quantity. In rural areas, special attention must be given to shallow groundwater sources because of the potential for contamination by surface water. The occurrence of groundwater at shallow depths should be thoroughly investigated before using it as a water source of any potable water supply project.

Toxic Minerals and Other Chemical Substances

Arsenic minerals occur as oxides, sulfides and in compound form with base metals. They occur at anomalous levels in ore deposits of nickel, cobalt, iron, copper and lead. Their presence is related to a variety of geologic processes often involving hydrothermal activity. Arsenic minerals are found in almost all ages of rocks, i.e. from the earliest (Archean) period to the present time, wherever hydrothermal processes have been active.

Tests for trace elements such as arsenic, barium, beryllium, etc. are not usually made for groundwater investigation purposes unless there are special circumstances where the presence of such elements is known to be a health hazard, as in the case of Bangladesh. Available data on the hydrochemistry of groundwaters in Ethiopia do not suggest that arsenic is a problem or that special water quality testing is necessary for arsenic minerals.

Two other chemical substances are relevant to the water resources potential of Ethiopia. Fluorine is a common element found in combination with a number of minerals in the form of fluorides, usually in the form of sodium fluoride. Relatively high concentrations of fluorides can be found in the groundwaters of the Rift Valley. Nitrate is a naturally-occurring ion that is part of the nitrogen cycle. It is found in surface and groundwaters that have been affected by the oxidation of ammonia in sewage wastes and in agricultural fertilizers.

A more detailed discussion of arsenic, fluoride and nitrate is given in chapter 5.4.1.

5.1.2 Environmental and Sustainability Issues

Environmental Problems in Rural Water and Sanitation Projects

Rural water supply and sanitation projects are intended to have positive health and environmental impacts, but without careful planning they may have significant negative effects on public health, environmental quality and natural resources. These negative impacts may arise from poor project design, inappropriate construction practices, improper use of the facilities and faulty operation and maintenance procedures.

Table 5.2 identifies the main environmental problems typically associated with small-scale potable water supply and sanitation projects.

Environmental Problems in Title II Activities

Although not all of the problems noted in Table 5.2 occur in the Title II program, many examples of adverse environmental situations can be found. The most common issues are the following:

Bacteriological, chemical and physical degradation of open water sources.

Open water sources are probably the most serious environmental problem because of the major hazards they pose to health. It is very difficult to maintain sanitary conditions in and around water sources that are subject to repeated contamination by surface runoff, people and animals. Ponds and open wells developed for potable water supplies become reservoirs for collecting contaminated surface water runoff, which in turn can also degrade the quality of water in shallow aquifers. Moreover, when people dip their unclean containers into the water, they pollute the source further.

- ***Monitoring indicators***: periodic sanitary surveys, including effects upon shallow aquifers; water quality testing, especially for bacteriological indicators.

- ***Mitigation measures***: The best measure is to avoid open water sources for potable supplies. Covered water sources, such as protected springs, hand dug wells with handpumps and rainfall catchment areas with storage tanks, offer protection against uncontrolled contamination. They also provide opportunities for subsequent disinfection of water, if it becomes necessary. When water sources cannot be covered, access to them should be restricted so that people and animals cannot introduce pollutants directly. Water should be withdrawn from such open sources by pumps or gravity pipelines and delivered to locations where people can fill their containers in a sanitary manner.

Creation of stagnant water around water points

The leakage and spillage of water around taps and wells result in muddy pools that provide breeding areas for disease vectors and sources of contamination to surface and groundwaters, especially shallow aquifers. Livestock are attracted to the pools, which then become further polluted and subject to progressive soil erosion and site degradation.

- ***Monitoring indicators***: periodic sanitary surveys; water quality testing.

- ***Mitigation measures***: The problem requires both technical and social responses. Improved design, construction and maintenance practices are essential. Technical guidelines for project facilities should be developed and improved training for both engineers and field technicians should be established. In addition, environmental and health awareness should be raised through community discussion and hygiene education. There also is need for rules regulating activities near the water points.

Sustainability Problems

From a long-term viewpoint, several problems related to hydrogeology and water resources affect the sustainability of Title II projects.

Poor design practices

Not all projects were based on appropriate design parameters, the most important being area and population to be served, design period, water demand, selection of water source, type and location of the facility to be provided. Among these, the choice of water source and type of scheme to be implemented are the key parameters affecting project sustainability. A lack of information about existing water resources, especially groundwater availability, resulted in a number of inappropriate water sources and schemes being developed.

- ***Monitoring indicators***: periodic evaluation of project performance.

- ***Mitigation measures***: establishment of technical standards; watershed assessments.

Poor construction practices

Poor construction practices, including the lack of proper drainage around water points, the failure to seal hand dug wells against surface contamination and incorrect placement of outflow pipes on storage tanks, were seen in some schemes. Over time, these problems endanger the integrity of the projects as well as the interest of the people in continuing to use them.

- ***Monitoring indicators***: post-construction audit of projects; period sanitary surveys.

- ***Mitigation measures***: establishment of technical standards; technical training for engineers and field staff.

Absence of water quality testing

As discussed earlier, no regular water quality testing occurs in the Title II program. Without information derived from properly-conducted analyses of water sources, especially their microbiological quality, it is difficult to ensure the current and future safety of the supplies.

- ***Monitoring indicators***: provisional water quality standards for Title II projects.

- ***Mitigation measures***: establishment of provisional water quality standards for Title II projects; provision of portable field testing kits to Cooperating Sponsors; development of a water quality testing program.

Absence of well monitoring practices

There is no regular monitoring of dug wells and boreholes to assess yields, depths to water table and water quality. The lack of such information prevents accurate assessment of current conditions and timely maintenance actions as well as accurate predictions of future adequacy of groundwater resources.

- ***Monitoring indicators***: provisional water quality guidelines for Title II projects.

- ***Mitigation measures***: establishment of a regular program of well monitoring

Insufficient catchment treatment

Some project areas have few, or even no, catchment treatment practices. Catchment treatment in the form of terracing, detention ponds and tree and bush planting can promote groundwater recharge to enhance the supply of water to springs, dug wells and boreholes. For

ponds and ground rainwater catchment schemes, catchment treatment can reduce soil erosion and siltation. (See Box 5.1 for an example of good practices.)

- ***Monitoring indicators***: watershed assessments; sanitary surveys.

- ***Mitigation measures***: implementation of catchment treatment based on needs identified in watershed assessments and sanitary surveys.

Box 5.1: Catchment Treatment Above a Pond

At one site, the rehabilitation of an existing pond also required the improvement and protection of the watershed catchment area immediately above the pond. Erosion and sediment inflow to the pond were the main concerns. The Cooperating Sponsor took several actions. One was to build 16 small (50 cm high) checkdams on the dry channels that carried seasonal rainwater runoff. These checkdams held sediments in place, thereby reducing both soil erosion and the sediments flowing into the pond. By also retaining some of the rainwater runoff, they enhanced groundwater recharge and reduced peak flows passing through the spillway of the pond during heavy rains. Another measure was to plant several thousand tree seedlings to hold the soil in place and to provide shade for recreational use by the local community. A third measure was the installation of nearly 500 metres of fencing to keep livestock away from the catchment area. All work was performed on a voluntary basis by the community.

Table 5.2: Environmental Problems in Water and Sanitation Projects

Problem	Impacts	Causes	Monitoring Indicators	Mitigation Measures
Water Supply Activities (ponds, springs, hand dug wells, boreholes, roof and ground rainwater catchments)				
Depletion of freshwater resources	Overall loss of water resources; loss of aquatic life; reduced flows for downstream uses; greater use of poor quality water; increased energy expenditure on pumping and water treatment	Water withdrawals exceed the safe yield of the groundwater and surface sources	Periodic stream gauging and well monitoring; water quality testing	Limit water uses to the safe yield of the source and effective demand of the users
Chemical pollution of ground and surface waters	Adverse health effects upon aquatic life, animals and humans; increased cost of water treatment	Discharge of chemical fertilizers, pesticides, industrial wastes and human and animal excreta into surface waters; overpumping of groundwater aquifers (excessive drawdown, salt-water intrusion, etc.)	Periodic sanitary surveys; water quality testing	Sound technical design and proper operating practices of water supply systems
Creation of stagnant water (near taps and other system facilities)	Contamination of water source; increase in water-related diseases in animals and humans; soil erosion and site degradation	Inadequate drainage system; poor construction practices; unsanitary behavior near taps	Periodic sanitary surveys; water quality testing	Proper drainage system; good construction practices; hygiene education
Sanitation Activities (latrines)				
Contamination of ground and surface waters, soil and food by human and animal excreta	Increase in excreta-related diseases; general site degradation; increased cost of water treatment	Incorrect siting of sanitation facilities; poor design, construction and maintenance of sanitation facilities; inadequate protection of surface and groundwaters; improper use of facilities	Periodic sanitary surveys; water quality testing	Correct siting, design, construction and maintenance of sanitation facilities; protection of water supply sources; hygiene education
Degradation of ecosystem	Increased disease transmission through vectors and contaminated water; loss of wildlife habitat; loss of biodiversity; soil erosion; greater need for water treatment	Incorrect siting of sanitation facilities; poor construction practices; improper use of sanitation facilities	watershed assessments; sanitary surveys	Proper construction and maintenance of sanitation facilities; environmental awareness raising; hygiene education

5.2 Engineering and Construction

5.2.1 Basic Principles

Ideal versus Realistic Standards

In an ideal technical world, water supply systems would provide unlimited quantities of safe water to satisfy the needs of both people and animals, while ideal sanitation systems would provide for the immediate disposal of all wastes, both liquid and solid, which endanger health. In a world of limited resources and major environmental and human constraints, however, there is need for more practical measures of technical improvements.

Community water supply systems can be assessed in terms of four fundamental performance indicators: quantity, quality, accessibility and reliability:

Quantity: the amount of water on a per capita daily basis available in the system.

Quality: the safety of the water in terms of its effect upon human health.

Accessibility: the proportion of the community using the system.

Reliability: the proportion of time that the system is operating properly.

Similarly, community sanitation systems can be assessed in terms of safety, accessibility and reliability:

Safety: the degree to which hazardous wastes are contained and not allowed to contaminate people, food, animals or the environment.

Accessibility: the proportion of the community using the system (latrines, etc.).

Reliability: the proportion of time that the system is operating properly.

For each of these indicators there is an ideal level of service but also a practical level. As an example, urban water systems in industrialized countries normally provide an average of several hundred liters of water per day to each of their consumers. For unpiped rural water systems, however, most international agencies recommend a minimum of 20 to 50 liters per capita per day. In Ethiopia, many people in areas served by Title II water projects live on only 10 to 15 liters per day, and often on much less. This use of water is probably greater than before the projects were implemented and therefore represents an improvement over pre-project levels. Given the various constraints in the Title II program, the current level of water consumption may be more realistic than an external international standard.

Similarly, the standard for ideal water quality could be based upon the international guidelines for drinking water quality developed by WHO. This would require the elimination of all the microbiological, physical and chemical contaminants in the water that pose a risk to health. Nowhere in Ethiopia, including Addis Ababa, is this standard of drinking water achieved. The same arguments against unrealistic standards can be made for accessibility (the ideal is for everyone to have tap water in the house) and reliability (the ideal is to be operational 100% of the time). In sanitation, the ideal system would probably be waterborne wastes with a flush toilet in the home that is always operational. Again, this is not a practical standard for Title II. Because of the many environmental, social and resource constraints in rural Ethiopia, the primary measure of technical soundness should be not be the achievement of an ideal standard, or even an arbitrary design standard, but rather whether a "significant" improvement in the pre-project service level has been attained.

Thus, Title II water and sanitation projects should be viewed in terms of the degree of improvement, or beneficial change, they bring about. The amount of improvement needed for Title II projects cannot be specified here, but it should be measurable, positive and acceptable to the communities using the projects, as well as the Cooperating Sponsors and USAID.

Design Considerations

Water and sanitation systems require proper technical design to function as intended. This requirement is no different for large municipal systems or small community systems. In both cases, the outcome of bad design is the same: poor technical implementation, sub-standard performance and unhappy users. When such outcomes occur, the long-term sustainability of systems is endangered.

Because community systems are small, the need for correct design is easy to overlook. Most small-scale water and sanitation interventions in Ethiopia are relatively uncomplicated – a pond, a hand dug well or a protected spring. To the untrained or inexperienced eye, they can appear to be the result of straightforward, even simple, efforts at digging a hole in the ground or placing a pipe in the side of a hill. The reality of these systems is usually different. To function efficiently and effectively, community systems must be based upon resource availability, engineering principles and environmental considerations.

The amount of water available to a new scheme is a critical issue in design. Water availability is determined by seasonal variations in rainfall, streamflow and groundwater levels. It also is influenced by many other factors, including landforms, surface vegetation, geologic formations and the people and animals that live in the area. Many small projects fail because of an inadequate understanding of the availability of the water resource over different periods of the year. Another crucial issue is the interaction of the project with the physical environment. Water and sanitation projects draw upon and use the resources of the environment, but at the same time

their very presence influences and changes the environment. Sustainable projects require a balance between using these resources for the benefit of the people and the long-term changes in the environment that such use involves.

The design of a water system must be based on a consideration of these factors and is shaped to the extent that the designer understands and can use them in an optimal manner. For this, the designer needs both training and experience in the principles of hydrology, geology, hydraulics, water chemistry and construction techniques. He or she also needs to know how to take account of the social, cultural and institutional aspects affecting project success. Indeed, the designer of small rural systems must be part engineer, part sociologist, part health worker and part community participation specialist.

The point being made here is that rural water and sanitation projects may be small and seemingly simple, but because of their inherent physical (and social) complexities they will not function well if they are not properly designed. The designer of such systems, whether he is an engineer or a field technician, needs training in engineering and scientific principles, experience with what works in the local context and guidelines for project design. These guidelines should be appropriate for the type of development being promoted.

Construction Considerations

Much of the discussion of design also applies to construction. In essence, there is need for training, experience and technical guidelines for construction activities to be properly conducted. Project design and construction are complementary components, with each dependent upon the other. Perhaps the best way to strengthen this linkage is for the designer to prepare clear plans, drawings and other necessary documentation to assist the constructor in building the project. As described above, these plans should be based upon available resources and environmental and social considerations. Small rural systems do not need elaborate blueprints, but they should have maps, sketches and technical instructions which clearly indicate the type of schemes to be constructed. The specific site design is usually complemented by general technical guidelines consisting of approved field criteria, type drawings and materials lists. The person in charge of construction should use the site plans and general guidelines, recording the materials used in the project and noting where changes in the design were necessary. Both the initial design plans and the construction records should be maintained and used for subsequent maintenance activities, periodic monitoring and, eventually, project evaluation.

Operation and Maintenance Considerations

All water and sanitation projects, no matter how well designed or how robust in construction, require proper care for sustainable operation. Two conditions are needed. First, the users of the systems must use it correctly and not abuse it. This means water taps should not be left running; waste water should not be allow to collect around tap sites; animals must be fenced

away from drinking water sites; and pathways to the site and water drainage from the site should not cause erosion. Second, maintenance to correct problems should be carried out both when needed and on a routine basis. Simple maintenance and repair work can be performed by a caretaker or a community water and sanitation committee. Such work can range from keeping a site clean to replacing mechanical components in a handpump and drop pipe. More complicated repairs, such as replacement of supply pipes or reconstruction of spring outlets, may require assistance from the government water office or the Cooperating Sponsor. In all cases, those responsible for operation and maintenance must have an appropriate level of training and access to tools and spare parts.

Technical Guidelines

There is a wealth of available material providing guidance on the design and construction of small-scale community water and sanitation systems. Almost all international and national organizations which support rural water and sanitation programs have developed, or at least have adopted, technical guidelines for their projects. Only a few can be mentioned here. A recent document by WHO, **Fact Sheets on Environmental Sanitation**, consists of a series of 69 specific fact sheets on the main technical aspects of water supply (example: sources, treatment, disinfection, monitoring, storage and various extraction technologies) and sanitation (example: excreta disposal, wastewater, solid wastes, public facilities and various latrine technologies).[10] These fact sheets can be used in training sessions as well as in field guidelines. Another technology guide, but directed only at water supply systems, is **Small Community Water Supplies** by the International Reference Centre for Community Water Supply and Sanitation.[11] For sanitation interventions, a good reference to design and implementation of small projects is **A Guide to the Development of On-Site Sanitation** by R. Franceys and colleagues.[12] Other international organizations, such as the World Bank, UNICEF and regional development banks, as well as national organizations, such as DFID (UK), GTZ (Germany) and SIDA (Sweden), also have developed guidelines for their water and sanitation programs. Many international NGOs, such as CARE and WVI, have developed their own internal guidelines.

In Ethiopia, two sets of technical guidelines are known to exist. The Ethiopian Social Rehabilitation and Development Fund (ESRDF) uses its **Technical Design Manual** in its water and sanitation activities throughout the country.[13] Guidelines are also available within the NGO community as a result of a **Training Manual on Community-Based Water Supply and**

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[10] WHO (1996). **Fact Sheets on Environmental Sanitation: Cholera and Other Epidemic Diarrhoeal Diseases Control**, WHO/EOS/96.4. Prepared by the Robens Institute, University of Surrey, UK.

[11] Hofkes, E.H. (ed.) (1983). **Small Community Water Supplies: Technology of Small Water Supply Systems in Developing Countries**. Chichester (UK): John Wiley & Sons

[12] Franceys, R. *et al* (1992). **A Guide to the Development of On-Site Sanitation**. Geneva: WHO.

[13] ESRDF (1997). **Technical Design Manual**. Prepared by Carl Bro International a/s.

Sanitation, which was developed under the auspices of the Christian Relief and Development Association (CRDA).[14] It is very likely that other Ethiopian organizations, such as the Ministry of Water Resources and some national NGOs (REST, EOC, etc.), have technical guidelines for their water and sanitation programs.

5.2.2 Environmental and Sustainability Issues

Performance Variations

In visiting the field sites of the Cooperating Sponsors, the Study Team saw a wide range of technologies and levels of service. Water quantities in the Title II projects visited ranged from per capita highs of 20 liters/day to as little as 2 to 3 liters/day, and then only for a few months following the rainy season. Water quality exhibited similar variations. Some projects had protected springs or hand dug wells with handpumps that appeared to be delivering water free of any obvious pollution, while other projects using open wells or open ponds probably were providing water that was more polluted than the pre-project sources. The accessibility or coverage of the water projects varied from those which served all or nearly all of the surrounding community to those which, for technical or social reasons, served only a handful of nearby households. Similarly for reliability: some water projects, mainly protected springs and covered wells, were reported to provide water throughout the year, but others, mainly ponds and rainfall catchments, held water only seasonally. In general, the quality of design and construction was judged to vary from excellent to poor. In a few instances, where projects were subject to imminent failure or gross contamination, the team found inappropriate designs or incorrect choices of technology.

It is harder to comment on sanitation projects, since very few were seen in the field. Only a few water projects had sanitation components, and no self-standing sanitation projects were found. Of the sanitation interventions seen, mainly latrines, showers and clothes washing slabs, some were heavily used and appreciated by the people while others received little use and often suffered from neglect or lack of maintenance.

Technical Deficiencies

A number of technical or performance deficiencies were noted in the field. The following is a discussion of the most common or most serious problems.

[14] CRDA (1999). **Training Manual on Community-Based Water Supply and Sanitation**. Training programme prepared by Mateferia Consulting Engineers, Debre Zeit, 4-13 January 1999.

Sanitation

There is very little sanitation in the Title II program. Almost all of the emphasis is on water supply. A few of the Cooperating Sponsors have promoted latrines within their water projects, but none have implemented any major latrine construction activities. Where latrines were found, they often were not heavily used. Much the same can be said about other sanitation activities, namely showers, clothes washing basins, handwashing facilities, waste disposal pits, etc. Several excellent washing basins were observed near handpumps or taps from protected springs, but only a small minority of water projects were so endowed.

Water quantity

Although most emphasis is placed upon water supply development, no project provides large quantities of water. In many cases, communities develop informal methods of conserving and rationing water. Some limit the hours when a water source (hand pump, protected spring, etc) is open to the public. Others limit the daily amount of water (2 containers, 40 liters, etc.) that can be taken by households. Where such rules are in place, there usually is a caretaker directly controlling the water supply. The problem of limited water quantities is further aggravated by sources that are subject to seasonal reductions or even interruptions in supply. Although no assessment has been made, it is likely that most of the water projects built under Title II experience some degree of supply limitation during dry seasons, and some, particularly ponds and rainfall catchments, always have seasonal interruptions. There also appears to be little knowledge of the basic availability of the water resources serving the projects since no monitoring of groundwater levels or well drawdowns is done within the program.

Water quality

The most serious problems in the projects built under the Title II program are those of water quality. Without exception, water receives no treatment at any site. Occasionally, disinfection of wells and protected springs is carried out on water sources near the end of the construction phase before allowing people to use the supply, but no further treatment of water, and certainly no disinfection, was noted in any of the projects. The need for either water treatment or improved water source protection was obvious at many sites. Various parasites (worms, leeches) could be seen in the water of a number of sources. At some sites the drainage of waste water and spillage was so poor that the standing pools of water around the taps clearly signaled a high risk of source contamination and the existence of disease vector breeding sites. In some projects, the original water quality became degraded through poor design or an incorrect choice of technology (see Box 5.2). One common problem appeared to be the siting of cattle watering troughs too close to the point (water tap, handpump, open well) where people drew their household water supply.

The problems of water quality are worsened by a lack of information on the risks at hand. Very little testing of water sources is carried out before they are developed and turned over to the communities. Some of the Cooperating Sponsors have sampled and tested some of their sources, but none has a regular program of water quality monitoring to determine what, if any, actions should be taken to protect the health of the user communities.

Box 5.2: Design Errors and Inappropriate Choice of Technology

Two examples of serious technical problems in the Title II program:

- At one site, the Cooperating Sponsor attempted to rehabilitate a traditional open well by widening and deepening it. It also attempted to improve access to the well by digging a 30–meter long sloping trench that was 3-meters deep at the point it intersected the well. A cattle trough was placed at the bottom of the trench, near the open face of the well. People from the surrounding area now herd their cattle down the trench to the well, where they use ropes and buckets to draw water for their domestic use and to fill the cattle trough. This project illustrates serious design and construction errors: (1) the excavated soil from the widened well was placed to close to the rim of the well where it erodes away and falls back into the water; (2) the use of unclean buckets and ropes to draw water introduces pollutants into the well; and (3) the trench can act as a drain to collect surface rainwater runoff and direct it into the well. All of these factors result in degrading the water quality in the well, making it worse than in its original condition.

- At another site, another Cooperating Sponsor constructed a pond, which fills during the rainy season, to supply drinking water to people who had been walking several hours to the closest available water source, a river. Water is collected by bucket or other personal container directly from the pond, which results in further contamination of the water and a continual agitation of sediments. No outlet pipe or drain was installed to carry the water outside the pond embankment where the people could fill their containers in a sanitary manner. This project illustrates an inappropriate choice of technology in that an open reservoir (pond) should not be constructed for domestic water supply without measures to protect the water from subsequent contamination.

Water collection and delivery

Two types of problems related to water collection and delivery were noted. The first concerns design and construction matters. The siting of hand dug wells with handpumps can occur only where the groundwater level is relatively close to the surface, usually at depths less than 20 meters. Because groundwater levels are often close to the surface in river valleys, a number of Title II-supported wells have been constructed in river flood plains, sometimes very near to a river or stream channel. If the top of the well and its cover slab are placed too low relative to the river flow, the well is in danger of inundation during rainy season floods. This poses the risk of contaminated surface water entering the well by filtering down through the soil or leakage directly into the well through cracks or openings in the well cover or the supporting rings. Several instances of both situations were observed in the field.

Another design and construction problem seen in the field was the placement of inlet and outlet/drain pipes in storage tanks at incorrect elevations. In the several cases where this was seen, the Study Team concluded that the community would have some difficulty conserving water during low flow periods and would encounter problems in cleaning out the tank at times of maintenance.

Environmental degradation of the tap sites caused by poorly-designed and/or poorly maintained drainage conditions around the water taps was also seen in several locations. The direct effects of poor drainage include the creation of stagnant pools of water and muddy areas around the taps. The undrained water can provide a breeding habitat for disease vectors (mosquitoes, worms, leeches) and a source of disease transmission if contaminated with human or animal excreta. Moreover large quantities of wastewater can lead to soil erosion and site degradation by attracting livestock.

At some of the sites where construction or maintenance problems were found, the caretakers and local committees responsible for the sites did not appear to have received any training in basic maintenance or have the necessary tools and spare parts to do so.

The second problem is one of omission rather than of action. There is considerable untapped potential for increasing water availability through rainwater harvesting technologies. Several innovative rainwater systems were noted during the field visits (see Box 5.), but a more common finding was a failure to utilize rainwater collection as a means of supplementing potable water supplies. Most communities in the Title II program have some houses with metal roofs suitable for rainwater collection with the installation of gutters and a cistern. A few Cooperating Sponsors are promoting rooftop systems with large (20 to 85 cubic meter) storage tanks. However, such projects are not very common in the program, and the potential for rooftop rainwater collection, especially for individual households, has not been well exploited.

5.2.3 Causes of Problems

In most cases the causes of problems are obvious, but in some less so. The following is a summary of the main reasons for the problems noted above.

Box 5.3: Innovative Rainwater Harvesting Technologies

Two examples of innovative systems in the Title II program:

- Rainfall is collected from the roofs of two school buildings and carried by sheet metal gutters to a 20 cubic meter capacity storage tank constructed of ferrocement. The water enters the tank after first passing through a small sand filter on the top of the tank. To minimize the dirt and other foreign matter that collects on roofs during the dry season, the first flush at the start of the rainy season is allowed to flow to waste and not to the tank. Two taps near the base of the tank provide water for the schoolchildren for several months of the year.

- Rainfall is used to supplement community needs at another site where groundwater is high in fluorides and the nearest available source is a one-day walking distance. Rain is collected from a hillside paved with approximately 500 square meters of stone and mortar. The water is channeled into a 133 cubic meter masonry storage tank, where it is available to the 33 households in the local community that contributed money and labor to the project. By limiting water use to 40 liters per household per day, the community can conserve its water supply for up to four months per year. The system has proven so attractive that another 44 households have constructed a similar rainwater catchment adjacent to the original one.

Lack of sanitation

The reason for a lack of sanitation starts with the Title II program itself. There is no emphasis in the overall program for sanitation activities or for linking them to water projects. Related to this are an inadequate program emphasis on health impacts and the absence of any USAID guidelines for appropriate types of sanitation facilities. In addition, both USAID and some of the Cooperating Sponsors appear to be unaware of the importance of sanitation to health impacts and to the sustainability of the water supply projects. The implementation of sanitation activities is further hindered by the relatively few field staff trained to promote sanitation, hygiene and health.

Insufficient water quantity

The immediate cause of small water quantities is that Title II water projects are small-scale, low-cost and employ simple technologies. The programmatic reason, however, is that there are not enough projects is provide adequate water supplies to project communities. Because of lack of funds, insufficient field staff and the need to distribute program activities over a wide geographic area, most Cooperating Sponsors have not attempted to develop multiple water projects in the same community. Other reasons are a lack of technical data about alternative water sources (groundwater potentials, rainfall patterns) and a lack of technical guidance on the adoption of alternative technologies that have proven to be successful elsewhere in Ethiopia.

Poor water quality

Water is not treated in the program because there are no requirements or standards for water quality. And standards cannot be established and maintained because the capacity to monitor water quality in the projects does not exist. As a result, the Cooperating Sponsors give little attention to water quality beyond basic engineering measures. When technical problems arise which endanger water quality, there is a general lack of sensitivity to the problems posed to health and to the need for corrective action.

Inadequate water collection and delivery

Design and construction problems of water collection and delivery are caused by inexperience and a lack of training on the part or the technical staff and the absence of USAID technical guidance within the program. Problems of operation and maintenance are usually caused by a lack of training, tools and spare parts for the site caretaker or the water and sanitation committee. The failure to exploit alternative technologies can be attributed to inexperience and the relative absence of information sharing between Cooperating Sponsors. Information on successful projects and the technologies they employ is not readily exchanged between organizations, with the result that technical staff are not stimulated to try new ideas and methods of water development.

5.2.4 Monitoring Indicators and Mitigation Measures

The engineering and construction problems can be summarized into the following issues, along with associated monitoring and mitigation suggestions.

Lack of Sanitation

Monitoring indicators: number of sanitation projects; number of water projects with sanitation components; amount of funding for sanitation.

Mitigation measures*:*

- There is need to develop technologically sound designs for sanitation facilities.
- The Title II program should require sanitation as an essential component in water projects.
- See section on health, chapter 5.3.3.

Insufficient Water Quantity

Monitoring indicators: per capita daily water use; number of water projects; amount of funding for projects.

Mitigation measures:

- Multiple water projects should be implemented in communities when the per available capita water quantities are low.
- Alternative water delivery technologies should be investigated.

Poor Water Quality (see section on water quality monitoring, chapter 5.4.3)

Inadequate Water Delivery

Monitoring indicators:

- An audit of project soundness should be made following the completion of project construction.
- An annual performance review should be made of all projects.

Mitigation measures:

- Deficiencies identified in the post-construction audit or annual performance review should be corrected.
- More technical training for project technical staff and community caretakers should be provided.
- There should be greater information exchange and experience sharing between Cooperating Sponsors.
- USAID should establish technical guidelines for Title II water and sanitation projects.

5.3 Health Promotion and Hygiene Education

5.3.1 Basic Principles

Global Burden of Disease

Diseases related to poor environmental sanitation have plagued mankind throughout recorded history. Despite major gains in public health services over the last century, rapid population growth among the poorest members of society and, in particular, in rural communities and peri-urban slums has resulted in a continual number of people suffering from conditions of poor environmental sanitation. Recent attempts to classify the global burden of disease set out three main groups of diseases: Group I – communicable, maternal, perinatal and nutritional conditions; Group II – non-communicable diseases; and Group III – injuries. There are wide

global disparities in the distribution of these disease groupings. Worldwide, in 1990, one death in every three was from a Group I cause, with 16.5 million of the total 17.3 million deaths from these causes occurring in developing countries, mainly India and Sub-Saharan Africa. Of all Group I deaths, 4 out of 10 were either due to pneumonia or diarrheal disease, which together accounted for over 7 million deaths. The vast majority of these deaths could have been prevented with existing interventions. Because Group I conditions affect children disproportionately, the age structure of deaths also varies sharply between regions. A baby girl born in Sub-Saharan Africa faces a 22% risk of death before age 15. In China the risk is less than 5% and in the established market economies the risk is just 1.1%.[15]

Prior to the 1980's, international assistance for health tended to be dispersed across a wide range of ages, diseases and levels of clinical care, with considerable emphasis on health infrastructure. The broad-based primary health care approach propagated at the Alma Ata conference in 1979 was quickly replaced by the concept of epidemiological targeting and cost effectiveness.[16] This led to a new strategy of targeting a few diseases which were responsible for a high percentage of mortality and morbidity and for which effective treatment measures existed. Resources were also increasingly directed to children and infants because of the disproportionately high mortality rates among this age group and the potential for a significant impact on mortality. One major consequence of this new strategy was that water supply and sanitation were seen to be not cost-effective and, therefore, were not included in the list of selected interventions.

The new strategy emphasized "child survival" programs, which set out measures for specific childhood diseases (immunization against measles, polio, diphtheria, tetanus, pertussis and tuberculosis) and diarrhea (through oral rehydration therapy and breast feeding). The results have been impressive. Over the past 25 years, significant declines have occurred in infant mortality. These programs, however, did not change the environmental causes of ill health or bring about a reduction in morbidity rates. The incidence of diarrheal and other diseases related to poor sanitation have remained persistently high and constitute a major component of the total disease burden. Of the ten highest risk factors within the global disease burden, the six most significant are malnutrition, unsafe water, poor sanitation and hygiene, unsafe sex, alcohol, tobacco and occupation. Malnutrition and poor sanitation alone are responsible for 17% of deaths. In order to capture the impact of both premature death and disability in a single measure, the disability-adjusted life year (DALY) was introduced. The DALY expresses years of life lost to premature death and years lived with disability of specified severity and duration. One DALY

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[15] Murray, C. and A.Lopez (eds.) (1996). **The Global Burden of Disease – A Comprehensive Assessment of Mortality and Disability from Disease, Injuries and Risk Factors in 1990 and Projected to 2020**. Published by the Harvard School of Public Health on behalf of the WHO and the World Bank.

[16] Walsh, J.A and K.S. Warren (1979). "Selective Primary Health Care: An Interim Strategy for Disease Control in Developing Countries." **New England Journal of Medicine**, 301:967-974.

is one lost year of healthy life. A "premature" death is defined as one that occurs before the age the dying person should have expected to survive if he were a member of a standardized model population. Overall, malnutrition and diseases associated with poor water supply and sanitation contribute to 23% of disability (see Table 5.3).

Table 5.3:

Global Burden of disease and Injury Attributable to Selected Risk Factors, 1990

Risk Factor	Total Deaths (No.)	Total Deaths (%)	Total DALYs (%)
Malnutrition	5,881,000	11.7	15.9
Poor water supply & sanitation	2,668,000	5.3	6.8
Unsafe sex	1,095,000	2.2	3.5
Tobacco	3,038,000	6.0	2.6
Alcohol	774,000	1.5	3.5
Occupation	1,129,000	2.2	2.7

Source: Murray, C. and A. Lopez (eds.) (1996). The Global Burden of Disease – A Comprehensive Assessment of Mortality and Disability from Disease, Injuries and Risk Factors in 1990 and Projected to 2020.

Mortality figures, however, are only one measure of overall health conditions. They provide limited information on the total disease burden and very little guidance on interventions to reduce infectious diseases. This latter function is the role of environmental sanitation interventions, which are primarily intended to prevent the transmission of disease, not to directly prevent mortality.

Key Diseases Affected by Water and Sanitation

White *et al* classifies diseases associated with water into four main categories[17]:

- Waterborne: diseases acquired by drinking water (ex: dysentery, typhoid)
- Water-washed: diseases acquired by not washing and bathing (ex: scabies, trachoma)
- Water-based: diseases acquired by coming into contact with aquatic organisms (ex: schistosomiasis, dracunculiasis)

[17] White, G.F. et al (1972). **Drawers of Water: Domestic Water Use in East Africa**. Chicago: University of Chicago Press.

- Water-related insect vectors: diseases acquired from water-associated insects (ex: malaria, onchocerciasis)

Infections arising from unsafe water and poor environmental hygiene can take a variety of routes, depending upon the disease:

Route of Infection	Diseases of Importance in Ethiopia
• Fecal-oral	• Major diarrheal pathogens (dysentery, typhoid, etc.), ascariasis
• Fecal-cutaneous	• Hookworm, schistosomisasis
• Cutaneous-oral	• Dracunculia
• Cutaneous-cutaneous	• Scabies, trachoma
• Vector borne	• Malaria

According to WHO (1996), nearly half of the world's population suffers from diseases associated with insufficient or contaminated water supplies.[18] Morbidity and mortality estimates and the relationship of disease to poor environmental sanitation are outlined in Table 5.4.

In 1996, diarrheal diseases, including dysentery, were the leading cause of global morbidity, with over 4 billion new cases in 1996, and the sixth leading cause of mortality, with almost 2.5 million deaths. During that same year, diarrhea accounted for 2.1 million deaths in children under the age of 5 years, or 19% of the total deaths attributed to that age group. WHO estimates that approximately 90% of the diarrheal burden is related to poor sanitation and lack of access to safe water and safe food.[19]

The Role of Water Supply and Sanitation in Health Protection

Despite the limitations of selective primary health care interventions (immunizations, breast feeding, oral rehydration), the concept remains the dominant health care approach in developing countries today. In the 1990s, a new emphasis on the integrated management of childhood illness (IMCI) was developed.[20] It continued the case management approach of primary health care, albeit with the additional inclusion of malaria and nutrition, but it took its focus as the individual child, not the whole population. From an environmental health standpoint, the IMCI approach does not include any water and sanitation activities or any other environmental interventions.

[18] World Health Organization (1996). **The World Health Report 1996: Fighting Diseases, Fostering Development**. Report of the Director-General, Geneva: WHO.

[19] WHO (1997). **Health and Environment in Sustainable Development: Five Years after the Earth Summit**. WHO/EHG/97.8. Geneva: WHO.

[20] WHO (1997). **The Management of Childhood Illness in Developing Countries: Rationale for an Integrated Strategy**. IMCI Information, Division of Child Health and Development. Geneva: WHO.

In contrast to these targeted approaches, the classical model of public health is concerned more with the physical and behavioral environment and existing infrastructure and resources. With high rates of mortality and morbidity in children and evidence that morbidity has not declined, a major concern is that child survival programs do not change the environmental causes of ill health. To impact morbidity, there is a need for a more formalized integration of the prevention of disease and a change of the child survival paradigm from a focus on case management and facility-based services to promoting packages of interventions which include both population-based preventive measures and integrated case management.

A conceptual framework for incorporating such an environmental approach to enhance child survival and maternal health is contained in the concept that prevention promotes "wellness," which places more emphasis on preventing the initial occurrence of disease than on curing it.[21] There are three stages of prevention. Primary interventions are those that block the proliferation, transmission and human contact with the agents of illness (pathogens, vectors carrying pathogens or pollutants). Secondary prevention consists of measures to increase host resistance and to reduce the chance of developing clinical illness once contact has occurred. Tertiary prevention focuses on treatment once the disease has occurred.

Figure 5.1 shows the epidemiological pathways to illness beginning with a disease agent risk factor and showing the steps from (1) breeding, multiplication and production to (2) transmission or emission to (3) exposure ending with illness and case management. Prevention, therefore, consists of interventions designed to address those three basic steps on the pathway to illness. Representative interventions consist of those which are community-based, household-based or facility-based. Primary interventions are all community or household based and consist of low-cost technologies and behavioral change approaches.

Community and household based measures that promote a cleaner environment and modify behaviors to diminish human contact with disease agents have the potential to make other child survival measures more sustainable.

[21] Murphy, H.*et al* (1996). **Environmental Health Interventions to Sustain Child Survival**. Environmental Health Project, Applied Study No 3, USAID.

Table 5.4: Global Estimates of Morbidity and Mortality of Diseases Related to Poor Environmental Sanitation

Disease	Morbidity (episodes/year or cases)	Mortality (deaths/year)	Relationship of Disease to Environmental Sanitation
Diarrheal diseases, including dysentery	4,002,000,000 episodes/yr	2,473,000	Strongly related to unsanitary excreta disposal, poor personal hygiene, unsafe drinking water
Typhoid fever	16,000,000 episodes/yr	600,000	Strongly related to drinking water and food contaminated by human excreta, poor personal hygiene
Dengue and dengue hemorrhagic fever	3,100,000 episodes/yr	138,000	Strongly related to unsanitary solid waste disposal
Amoebiasis	48,000,000 episodes/yr	70,000	Related to unsanitary excreta disposal, poor personal hygiene, food contaminated by human excreta
Hookworms	151,000,000 cases	65,000	Strongly related to soil contaminated by human excreta, poor personal hygiene
Ascariasis	250,000,000 cases	60,000	Related to unsanitary disposal of human feces, food contaminated by soil containing human feces, poor personal hygiene
Schistosomiasis	200,000,000 cases	20,000	Strongly related to unsanitary excreta disposal and absence of nearby sources of safe water
Trichuriasis	45,530,000 cases	10,000	Related to soil contaminated by human feces, poor personal hygiene
Cholera	120,000 episodes/yr	6,000	Strongly related to drinking water contaminated by human feces
Giardiasis	500,000 episodes/yr	-	Strongly related to drinking water contaminated by human fecal matter, poor personal hygiene
Trachoma	152,420,000 cases	-	Related to poor personal hygiene, lack of soap and water
Dracunculiasis (guinea worm)	130.000 cases	-	Strongly related to drinking water containing infected copapods

Source: WHO (1997). The World Health Report 1997: Conquering Suffering, Enriching Humanity.

To illustrate Figure 5.1, the environmental health interventions to prevent diarrheal diseases include (1) excreta containment and treatment, (2) water source protection and handling, (3) food safety and hygiene, and (4) personal and domestic hygiene. Excreta is the primary source of diarrheal disease agents which are further transmitted through foods, fingers, fluids and

fields. The containment and treatment of excreta, therefore, is the best means to prevent diarrheal disease agents from proliferating and being transmitted. This can be done through latrines and by hand washing. Such appropriate use of excreta disposal systems is a critical determinant of diarrheal disease transmission. Evidence also shows that community-wide sanitation is more important than individual household coverage.

WHO estimates that up to 70% of childhood diarrheal episodes in developing countries are due to pathogens transmitted through food. The sources of contamination include nightsoil, polluted water, flies, pests, domestic animals, unclean kitchen utensils, food handlers, dust and dirt. Measures to control this include the protection of food from contamination by unsafe water, avoiding cross contamination of raw foods with cooked foods, protecting food from vectors (flies, pests, domestic animals), improving hygiene (handwashing) and cooking practices, cooking food at high enough temperatures for long enough, promotion of exclusive breast feeding and the use of cup and spoon for weaning infants.

Of the personal hygiene behaviors, handwashing is the most critical determinant of diarrheal disease. The contamination points are contact with feces during defecation, handling children's feces, touching other contaminated hands, preparing or consuming foods with contaminated hands and placing soiled hands in the mouth. Handwashing at critical times–after defecation, after handling children's feces, before preparing meals, before eating–can significantly decrease transmission of diarrheal disease. Reductions in diarrheal disease of 32-43% have been documented through handwashing with soap in a variety of settings, including reductions in dysentery (genus *shigella*) by 35% and non-dysentery by 37% among all age groups in urban Bangladesh[22]. In three studies assessing handwashing (education and soap), the reduction ranged from 30-48%[23]. Reducing the number of flies through the proper disposal of wastes and corralling domestic animals also limits the possibility of contaminating food and water supplies.

The growing evidence of measurable links between water and sanitation improvements and reduction in disease morbidity is encouraging new efforts by international development institutions to promote the inclusion of environmental water and sanitation programs. In 1995, UNICEF adopted new strategies for water and environmental sanitation with the overall objective "to contribute to child survival, protection and development by supporting efforts to achieve universal access to safe water supply and environmental sanitation services"[24].

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[22] Feacham, R.G. (1984). "Interventions for the Control of Diarrheal Disease among Young Children: Promotion of Personal and Domestic Hygiene," in **Bulletin of the World Health Organization**, 62:3:467-476.

[23] Boot, M.T. and S.Cairncross (eds.) (1993). **Actions Speak: The Study of Hygiene Behavior in Water and Sanitation Projects**. The Hague: IRC International Water & Sanitation Centre/London School of Hygiene & Tropical Medicine.

[24] UNICEF (1995). **UNICEF Strategies in Water and Environmental Sanitation**. New York: UNICEF.

Systematic reviews show that better water and sanitation is associated with decreased diarrheal morbidity, improved nutritional status, lower childhood mortality and less morbidity from ascariasis, guinea worm, schistosomiasis, and trachoma. Although comparison of studies is difficult, the magnitude of improvements in health outcomes has been shown to increase from no sanitation, to the use of latrines, to the use of toilets. The evidence for a dose-response relationship indicates that the level of a particular intervention influences the degree of pathogen transmission and disease reduction. The number of pathogens transmitted also depends on the routes available and the opportunity for proliferation. Some interventions may reduce the transmission of pathogens by a greater number and, therefore, reduce disease by a greater extent than others. For instance, proper disposal of contaminated feces may reduce the number of pathogens being transmitted through several routes such as food, hands and drinking water. Once in the environment, pathogens may not only survive and diperse but thrive in food or media that is ingested by young children.

In addition, to proper fecal disposal, increasing the quantity of available water may reduce the proliferation of pathogens in contaminated food if more water results in more frequent food preparation and feeding, thereby reducing the opportunity for pathogens to multiply sufficiently to cause disease. The multiple factors involved in the studies examining the health effects of water and sanitation are difficult to control and sometimes give varying results (see Table 5.5). Nevertheless, the general conclusion of such studies is that water and sanitation interventions that complement pathogen-reducing factors are more likely to result in great improvements in health than those which do not attempt to reduce pathogens.

Table 5.5: Expected Disease Reductions from Improved Water and Sanitation

Disease	All Studies		Better Studies	
	No.	Median	No.	Median
Diarrhea Morbidity	49	22%	19	26%
Diarrhea Mortality	3	65%	-	-
Ascariasis	11	28%	4	29%
Dracunculiasis	7	76%	2	78%
Hookworm	9	4%	-	-
Schistosomiasis	4	73%	3	77%
Trachoma	13	50%	7	27%
Overall Impact on Child Mortality	9	60%	6	55%

Source: Esrey, S.A. et al (1991). "Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhoea, Dracunculiasis, Hookworm Infection, Schistosomiasis and Trachoma," in WHO Bulletin, 69(5): 609-621.

Bearing in mind that the majority of the burden of disease caused by poor water supply and sanitation falls upon children, there are two main pathways through which improvements in domestic water supplies, excreta disposal facilities and hygiene education are thought to have the most direct potential to benefit the health and nutrition of children: (1) reduction in morbidity and mortality due to diarhheal and parasitic infections and (2) reduction in water collecting times with allocation of that time to child health and nutrition enhancing activities. In addition to the impact of a reduction in diarrhea, improvements in child growth and reductions in total mortality, water and sanitation projects also have the potential to reduce exposure to other diseases, such as guinea worm, schistosomiasis, ascariasis and trachoma. These diseases affect both adults and children. Therefore, reductions in morbidity have the potential to benefit all members of the household, not only children.

5.3.2 Environmental and Sustainability Issues

Environmental Health in Ethiopia

In Ethiopia, diarrhea is the second cause of mortality and morbidity in children under 5 years of age and is a factor in 46% of all childhood deaths. Each child has an average of five episodes of diarrhea per year[25]. Epidemic bacillary dysentery due to *Shigella spp.* is common and

[25] Ministry of Heath/WHO (1995). **Health Facility Survey on Diarrheal Disease Case Management**.

is responsible for 10% of acute diarrhea seen in children under the age of 5 years. Treatment is complicated by multiple drug resistance and a mortality rate of 20%. Typhoid is also common but there are considerable difficulties in diagnosing the disease in most laboratories in Ethiopia. In a health facility assessment carried out in the Southern Nations Nationalities Peoples' Region (SNNPR) by the Regional Health Bureau as part of the USAID/Ethiopia-funded health sector program, 48% of the 144 children seen during the survey period had diarrhea[26]. These figures represent only the tip of the iceberg in terms of morbidity, as health service utilization is generally low and official statistics do not reflect the full extent of diarrheal diseases. For example, health facility utilization in the SNNRR averages only 0.34/visits/person/year, while WHO guidelines recommend that facilities plan on 2.5 visits/person/year.[27]

A number of community-based studies examining parasitic loads in school children show the effects of diverse environmental conditions upon disease prevalence in Ethiopia. All studies show a high parasitic load, which reflects the generally poor water and environmental sanitation conditions within the country. Some examples:

- In a survey of 11,825 children, (4126 in-school and 7699 not in-school) covering 93 communities in various parts of the country, the overall prevalence of giardiasis was 8.9% in school children and 4.4% in non-school children. The highest rate of infection was in children between 5-9 years of age (12.5% for school children and 4.4% for non-school children)[28]. This difference is attributed to the greater chance of direct person-to-person transmission under non-hygienic conditions found in many schools.

- In another study involving 698 school children in three localities in South Wello, 43.6% were positive for intestinal parasites. Of these, *Schistosoma mansoni* was found in 24.9%, with the highest rate found in boys aged 10-14 years old. Moreover, ascariasis accounted for 18.3%, trichuriasis for 4.4%, hookworm for 2%, *Hymenolepis nana* for 1.3% and giardiasis for 1.1%[29].

In the Dembia plains of north-western Ethiopia (altitude 1850-2000 meters above sea level), ascariasis was present in 41.3% of elementary school children. In addition, *Schistosoma mansoni* was found in 35.8%, hookworm in 22.8% and *Trichuris* in 16.5%. Ascariasis was found

[26] Manoncourt, S. and J.Murray (1996). **Ethiopian Health Facility Assessment: Using Local Planning to Improve the Quality of Child Care at Health Facilities in the Southern Nations and Nationalities Peoples' Region**. Regional Health Bureau, SNNPR. USAID/BASICS/ESHE.

[27] SNNPR Regional Health Bureau (1998). **Health Sector Development Program 1990-1994 (E.C.)**.

[28] Birrie, H. and B.Erko (1995). "Giardiasis in Ethiopia," in **Ethiopian Journal of Health Development**, 9:2:77-80.

[29] Assefa, T. *et al* (1998). "Intestinal Parasitism among Students in Three Localities in South Wello, Ethiopia," in **Ethiopian Journal of Health Development**, 12:3:231-235.

to be high in many of the children and double infections, usually Ascaris and S. mansoni, were found in 54% them. Triple infections were present in 7.1% f the children[30].

Malaria

A special note needs to be made regarding malaria in Ethiopia. Malaria continues to be one of the foremost public health problems facing sub-Saharan Africa. In Ethiopia, malaria ranks among the top five causes of mortality and morbidity. Environmental changes brought about by expanded land use for agriculture, forestry and human settlement have increased malaria in many areas. Malaria in Ethiopia is unstable and epidemic in nature, mainly due to topographical and climatic factors, with seasonal transmission peaks between September-November after the main rainy season, and in some parts of the country in March-April after the small rains. This means that most of the population do not develop resistance. Malaria epidemics have been both frequent and widespread in recent years.

Two types of malaria, *Plasmodium falciparum and Plasmodium vivax*, are found in Ethiopia. The severity of these epidemics, coupled with the recent decentralization of the health system, have necessitated a re-orientation of the malaria control strategy[31]. The current focus of malaria control is limited to case management, environmental management, chemoprophylaxis of pregnant women and a few pilot projects examining the practicalities of using insecticide-impregnated mosquito nets. In general, effective malaria control presents both challenges and opportunities for encouraging intersectoral collaboration (among agencies involved in public health, agriculture, public works and water resources) as well as community involvement in prevention and treatment.

Areas of stagnant water associated with poor drainage from water and sanitation facilities provide potential breeding sites for the *Anopheles* mosquito, the vector which transmits malaria. As malaria exists nationwide, it is unlikely that water and sanitation projects under the Title II program present any significantly increased risk in relation to the overall prevalence of malaria in the country. The only possible exception to this is in Tigray where the Regional Government has embarked upon a program of widespread dam building (not funded by Title II). Tigray is a region if great water scarcity. In the project sites visited during this assessment, it was stated that the reservoirs of water resulting from dam construction were primarily for irrigation use. It is very likely, however, that communities lacking a protected and easily accessible water source will draw water from these reservoirs. In a recent community survey of children under 10 years of age, there was a 7.3-fold increase in the incidence of malaria in villages within 3 km of the

[30] Jemaneh, L. (1998). "Schistosomiasis mansoni and Geo-Helminthiasis in School Children in the Debia Plains of North-Western Ethiopia," in **Ethiopian Journal of Health Development**, 12:3:237.

[31] Abose *et al*. (1998). **Re-Orientation and Definition of the Role of Malaria Vector Control in Ethiopia**. WHO/MAL/98. World Health Organization.

reservoirs, especially at altitudes below 1900 meters[32]. Therefore, although there is probably no significant impact of malaria associated with water and sanitation projects built with Title II resources, care should be taken to avoid pools of stagnant water and other potential mosquito breeding sites and there should be an associated community program of environmental health education.

The Key Role of Health in the Title II Program

Although the case for the inclusion of water and sanitation activities has been primarily presented for inclusion within health programs, there is also an opportunity within the design of Title II programs to include health activities within water and sanitation projects. Title II programs are directed towards food insecure areas in Ethiopia. These are characterized by fragile and degraded environments and growing population pressures. As population increases, the land becomes less able to meet the basic needs for food, fodder, fuel and water. The Title II program in Ethiopia was designed to help alleviate the causes of profound household food insecurity, using as its conceptual paradigm the USAID-developed definition of food security which focuses on actions to increase food availability, the access of food-poor households to food on a sustainable basis and the appropriate nutritional utilization of food by all household members. This includes both environmental protection activities and child survival strategies within the Title II Special Objective of "enhancing household food security in target areas."

The potential effects of water and sanitation extend far beyond those resulting from pathogen reduction alone. Collecting water is almost universally the role of women. Accessible domestic water supply augments the time and energy of women. The time saved by access to water close to home may be translated into more time spent on food production and preparation, income generation and self-improvement. Time savings allocated to child care activities, such as feeding, may have a direct effect on child health and nutrition (see Box 5.4). Maternal energy saved may be particularly important during periods of low water availability and seasonal increases in agricultural work load, which often coincide with decreased food availability, and during pregnancy and lactation. Thus, the easing of the energy-expenditure burden through more accessible water supplies might also improve the nutritional status of the mother and improve pregnancy outcomes.

[32] Ghebreyesus, T *et al* (1999). "Incidence of Malaria among Children Living near Dams in Northern Ethiopia: A Community-Based Incidence Survey," in **British Medical Journal**, 319:663-666.

Box 5.4: The Impact of Distance to Water

In the Rift Valley in Ethiopia there is an absolute scarcity of water. Ground water has a high fluoride content. Alternatives for clean water supply are, therefore, limited to rain water harvesting or boreholes. In one village, although both men and women buy water from the nearest potable source 14 kms away, with a round trip of about 6-8 hours, the heaviest burden for water collection falls on women. On an average, each household purchases 20-40 liters every other day, carrying the water back by donkey or on their backs. Women complain of a high rate of miscarriages. Some communities have constructed ground rainwater catchment systems which provide 40liters/household/day of clean water for 2-4 months of the year. These systems are a great source of pride and some communities are now discussing their potential contributions towards building more catchment systems**.**

The multifaceted nature of the Title II program provides an opportunity to incorporate both natural resource management activities and water and sanitation activities within IR3: improved health status of households, thus supporting the paradigm that environmental measures can contribute towards improved health (see measures suggested in Figure 5.1). Seven of the eight Cooperating Sponsors under the Title II program do, in fact, include such activities under IR3.

The field visits undertaken during this assessment provided a wide range of examples of different water delivery systems ranging from temporary ponds, spring protection, hand pumps, boreholes and roof-top and ground rainwater harvesting. Although limited in their population coverage and impact, as discussed in other sections of this report, there were several examples of appropriately developed water delivery systems which enjoyed good community participation and included many of the requirements to ensure sustainability.

Water is indeed a valuable asset, and there was little evidence in the field of any wastage. In general, community members were aware that there is an association between contaminated water and diarrheal disease, although there was little appreciation of the importance of environmental sanitation. In several communities, leeches in springs were a major problem prior to the protection of the water source. Leeches can be swallowed by humans and animals and cause significant morbidity. Community members clearly associated the protection of the water source with a subsequent decrease in the incidence of leeches.

On the other hand, evidence of sanitation activities in general were extremely limited, although a few projects had good examples of latrines, clothes washing basins and cattle troughs associated with protected water supplies.

5.3.3 Causes of Problems

As expected in a study designed to suggest ways of strengthening and improving the program, a number of deficiencies limiting the effectiveness and impact of the water and sanitation interventions were identified. The following section discusses the main deficiences from an environmental health perspective.

Lack of Sanitation in Title II Projects

There is a serious lack of sanitation activities in the majority of the Title II-supported projects in Ethiopia. Emphasis is given to developing water projects with very little consideration directed towards sanitation projects or, better yet, integrating water and sanitation together. This reflects not only the general situation within Ethiopia, in which access to sanitation is very low and little importance is given to its promotion, but also a lack of awareness within the design of Title II projects as to the importance of the combination of both water and sanitation interventions.

As discussed above, there is clear evidence that appropriate excreta disposal is a more critical element in reducing disease than water supply. For most of the diseases listed in Table 5.4, unsanitary disposal of human excreta is the main cause and starting point of ill health. Pathogenic organisms, whether bacteria, viruses or intestinal parasites, are frequently contained in human excreta, most often in feces. Improper disposal of human excreta allows these pathogenic organisms to contaminate the soil and water sources, and eventually spread to drinking water, cooking utensils, food and the people themselves.

While some of the diseases mentioned in Table 5.4, such as dengue fever, trachoma and guinea worm, are not transmitted through human fecal matter, they tend to flourish where general cleanliness, personal hygiene and sanitary behaviors are either poor or lacking. In rural Lesotho, child growth was found to be greater among households that had both a latrine and increased water usage than among those that only increased their water usage or only had a latrine, or neither[33].

The use of open fields for defecation/urination is a common practice among almost all of the rural population. The generally poor conditions of environmental sanitation observed at all visited sites suggests that there is a high likelihood of water contamination in open ponds and open wells. Unless water quality testing can show such sites to be acceptable, alternative means of providing potable water ought to be sought.

[33] Esrey, S.A. *et al* (1992). "The Complementary Effect of Latrines and Increased Water Usage in the Growth of Infants in Rural Lesotho," in **American Journal of Epidemiology**, 135:659-666.

According to the Ministry of Health and UNICEF, there is a general lack of awareness of the health implications of sanitation as well as a lack of technical expertise and financial resources for developing sanitation facilities.[34] In addition, latrines intended for household use should be of an appropriate design, child- friendly and culturally acceptable. The general lack of awareness, poor structural design and pervasive level of rural poverty all result in insufficient or even no involvement of communities in sanitation promotion and development. This presents a serious programmatic challenge to the Cooperating Sponsors. When latrines incorporating these features were constructed and supported with health education, they appeared to be used. When these conditions did not hold, it was observed that latrines, even those constructed under Title II, tended not to be used. However, evidence was found that once communities understood the importance of containing human excreta they took the initiative to build more household latrines. Verification of these impacts should be made to guide future project design.

Insufficient Water to Meet Basic Needs

Rural communities in Ethiopia have very poor access to adequate supplies of protected water. Over three-quarters of the respondents in a recent rural survey carried out by the Ministry of Health reported that they used water from unprotected sources. In urban areas, only a small proportion of households have access to piped water supplies. There is an absolute scarcity of accessible water in many of the Title II project areas. Most of the visited communities did not reach the minimum WHO guideline level of 20 liters/capita/day. In the majority of communities, daily per capita water usage is as low as 4 to 5 liters. Most Title II projects, although providing an increased amount of water to the community, either do not provide sufficient water to meet basic needs or can only provide water for a limited period of time. In some cases, such as those of open ponds, not only is the supply of water limited to a short seasonal period of a few months, but water quality is not protected against contamination by people and animals.

Literature reviews of water and sanitation generally conclude that water quantity is more important for health than water quality in a contaminated environment and that water quality might not have an effect until most major routes of contamination are eliminated. Most water projects in Title II do deliver an increased, albeit still inadequate, amount of water to the communities served. Until adequate quantities of water to meet basic requirements are delivered, however, sanitation activities are likely to remain low priority. There will be continuing health hazards in areas of low per capita water consumption. Title II projects need baseline information on disease morbidity and community practices so that monitoring can measure changes in the incidence of diseases associated with poor water and sanitation. Evaluation of successful projects may provide guidelines for future interventions.

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[34] Ministry of Health/ UNICEF (1997). **Knowledge, Attitudes and Practice on: Water Supply, Environmental Sanitation and Hygienic Practices in Selected Woredas of Ethiopia**. Environmental Heath Department, Ministry of Health.

Improving personal and domestic hygiene is difficult in situations where basic minimum per capita water needs are not served. In those projects where more water is available and clothes washing facilities are provided nearby, such facilities are used. Comments made by community residents clearly associated improved access to water with decreases in both diarrhea and skin diseases.

Unsafe Water Quality

Improved water supplies, through improved quality and greater quantities, may decrease exposure to pathogens. Unreliable and inappropriately designed water supply systems, if constructed in areas with poor environmental hygiene, may actually increase pathogen exposure (see Box 5.5). All communities familiar with water scarcity have traditional coping mechanisms, such as alternative water sources and water conservation measures. The strengths of such mechanisms should be identified and built upon when planning new supplies.

In general, there is a great lack of awareness of the need to monitor water quality. There is so little experience of water quality monitoring in Ethiopia that even trained technical staff and health workers fail to consider water testing as important to project effectiveness.

Due to poor environmental sanitation, it is possible that community water supplies may be clean at the point of water collection but contaminated with fecal pathogens between collection and ingestion. Thus, improvements in the quality of drinking water may be lost or diminished if the collection point is far from the point of use or if there are insufficient hygienic measures employed within the household. In general, water is collected in plastic jerry cans at most sites. Wide-necked containers of pottery or plastic are rarely used as it is difficult to carry water in such containers because of weight and spillage.

Box 5.5 : Water Supply from an Open Pond

At one site, where people drew water directly from a newly-constructed open pond, the community was pleased that they did not have to walk several hours to get water from the nearest river. The community health worker assigned to the area noted, however, that there was an increased incidence of dysentery within the community after the people started using the pond.

A study of the impact of sanitation on water quality in rural Malawi showed that the risk of diarrhea in children under 5 years of age was 20% less among families which had both a piped

water system and a latrine compared to those families that had neither[35]. The presence of a piped water supply did not influence the quantity of water used, but the fecal coliform count was significantly lower at both the source and in the home when water was collected from a piped water system rather than from other sources. These findings suggest that improved sanitation will enhance the effect of piped water. However, there is need for further studies to assess the effects of sanitation and water quality to see which has the greater impact.

Inadequate Health and Hygiene Education

Community members generally are aware of the relationship between contaminated water sources and diarrhea and some intestinal parasites. Unfortunately, there is less awareness of the relationships among other diseases associated with poor environmental hygiene, such as scabies and trachoma. In areas where malaria is prevalent, people recognize that malaria is linked to pools of stagnant water, but often the necessary environmental measures to reduce disease transmission are not undertaken.

Most Cooperating Sponsors have incorporated health education within their activities. Almost without exception, this was limited by inadequate health education training skills and a nearly complete lack of teaching materials. There is a severe dearth of innovative health education materials on water and sanitation in Ethiopia.

Government responsibilities for health education in water and sanitation are split between the water resources and health sectors. As a result, there is a lack of understanding of the synergy between clean water and sanitation activities. In addition, there is a general lack of resources for promoting health education activities. In view of the fact that over 75% of morbidity in the country is attributable to diseases associated with poor environmental conditions, there obviously is a major void which needs to be addressed. UNICEF is in the process of developing such materials in cooperation with the Jimma Institute of Health Sciences, but progress has been slow.

5.3.4 Monitoring Indicators and Mitigation Measures

Lack of Sanitation in Title II Projects

Monitoring indicators: number of sanitation projects; number of water projects with sanitation components; amount of funding for sanitation.

[35] Young, B. and J.Briscoe (1987). "A Case-Control Study of the Effect of Environmental Sanitation on Diarrhea Morbidity in Malawi," in **Journal of Epidemiology & Community Medicine**, 42:1:83-88.

Mitigation measures:

- There is a need to create greater awareness of the importance of sanitation activities as an essential part of improving water supplies. This awareness raising is required at all levels, from Title II program design in USAID through institutions involved in water and sanitation and finally to communities and households.

- There should be no Title II water project which does not incorporate sanitation activities.

- Under the prevailing environmental conditions present in Title I project areas, open ponds and open wells should not be constructed for human water consumption.

- There is a need to develop appropriate, culturally acceptable and affordable designs for rural latrine construction.

- There is a need for more resources to provide better sanitation. These could be diverted from other Title II activities, or they could be obtained from increased program funding.

Insufficient Water to Meet Basic Needs

***Monitoring indicators*:** per capita daily water use; allocation of water to different uses; time spent collecting water.

Mitigation measures:

- Appropriate technical designs, based on adequate baseline information, must be used so as not to risk increased health hazards.

- Successful examples of water systems meeting community needs should be replicated so as to increase the absolute per capita water availability.

- Human and animal water points should be clearly separated and measures instigated to prevent cross-contamination of the water points. These should include proper drainage of run-off water.

Unsafe Water Quality

Monitoring indicators: water quality analysis of basic bacteriological and chemical parameters; statistical data and patient records from nearby health facilities

Mitigation measures:

- Regular water quality testing should be required of all water sources. In order to do this, laboratory facilities must be improved throughout the Title II program area and potable field test kits should be available at field offices of the Cooperating Sponsors.

- Health education aimed specifically at decreasing contamination of water supplies at the point of collection should emphasize the better type of containers used to store drinking water (narrow-necked) as well as handwashing after defecation and before the preparation of food.

Inadequate Health and Hygiene Education

Monitoring indicators: number of staff available for health education; type and availability of health/hygiene teaching aids; participation of government and/or other organizations; type and frequency of health/hygiene education activities; available funds.

Mitigation measures:

- There is an urgent need to develop hygiene education materials and to support capacity-building among all personnel involved in water and sanitation activities. The potential for joint action by the government, donor agencies and NGOs should be actively explored.

- The division of responsibility between two governmental sectors (water resources and health) needs to be bridged so that a unified concept of environmental health can be promoted.

- There is a need for a concerted campaign to increase awareness of the importance of clean water and proper sanitation at all levels of the Title II program.

5.4 Water Quality

5.4.1 Basic Principles

General Aspects

Safe and adequate water should be considered a basic human right, whether it be in the industrialized or the developing world. In assuring safe and adequate water supply for a community, a service must meet certain qualitative and quantitative standards.

According to the Ministry of Health, less than 15% of the rural population have access to facilities that provide proper quality and quantity of water for domestic needs and less than 10% have access to a sanitary latrine.[36] Moreover, the facilities that are found in rural areas generally fail to meet the conventional guidelines for water supply and sanitation set by WHO and other international organizations.

The quality of drinking water is important because of its effects upon human health, while the quality of water bodies, such as springs, streams and ponds, is important because of its effects upon the natural environment. The major water quality indicators of both drinking water and water bodies are characterized by their physical-chemical and biological parameters, which in turn are affected by both the physical environment and human activities. Potential environmental problems in water supply projects in Ethiopia include the following:

Biological degradation of drinking water sources

Biological degradation is the contamination of water sources by waterborne pathogens, such as bacteria and viruses, and the water-based pathogens, such as protozoa, helminths and other free-living organisms that pose a hazard to human health. The most common cause of biological pollution of drinking water sources in the Ethiopian context is the presence of human and animal excreta in the water and in the soil near water sources. Problems of biological degradation are especially severe where sanitation facilities are absent or poorly functioning. Impacts may include a variety of health problems to the users of the water as well as damage to aquatic life and higher water treatment costs.

Chemical degradation of drinking water sources

Chemical degradation is the result of source contamination by wastewaters, natural runoff or pollutant intrusions. The pollutants can be chemical fertilizers, pesticides, by-products of human and industrial wastes and naturally-occurring minerals in groundwaters. It is a minor problem in most Ethiopian rural settings employing traditional agricultural practices and using handpumps and protected springs, but it can be more serious in areas with modern agricultural or industrial activities or with pumped systems withdrawing large quantities of water. Overpumping of water from a stream or lake reduces the capacity of a water body to dilute incoming pollution and increases the concentration of contaminants in the remaining water. Overpumping from deep wells can increase groundwater drawdowns and encourage salt water, or other undesirable, intrusions into aquifers. As in the case of resource depletion, the consequences can include adverse health impacts, damage to aquatic life and higher water treatment costs for downstream users.

[36] Private communication from Ato Muchie Kidanu Workineh, Head of the Water Quality Control and Waste Management Team, Department of Hygiene and Environment, Ministry of Health.

Biological Aspects

The potability of water is assessed in terms of its contamination by living organisms or chemical constituents. Biological contaminants of water range from the microorganisms represented by viruses and bacteria to the larger helminths represented by whipworms and leeches. The following discussion outlines the major environmental problems related to biological organisms in water supply systems.

Bacteriological problems of water quality

There are three groups of bacterial flora that can be classified on the basis of their appearance in water:

- **Opportunistic water bacteria,** which are naturally present in the environment, and can be found even in waters considered to be unpolluted. They are relatively hardy, but are not formally regarded as pathogens. Examples of this group include flourescent bacteria (*Pseudomonas* spp.), chromogenic bacteria (*Serratia* spp.) and achromogenic bacteria (*Achromobacter* spp.).

- **Soil bacteria,** which are not commonly found in water but can contaminate water bodies when introduced on soil particles. Examples of this group include *Bacillus subtillis, Enterobacter aerogenes, Enterobacter cloacae,* nitrifying bacteria and *Streptomyces* spp.

- **Sewage bacteria,** which are the normal inhabitants of human and animal intestinal tracts. This group also includes bacteria found on decomposing organic matter of either animal or vegetable origin. Examples include the fecal coliforms of *Escherichia coli, Streptococci faecalis, Clostridium perfringens, Salmonella* spp. and *Shigella* spp.

From a public health standpoint, water contamination by sewage and industrial effluents are of paramount importance. In Ethiopia, the major forms of biological contamination derive from human and animal fecal matter in the water supplies. The type and amount of bacterial contamination often depends upon the source of the water:

- **Atmospheric water,** both rain and snow, normally is safe from bacterial contamination but may contain a considerable bacterial load due to dust picked up in the air.

- **Surface water,** which is the result of surface runoff of rain and snowfall, is found in streams, ponds, lakes and shallow wells, but is subject to contamination by soil bacteria, sewage and industrial effluents.

- **Groundwater,** drawn from deep wells and springs, is generally free of bacterial contaminants due to the filtering and decomposition actions of the soil layers through which the water flows.

Microbiological water testing

The primary indicators of the bacteriological quality of drinking water are the fecal coliforms represented by *Escherichia coli,* thermotolerant and other coliform bacteria, fecal streptococci and certain forms of clostridia. *E. coli* is the indicator of first choice as it provides the most meaningful results when resources for water testing are limited. Although *E. coli* is not normally harmful when ingested, it is a specific indicator of fecal pollution, and its presence in water is a sign that other bacteriological contaminants, some possibly pathogenic, may also be present. Occasionally, fecal streptococci and sulfite-reducing clostridia (*Clostridium perfringens*) are used as indicators of fecal contamination of treated water, but their relevance to rural water supplies in Ethiopia is limited.

Microbiological testing of water in a laboratory typically involves three steps:

- **A "presumptive test,"** whereby a sample of the water is cultured in test tubes over 48 hours to determine the possibility of coliform organisms;

- **A "confirmed test,"** whereby samples from the presumptive test are cultured with another media over 24 and 48 hours to confirm the presence of the coliform group and fecal coliforms, respectively; and

- **A "completed test,"** whereby more specific confirmation and identification of *E. coli* strains can be made.

Comparable results also can be achieved through membrane filtration techniques, whereby water samples are cultured on membrane media to determine coliform strains and various pathogenic organisms.

In Ethiopia, only a few laboratories are capable of carrying out microbiological testing of water and these tend to be located in the main cities and towns. The following laboratories are located in the Title II program areas:

- *Addis Ababa*: (2 laboratories) Public Health Bacteriology Laboratory in the Ethiopian Health and Nutrition Research Institute (EHNRI) and the water and wastewater laboratory of the Addis Ababa Water and Sewerage Authority

- *Mekele*: (2 laboratories) Public Health Bacteriology Laboratory of the Regional Health Bureau and the Public Health Bacteriology Laboratory of the Regional Water Authority Bureau

- *Dessie*: Public Health Bacteriology Laboratory of the town
- *Bahar Dar*: Public Health Bacteriology Laboratory of the Regional Health Bureau
- *Gondor*: Public Health Microbiology Laboratory of Gondor College
- *Awasa*: Regional Referral Laboratory
- *Jimma*: (2 laboratories) Microbiology Laboratory of Jimma Health Institute and the Public Health Microbiology Laboratory of the Regional Health Bureau

With the exception of some water quality testing for protected springs in the vicinity of Addis Ababa, no sampling and testing of drinking water is being carried out by any of the Cooperating Sponsors in the Title II program. The reasons are fourfold: (1) samples for microbiological testing should be analyzed immediately and in all cases within 24 hours, but few project sites are within easy access of a suitable laboratory; (2) collaboration between the Cooperating Sponsors and the regional bureaus of government agencies that have water quality laboratories is limited; (3) staff of the Cooperating Sponsors appear to have little understanding of the importance of water quality monitoring, and there seems to be a general belief among technical staff that the physical improvement of a water source by itself guarantees adequate water quality; and (4) USAID has not required water quality testing as a part of the Title II program. Although the constraints inherent in each of these reasons are rapidly changing in Ethiopia, the overall effect to date has been to minimize the importance of water quality monitoring and testing for the success of Title II activities.

Alternatives to the laboratory testing of water samples do exist. A variety of portable field testing kits are available for use when project sites are too remote from established laboratories or when rapid results are needed in the field. Portable kits containing battery-powered incubators, specific culture media and field-oriented equipment have been developed to assess the most important microbiological indicators as well as several physical and chemical parameters using membrane filltration procedures. Microbiological testing can be done overnight with the results available in the morning. Depending on the type of field kit used, tests can be made for both total and fecal coliforms, with the results given either as basic presence or absence of the indicator organisms or the number of coliform colonies counted on a membrane filter which has been incubated with a selected culture medium. Test results are considered to be equivalent to those obtained in laboratories, and field personnel can be trained to use these kits in just a few hours.

The main manufacturers of such equipment are Robens Institute of the University of Surrey (UK), Hach Company of Loveland, Colorado (USA) and Millipore Company of Stamford, Connecticut (USA). During the field visits, the Study Team learned that several of the Cooperating Sponsors had acquired a DelAgua water testing kit designed by the Robens Institute

which they intended to use for field testing of water projects. However, none had yet prepared any water quality monitoring program or trained their staff to use the equipment.

Other biological problems of water quality

The more common pathogenic parasites found in Ethiopia are amoebic cysts, intestinal nematodes, cercariae of schistosomiasis, some specie of leeches, etc. Chlorination, which is the most common means of disinfection in water works, is usually ineffective against protozoal and helmenthic parasites. Parasitic problems such as these can be eliminated from drinking water only by filtration or by chlorine dosages higher than can be easily tolerated without subsequent de-chlorination. The following parasitic problems are found in Ethiopia:

- **Intestinal protozoa:** Protozoa are minute, single-celled animals that generally live in water (a major exception are the protozoa which cause malaria). The main water-based protozoa pathogens are *Giardia* spp., *Cryptosporidium* spp. and *Entamoeba histolytica*. Amoebiasis, or amoebic dysentery, is caused by an infective cyst of *Entamoeba histolytica*, which lodges in the liver or intestines. Transmission usually occurs through the ingestion of water or food contaminated with fecal matter containing the cysts. Resistant to chlorination, the cysts can survive for several weeks in natural water sources. Detection of the cysts can be made by microscopic examination of feces or water samples. The primary protection against amoebiasis is sanitary fecal disposal, good personal hygiene and proper installation of water distribution systems.

- **Malarial protozoa:** Another group of pathogenic protozoa in Ethiopia are the *Plasmodium* spp., which cause malaria. The organisms are carried by the *Anopheles* mosquito and injected into the blood of the human host where they develop and migrate throughout the bloodstream. The *Plasmodium* protozoa are not directly found in drinking waters, but the *Anopheles* mosquitos breed in static water empondments, such as swamps, pools and reservoirs. In Ethiopia, severe outbreaks of malaria have occurred in Tigray region in the last few years as a result of the construction of dozens of microdams to support irrigated agriculture (see chapter 5.3).

- **Trematodes:** Trematodes, or blood flukes, particularly *Schistosoma mansoni* and *Schistosoma haematobium*, affect the intestinal and urinary tracts, respectively, causing schistosomiasis. Infection in humans is acquired by contact with water containing free-swimming cercariae that have developed in several species of freshwater snails. The cercariae penetrate human skin and migrate to the lungs, liver and abdominal cavity. The cycle is completed when human feces or urine containing the eggs *S. mansoni* or *S. haematobium* are deposited in water bodies and larvae from the eggs subsequently infects the snails which act as intermediate hosts for the

disease. Water bodies containing snail-breeding sites can be treated with molluscicides, but the most effective method of eliminating the problem is proper disposal of feces and urine to keep infective eggs away from intermediate snail hosts. The cercariae of schistosomiasis can be detected by microscopic examination of excreta.

- **Helminths:** Helminths constitute a family of worms usually associated with human feces. The most common helminths in Ethiopia are *Ascaris lumbricoides* (human roundworms) and the nematodes, including *Trichuris trichuria* (whipworms), *Ancylostoma duodenale* and *Necator americanus* (hookworms). The roundworms and whipworms are transmitted by eating fecally-contaminated food containing the eggs of the helminth, while the hookworms are transmitted by walking in soil containing feces with helminth eggs. Microscopic examinations are used to detect helminth eggs, but, once mature, the worms can easily be seen with the naked eye.

- **Guinea-worm:** One particular type of helminth, the nematode *Dracunculus medinensis* (Guinea-worm), is not associated with human feces. When minute crustacean copopods (*Cyclops* spp.), infected with the larvae of the nematode, are ingested in drinking water, the larvae are liberated in the stomach and develop into worms of up to a meter in length. These worms migrate to the extremities of the body, often the legs, where they form a blister that ruptures when immersed in water. New larvae are discharged from the ruptured blister and ingested by suitable copopods to continue the cycle of infection. Humans are an essential reservoir for Guinea-worm. Ethiopia used to have a serious problem with the disease, but as a result of a worldwide campaign to eliminate Guinea-worm, it is now limited to a few lowland areas. Guinea-worm transmission can be interrupted, and the disease eliminated, by filtering drinking water through a fine mesh to remove the copopods.

- **Leeches:** Another major group of human parasites in Ethiopian waters includes the annelids, which are segmented worms of the class *Hirudinea*, commonly known as leeches. Biologically, the class of *Hirudinea* consists of more than 300 species of marine, freshwater and terrestial worms or leeches. Although a number of these organisms are free living, some are parasitic blood suckers that prey on mammals. Leeches can be as small as 1 cm in length, although most species are 3 to 5 cm. Some species, including the *Hirudo medicinalis*, can attain a length of 20 cm. Unlike many of the common leeches, the aquatic *Hirudo medicinalis* leeches are blood-sucking ectoparasites which attack a variety of hosts, especially humans and animals. These leeches suck blood from the skin, inside the mouth or the nasal membrane of their hosts. Blood-sucking species secrete chemicals, called hirudin, that can prevent coagulation of the host's blood. Such leeches can ingest from two up to ten times their own body weights in blood.

- Most freshwater leeches prefer shallow water bordering ponds, lakes, sluggish streams and unprotected springs. They are very common in the Ethiopian highlands. Leeches in general are hermaphodites, laying eggs from two days to several months after fertilization. Some aquatic leeches, such as the *Hirudo*, leave the water to deposit a cocoon with eggs in damp soil. During their subsequent development, the embryonic leeches break free of the cocoon and enter the normal aquatic habitat of the adult leech. Control of leeches can be affected through a combination of initial heavy chlorination of newly protected springs and wells and subsequent filtration of water drawn from these sources.

Physical-Chemical Aspects

Chemical contamination of water supplies includes both substances that change the physical characteristics of the water but have little or no effect on human health and substances which are toxic and represent a direct health threat. The physical and chemical analyses of water are used to protect humans, and animals, from these water-related hazards. Primary attention is usually directed to toxic chemicals and other substances that may affect the safety and acceptability of water for domestic uses. Although frequent bacteriological examination is needed for the hygienic control of drinking water supplies, chemical examination is normally required much less frequently.

Physical-chemical acceptability of water quality

A variety of physical parameters of water are not directly related to health but have a major effect upon the acceptability of the supply to the users. These include color, taste and odor, temperature, turbidity and a number of inorganic constituents, such as chloride, hardness, iron, pH, sodium, sulfate and total dissolved solids. In general, there are no health guidelines for these parameters, and water containing excessive levels of these constituents usually becomes unpalatable before it becomes harmful. The taste thresholds of a number of organic constituents (toluene, xylenes, etc.) and disinfectants (chlorine and chlorophenols) also are reached long before health is affected. For some of the parameters (pH, turbidity, etc.), the level of concentration is important in the design of appropriate levels of disinfection of microbiological contaminants.

The determination of physical characteristics of water supplies, therefore, is made to assess acceptability, to design treatment processes and, only nominally, to ensure the safety of the water. For chemical contaminants that are toxic, however, water quality analyses become of critical importance as the protection of human health is the overriding issue.

Toxic and hazardous chemical substances

A number of chemical substances are toxic if present in drinking water above certain levels of concentration. The limit of such substances, as recommended by WHO, is based upon the maximum amount of a chemical constitutent that a person can safely consume over a lifetime without a significant risk to health. Lifetime limits are established on an assumed daily intake of 2 liters of drinking water by a person weighing 60 kg.[37] Recommended limiting values for most toxic substances commonly found in water are included in the international guidelines for drinking water quality developed by WHO. These limits are drawn from toxicological studies and total body concentrations derived from all sources, including water, food and air.

There are several ready sources of chemical contamination of water supplies. Chemical substances often originate in the geological formations through which groundwater flows, while other sources of hazardous chemicals are industrial and commercial wastes. The chemical quality of water resources also can be degraded by the introduction of human excreta or the by-products of the decomposition of domestic solid wastes. Some of the most hazardous substances that can affect drinking water are arsenic, cadmium, cyanide, fluoride, lead, mercury and nitrate/nitrite. In Ethiopia, the following chemical substances are considered to be most relevant to the Title II program:

Arsenic: Arsenic is widely distributed in the Earth's crust and is found in water flowing through arsenic-rich rocks, especially those containing arsenopyrite, and in runoff from volcanic formations. It often occurs as arsenic sulfide or as a compound of lead or potassium. It is present in water through the dissolution of minerals and ores, from industrial effluents and by atmospheric deposition. Traces of arsenic can be found in most natural waters, generally at concentrations between 0.001 and 0.002 mg/l or, as normally stated, between 1 and 2 micrograms per liter. Under certain conditions, the concentration of arsenic in groundwater can become very high. Many shallow wells in Bangladesh, for example, have arsenic concentrations in excess of 1.0 mg/l.

Although the health effects of arsenic are not well known, particularly the dose-response relationship, it is acutely toxic and as the concentration rises it can cause diarrhea, dermal lesions, skin and internal organ cancers and eventually death. WHO has recommended a provisional health-based guideline for arsenic in drinking water of 0.01 mg/l.[38] Most human

[37] WHO acknowledges that these assumptions underestimate the amount of water consumed in hot climates and, thus, the exposure to hazardous chemicals. WHO (1996). **Guidelines for drinking-water quality,** vol. 2, pp 121-2.

[38] The WHO guideline value for arsenic is provisional because of the lack of suitable testing methods for concentrations below 0.01 mg/l. It is worth noting, however, that the U.S. Environmental Protection Agency is expected by April 2000 to propose reducing the U.S. federal standard on arsenic from 0.05 mg/l to 0.005 mg/l. Source: **AWWA Public Affairs Advisory**, 30 November 1999.

intake of arsenic is via foods, such as fish and meats, with a lesser amount from drinking water. Arsenic in food is primarily organic and of low toxicity, whereas arsenic in drinking water is inorganic and of higher toxicity. Arsenic in nature can exist in several chemical forms, but in groundwater it usually is found as either arsenite or arsenate, with the former being many times more toxic than the latter due to its reactions with enzymes in human metabolism.

There is no consensus on the definition of arsenic poisoning, but chronic poisoning, which is the form that arsenic in drinking water normally takes, is the ingestion of small amounts of a toxic substance over long periods of time. Fortunately, arsenic, unlike many other toxic chemicals, is excreted through the kidneys. However, if ingested faster than it can be excreted, generally when the concentration in drinking water exceeds 0.5 mg/l, arsenic accumulates in skin, bones and muscles.

Four stages of arsenicosis can be identified. In the preclinical stage, no symptoms are visible, but arsenic can be detected in urine or body tissue samples. The first clinical stage reveals various effects on the skin, the most common being a general darkening of the skin (melanosis), often observed on the palms. Dark spots on the chest, back, limbs and gums have also been reported. Edema or swelling of the hands and feet is often seen. A more serious symptom is keratosis, or hardening of skin into nodules, often on palms of hands and soles of feet. This stage may require up to 10 years of exposure. The third stage involves more serious complications, as clinical symptoms become more pronounced and internal organs are affected, including the enlargement of the liver, kidneys and spleen. Conjunctivitis (pink eye), bronchitis and diabetes may also occur. In the fourth stage, tumors affecting the skin and internal organs appear. In general, there is no effective treatment for arsenic poisoning. The most important remedial action is to prevent further exposure by providing safe drinking water.

For several reasons, the global extent of arsenic contamination of drinking waters is poorly understood. The delayed health effects and the lack of a common definition of arsenic poisoning are major constraints to determining the extent of the problem, as is the generally poor reporting and the inadequate awareness of the health issues involved. Serious cases of arsenic in drinking water have been reported from such countries as Argentina, Bangladesh, China, Chile, Ghana, Hungary, India, Mexico, Nepal, Philippines, Thailand and the USA. Recent findings in Bangladesh and India of massive and widespread arsenic contamination of shallow tubewells and growing numbers of people manifesting asenicosis in these areas (see Box 5.6) have prompted USAID to call for arsenic testing in all water supply projects subject to environmental reviews under 22 CFR 216. To date, no testing for arsenic has been performed on Ethiopian drinking waters and, consequently, the level of arsenic in both natural water sources and drinking water supplies is unknown.

Arsenic removal in water treatment plants is a costly and relatively sophisticated process involving the coagulation and precipitation of arsenic with alum and iron salts. It is not applicable to small-scale rural systems, and especially so to the very small water systems built

Box 5.6: Arsenic Contamination in Bangladesh and West Bengal

Most of Bangladesh and the adjacent region of West Bengal, India have a serious problem of arsenic contamination of drinking water drawn from shallow tubewells. First identified in 1993 and confirmed in a series of intensive water quality testing studies since then, arsenic has been found in wells in over half of the 64 districts of Bangladesh and in many villages of West Bengal. Ironically, the shallow tubewells which are most subject to arsenic contamination were installed in massive numbers by UNICEF and other organizations over the past 25 years to counter the high degree of bacteriological contamination found in the surface water sources traditionally used by rural populations. Unfortunately, these tubewells penetrated shallow aquifers, usually less than 100 meters deep, containing high concentrations of arsenic of geologic origin. A comprehensive picture of the problem is not yet available, but one program using field testing kits on 25,000 samples showed that 20% of the sites have arsenic levels above the Bangladesh standard of 0.05 mg/l (the WHO health guideline is 0.01 mg/l). Various surveys indicate numerous sites with excessive arsenic levels up to 1.0 mg/l and some have been detected as high as 4.0 mg/l.

There are approximately 4 million tubewells in Bangladesh, of which 75% are privately owned. Until the discovery of arsenic in groundwater in 1993, well water was considered to be safe. Now there are fears for the millions of people in the two countries who are exposed to high-risk levels of arsenic poisoning. Already the signs of widespread arsenicosis are emerging and the problem is expected to worsen as the delayed affects of the disease appear over time. In West Bengal, the appearance of symptoms is occurs after 6 and 24 months at mean arsenic concentrations of 0.032 mg/l in drinking water. In 1997, a WHO regional consultation declared arsenic in the area's drinking waters to be a "major public health hazard which should be dealt with on an emergency basis."

Because of a lack of resources, Bangladesh and West Bengal cannot afford the conventional arsenic-removal methods used in modern water treatment plants. Instead, primary efforts are being directed to identifying arsenic-free water supplies and to the development of alternative water sources, including deep tubewells (more than 100 m), ponds with sand filters, rainwater harvesting systems and household water filters. One continuing problem is the lack of inexpensive and reliable field test kits for the millions of tubewells that need to be tested. At least six different kits have been tested in the field, but none has been fully satisfactory because of measurement problems or high costs.

Sources:

- WHO (1997). **Arsenic in Drinking Water and Resulting Arsenic Toxicity in India and Bangladesh**.
- WHO (1999). **Arsenic in Drinking Water**. Fact Sheet No. 210.
- Whitney. J.W. (personal communication, 1999). USGS.
- Pospisilik, J. (personal communication, 2000). WHO.

under the Title II program in Ethiopia. As a result of the Bangladesh crisis, concerted efforts are being made to develop new, simplified methods of water treatment for arsenic, among which are co-precipitation treatment, ion exchange, activated alumina filtration and various systems of individual household treatment. In addition, a number of simple field testing kits for arsenic have been developed and currently are being tested. The main problem they must overcome is the

difficulty in detecting the relatively low concentrations of arsenic which still pose hazards for human health.

Fluoride: Fluoride is found in a number of minerals, often in the form of sodium fluoride. It occurs in relatively high concentrations in the groundwaters of the Rift Valley. Although traces of fluoride can be found in many public water supplies, high levels can cause dental and skeletal problems. In concentrations between 0.5 and 2.0 mg/l, fluoride provides protection against dental caries, especially in children, but at higher levels it gives rise to dental fluorosis (discoloration of teeth). If present in even higher concentrations, generally above 4 mg/l, fluoride in drinking water may cause crippling skeletal fluorosis, including changes in bone structure and fractured teeth. There is no easy way to remove excess fluorides from drinking water, although filters using charred bone meal are sometimes recommended for small community supplies. In most instances of high fluoride concentrations, it often is better to seek out a water source with lower concentrations of the substance. The WHO guidelines recommend a fluoride limit of 1.5 mg/l.

Nitrates and nitrites: Nitrates and nitrites also are important in determining the potability of water. These two ions can occur naturally in surface and groundwaters, usually as the result of the oxidation of ammonia in human and animal sewage wastes and the excessive use of nitrate fertilizers in farming. Concentrations of nitrate in surface and groundwaters normally is less than 10 mg/l. In the presence of inorganic fertilizers and animal wastes, however, nitrate levels of 50 mg/l or more can be encountered. High levels of nitrate and nitrite in drinking water cause the haemoglobin in the blood to be oxidized to methaemoglobin, which is unable to transport oxygen to the tissues of the body. At nitrate levels above 50 mg/l, severe cases of methaemoglobineamia can result in cyanosis and asphyxia. Infants and young children are particularly susceptible to methaemoglobineamia. To limit the risk of methaemoglobineamia in infants, WHO international guidelines limit nitrate to 50 mg/l and nitrite to 3 mg/l, but the simultaneous presence of the two ions in drinking water calls for a lower combined value. There is no simple method to remove nitrates and nitrites in rural water supplies. For infants, who are most at risk, it is advisable to provide them with an alternative source of drinking water.

Physical-chemical water testing

Physical-chemical indicators of water quality can be divided into core tests that can be carried out relatively easily, and sometimes in the field, and secondary tests that must be performed in a properly-equipped laboratory using more sophisticated equipment. The core tests include most of the parameters measured for acceptability or water treatment purposes, such as color, taste and odor, temperature, turbidity, electrical conductivity and pH plus some of the basic inorganic chemicals, such as calcium, chloride, iron, sodium, sulfate and carbonate. Core tests also include the parameters of nitrate and nitrite.

Secondary tests generally are performed only in a laboratory, as is the case with most toxic chemical contaminants. While "portable" testing equipment suitable for use in the field has been developed for many chemicals, such equipment tends to be specific to a particular chemical and usually cannot be used for testing other chemicals. Because of the costs and logistics requirements of testing for chemicals in the field, most chemical analyses are performed in the laboratory. In the case of arsenic and cadmium, there is no readily available alternative to laboratory testing.

Water quality testing for a full range of physical-chemical parameters is carried out in Ethiopia at the regional laboratories of the Bureau of Environmental Health as well as at various laboratories run by the Bureau of Water Resources. In addition, water samples are analyzed by the referral laboratory at the Ethiopian Health and Nutrition Institute (EHNRI) in Addis Ababa and by the water and wastewater laboratory of the Addis Ababa Water and Sewerage Authority.

In the case of arsenic, however, no water quality testing is being done and no capability appears to currently exist for testing this chemical in Ethiopia. The standard test procedure is to use silver diethyldithiocarbamate solution in a spectrophotometer to detect the concentration of arsenic. Another method is to use an atomic absorption spectrophotometer in combination with high-pressure liquid chromatography. There is an atomic absorption spectrophotometer at the Ethiopian Health and Nutrition Institute (EHNRI), but it is not used for water quality testing and reportedly has no reagents available for such tests. Inquiries at the Environmental Protection Authority and other agencies failed to identify any laboratories with an atomic absorption spectrophotometer. One institution, the Crop Production & Protection Technology & Regulatory Department of the Ministry of Agriculture, which uses a gas chromatograph for pesticides analysis, indicated that they might be able to develop a method of testing for arsenic in water if they had the appropriate standards.

Some basic physical-chemical testing of water is possible in the field. The portable water test kits produced by Del Agua, Hach and Millipore are designed primarily for bacteriological analysis in the field. However, most kits also can carry out a number of core physical-chemical tests, including pH, total chlorine and free chlorine residual. Depending on the type of testing kit employed, additional field testing is possible for turbidity, total dissolved solids, nitrate and electrical conductivity.

Water Quality Standards

Drinking water quality standards are set by national authorities to achieve specific purposes. The purpose most widely adopted worldwide is the protection of human health. Most countries base their water quality standards upon guideline values recommended by the World

Health Organization (WHO).[39] These values represent the concentration of substances that do not result in any significant health risk to the consumer over a lifetime of consumption.

Because WHO water quality guideline values are based solely on health risks, and do not take into account any social, economic or cultural issues, countries are advised to adopt their national standards by taking into consideration both the WHO guidelines and their own national characteristics and constraints. National standards, thus, may differ appreciably from the guideline values and, in some cases, may constitute less-rigid interim standards as a medium-term goal to the eventual achievement of guideline values. The establishment of interim standards is particularly relevant in countries where water quality is generally poor and resources for water treatment are limited.

In practice, many countries, for a variety of reasons, are reluctant to adopt interim standards and instead accept the WHO guidelines as their *de facto* standards. As a result, the standards cannot be achieved and, even worse, fail to have a positive influence upon the improvement of water quality. This is very much the case in rural Ethiopia, where there are no appropriate water quality standards and little concern for water quality improvement.

As described in chapter 3, the Ethiopian water quality standards are based upon the WHO guidelines but do not reflect the particular conditions of the country. Moreover, the existing standards date to 1990 and do not incorporate the most recent (1993) WHO guidelines, nor do they refer to small-scale water supply activities found in rural areas.

Some attempts have been made to develop interim water quality standards for Ethiopian agencies responsible for small water system development. For example, the technical design manual of the Ethiopian Social Rehabilitation and Redevelopment Fund (ESRDF) sets out "temporary recommended water quality standards" for rural water supplies (see Table 5.6). In practice, however, the ESRDF carries out no water testing because it has no laboratory facilities and the recent emphasis of the organization has been to implement as many projects as possible.

WHO recommends that water quality targets should be based on national standards, but for rural supplies the two most important activities are sanitary inspections and water quality analysis. A sanitary inspection is an on-site review of all conditions, devices and practices in the water supply system that pose any danger to the health of the consumer. It identifies and assesses the potential sources of contamination and provides recommendations for protecting and improving the supply. A comprehensive sanitary inspection in combination with water quality analysis can indicate the hazard or risk to health of the water system. For unchlorinated community water supplies, WHO recommends developing a risk classification system based on

[39] The most current international water quality guidelines, and the ones referenced in this report, are in WHO (1993-97). **Guidelines for Drinking-Water Quality**. 3 vols.

the presence of either thermotolerant (fecal) coliform bacteria or E. coli, as shown in the example in Table 5.7.

Each increasing level of risk in Table 5.7 should be accompanied by an increasing priority of remedial actions to improve the water supply. Although the levels of risk will vary according to the circumstances in each country, a classification scheme such as that shown above helps to direct remedial actions to the most urgent needs.

Table 5.6: Temporary Recommended Water Quality Standards of the ESRDP

Parameter	WHO Guideline Value	Temporary Recommended Standard	Remarks
Min pH	6.5	5.0	Corrosion problems
Max pH	8.5	9.5	-
Total solids	1000 mg/l	2000 mg/l	Taste and user acceptance
Total hardness	500 mg/l	600 mg/l	Taste and user acceptance
Chloride	250 mg/l	800 mg/l	Taste and user acceptance
Sulphate	400 mg/l	600 mg/l	Taste and user acceptance
Fluoride	1.5 mg/l	4 mg/l	-
Iron	0.3 mg/l	3 mg/l	Taste and user acceptance
E. coli	10 per 100 ml	30 per 100 ml	Un-piped supplies
Nitrate	10 mg/l	40 mg/l	Health

Source: ESRDF (1997). Technical Design Manual.

Table 5.7: Example of Health Risks of Fecal (*E. coli*) Coliforms

Count per 100 ml	Level of Risk
0	Conforms to WHO guidelines
1-10	Low risk
10-100	Intermediate risk
100-1000	High risk
over 1000	Very high risk

Source: WHO (1997). Guidelines for Drinking-Water Quality. vol.3.

5.4.2 Environmental and Sustainability Issues

From the above review of water quality considerations relevant to Ethiopia, the following environmental and sustainability issues are significant to the Title II program.

Drinking Water Quality

Little is known about the quality of drinking water supplies in the Title II program. No formal programs of water quality monitoring and testing are in place. Some Cooperating Sponsors do make an effort to sample and analyze new water sources, but none has a consistent program for monitoring water quality during the overall planning, implementation and operational phases of projects. There is a logistics problem in most areas in accessing the few established water quality laboratories. For the crucial tests of fecal contamination, however, none of the Cooperating Sponsors has yet developed the capability for microbiological testing of water in the field, although several have taken the first step by obtaining a DelAgua field test kit. In general, there is little understanding of the importance of regular water quality monitoring. USAID has not required monitoring in the past, and the DAPs of the Cooperating Sponsors do not propose such activities as part of their potable water activities. With a few major exceptions, the Cooperating Sponsors also have not established cooperative links with then national and regional agencies that maintain water quality laboratories. The consequence of inadequate water quality monitoring is the risk that systems are supplying water with biological and chemical contaminants hazardous to health.

Too some extent, this lack of information on water quality is reflected in the general state of water supply development throughout Ethiopia. Although government agencies, such as the Ministry of Water Resources and the Ministry of Health and their respective regional bureaus, are said to have standards and guidelines for drinking water quality, the Study Team found it difficult to obtain sufficient information to make general conclusions about the state of water quality in the rural areas. A review of some physical-chemical water quality data developed by the Ethiopian Health and Nutrition Research Institute is described in Box 5.7.

Box 5.7: Physical – Chemical Characteristics of Ethiopian Water Sources

A separate review of the physical-chemical analyses of 89 water samples collected from rural areas throughout Ethiopia and recently analyzed by EHNRI showed a number of potential problems in untreated water supplies. Most samples came from wells with smaller numbers drawn from springs, rivers, lakes, piped systems and reservoirs. A large majority of samples contained sediments, but most parameters were within acceptable limits. Several of the samples showed high levels of either nitrite or nitrate, indicating a risk of methaemoglobinaemia for infants. More worrisome, however, were the excessive levels of fluoride found in 22 of the samples. Of these, six samples had fluoride concentrations between 4.0 amd 9.0 mg/l, levels at which crippling skeletal deformations begin in the consumers.

Source: EHNRI data.

In visiting the field sites, the Study Team attempted to assess water quality through visual observation of the sanitary environment and technical features of the water systems, discussions with technical staff of the Cooperating Sponsors and by taking water samples from selected projects. A total of 10 water samples were taken from protected springs, hand dug wells and ponds constructed by the Cooperating Sponsors in different areas of the country. These samples were carried back to Addis Ababa, where the standard physical-chemical parameters were analyzed at the Ethiopian Health and Nutrition Research Institute (EHNRI). Because of time and logistics constraints, no attempt was made to analyze the microbiological parameters. Also, as discussed earlier, no tests for arsenic could be carried out, but analyses of nitrite, nitrate and fluoride were performed.

The results of these tests (shown in Table 5.8) indicated a generally acceptable quality of water from the physical-chemical standpoint. One sample, taken from an open well, showed excessive levels of nitrate, probably the result of contamination of the area by cattle. No other measures for the critical chemical parameters of nitrite, nitrate or fluoride exceeded WHO guidelines. Several samples did show high levels of total hardness (as calcium carbonate), sulphates and chloride, but these parameters affect the taste and acceptability of the water rather than the health of the consumers.

Table 5.8: Physical-Chemical Characteristics of Title II Water Supplies

Source	hand-dug well	hand-dug well	hand-dug well	spring	spring	pond	pond	ground rain catchmnt	bore hole	bore hole
Geologic area	highland	highland	lowland	highland	highland	Rift Valley	lowland	Rift Valley	highland	highland
Appearance	colorless	cloudy	colorless	colorless	colorless	muddy	colorless	colorless	colorless	colorless
Odor	odorless	odorless	odorless	odorless	odorless	odorless	odorless	odorless	odorless	odorless
Taste	tasteless	salty	salty	tasteless	tasteless	tasteless	tasteless	tasteless	tasteless	tasteless
Settleable solids	yes	yes	yes	es	yes	yes	yes	yes	no	yes
Floating solids	no	no	no	no	no	no	no	no	no	no
Suspended solids	no	yes	yes	no	no	yes	no	no	no	no
Color	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless
Turbidity (FTU)	clear	clear	clear	clear	clear	18.0	clear	clear	clear	clear
Dried residue	266.0	2514.0	1332.0	648.0	268.0	82.0	144.0	116.0	446.0	292.0
Conductivity (μmhos/cm)	415.6	2523.6	2060.0	959.0	424.0	131.2	145.0	201.0	656.1	319.7
pH	7.1	6.6	7.3	7.3	7.8	6.6	6.1	9.2	7.0	6.9
Carbonate alkalinity	nil	nil	nil	nil	nil	nil	nil	8.0	nil	nil
Bicarbonate alkalinity	196.0	296.0	536.0	420.0	220.0	52.0	64.0	32.0	268.0	164.0
Hardness as $CaCO_3$	208.0	1640.0	532.0	440.0	240.0	52.0	60.0	36.0	268.0	144.0
Silica	30.8	30.4	47.6	32.0	25.6	13.6	28.8	8.8	26.4	85.2
Ammonia	nil	0.01	0.06	nil	nil	0.04	0.30	0.17	0.01	nil
Sodium	10.2	68.0	285.6	54.4	6.8	2.38	6.8	18.7	20.4	13.6
Potassium	1.32	2.64	3.3	5.28	1.0	3.3	1.32	11.88	1.65	6.6
Calcium	60.92	549.10	91.38	117.0	78.16	17.64	16.03	12.83	88.2	44.9
Magnesium	13.6	65.66	24.90	36.0	10.94	1.95	4.86	0.97	21.4	7.8

Source	hand-dug well	hand-dug well	hand-dug well	spring	spring	pond	pond	ground rain catchmnt	bore hole	bore hole
Iron	0.29	nil	0.10	0.20	0.17	1.08	0.06	0.02	0.05	0.25
Manganese	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Chloride	14.8	50.0	314.9	58.0	10.5	4.8	10.0	10.8	30.8	10.8
Nitrite	0.01	0.03	3.13	0.01	0.01	nil	nil	0.01	0.01	nil
Nitrate	15.0	46.2	78.65	9.7	4.48	3.6	nil	nil	14.4	0.52
Fluoride	0.60	0.77	1.5	0.22	0.06	0.36	trace	0.10	0.36	0.65
Bicarbonate	239.12	361.12	653.92	512.4	268.4	63.44	78.08	39.04	326.96	200.08
Carbonate	nil	nil	nil	nil	nil	nil	nil	9.6	nil	nil
Sulphate	nil	1326.7	103.3	48.56	-	nil	nil	27.98	28.0	nil
Phosphate	0.03	nil	0.20	0.05	0.02	0.19	0.04	nil	nil	nil

Note: All units in mg/l unless otherwise indicated. Figures with grey background exceed WHO international guideline values for health.
Source: Laboratory data from Industrial Chemistry Laboratory, National Research Institute of Health. November 1999.

Water Treatment

No effective water treatment processes are used in any of the Title II water projects. One Cooperating Sponsor has plans to use the filtering action of the soil by siting water wells below the downstream embankment of ponds. This may remove some of the sediments and suspended matter normally found in pond waters, but effective filtering depends upon sufficiently-large diameter wells with covers and handpumps to minimize disturbing the water in the bottom of the wells. To date, none of these wells have been completed in the Title II program. Another Cooperating Sponsor channels rainwater collected from roofs through small sand filters before sending it to storage tanks. This method is useful for removing large objects (leaves, insects, heavy dust) from the collected rainfall but does little to remove bacterial contamination from entering the tanks.

Without treatment for the most critical water quality hazards, namely microbiological contamination (fecal coliforms) and pathogenic parasites (protozoa, helminths, leeches), consumers face unknown but serious risks to health. Field observations of some of the water projects revealed a high potential of fecal contamination of the surrounding areas from livestock as well as access to the water source by rodents. Moreover, at many of the sites, water-based parasites such as leeches and other types of worms could be seen. Complaints were heard from local residents at a number of sites that the leeches that could be seen in the water were affecting the health of their cattle. Filtration is the most effective method of removing water-based parasites.

The most effective solution to the problems of bacterial contamination is disinfection of the water supply. Small rural water systems are commonly disinfected with chlorine products in the form of hypochlorites (chlorinated lime, sodium hypochlorite, calcium hypochlorite), which kill pathogenic organisms, mainly bacteria, but are less effective against protozoa and other

water-borne parasites. A major benefit in using chlorine products as a disinfectant is the chlorine residual which remains in the water and provides a degree of protection against re-contamination. For rural systems in Ethiopia, sodium hypochlorite, which normally exists as a solution of 12 to 15% available chlorine, or calcium hypochlorite, which is available as a powder or tablet of 65 to 70% available chlorine, would be most appropriate. The hypochlorite can be fed into the water systems by a variety of relatively simple devices, including hand feeding, pot chlorinators, drip feed systems, floating bowls, cannisters, etc. The operational objective of disinfection should be to maintain a positive chlorine residual measurement thoughout the water system at all times. (WHO recommends at least 0.2 mg/l residual.) The main constraints on disinfection are the recurrent cost of the disinfectant and the requirement for trained and reliable operating personnel.

Arsenic Testing

It is not currently possible in Ethiopia to test for arsenic in water supplies. No institution in the country is performing any of the standard procedures for arsenic testing. The Ethiopian Health and Nutrition Research Institute (EHNRI) could carry out a colorimetric analysis for arsenic, if requested, but the necessary reagents are lacking. A more accurate instrument, the atomic absorption spectrophotometer, can be found in the EHNRI, but technical modifications are required as it has been used only for food composition analysis in the past. Because no arsenic testing has been done to date, the existence of the chemical in Ethiopian water supplies is unknown.

National Water Quality Standards

Ethiopia has not established drinking water quality standards applicable to small-scale rural systems (see chapter 3.3.5). Several governmental agencies do have informal standards for their internal use, but nothing is available for the general guidance of all organizations working in the rural water supply sub-sector. This results in great variations between programs, a perpetuation of water-related disease patterns and the promotion of project designs that may be unsustainable because they do not meet critical local needs.

Title II Water Quality Standards

Similarly, neither USAID nor the Cooperating Sponsors have set up standards for water quality or for the monitoring of water systems within the Title II program. The recent movement towards water quality monitoring under 22 CFR 216 has not evolved to the point of setting out acceptability levels, or even general guidelines, for the critical water quality parameters. Measures of water quality are among the most effective indicators of potential health impact. Given the small scale of the Title II water projects and the limited resources for such water supply development, it would be appropriate to establish interim standards for the program that would provide guidance for the Cooperating Sponsors related to minimum acceptable water

quality, water quality monitoring and associated water treatment. Without such standards, there is no way to judge whether a project is providing water of a desired quality. The absence of water quality standards diminishes the importance of health in program planning, increases the likelihood of future health hazards through inappropriate project design and, thereby, compromises the long-term sustainability of the project.

Establishing water quality standards, even interim levels, for the Title II program is no easy task. The microbiological parameters, primarily *E. coli*, should be the initial concern. The WHO guidelines strongly recommend against the presence of any fecal coliforms in drinking water. In the case of Ethiopia and the current status of the Title II water projects, this standard is unrealistic and should not be adopted at this time. It would be better to assess the present quality, in terms of fecal coliforms, of all the existing Title II water projects and then adopt a provisional guideline (which may be 50 fecal coliforms per 100 ml, or 30 fecal coliforms, etc.) which will require immediate action at the worst water systems and secondary efforts at those only slightly better. As water quality is improved over time, perhaps through source protection, proper maintenance or disinfection, the provisional water quality standards can be incrementally raised until they eventually reach some desired level.

5.4.3 Monitoring Indicators and Mitigation Measures

Monitoring Indicators for the Title II Program

For the small-scale, rural water supply projects implemented as part of the Title II program, there is need to establish relatively simple, but effective, indicators of water quality. These indicators must be clearly linked to health impacts, easy to measure, straight-forward in interpretation and low in cost. The following indicators are recommended for use in the program.

Microbiological indicators

E. coli is the single most important indicator of fecal contamination of water by humans or animals. Where only one bacterial organism is to be tested, *E. coli* is the best choice. It can be tested both in the field, using field test kits with portable incubators, or in the laboratory, using either multiple tube fermentation methods or membrane filtration techniques. The presence of any *E. coli* organisms in a water sample is a sign of recent fecal contamination and should be taken as a warning that other pathogenic organisms may also be present.

If additional microbiological parameters are desired, coliform organisms as a group provide a good indicator of drinking water quality, especially water that has been treated with disinfectants. Coliforms can be used as a measure of treatment efficiency and of the soundness of a piped distribution system.

Biological parasitic indicators

Water-related parasites are very common in Ethiopian waters. The most relevant are the protozoa (such as Giardia and amoebas), helminths (such as roundworms, hookworms and Guineaworms), tremotodes (which cause schistosomiasis) and annelids (leeches). In some cases they can be seen with visual observation of the water source, but in most instances microscopic examination is needed to detect ova in feces or in soil near the water. This is most easily performed in a laboratory.

Physical-chemical indicators

Primary attention should be given to chemical constituents that are toxic or have serious affects upon health. In Ethiopia, these are fluoride and nitrite/nitrate. Although little is known about the presence of arsenic in Ethiopian waters, its occurrence can be devastating to health. Therefore, until the risk of arsenic contamination can be ruled out, it should be included as a chemical indicator of primary importance in Ethiopia. Portable kits do exist for testing all three of these chemicals in the field, but the equipment is expensive and in the case of arsenic not always reliable. Given that chemical analyses are not time dependent, as in the case of microbiological tests, it would be better to refer all toxic chemical samples to a single or at most a few central laboratories.

Secondary attention can be directed to physical and chemical indicators that have a less immediate or even no effect upon health. Some of the physical-chemical tests important to the efficiency of water treatment (pH, chlorine residual, turbidity) can be performed in the field with simple portable test kits. Other tests, which relate to both treatment efficiency (hardness, chloride, iron) and acceptability of the water to users (taste, odor, color), are more readily carried out in a laboratory.

Mitigation Measures in the Title II Program

Water quality monitoring program

For Title II water projects, a water quality monitoring program should be established with the same characteristics as the monitoring indicators, that is, it should be linked to health impacts, easy to implement, straight-forward in interpretation and low in cost. There are four distinct steps in the establishment of such a program.

1. The first step is an on-site sanitary survey of all water sources in the Title II program to determine the risks to health of either existing or planned supplies. The purpose is

to establish a record of risk factors and associated remedial actions. The following procedure can be followed:[40]

- Identify all potential sources of contamination to the water supply;
- estimate the level of health risk from each source of contamination (low, medium, high);
- draw a sketch of the site showing the sources of contamination and explaining the sanitary risks; and
- prepare a survey report of the visit giving suggestions for remedial actions to minimize the risks to health.

Standard reporting forms can be developed for different types of water systems as described by Lloyd and Helmer.[41]

2. The second step is to set up regular sampling of water sources in the program. As in the case of sanitary surveys, every water source should be sampled before construction (if possible) and then periodically after project completion. For the small-scale untreated projects in the Title II program, the minimum sampling regime should be annual sampling. Water sources subject to surface contamination, such as ponds, open wells and springs, should be sampled more frequently, ideally on a quarterly basis.

   For toxic chemicals, such as arsenic and fluoride, the water source should be sampled before being put into service and, if acceptable, re-sampled one year later. For nitrite and nitrate, deep boreholes require only an initial sampling, but seasonal variations in the contamination of shallow groundwaters due to the presence of animal manure or agricultural fertilizers may require more frequent sampling. In this case, springs and shallow wells should be sampled quarterly.

3. The third step in a monitoring program is analysis of the water samples. Microbiological testing for fecal coliforms (*E. coli*) must be started within 6 hours to avoid bacterial die-off, or within a maximum of 24 hours if the samples are properly iced. If the samples cannot be brought to a microbiological laboratory within 6 hours, it is recommended that the analysis be done in the field with a potable testing kit. Of

[40] Lloyd, B. and R.Helmer (1991). **Surveillance of Drinking Water Quality in Rural Areas**. Essex (UK): Longman Scientific & Technical.

[41] Lloyd, B. and R. Helmer (1991). Surveillance of Drinking Water Quality in Rural Areas. Essex (UK): Longman Scientific & Technical.

the several commercial models available on the market, the DelAgua Water Testing Kit is used in many WHO-supported activities. Moreover, several Cooperating Sponsors already possess DelAgua kits, although they are not yet being used.

Physical-chemical analyses can be performed either in the field, if appropriate equipment is available, or in a laboratory. Several physical-chemical parameters, such as pH, chlorine residual and turbidity, can be measured with the portable field kits developed for microbiological analyses. Time is not a major factor with physical-chemical samples and, in most instances, they can be held until a convenient time for delivery to a laboratory. It is recommended that all tests for fluoride, nitrite/nitrate and arsenic be done at properly-equipped laboratories.

4. The final step is the recording and reporting of the results of the sanitary surveys, water sampling and testing. Reporting forms for each of the previous steps should be developed and maintained in project files, where they remain available for the various design, construction and maintenance activities as well as overall program reporting, evaluation and any unexpected follow up. Where appropriate, monitoring information should be shared with the regional bureaus for water and for health.

Other mitigating measures

- Establish provisional water quality standards for the Title II program.
- Develop technical guidelines for project design, water treatment and water quality monitoring for use by the Cooperating Sponsors.
- Encourage Government to establish national water quality standards applicable to the rural areas of Ethiopia.
- Strengthen the water quality laboratories of the regional bureaus for water and for health where water samples from the Title II program are analyzed.
- Provide portable field testing kits to all Cooperating Sponsors for microbiological and physical-chemical analyses of water.

5.5 Community Participation and Empowerment

5.5.1 Basic Principles

General Concepts

The need for community participation to initiate and support sustainable water and sanitation projects in the developing countries has been clearly recognized since the beginning of the International Drinking Water Supply and Sanitation Decade in the 1980s. During this period, a great deal of emphasis in Africa, Asia and Latin America was given to the involvement of local communities in all phases of water and sanitation projects. It is now fully accepted that water supply and sanitation activities, particularly in the rural areas, involve human interactions and require group responses. Experiences in Ethiopia and elsewhere show that lack of genuine participation by the community is a major cause of failures in water supply and sanitation projects. On the other hand, projects that are planned and executed with the active participation of the community are more often found to be successful and sustainable.

Genuine community participation entails the active involvement of the people in the projects affecting their lives. In the context of water supply and sanitation activities, it means ensuring the practical participation of the community in the planning, design, construction/implementation, operation and maintenance phases of a project. The concept of community participation is grounded on the recognition that communities have a wealth of information needed at all stages of project development. Both the recognition and the involvement are essential for successful project development.

Most rural communities in Ethiopia have local leadership structures to control and manage traditional water supply sources. The traditional water management systems are relatively permanent and have well defined social sanctions serving as effective enforcement mechanisms for sustainable utilization of water sources. Elders and individuals that have won the respect of the people manage the water sources in the interest of the community. The existence of local leadership and experience should serve as a basis for mobilizing collective action for self-help water supply and sanitation projects. It is important to acknowledge the role of this traditional leadership and the respect accorded to it. Such leadership should be incorporated into the newly established water and sanitation committees in order to take advantage of its potential for mobilizing the community.

Genuine community participation is also viewed as an important instrument for recognizing the role of rural women in water supply and sanitation, especially at the household level. Fetching water and maintaining facilities in a sanitary manner are considered to be the responsibilities of the female members of households in Ethiopia. Past experiences in both Ethiopia and elsewhere show that a significant involvement of women in all phases of these

projects is indispensable to their success and sustainability. The views and concerns of women need to be given much more attention in all cycles of these projects. Community participation, therefore, should ensure a significant representation of women in major decision-making positions within the leadership structure as opposed to the usual nominal membership on committees. The involvement of women in water supply and sanitation activities should be viewed both as a condition for the success of projects and as a prerequisite for genuine advancement of women's interests.

Direct involvement of the community in the various aspects of a project is essential for the promotion of participatory development. In general, wider community participation can be ensured when:

- the community is actively involved in needs identification and prioritization;
- the leadership fully represents the interests of the community and is able to control project resources and activities;
- the existing local organizations are involved in creating the management structure of the project;
- the community is able to raise a reasonable amount of resources to finance project activities; and
- the community has an organization with adequate capacity to manage and supervise project activities.

Successful community participation is related to the capacity of the community at two levels: adequate institutional capacity to manage water points and sanitation activities, and individual capacity to pay water-use fees. Strengthening capacity at both levels is central to promoting wider participation of the community in order to ensure the success and sustainability of water supply and sanitation projects.

Available Guidance Materials

In recent years there has been a great deal of progress among international agencies in developing innovative participatory methods involving women in water and sanitation development. UNDP, through its PROWWESS (Promotion of the Role of Women in Water and Environmental Sanitation Services) initiative, formulated mechanisms for the involvement of women in decision-making on water and sanitation.[42] Another recent linkage of participatory methods with hygiene education concepts is the PHAST (Participatory Hygiene and Sanitation

[42] Srinavasan, Lyra (1990). **Tools for Community Participation**. New York: PROWWESS/UNDP.

Transformation) initiative, developed by WHO and the UNDP-World Bank Water and Sanitation Program, which assumes that people solve their own problems best in a participatory group process and that the group collectively has enough information and experience to begin to address its own problems.[43] PHAST employs a variety of techniques to assist the participatory learning process, including workshops and a series of participatory tools for involving the community in dealing with the health aspects of their water and sanitation problems.[44]

Many international organizations now formally link community participation and hygiene education in order to obtain desirable behavioral changes. The close cooperation between research institutions (London School of Hygiene and Tropical Medicine), community-oriented NGOs (CARE, IRC International Water and Sanitation Centre) and international development organizations (UN agencies, bilateral agencies) is encouraging the adoption of these concepts and methods. The various working groups and the global and regional meetings of the Water Supply and Sanitation Collaborative Council have further advanced new ideas and exchange of information on participatory development. The impact of these concerns can be seen in the currrent general acceptance of the concepts of community participation, the role of women and the importance of hygiene education in water and sanitation programs. UNICEF is in the forefront of implementing this integrated approach, and has developed programming guidelines that incorporate many of these concepts.[45]

The impact of these conceptual advances has not been lost on Ethiopia. Many of the recent methodological approaches have been incorporated into the guidelines and training manuals of Ethiopian agencies. The Ethiopian Social Rehabilitation and Development Fund (ESRDF) promotes participatory methods in its **Community and Institutional Development Manual** (1997)[46], while the Christian Development and Relief Association (CRDA) has included some of these approaches into its **Training Manual on Community-Based Water Supply and Sanitation** (1999).[47]

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[43] WHO (1996). **The PHAST Initiative: Participatory Hygiene and Sanitation Transformation: A New Approach to Working with Communities**. WHO/EOS/96.11. Geneva: WHO.

[44] WHO (1998). **PHAST Step-by-Step Guide: A Participatory Approach for the Control of Diarhoeal Disease.** WHO/EOS/98.3. Geneva: WHO.

[45]UNICEF and USAID/EHP (1997), **Better Sanitation Programming: A UNICEF Handbook**, EHP Applied Study No. 5, Washington, DC, USAID.

[46] ESRDF (1997), **The Community and Institutional Development Manual**, Prepared by Carl Bro International a/s in association with Metaferia Consulting Engineers PLC.

[47] CRDA (1999), **Training Manual on Community-Based Water Supply and Sanitation**, Training programme prepared by Mateferia Consulting Engineers, Debre Zeit, 4-13 January 1999.

5.5.2 Environmental and Sustainability Issues

After extensive field observations and careful review of the overall activities of the Cooperating Sponsors in water supply and sanitation, the study team identified the following major deficiencies with regard to community participation that could endanger the sustainability and environmental soundness of these projects.

Level of Community Involvement

Field observations revealed a common weakness in that little effort was made to involve communities from the initial planning phase of project. It was generally found that direct participation of communities was encouraged during the construction phase and during the establishment of water and sanitation committees (WSC). This approach was followed by all Cooperating Sponsors. In some instances, however, the committee was not established until the construction work was completed. Communities were rarely consulted during the identification of needs or during the site selection or design phases.

There were cases where management committees were instituted by the rural kebele administration without direct consultation with the larger community. In such occasions, the WSC members are individuals appointed by the kabele officials. Community members in some areas mentioned that WSC members were introduced to them during the handing-over ceremony of completed water points. As a result, the people in such areas tend not to be well informed about their responsibilities for maintaining these projects and, consequently, the strong sense of project ownership essential for project sustainability fails to develop.

The low level of community participation is also reflected in the relatively small amount of resources contributed by the community to the total investment costs. There are communities who are unable to pay salaries to caretakers. Households in these areas are food insecure with virtually no cash income. Consequently, individual households in the poorest areas do not have the capacity to pay water-use fees. Moreover, most of the WSCs have not yet developed the level of skills required to effectively manage and maintain the water points.

The study team felt that the current inadequate level of participation, weak capacities to manage and maintain systems, and the lack of a sense of project ownership by communities would have a negative environmental impact through progressive environmental degradation of project sites. Sustainability of these projects will be threatened, as there is a risk of system failure through weak community support.

Role of Water and Sanitation Committees

The water and sanitation committees (WSC) are local level community organizations established to manage the overall aspects of water supply and sanitation projects. In general, they

are responsible for mobilizing and coordinating community contributions (in the form of cash, materials or labor) to the project, creating awareness by promoting sanitation and improved hygiene behaviors among their fellow villagers and taking charge of operation and minor maintenance.

As a matter of fact, most of the WSCs observed were lacking the necessary level of managerial capacity and organizational strengths to sustain the water and sanitation facilities. Except for a few notable exceptions (see Box 5.8), the existing operation and maintenance capacity of the committees observed during the field visits was generally found to be inadequate.

Box 5.8: Community Maintenance of a Handpump

To solve its water supply problems, one community with the help of a Cooperating Sponsor constructed a hand dug well and fitted it with a handpump. Control of the water source and mantenance of the handpump were entrusted to a local water and sanitation committee consisting of 3 men and 3 women. The Cooperating Sponsor provided training and basic tools to the committee. To demonstrate to the Study Team that it was familiar with essential maintenance procedures at the well, the committee members dismantled the handpump, removed the pump rods and showed how to replace the rubber seals on the plunger.

Role of Women

As a general rule, women are represented in all WSCs in Title II projects. The proportion of women committee members in the projects visited by the team varied from 25 to 50% of the total membership. The representation of women in these committee is a recognition of their importance in water supply and sanitation activities, but they rarely hold key leadership roles.

Field observations revealed that women did not serve in executive positions in the management structure of the WSCs. It was a rare case to find a woman elected to be chairperson, secretary or treasurer of a committee. Moreover, except in one project, women were not assigned the role of water caretakers, a position usually held on a salary basis by men.

5.5.3 Causes of Problems

There are several factors responsible for the major deficiencies mentioned above.

Insufficient Mobilization of Communities

Inadequate community participation in project activities is primarily due to insufficient time devoted by the implementing agency to creating awareness within the community and establishing local organizational capacity for direct and active involvement in the project. It was

observed that some implementing agencies attempted to establish water and sanitation committees and mobilize communities in a period of less than a month. In such instances. it was not possible to create in these communities a feeling of ownership and commitment to the success and sustainability of the projects. Except in rare instances, little effort was made to involve communities in all aspects of project development.

Insufficient Preparation of Water and Sanitation Committees

Insufficient time devoted to community participation also is one of the major causes of weak water and sanitation committees. WSC members in most project areas are reluctant to play active roles in facilitating project activities. This due to the fact that adequate time was not given to creating awareness and convincing the communities about the projects and to electing competent leaders through popular participation. Other factors which have contributed to the low competence of the WSC include :

- Traditional leaders in water management—usually referred to as the "father of water" in most rural communities in Ethiopia—are not included in most new WSCs. This represents a missed opportunity to tap available experience and leadership stature.

- The WSC members usually lack basic technical knowledge and leadership skills and hence are unable to manage the water systems properly or to mobilize the community for future projects.

- The training provided to the WSC members is not adequate to manage and maintain the water and sanitation facilities.

- There is often a lack of technical support from both Cooperating Sponsors and government after project hand-over.

- There is a general lack of tools and available spare parts.

The inability of the WSCs to effectively manage, operate and maintain the installations will adversely affect the environment through the likely contamination of water sources, site degradation through poor drainage and eventual breeding of insect vectors. The sustainability of the water points and the sanitation facilities will also be affected if the WSCs do not acquire the capacity to maintain and provide reliable services in a sustainable manner.

Insufficient Involvement of Women

In general, women in Ethiopia have fewer opportunities than men to be leaders of local organizations. In fact, women's voices are rarely heard in rural communities because of social and cultural factors, but primarily because of traditional male domination of community affairs. The study team concluded that insufficient efforts are being made to empower women in project

development, which reinforces their passivity and lack of leadership roles. Since women are traditionally the primary caretakers of household water supply and sanitation services, the absence of women leaders in water and sanitation projects will seriously impact the sustainability of future operation and maintenance. An increased risk of system breakdowns due to negligence is likely to be the case.

5.5.4 Monitoring Indicators and Mitigation Measures

The review of the water and sanitation projects implemented by the Cooperating Sponsors showed that the construction of ponds, springs, water wells and other physical structures has been a preoccupation in the program. Little or no attention has been given to the human elements, such as acceptance of project activities, changes in behaviors and levels of involvement by the community, in general, and women, in particular. These factors are very important for the success and sustainability of projects. One general weakness is the absence of well-defined indicators that could be used to monitor the extent of community participation at all stages of project development.

The following measures are recommended for mitigating deficiencies in community participation and empowerment along with a few suggested monitoring indicators:

Promote Active Community Participation

Monitoring indicators: amount of preparation time devoted to mobilizing the community; degree of community involvement in the various phases of the project.

Mitigation measures: Community involvement should start with project identification. It is important to secure the agreement and acceptance of the community about the project at the very beginning. Project planners should ensure that the community has effectively participated in needs identification, site selection, technology choice and other aspects of project development. Sufficient time should be given to creating awareness among the community and securing its decision to implement the project. Experience in Ethiopia shows that at least 6 to 12 months of working with the community is necessary to obtain their its full acceptance and active involvement in a project and to establish an appropriate water and sanitation committee.

Strengthen the Capacity of the Water and Sanitation Committees

Monitoring indicators: amount of time spent mobilizing the WSC; methods used to select WSC members; presence of traditional leaders in the WSC; type of raining given to the WSC; availability of tools and spare parts for operation and maintenance; availability of follow-up technical assistance from the Cooperating Sponsor.

Mitigation measures: Several distinct measures are possible:

- WSCs should be organized in the planning phase of the project and the active involvement of the community should be encouraged in all subsequent phases. The establishment of a WSC during this early stage will enable it to secure the involvement and support of the overall community. It also allows time for the WSC to acquire skills and experience in the operation and management of the facilities.

- WSC members need to be elected democratically by the entire community. It also is important to include traditional leaders on the WSC and use their authority and experience in the management of project activities.

- Extensive training is required to upgrade the skills and knowledge of WSC members and caretakers. This review shows that WSCs in general are not capable of ensuring the resources and mantenance services needed by water and sanitation facilities in the Title II program.

- There is a need to provide adequate tools to WSCs and caretakers to facilitate, when necessary, minor maintenance by the community itself. The Cooperating Sponsors should make efforts to facilitate the supply of spare parts in order to support maintenance services. This could be done by encouraging the private sector (for example, local merchants) to keep a stock of spare parts in accessible locations.

- It is also important to consider the provision of follow-up technical assistance from the Cooperating Sponsors after the hand-over of the facilities. The capabilities of the WSCs to manage and operate projects may need to be supported for a period of time after hand-over.

Encourage Participation and Leadership by Women

Given their central role in water supply and sanitation within the household, the importance of the active involvement of women in all aspects of community water and sanitation projects cannot be overemphasized. Changing existing negative attitudes towards the involvement of women in local leadership and project management will require both time and a continued awareness campaign within the community.

Monitoring indicators: proportion of women on WSCs; proportion of women holding executive positions on WSCs; number of women holding position of project caretaker.

Mitigation measures: The active participation of women in these projects can be encouraged by providing them with training in technical and leadership skills. Training programs should take into account the time and household requirements of women to ensure their

maximum participation. For example, training venues arranged in near homes in rural areas would facilitate the participation of young and lactating mothers. Similarly, the participation of women in water and sanitation meetings and in WSC management can be encouraged by arranging meetings at a time and place that suits them. It is also important to ensure the fair representation of women in important decision-making positions (chairperson, secretary, treasurer and caretaker).

Chapter 6. Conclusions

6.1 General Observations

After reviewing project documents and technical literature, meeting with representatives of the Cooperating Sponsors, project communities, Government of Ethiopia, and other development organizations and visiting water and sanitation projects in the field, the Study Team concluded that the Title II program has considerable strengths but a number of significant weaknesses. Underlying all these issues are the fundamental difficulties of working in rural Ethiopia.

The Cooperating Sponsors are working in predominantly remote areas under geographical and socioeconomic circumstances (frequent droughts, rugged topography, dense populations and geographic isolation) which are at the very roots of the causes of food and water insecurity. There has been a tendency in the program to concentrate on achieving household food security but, at the same time, to often underestimate the need to develop "water security." Moving towards one without the other will not fundamentally change the conditions of the people in the project areas. Furthermore, Cooperating Sponsors work not only in areas of severe deprivation but also within the fairly rigid parameters of Title II, which tend to direct activities into labor-intensive development efforts utilizing food resources. Thirdly, the Development Activity Proposal (DAP) prepared by all Cooperating Sponsors covers a set time frame, usually 3 to 6 years. The collection of necessary hydrogeological and meteorological data and the need to establish a firm foundation of community participation may not be fully compatible with this period.

6.2 Major Concerns

The following is a summary list of the major deficiencies impacting upon the water supply and sanitation activities in the Title II program:

- Sanitation is lacking in most water supply projects.
- The number of water and sanitation projects being implemented are insufficient to bring about a significant developmental effect.
- Inappropriate technologies for water systems are sometimes used.
- Technical design of water systems is sometimes sub-standard.
- Water quality monitoring is rarely done and never on a regular basis.

- Neither USAID nor Government of Ethiopia technical guidelines exist for guiding the design, construction, operation and maintenance of systems.
- The integration of Title II projects in community-wide development efforts rarely occurs.
- Community participation is inadequate to fully involve communities in all aspects of the projects.
- Water and sanitation committees are generally weak and unable to properly manage the systems.
- Women do not sufficiently participate in project development or have responsible leadership roles.
- Health and hygiene education is inadequate for raising awareness or changing health-related behaviors.

The first six issues in the above list relate primarily to technical and scientific concerns, while the remaining five issues deal primarily with social and institutional concerns.

6.3 Environmental Impacts

One primary conclusion of the study is that there are no major environmental impacts upon the physical environment. The review of project implementation found no significant pollution of either surface or groundwater systems that originates in the Title II program. The water and sanitation projects in the program are modest in extent, involve relatively small uses of water and, therefore, have little effect beyond their immediate sites on either the physical or ecosystem environments. Nevertheless, some sites are experiencing severe problems involving stagnant pools of water and soil erosion around tap stands as well as site degradation caused by animals seeking water.

The most serious environmental problems relate to the health aspects of poor water quality, poor technical design, inappropriate technologies and poor maintenance. Since health statistics were not available for review, these conclusions are based upon environmental health conditions at the sites. Although most water projects provide good protection against outside contamination, some do not and the result is the provision of water that is unsafe and even worse than before project implementation. Microbiological contamination (pathogenic bacteria) deriving from human and animal excreta is the most serious health risk followed by water-associated parasites (worms, leeches). Water systems that cannot be protected from gross pollution should not be implemented in the Title II program. The Study Team believes that open

wells and open ponds which require people to manually dip their containers into the water should not be built.

Other health-related problems are the insect vectors and water-associated parasites that can be found around tap stands that are leaking, badly drained or poorly maintained.

The problems of water quality are heightened by the absence of water treatment, the lack of water quality standards and the failure to monitor water quality. Without water quality testing, there is no way to determine the safety of water or to confirm sanitary observations made in the field. Because there are no USAID guidelines or standards for either water quality or for technical design, there is a tendency to overlook the health impacts of the projects.

Health concerns are further marginalized by the general lack of sanitation activities in the program. There is a lack of awareness of the need for sanitation which stems from the basic relief orientation of the Title II program (see chapter 7.3). Only a few Cooperating Sponsors have made serious efforts to link sanitation (latrines, showers, washing slabs) with water projects. Since sanitation is not a major element in the program, unsanitary conditions at the sites and in the communities and the health risks they pose to the water systems are not carefully considered in project development.

A number of social issues adversely impact on the environment. The involvement of communities in project development and on the water and sanitation committees is inadequate to the needs of a community-based program. Women, in particular are marginalized, and are not well represented in leadership roles. The major impacts of weak community involvement are inadequate attention to project operation and maintenance and a progressive degradation of project sites and water quality.

A summary of the key environmental impacts is shown in Table 6.1.

6.4 Sustainability Impacts

Sustainability impacts are a more serious problem to the Title II program than are environmental impacts.

The sustainability of water and sanitation projects is directly related to the lack of technical standards for project design, technology choice and water quality monitoring on the one hand and insufficient community involvement in all aspects of project development on the other. Both problems endanger the continued future operation of projects.

Technical deficiencies, such as poor drainage around tap stands, source contamination of wells and springs and selection of inappropriate technologies, can lead to ultimate failure either from system breakdowns or from community rejection of undesirable projects. One of the main

reasons for these deficiencies is the lack of technical guidance for water and sanitation activities in the Title II program. The Cooperating Sponsors must develop or choose their own technical standards for design, construction and system operation. The absence of program standards leads to great variations in project design and implementation between Cooperating Sponsors. This is often compounded by a lack of experienced field personnel and technical backstopping at headquarters level. In the most serious cases, unsustainable systems risk structural failure or may cause widespread discouragement with future development efforts on the part of the community.

As in the case of environmental impacts, the lack of sanitation in the program endangers water quality, conditions around the taps and ultimately the health of the community. This is compounded by a division of responsibility between water supply and sanitation efforts within government institutions, as water supply is under the control of regional bureaus of water and sanitation is the responsibility of bureaus of health. Moreover, there is a great lack of appropriate health and hygiene educational materials in the field to promote health-related behavioral changes. The ultimate consequence of all these factors is unsanitary water sites leading to unsustainable projects and, possibly, the rejection by the community of the Title II program itself.

The social and institutional aspects are crucial to project sustainability. The lack of community involvement in the early aspects of project development limits the sense of ownership that should arise. Moreover, the relatively weak water and sanitation committees that are formed in the latter stages of project development are generally incapable of long-term system management. Many of the existing Title II projects are not sustainable and require external technical and financial support to continue. The most critical deficiencies affecting sustainability are poor technical and management training for the committees, lack of spare parts and absence of women leaders.

Lastly, there is insufficient integration among water and sanitation projects and between these projects and other activities in the Title II program. This is caused partly by the dispersal of a small number of projects over large geographic areas and partly by inadequate attention on the part of the Cooperating Sponsors to creating coordinated development plans for all Title II activities in communities. Isolated as most of the water and sanitation projects are, there is little opportunity for a development synergy to occur among projects.

A summary of the key sustainability impacts is shown in Table 6.1.

6.5 Monitoring Indicators

Most of the deficiencies noted above can be monitored, either through regular Title II program documentation (IEE, DAP, PAA), routine project reviews (water quality monitoring, sanitary surveys, post-construction audits, annual status assessments) or specific assessments to

determine potential problems. Several general types of monitoring activities are needed in the program. The first is the sanitary survey, which should be carried out to establish a baseline at the start of project development. Periodic sanitary surveys (described in chapter 5.4.3) also should be made after systems are operational to assess the environmental conditions and their impact on health.

A second type of monitoring involves assessments of engineering soundness, including the design criteria employed, audits at the completion of construction and periodic performance reviews (leakage, structural damages, per capita water consumption, system reliability). The frequency of such assessments should be determined by the need to assure technical compliance with program standards.

The third type of monitoring is the sampling and testing of water to determine compliance with applicable standards and the general safety of the water for human consumption. At a minimum, water quality monitoring should include tests for *E. coli* as an indicator of fecal contamination and for fluoride, nitrate and arsenic as indicators of hazardous chemical contaminants. Water samples should be tested at the start of a project to determine source suitability and to establish a baseline and then periodically, but at least annually, to monitor any changes in water quality. Microbiological monitoring can be done in the field with portable test kits, and all Cooperating Sponsors should be required to obtain and use such equipment. There is also a general need to strengthen the Ethiopian government's laboratory support for these procedures, as well as a specific need for the establishment of national water quality standards for small-scale rural water supplies.

The fourth type of monitoring consists of the description and enumeration of essential social and institutional conditions. This should include the number of projects with and without sanitation components, the number of technical and health staff in the field, the number of women active in water and sanitation committees, types of training course offered, etc. The parameters to be monitored will depend upon the specific deficiencies to be addressed in future projects.

All four types of monitoring are crucial for environmental protection and project sustainability. To be effective, monitoring must be linked to criteria and standards that define acceptable levels of parameters. For the successful implementation of Title II water and sanitation projects, the most important monitoring indicators are those based upon water quality standards and technical guidelines for design and construction.

A summary of key monitoring indicators is shown in Table 6.2.

6.6 Mitigation Measures

Mitigation measures arise directly from the deficiencies noted in sections 6.1 and 6.2. Sanitation should be emphasized in future projects. A growing body of evidence indicates that sanitation, especially sanitary excreta disposal, is far more effective in preventing and reducing diseases than water supply alone. The Study Team believes that all Title II water projects should have a sanitation component, unless clear justification for omitting sanitation in specific cases can be given.

A related issue is the need to promote a momentum for development by increasing the number of projects or, alternatively, by concentrating projects in a few limited areas. Projects need to be close enough together to allow the enthusiasm and community spirit from one successful project to influence the implementation of another. This process is further encouraged by integrating all of the Title II projects, whether water or agricultural or some other sector, into a coordinated package in a given community. At present, most water and sanitation projects are too dispersed and are not adequately integrated with other Title II projects to have a critical development effect on communities.

Technical deficiencies call for obvious mitigation measures. The most important measure needed in the overall program is the establishment of USAID guidelines for technical design, construction and water quality monitoring. The program must have criteria for project development, including the quality of water provided to the people. These guidelines can be established, or adopted, in a variety of ways, but perhaps the most effective and acceptable method would be to ask the Cooperating Sponsors to jointly propose appropriate guidelines for the program. This could be done in a workshop of several days' duration attended by the lead technical representatives of the Cooperating Sponsors. These technical representatives, in turn, should strengthen the technical skills of their field personnel.

Social and institutional deficiencies are less obvious but no less important. The full involvement of the community must be seen as essential to project sustainability. This means the active participation of the community at the start of project development, the establishment of effective water and sanitation committees and the promotion of women in leadership roles. This involves working with the communities for up to a year before project construction begins, promoting behavior change through health and hygiene education and providing technical and management training to water and sanitation committees. The success of these measures should be judged not on the ease of implementing them but rather on the degree to which the community develops a sense of ownership of the project, takes responsibility to maintain it and considers undertaking other development activities.

A summary of key mitigation measures is shown in Table 6.2.

6.7 Lessons Learned Regarding Water Shortages in Ethiopia

Although Ethiopia has considerable water resources potential, it also is subject to great variability in the distribution and availability of water. Periodic droughts are a fact of record in Ethiopia. Over the past two centuries, there have been at least seven or eight major droughts and many minor periods of poor rainfall that have devastated large areas of the country. The most recent event of major impact was the crippling drought and famine of 1984-1985. It is only within the last 40 years, however, that international relief assistance has been available to ameliorate some of the most serious consequences of drought in Ethiopia.[48]

Currently (early year 2000), the southern and southeastern pastoral areas of Ethiopia are experiencing severe drought conditions and shortages of drinking water for both people and livestock. The rains have been more reliable in other areas of the country, but only in comparison to the southern pastoral region. Most areas of Ethiopia, even in the good years, experience some degree of water shortage and the specter of drought is usually present.

[48] Warner, D.B. (1985). **Emergency Water Supply and Sanitation to the Ethiopian Drought and Famine**. WASH Field Report No. 135. USAID WASH Project, Washington DC.

Table 6.1: Summary of Key Issues Affecting Environmental Protection and Project Sustainability

Major Deficiencies	Phase	Causes	Consequences	Environmental Impacts	Sustainability Impacts
Lack of sanitation in water projects	1-3	Lack of awareness; low priority; lack of funding	Poor environmental health conditions	Continuation of health hazards	Water quality will not remain safe
Insufficient number of projects	1, 2	Lack of funding; lack of technical capacity	Low WSS coverage	Continuation of health hazards	No development effect generated
Inappropriate technology	1-6	Lack of data; lack of technical guidelines; lack of technical expertise	Insufficient water quantity to meet basic daily needs	Increase health hazards	Project failure; risk of community rejection
Poor technical design	2, 3	Lack of technical guidelines; lack of technical expertise	Unsafe water quality for human consumption	Increase health hazards	Limited by project design
No water quality monitoring	2, 5, 6	Lack of awareness; lack of laboratories; lack of field equipment	Potential health hazard to consumers	Increase health hazards	Risk of community rejection
No USAID technical guidance	2-6	Lack of awareness; lack of USAID technical staff	Sub-standard projects implemented	Contamination of water sources; poor drainage; breeding of insect vectors; interference with downstream users	System reliability is compromised; accessibility is sub-optimal
Inadequate integration of projects	2-4	Dispersal of projects over large areas; lack of awareness	Projects have little developmental effect upon community	Environmental changes not readily observed	Risk of system failure through weak community support
Inadequate community participation	2-6	Insufficient time devoted to community participation before project implementation; failure to involve community in all aspects of project	Projects not have full community support	Progressive environmental degradation of project site	Risk of system failure through weak community support
Weak water and sanitation committees	2-6	Insufficient time devoted to community participation; absence of traditional leaders; inadequate training of committees; lack of tools and spare parts; lack of technical support after project hand over	Inadequate operation and maintenance	Contamination of water sources; poor drainage; breeding of insect vectors	Project breakdowns; unreliable services
Insufficient participation and leadership by women	2-6	Traditional male domination of community affairs; insufficient empowerment of women during community participation	Women not influential on water and sanitation committees	Failure to maintain an hygienic environment	Risk of system breakdowns through caretaker negligence
Inadequate health and hygiene education	2-6	Lack of awareness; low priority; lack of institutional responsibility; lack of resources (staff, materials, funding)	Poor understanding of health aspects of water and sanitation	Failure to maintain an hygienic environment	Risk of system breakdowns through poor maintenance

Table 6.2: Summary of Monitoring Indicators and Mitigation Measures Affecting Environmental Protection and Project Sustainability

Major Deficiencies	Monitoring Indicators	Mitigation Measures
Lack of sanitation in water projects	Number of projects with sanitation; funding for sanitation	Increase awareness of sanitation; require sanitation component in all water projects; increase funding
Insufficient number of projects	Number of projects; funding for projects	Increase funding for projects; strengthen technical capacity
Inappropriate technology	Post-construction audit of project suitability; annual performance review	Establish baseline data; follow USAID technical guidelines; provide technical training
Poor technical design	Technical criteria in guidelines	Follow USAID technical guidelines; provide technical training
No water quality monitoring	National water quality standards; USAID water quality criteria	Require water quality testing of all sources; improve laboratory capabilities; provide field test kits
No USAID technical guidance	Compliance with technical guidelines for all Title II WSS projects	Establish USAID technical guidelines
Inadequate integration of projects	WSS projects integrated with other Title II activities in the planning, design and implementation phases	Concentrate projects in limited areas; integrate water and sanitation with other Title II activities
Inadequate community participation	Active community involvement in all phases of the project	Begin community awareness 6 to 12 months before implementation; fully involve community in all phases of the project
Weak water and sanitation committees	Water and sanitation committee active in all phases of the project	Begin organizing the committee in the planning phase of the project; include traditional leaders; provide training; provide tools and spare parts; provide technical support after hand over
Insufficient participation and leadership by women	Number of women in water and sanitation committees; number serving as chairpersons and water caretakers	Awareness raising within the community; provide leadership training for women
Inadequate health and hygiene education	Number of health staff available; availability of teaching aids; funding for health education	Emphasize importance of health issues; provide staff training; promote institutional cooperation; provide materials; increase funding

The severity and frequency of drought conditions in Ethiopia raise the question as to how can the Title II program best address the recurring problem of water shortages. Although not comprehensive on the issue of drought, this study of the environmental affects of potable water and sanitation provides several tentative conclusions:[49]

[49] The conclusions shown here were suggested by: Moris, J.R. (1999). **Under Three Flags: The Policy Environments for Pastoralism in Ethiopia and Kenya**. SR/GL-CRSP Technical Report No. 04/99. Utah State University, Logan.

- **Land and water management should be integrated**

Water supply for domestic purposes cannot be easily separated from that for livestock, agriculture or any of a number of other productive uses. The development of water resources is an integral part of land management, especially in pastoral areas where water sources are limited in number and usually seasonal in nature. The identification and exploitation of water sources should be carried out with the full participation of local communities in order to ensure that water projects meet both the domestic and the occupational needs of the local population. Increasingly, major rural development projects are using participatory rural appraisal (PRA) methods to link development decisions to local preferences. International donors, including USAID in the Title II program, should insist that rural development activities are planned in the context of overall woreda development, that all relevant governmental and non-governmental organizations be consulted and that communities be an integral part of the overall process. For example, the Famine Early Warning System (FEWS) supported by USAID and the European Union should be closely integrated into rural development planning.

- **National policy environments are essential for coordinated planning**

Title II activities in Ethiopia are being implemented within an uncertain national policy environment. The main legislative acts for water, health and environment are languishing in draft form and, therefore, provide little influence upon development planning. Many unresolved policy issues need attention, including land tenure, privatization and settlement policies. In the southern pastoral areas, where the water shortages are most severe, these policy issues strongly influence the types of water projects that can and should be built. To the extent that major policies remain uncertain, there will be a tendency to have uncoordinated multisectoral programs. The likely consequences for potable water programs that are not well coordinated with other development sectors are a lack of sustainability and a vulnerability to periodic droughts. Changes in the policy environment are the exclusive responsibility of the Ethiopian Government, as international donors and NGOs are not allowed to directly influence policies.

- **Local capacities need strengthening**

One of the great weaknesses of rural development in Ethiopia is the lack of local capacity to manage, operate and maintain infrastructure. This is especially true regarding potable water systems, whether primary responsibility lies with local government or local communities. The woreda, or district-level, administration generally is technically weak, subject to frequent staff changes and suffers from a shortage of funds and transport. As a result, little direct support can be given to communities to assist them with system management, operation and maintenance. There is need at both the woreda and community levels for more training, guidance materials, repair tools, spare parts and technical support. There are few sources of technical assistance available to woredas and communities. Some support may be provided by the regional or zonal

water offices, but in practice the amount of available technical assistance is very limited. It might be worthwhile to explore possibilities of obtaining technical assistance from the Ethiopian Social Rehabilitation and Development Fund (ESRDF), which operates nationally, and from the Southern Rangelands Development Unit (SORDU), which operates only in the southern pastoral areas. USAID and the Cooperating Sponsors should give serious consideration to strengthening the capacities of the woreda administrations and the local communities to manage and technically operate their water systems. There is perhaps nothing more important to achieving long-term sustainability of water (and sanitation) improvements.

- **Drought protection requires a development approach**

Despite significant efforts in recent years to meet the evolving requirements of the program, the basic philosophy behind Title II water and sanitation activities is that of relief, not development. Project communities tend to be selected because of their immediate needs for water rather than on the long-term development prospects of the area. The result is that many water systems provide only temporary relief. They are not year-round sources of supply and often function for only a few months following the rainy season. While such short-term mitigations serve an immediate need and undoubtedly are appreciated by the local communities, they merely reduce the problems of water shortages but do not eliminate them. Most Title II water systems provide only small quantities of water, involve considerable walking distances from households and are subject to seasonal supply variations. Consequently, they can support only marginal social and economic improvements in the user communities. Such systems provide little developmental input in good years and are vulnerable to droughts in bad years. To promote long-term system sustainability and to protect the community from periodic droughts, Title II projects should also include drought-resistant solutions, such as deep boreholes or pumping from distant, but more permanent, surface sources. This implies a mix of both short-term relief activities and long-term development activities. The overall mix may involve more costly and sophisticated technologies with all of their consequent demands upon community management and operational personnel. However, future development and drought protection can only be achieved by eventually shifting from an immediate-needs relief approach to a future-needs developmental approach.

Chapter 7: Recommendations

7.1 Program Requirements

The Title II program can be strengthened and improved through the adoption of several requirements in the implementation of potable water and sanitation projects. These requirements should be part of basic program policy shaping the development of all new water and sanitation projects and influencing the implementation efforts of the Cooperating Sponsors. In order of priority, three new requirements are recommended for the program:

- **Sanitation should always be linked with water supply**

Sanitation improvements should always be included with water supply activities. Without complementary sanitation, water supply alone will result in only limited health benefits. All plans for new projects should include a sanitation component unless specific reasons can be given which justify water supply improvements alone.

- **The planning, design, implementation, operation and maintenance of water and sanitation projects should be based on approved technical guidelines**

Technical guidance is needed to assist Cooperating Sponsors in the development of water and sanitation projects and the formulation of budgets for their support. As no guidelines specific to Title II currently exist, projects to date have been developed to varying standards, some of which should not be supported in the future. USAID should establish technical guidelines appropriate to the needs of the program and the capabilities of the Cooperating Sponsors.

- **The planning, design, implementation, operation and maintenance of water and sanitation projects should be carried out by competent technical personnel**

Each Cooperating Sponsor should ensure that adequate technical expertise is available for the Title II program. Where properly-trained and experienced personnel are not available, efforts should be made to establish in-house, as well as program-wide, training programs. Other means to improve technical capabilities include short-term consultants, technical cooperation between Cooperating Sponsors and the establishment of technical review boards.

- **Water quality monitoring should be required for all potable water systems**

Water supply projects should improve, rather than degrade, the quality of drinking water. Changes in water quality can be determined only through regular sampling and analyses of water

sources and distribution points. USAID should establish for the Title II program provisional standards for drinking water quality and appropriate guidelines for water sampling and testing.

7.2 Program Emphases

In addition to the policy requirements shaping the technical nature of the water and sanitation projects, a number of new emphases should be brought into the program. It should be the responsibility of both USAID and the Cooperating Sponsors to incorporate these emphases into water and sanitation projects. The following list is in order of decreasing priority.

- **Water and sanitation projects should be concentrated with other Title II activities in a few geographically-limited areas**

Developmental effects are enhanced when water supply and sanitation activities are concentrated in a limited area and are integrated with other related activities. By themselves, widely-dispersed water and sanitation projects cannot produce much sustainable developmental change. The effects of proximity among water and sanitation projects and integration with other Title II activities can stimulate a development effect in the host community.

- **Effective water and sanitation committees should be established in all project communities**

These committees represent the primary assurance for the long-term sustainability of the systems. To provide this assurance, water and sanitation committees must take responsibility for the management, operation and maintenance of the completed systems. The establishment of effective committees involves a long period of community preparation, promotion of women leaders; technical and management training, spare parts and back-up technical assistance.

- **All projects should draw water from protected sources**

Projects should provide safe water, and in no event should a new project supply water of lower quality than traditional sources. Open water sources, such as unprotected wells and ponds, should not be developed as drinking water supplies unless measures can be put in place to either protect the water from contamination or provide an appropriate level of treatment. Greater efforts should be given to developing water supplies based upon deep boreholes and rainwater harvesting systems.

- **Appropriate health education materials should be developed and disseminated**

Community health is greatly affected by individual behaviors, personal hygiene and domestic sanitation.

Many communities served by Title II projects do not understand well these concepts. Health education programs, methodologies and teaching materials are needed in these communities to enhance the potential health benefits of water and sanitation activities.

- **Active information dissemination and experience-sharing should occur among the Cooperating Sponsors**

There are many examples of successful water and sanitation strategies, methodologies and projects among the Cooperating Sponsors, but the degree of technical expertise and knowledge of successful development applications varies greatly between them. A program of training courses and workshops on relevant technical issues for the organizations involved in Title II can significantly strengthen the program and improve the effectiveness of projects.

7.3 Other Considerations for USAID

- **The relief versus development dilemma in Title II**

Title II of the P.L. 480 Program originated over 40 years ago to provide international food relief to emergency situations arising from civil strife and natural disasters. Over the years, it has channeled food assistance through a variety of PVOs, NGOs and international agencies to meet its original relief objective and increasingly to also serve development needs. Currently, approximately half of Title II resources are devoted to relief and half to development.

The dilemma for the Title II program as it is presently constituted is that the objectives and planning approaches for relief activities are different than those for development activities. The relief approach requires attention to immediate needs where response time is often crucial and the building of long-term human and institutional capacity may not be possible. The development approach, on the other hand, requires attention to long-term capacity building as a means of ensuring sustainability. As a result, relief is intended to serve immediate needs (food, shelter, medical attention) while development is intended to serve longer-term needs (expanded agricultural capacity, upgraded housing, modern health care).

In Ethiopia, the USAID food assistance strategy as set out in Special Objective (SPO 1): *Enhanced Household Food Security in Target Areas* is defined primarily in development terms (increased agricultural production, increased household income, etc.). Program and project planning, however, appear to be based primarily on relief concepts (crop failures, severe malnutrition, etc.). Given the wide range of interventions possible under the Title II program (soil conservation, tree planting, water supplies, road construction, etc.), it would be consistent with a development approach to plan coordinated packages of these interventions to bring about long-term social and economic improvements in selected communities. Yet, this does not seem to be what is happening in Ethiopia under Title II support. Activities funded by the Title II

program seem to be directed at meeting immediate needs for food and work with little obvious relationship to integrated and sustainable development in targeted communities. The consequence of this relief-dominated approach is that the one-half of the Title II program defined as development is not structured to achieve long-term developmental objectives.

It is suggested that USAID consider formally designating some portion of the Title II funding in Ethiopia as development monies subject to project formulation using development methodologies. Cooperating Sponsors should be requested to prepare their program proposals (DAPs) in a manner which distinguishes between relief-oriented activities and development-oriented activities. Subsequent project implementation and eventual evaluation would be carried out according to whether a relief or development approach had been proposed. Making such distinctions in the use of Title II resources would maintain the traditional relief objective of the program but at the same time clearly identify those activities specifically formulated to support sustainable development.

- **Program funding for potable water and sanitation activities**

Many, but not all, of the recommendations in 7.1 and 7.2 require additional funding to be properly implemented. USAID should consider the importance of water and sanitation to long-term development and sustainability of the Title II program and then allocate the funds necessary to support its objectives. Increased funding, however, is not necessarily the only possible action. It may not even be desirable if the Cooperating Sponsors are unable to provide the essential technical and managerial support for a water and sanitation component that is both restructured and enlarged.

A slow but deliberate process of change in the planning and implementation of water and sanitation projects is recommended. The basis of this process would initially involve agreement by the Cooperating Sponsors on which of the recommendations they could progressively adopt and then a reallocation of water and sanitation funds to support the new program strategies. Over a set period of time, say 3 to 5 years, the water and sanitation program would have adopted the new requirements and emphases recommended in this report and the Cooperating Sponsors would have developed new capacities to plan and implement them.

Chapter 8: Training Workshop on Potable Water and Sanitation

8.1 Organization of the Training Workshop

It was anticipated in the objectives of this study that there would be the need to prepare a training module to assist the Cooperating Sponsors in developing sustainable and environmentally sound water and sanitation activities. This report indicates a clear need to strengthen the capacity of the Cooperating Sponsors to plan and implement water and sanitation projects within the Title II program. The following is a description of the nature and content of a training workshop to assist in this process. It addresses the main deficiencies identified in this study and gives particular emphasis to the monitoring and mitigation of environmental and sustainability problems.

Purpose: The purpose of the workshop is to address the problems affecting environmental protection and long-term sustainability which were found in the environmental study of Title II-supported potable water and sanitation projects in Ethiopia.

Description: The workshop should have a duration of five days, including one day spent on a field trip. Each day has a total of at least 8 hours of instruction, discussions and working sessions. A total of 20 to 25 participants can be accommodated in the workshop. Participants are to be drawn from country staffs of the Cooperating Sponsors with special emphasis upon the involvement of senior technical and program development officials. This includes appropriate personnel drawn from both head office and field office locations.

Objectives: The overall objective of the workshop is:

To improve the long-term sustainability and environmental protection of potable water and sanitation activities in the Title II program in Ethiopia.

Specific training objectives are:

- To identify to the participants the key aspects affecting the long-term sustainability and environmental protection of water and sanitation projects;
- To improve the knowledge and skills of staff of the Cooperating Sponsors to plan and implement successful water and sanitation projects;
- To establish a forum for information exchange and sharing of experiences among the Cooperating Sponsors; and

- To give USAID/Ethiopia a mechanism for emphasizing critical issues in the Title II program.

Structure: The workshop is structured around a series of 24 independent modules, each of which deals with a specific topic. The agenda for the basic workshop is designed to serve the needs of senior personnel with varying backgrounds – technical, social/institutional, legal, etc. The course content in this track covers all relevant issues to meet workshop objectives. If it is desired to focus the workshop on specific types of personnel, two alternative specialist tracks are available. The first is directed at personnel mainly concerned with engineering/construction issues, while the second is for personnel working on social/health/institutional issues. By substituting a few specialist modules into the basic workshop program, one or the other of the specialist tracks can be followed. For purposes of simplicity, such substitutions are clustered within to a single day.

Methodology: The learning approach is based on a mix of expert presentations, individual instruction, group discussions and interactive working sessions. Each day includes approximately 5 hours of presentations and group discussions and 3 or more hours of group working sessions. Participants will be encouraged to share their own experiences in the development of water and sanitation activities and thereby establish an informal network for information exchange and technical assistance.

Course modules are independent and self-contained sessions that can be shifted in the workshop program to suit particular needs. Each module has a similar framework consisting of the following:

- topic (description and background of subject matter)
- objectives (specific learning issues to be achieved)
- session outline (sequence of activities and subject matter; identification of main points)
- appropriate technical materials (models, criteria, case studies, reports)
- reference list (further readings)

Workshop manual: There is need to prepare a workshop manual for use by facilitators and participants. This manual should have each of the course modules (described in section 8.2) developed and ready to use in the workshop. The modules could be prepared by external consultants or, alternatively, by the Cooperating Sponsors using experience from Ethiopia as the basis and supplementing it with external technical expertise where necessary.

8.2 Workshop Agenda

The daily agenda for the basic workshop is shown below. Group working sessions in support of modules are not shown. For workshops intended to follow the engineering/construction track or the social/health/institutional track, alternative modules are presented for Day 2.

Day 1

- Module 1: Introduction (1 hr)
- Module 2: Overview of Water and Sanitation in the Title II Program in Ethiopia (2 hrs)
- Module 3: Policy and Legislative Frameworks (1 hr)
- Module 4: Institutional Frameworks (1 hr)

Day 2 Basic Workshop Track

- Module 5: Potable Water Supply and Sanitation Systems (2 hrs)
- Module 6: Water Disinfection (1 hr)
- Module 7: Community Health and Hygiene (1 hr)
- Module 8: Participatory Methods (1 hr)

Day 2 Alternative Engineering/Construction Track

- Module 9: Potable Water Supply Systems (2 hrs)
- Module 6: Water Disinfection (1 hr)
- Module 10: Sanitation Systems (2 hrs)

Day 2 Alternative Social/Health/Institutional Track

- Module 11: Potable Water and Sanitation Systems (1 hr)
- Module 12: Community Health and Hygiene (2 hrs)
- Module 13: Participatory Methods (2 hrs)

Day 3

- Module 14: Water and Health (1 hr)
- Module 15: Sanitary Surveys (1 hr)
- Module 16: Water Quality Monitoring (1 hrs)
- Module 17: Community Participation (1 hr)
- Module 18: Leadership and Empowerment (1 hr)

Day 4

- Module 19: Field Trip (all day)

Day 5

- Module 20: Environmental Protection (1 hr)
- Module 21: Project Sustainability (1 hr)
- Module 22: Project Planning and Organization (1 hr)
- Module 23: Project Monitoring and Record Keeping (1 hr)
- Module 24: Project Appraisal and Evaluation (1 hr)

8.3 Outline of Course Modules

The following indicates the topics and issues to be covered in each module. The full citations to reference materials are given in Annex A.

Module 1: Introduction (1 hr)

- Introduction of participants and facilitators
- Review of workshop agenda and objectives
- Review of workshop approach and methodology
- Administrative issues
- References: Workshop Manual

Module 2: Overview of Water and Sanitation in the Title II Program of Ethiopia (2 hrs)

- Summary presentation of the key issues in all of the modules to give the participants an overview of the Title II program
- References: USAID (2000), Food and Water in Environmentally Sustainable Development

Module 3: Policy and Legislative Frameworks (1 hr)

- Constitutional provisions for water supply and sanitation in Ethiopia
- Water resources policy
- Environmental policy
- Health policy
- Draft water resources management proclamation
- Draft environmental proclamation
- Draft public health proclamation
- USAID environmental procedures in 22 CFR 216
- References: USAID (2000), Food and Water in Environmentally Sustainable Development (chapter 3)

Module 4: Institutional Frameworks (1 hr)

- Federal and regional institutions
- Responsibilities of federal and regional governments in the water sector
- Responsibilities of federal and regional governments for the environment
- Community-based institutions
- NGO framework in Ethiopia
- International donor agencies in Ethiopia

- References: USAID (2000), Food and Water in Environmentally Sustainable Development (chapter 3)

Module 5: Potable Water and Sanitation Systems (2 hrs)

- Descriptive review of water supply systems (protected springs, ponds, hand dug wells, handpumps, roof rainwater catchments, ground rainwater catchments, storage tanks, tap stands)
- Descriptive review of sanitation systems (latrines, showers, clothes washing basins, waste disposal pits, drainage)
- Technology selection
- Factors in planning, design, construction, operation and maintenance
- References: ESRDF (1997), Technical Design Manual; CRDA (1999), Training Manual on Community-Based Water Supply and Sanitation; WHO (1996), Fact Sheets on Environmental Sanitation

Module 6: Water Disinfection (1 hr)

- Purpose of disinfection
- Types of disinfection methods
- Disinfection of springs and wells
- References: WASH (1992), Disinfection for Rural Community Water Supply Systems in Developing Countries; WHO (1996), Facts Sheets on Environmental Sanitation; Water Research Centre (1989), Disinfection of Rural and Small-Community Water Supplies: A Manual for Design and Construction

Module 7: Community Health and Hygiene (1 hr)

- Environmental hygiene
- Diseases related to unsafe water and poor environmental sanitation
- Methods of disease transmission
- Health hazards of water and sanitation systems
- Role of health promotion and hygiene education

- References: USAID (2000), Food and Water in Environmentally Sustainable Development (chapter 5.3)

Module 8: Participatory Methods (1 hr)

- Purpose of participation
- Methods of participation
- Role of facilitator
- References: L.Srinivasan (1990), Tools for Community Participation; WHO (1996), The PHAST Initiative – Participatory Hygiene and Sanitation Transformation

Module 9: Potable Water Supply Systems (2 hrs)

- Identification of water sources
- Methods of groundwater exploration
- Basic water supply facilities (protected springs, tap stands, open wells, ponds)
- Engineered water supply systems (handpumps, boreholes, storage tanks, distribution piping, rainfall harvesting, water treatment)
- Borehole siting and drilling
- Technology selection
- Factors in planning, design, construction, operation and maintenance
- References: E.H.Hofkes (1983), Small Community Water Supplies: Technology of Small Water Supply Systems in Developing Countries; WHO (1996), Fact Sheets on Environmental Sanitation; CARE (2000), Best Practice Sourcebook on Water, Sanitation and Environmental Health (in press)

Module 10: Sanitation Systems (2 hrs)

- Purpose of sanitation
- Methods of excreta disposal (communal latrines, household latrines, buckets, cartage)
- Technical aspects of latrines (pit, floor slab, superstructure, vent pipe)
- Showers and hand washing facilities

- Drainage around water points
- Technology selection
- Factors in planning, design, construction, use and maintenance
- Sanitation promotion
- References: R. Franceys et al (1992), A Guide to the Development of On-Site Sanitation; WHO (1996), Fact Sheets on Environmental Sanitation; CARE (2000), Best Practice Sourcebook on Water, Sanitation and Environmental Health (in press); M.Simpson-Hebert and S.Wood (1998), Sanitation Promotion

Module 11: Potable Water and Sanitation Systems (1 hr)

- Similar to Module 5 but reduced from 2 hours to 1 hour

Module 12: Community Health and Hygiene (2 hrs)

- Similar to Module 7 but increased from 1 hour to 2 hours

Module 13: Participatory Methods (2 hrs)

- Similar to Module 8 but increased from 1 hour to 2 hours

Module 14: Water and Health (1 hr)

- Review of water-related diseases
- Water uses and health
- Effects of quantity versus quality
- Awareness raising and behavior change
- References: USAID (2000), Food and Water in Environmentally Sustainable Development (chapter 5.3 and 5.4); WHO (1996), Fact Sheets on Environmental Sanitation; S.A.Esrey (1991), "Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhoea, Dracunculiasis, Hookworm Infection, Schistosomiasis and Trachoma," Bulletin of the World Health Organization

Module 15: Sanitary Surveys (1 hr)

- Purpose of sanitary surveys
- Potential sources of contamination

- Estimating health risks
- Preparing a site sketch
- Preparing a survey report
- References: B.Lloyd and R.Helmer (1991), Surveillance of Drinking Water Quality in Rural Areas; WHO (1996), Fact Sheets on Environmental Sanitation

Module 16: Water Quality Monitoring (1 hr)

- Purpose of water quality monitoring
- Biological issues (bacteria, parasites)
- Chemical issues (fluorides, nitrates, arsenic)
- Water quality standards (international, Ethiopian, Title II)
- Water sampling
- Laboratory testing
- Field testing
- Water quality indicators
- References: WHO (1993), Guidelines for Drinking-Water Quality (3 vols.); USAID (2000), Food and Water in Environmentally Sustainable Development (chapter 5.4)

Module 17: Community Participation

- Characteristics of community participation
- Role of the Cooperating Sponsor
- Role of water and sanitation committees
- Role of women
- Mobilization and promotion of community involvement
- References: L.Srinavasan (1990), Tools for Community Participation; C. McCommon et al (1990), Community Management of Rural Water Supply and Sanitation Services; USAID (2000), Food and Water in Environmentally Sustainable Development (chapter 5.5)

Module 18: Leadership and Empowerment

- Characteristics of leadership
- Sources of community leadership
- Empowerment of women
- Effects upon project sustainability
- Role of Cooperating Sponsor
- References: W.Wakeman (1995), Gender Issues Sourcebook for Water and Sanitation Projects; Reports and materials from USAID/Winrock EMPOWER Project

Module 19: Field Trip

- One or more field sites to observe practical applications of the implementation of water and sanitation activities under Title II
- Discussions with water and sanitation committees, community leaders, and officials from the water and health regional bureaus

Module 20: Environmental Protection

- Environmental issues in Title II projects
- Causes of environmental problems
- Indicators of environmental impacts
- Mitigating measures
- References: USAID (2000), Food and Water in Environmentally Sustainable Development (chapters 5 and 6); A.Wyatt et al ((1992), Environmental Guidelines for PVOs and NGOs: Potable Water and Sanitation Projects; W.I.Knausenberger et al (eds.) (1996), Environmental Guidelines for Small-Scale Activities in Africa

Module 21: Project Sustainability

- Sustainability issues in Title II projects
- Causes of sustainability problems
- Indicators of sustainability impacts

- Mitigating measures
- References: USAID (2000), Food and Water in Environmentally Sustainable Development (chapters 5 and 6); A.Wyatt et al ((1992), Environmental Guidelines for PVOs and NGOs: Potable Water and Sanitation Projects; W.I.Knausenberger et al (eds.) (1996), Environmental Guidelines for Small-Scale Activities in Africa

Module 22: Project Planning and Organization

- Setting project objectives
- Sources of information
- Site visit
- Community involvement
- Technical design
- Costs and resource needs
- Implementation schedule
- Role of Cooperating Sponsor
- References: WHO (1996), Facts Sheets on Environmental Sanitation; R.Franceys et al (1992), A Guide to the Development of On-Site Sanitation

Module 23: Project Monitoring and Record Keeping

- Information requirements
- Sanitary surveys
- Water quality data
- Water source measurements
- Project plans and designs
- Operational records
- References: P. Billig et al (1999), Water and Sanitation Indicators Measurement Guide; WHO (1997), Guidelines for Drinking-Water Quality (vol. 3)

Module 24: Project Appraisal and Evaluation

- Types of evaluation
- Baseline information
- Data collection
- Participatory Rural Appraisal
- References: P. Roark (1990), Evaluation Guidelines for Community-Based Water and Sanitation Projects, D.Nayaran (1993), Participatory Evaluation: Tools for Measuring Change in Water and Sanitation.

Annex A: Relevant Documents and References

General References and Background Information

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Annex B: List of Officials Interviewed

In Addis Ababa:	
USAID	
David Eckerson	Deputy Mission Director
Timothy Shortley	Head, Food and Humanitarian Assistance, tel 51 07 06
Dennis Panther	Agriculture & Natural Resources, tel 51 07 13
Elizabeth Lukasavich	Food and Humanitarian Assistance, tel 51 00 88
CARE	
Salvador R. Baldizon	Food Sector Coordinator, tel 61 34 22
Fikre Negussie	Coordinator, Food Information Systems Project
Sorssa Natea	Project Coordinator
Zewdie Serbano	Project Coordinator, Addis Ababa Urban Food-for-Work Project
Tedla Assefa	Project Coordinator, East Hararghe
Ed Shea	Project Coordinator, West Hararghe
Catholic Relief Services (CRS)	
Anne Bouquet	Assistant Country Representative
Amsalu Gebre Selassie	Head, Program Department
Dr Merid Mekonnen	Head, Technical Support Section
Hanna Dagnachew	Head, Health Unit
Bekele Abaire	Project Officer, Water and Sanitation
Ethiopian Orthodox Church (EOC)	
Rufael Kendie	Food Security Officer
Haddish Asghedom	Food Security Program Coordinator
Gashaye Chekol	Water Engineer
Food for the Hungry International (FHI)	
Thomas A Stocker	Country Director, tel 66 02 61
Endalkachew Getaneh	Co-Director of Programmes, tel 09-20 22 57
Ato Biruk	Monitoring and Evaluation Officer
Relief Society of Tigray (REST)	
Maria Strintzos	Public Relations, tel 51 43 78
Save the Children/USA (SCF)	
Jay Zimmerman	Field Office Director, tel 65 32 83
Joyce LeMelle	Programme Director, tel 65 59 68
World Vision International (WVI)	
Mulugeta Dejenu	Bi-Multilateral programs Manager, tel 61 21 11
Mengistu Buta	Rural Water Supply and Sanitation, tel 61 21 11
Million Solomon	Water Officer
Environmental Protection Authority	
Worku Damena	Head, Environmental Protection Policy and Legislation Department, tel 18 61 81
Tequam Tesfamariam	Leader, Environmental Pollution and Hazardous Waste Management
Ministry of Agriculture	
Dr Bateno Kabeto	Head, Crop Production & Protection Technology & Regulatory Department
Biratu Oljira	Pesticides Chemist, Crop Production & Protection Technology & Regulatory Department
Ministry of Health	
Muchie Kidanu Workineh	Head, Water Quality Control & Waste Management Team, Department of Hygiene and Environment, tel 15 66 70
Worku G./Selassie Wolle	Head Hygiene & Quarantine Control Team, Department of Hygiene & Environment, tel 51 52 76

Ethiopian Social Rehabilitation and Development Fund (ESRDF)	
Gedlu Sima	Acting Team Leader, Rural Water Supply and Sanitation, tel 12 34 03
Fikru Tesfaye	Economist (Senior Expert, Rural Water Supply and Sanitation), tel 12 34 03
Merid Atnafu	Sanitary Engineer (Senior Expert, Rural Water Supply and Sanitation), tel 12 34 03
UNICEF	
Colin Davis	Head, Watsan Office
WHO	
Dr Michel Jan Cloes	Representative, tel 53 15 50
Winrock International Ethiopia	
Jember Wolde Mariam	Training Coordinator, EMPOWER Project, tel 65 55 37
Field Visits:	
In Addis Ababa (21 Oct 1999):	
Tesfaye Kunbi	Senior Construction Engineer, Urban Food for Work Project, CARE
Sefialem Liben	Chairman, Water and Health Committee, Woreda 28, Kabele 02
In Mekele (25 Oct 1999):	
Berhane Gebru	Head Rural Water Supply Development Department, REST
Getachew Haile	Head, Hand Dug Wells and Springs Development Division, REST
Abraha Ghidey	Head, Monitoring and Evaluation Unit, REST
Berhanu Wendaferew	Head, Tigray Water, Mines & Energy Bureau, tel 04-40 02 68
Dr Mengistu Mesfin	Head, Department for Disease Prevention, Bureau of Health
Abebe H. Mariam	Head, Water Department, tel 4 49 08 46
Tamrat Belay	Vice-Chairman, Women's Association of Tigray
In Michew (27 Oct 1999):	
Endamehoni Bogale	Project Coordinator, Endamehoni Food Security Project, EOC
In Wadla (28 Oct 1999):	
Bikes Bezah	Accountant, Wadla Food Security Project, EOC
In Nefas Mocha (29-30 Oct 1999):	
Yohannes Belihu	Project Manager, Lay Gayint Integrated Food Security Project, FHI
Mulugeta Azeze	Water Team Leader, Lay Gayint IFSP, FHI
	Study and Design Expert, Zonal Department of Water, Debra Tabok
Alebachew Kassa	Head, Woreda Water Assistance, Lay Gayint
Melese Wosen	Director, Yessero Elementary School, Lay Gayint
Mekursa Belachew	Team Leader, Woreda Health Office
Silessi Tessera	Project Manager, Tach Gayint Integrated Food Security Project (IFSP), FHI
Friehiwet Kassahun	Community Health Nurse, Tach Gayint IFSP, FHI
Gebreyesus Tenagashaw	Community Empowerment Programme Officer, Tach Gayint IFSP, FHI
Abayneh Mechal	Water Team Leader, Woreda Water Office
In Nazereth (3 Nov 1999):	
Sorsa Natea	Project Coordinator, Shoa Health, Education, Water and Agriculture (SHEWA) Project, CARE
Ashenafi Zerihuri	Site Supervisor, SHEWA Project, CARE
Mulugeta Yeshitila	Site Supervisor, SHEWA Project, CARE
Seblegenet Zemdie	Supervisor, Family Planning/AIDS, CARE
Dr Jemal Adem	Head, Zonal Health Bureau
Mulugeta Angaw	Sanitarian, Zonal Health Bureau
In Negelle (8-10 Nov 1999)	

Abraham Bongassie	Project Manager, Liben Project, SCF
Dereje Jesa	Food Security Programme Coordinator, SCF
Gomfa Bayiosa	Infrastructure and Water Development Coordinator, SCF
Mezgebu Onaka	(Acting) Health and Child Survival Programme Coordinator, SCF
Merid Kebede	Assistant Food Security Officer, SCF
Beriso Kilta	Extension Agent, SCF
Dr Assefa Seme Deresse	Head, Zonal Health Department, tel 45 01 12
Girma Senbeta Ararso	Head Rural Development Department, Zonal Water, Mines and Energy
In Woreda Adama (11 Nov 1999)	
Dawit Hagos	Grant Officer/Food Programmer, Adama Area Development Programme, WVI
Kahede Kwehi	Community Health Worker, Adama Area Development Programme
In Tiya (12 Nov 1999)	
Taye Yadessa	Project Development Coordinator, WVI
Mengistu Buta	Title II Projects Coordinator, WVI
Haile Mariam Gebre	Teacher, Haro Junior Seconday School
In Dire Dawa Administrative Council (15-16 Nov 1999)	
Belihu Negesse	Dap Programme Coordinator, Hararghe Catholic Secretariat (HCS), Dire Dawa
Dubale Worku	Water Technician, HCS, Dire Dawa
Tewodros Hailu	Kombolecha Wereda Coordinator, HCS
Bekele Abaire	Water and Sanitation Project Officer, CRS, Addis Ababa
Yetemwork Petros	Health Animator, HCS, Meiai Village
Morsel Belayneh	Health Animator, HCS, Meiai Village
Afudi Ahmad	Health Animator, HCS, Meiai Village
Konchiwedwa Lema	Health Animator, HCS, Meiai Village
In Garamuleta Zone, Grawa Woreda (17-18 Nov 1999)	
Taye Dejene	Asst Project Manager, Garamuleta Rehabilitation and Development Project, CARE, Dire Dawa
Deriba Kebede	Field Officer, Micronutrient and Health Initiative (MICAH), CARE, Dire Dawa
In Washington DC (8-19 Dec 1999)	
Dr Carl M. Gallegos	Deputy Director, Agriculture, Natural Resources & Rural Enterprise Division, Africa Bureau Environmental Coordinator, USAID/AFR/SD/ANRE, tel (202) 712-5535
J. Paul E. Des Rosiers	Environmental Officer, Bureau for Global Programs/Bureau for Humanitarian Response, USAID/G/ENV/ENG, tel (202) 712-1873
Dr John E. Borrazzo	Environmental Health Advisor, Office of Health and Nutrition, USAID/G/PHN/HN/EH, tel (202) 712-4816
Dr John H. Austin	Environmental Health Advisor, USAID/G/PHN/HN/EH, tel (202) 712-5763
Dr Matthew C. Lynch	Environmental Health Technical Advisor, USAID/G/PHN/HN/EH, tel (202) 712-0644
Craig Hafner	Deputy Director, USAID Environmental Health Project, tel (703) 247-8730
Charlotte Bingham	Environmental Officer, World Bank
Thomas Gardiner	Director, Natural Resources Management, ACDI/VOCA, tel (202) 879-0264
Dr C. Gaye Burpee	Senior Technical Advisor, Agriculture/Environment, CRS, tel (410) 625-2220
Paige Harrigan	Deputy Coordinator, Food Aid Management, tel (202) 544-6972
Ellen Wertheimer	Associate Director, OIC International, tel (215) 842-0220

Annex C: Study Team Members

Dr Dennis B. Warner. Team Leader. Independent consultant. Development planner with over 30 years experience with water supply, sanitation and environment planning and implementation in more than 40 countries. Former head of water supply, sanitation and rural environmental health for the World Health Organization, and former director of the USAID Water and Sanitation for Health (WASH) Project. Ph.D. in civil engineering (engineering-economic planning) from Stanford University (USA).

Dr Carmela R. Green-Abate. Environmental health specialist. Independent consultant. Twenty-five years wide-ranging experience in child health in Ethiopia at primary and tertiary levels, including undergraduate and postgraduate teaching and ongoing clinical research. Former health sector senior technical advisor for six years with USAID in Ethiopia with oversight of HIV/AIDS and child survival programs. Sixteen years experience in community development activities with NGOs including establishing, organizing and providing management oversight of an indigenous NGO. International research links with universities in the UK and USA. M.B. and B.S. in medicine from the University of London (UK).

Dr Addis Allem Zeleke. Hydrogeology and water resources specialist. Independent consultant. Over 16 years experience in hydroeological research and field applications of groundwater studies, geotechnical investigations and drilling. Eight years direct experience as geologist, mineral and water resources development sector coordinator and hydrogeological project manager in Ethiopia. Ph.D. in geotechnics from the Universite Libre de Bruxelles (Belgium).

Dr Aberra Geyid. Water quality and microbiology specialist. Director of Ethiopia Health and Nutrition Research Institute In Addis Ababa. Twenty-one years experience as a biologist, microbiologist, nutritionist and water quality chemist with government reserarch institutes in Ethiopia. External examiner for M.Sc. candidates at the Addis Ababa Medical School. Ph.D. in molecular chemistry/microbiology at Addis Ababa University (Ethiopia) and Lund University (Sweden).

Ato Nuri Kedir. Community participation and gender specialist. Independent consultant. Twenty-two years experience in smallholder agricultural development with both government and NGOs. Former head of socio-economic research in Ministry of Agriculture. Specialized experience in project planning, monitoring and evaluation and in food security and gender-related development. Workshop facilitator for development training courses in Ethiopia. M.Sc. in development economics from the University of Queensland (Australia).

Ato Imeru Tamrat Yigezu. Policy, legislative and institutional specialist. Food rights campaign coordinator for ActionAid-Ethiopia. Twelve years experience as a senior policy and legal expert on water resources and water law in both Ethiopia and countries of Africa. Member of official delegations to the United Nations, OAU Council of Ministers, World Bank and Nile river basin organizations. LLM in international natural resources and environmental law from the University of London (UK).

Ato Yesuf Abdella. Rural water supply and sanitation specialist. Technical officer/program monitor with USAID/Ethiopia. Over 13 years experience in rural infrastructure and natural resources development, with emphasis in rural water supply, for government and the ESRDF in northeastern Ethiopia. Also small-scale civil works consultant for UNOPS/UNDP in the Arsi-Bale Rural Development Project. M.Sc. in irrigation engineering from the Institute of Irrigation Studies, Southampton (UK).

Ato Aberra Olijirra. NGO water and sanitation specialist (agricultural engineer). Assistant project coordinator for CARE in the Nazereth field office. Responsible for planning and managing CARE water, sanitation and irrigation activities in East Shoa Zone.

Mr. M. Nassirou Ba. NGO development specialist (development economist). Food security officer for SCF/USA in Addis Ababa. Extensive experience in the planning and evaluation of food security programs in both Ethiopia and other countries.

Annex D: Study Methodology

The methodology of this study was designed to be both participatory and interactive. It was participatory in that all individuals and organizations which had significant involvement with Title II-supported water and sanitation projects were encouraged to be full partners in the study. It was interactive in that these same individuals and organizations were also encouraged to take an active role in the reviews, discussions and critiques of the study, the Study Team and their work. This approach was taken because it was believed to be important to develop a sense of understanding of the study and ownership of its conclusions. That these ambitious objectives were not always achieved is, perhaps, understandable, given the complexity of the subject and the numerous perspectives of the participants.

The methodology underlying this approach is as follows:

Terms of Reference

The initial definition of this study was set out in a scope of work (SOW) prepared by USAID in mid-1998. This SOW called for a "scoping process" by an expert in potable water and sanitation to include (1) a review of the "scoping document" being prepared at that time for a Programmatic Environmental Assessment (PEA) of small-scale irrigation activities in Ethiopia, (2) to meet with USAID, Cooperating Sponsors, donors and government institutions, (3) to identify likely members of the Study Team and (4) to prepare a scoping document (i.e. terms of reference) for an environmental study of potable water and sanitation in the Title II program in Ethiopia. The work was requested of International Resources Group Ltd under their Indefinite Quantity Contract (IQC) with USAID for Environmental Policy and Institutional Strengthening (EPIQ) services. IRG subsequently subcontracted the task to Winrock International, which managed both the scoping process and the later environmental study. Winrock also recruited the expert for the scoping process and hired the consultants which participated in the study.

The preparation of the scoping document was carried out by the expert designated as Team Leader of the environmental study. He visited Ethiopia over the period 28 August – 9 September 1999 to develop the subsequent study and prepare detailed terms of reference for it and the consultant team. The objectives developed for the environmental study are shown in chapter 2.3. (It should be noted that these objectives implicitly require a participatory and interactive approach if they are to be achieved.)

The scoping document for the study was accepted by USAID in late September 1999. The expert returned to Ethiopia, where he acted as Team Leader for the study over the period 9 October-2 December 1999. Draft report preparation was directed by the Team Leader from his

home over the period December 1999 to late-February 2000, when the final report was submitted to USAID.

Recruitment of Consultants

The Study Team consisted of the Team Leader, five independent consultants, two representatives from Cooperating Sponsors and one from USAID. Outside of the Team Leader and the Environmental Health Specialist who has long-term experience in Ethiopia, all team members were Ethiopian nationals. The Environmental Health Specialist also had served on the earlier team that carried out the PEA of small-scale irrigation activities for USAID and, therefore, provided a valuable link to the environmental perspective of the earlier assessment. The independent consultants were recruited from candidates identified by the Cooperating Sponsors and others familiar with Ethiopian professional resources to fill specific roles set out in the scoping document. Detailed scopes of work prepared during the scoping exercise were used to match candidates to tasks in the study. All candidates were interviewed by the Team Leader who made the final selection of personnel. The two representatives of Cooperating Sponsors who participated on the team did so for limited periods of time. The representative from USAID was available for approximately the entire period that the team functioned as a group, mid-October to 2 December.

Team Planning

Following recruitment of the consultants, a week-long team planning exercise was held 18-22 October to review the tasks of the study, to develop an agreed methodological approach and to build a sense of teamwork among the members of the team. The approach used in this team building activity was adopted from the successful approach developed for consultant teams by the USAID Water and Sanitation for Health (WASH) project[50]. During the week, the team spent a total of three days in discussions of the terms of reference, objectives, identification of clients, individual roles and responsibilities of team members, outputs, work plan, field schedule and logistical arrangements. These discussions were important not only to define the study but also to understand the philosophical background to environmental concerns in the Title II program. During this period, the Team Leader made presentations to the Cooperating Sponsors (20 October) and USAID (21 October) summarizing the team's approach to the study. The team spent the final day testing its field procedures in a visit to Title II-supported water and sanitation projects in the peri-urban areas of Addis Ababa.

[50]Gormley, W. and F. Rosensweig (1985). **Facilitator Guide for Conducting a Team Planning Meeting**. WASH Technical Report No. 32. Washington DC: USAID

Information Collection

Background information relevant to the study was distributed to the team members at the team planning meeting. General information, such as IEEs, DAPs and other reports by Cooperating Sponsors and USAID, were made available to participants either as copies or in a circulating pool of documents. The team members were expected to use their professional contacts in government and the NGO community to identify and collect the specific information necessary to carry out his or her individual scope of work. The Team Leader coordinated this process and served as the official contact with USAID and the Cooperating Sponsors. Frequent informal team meetings throughout the study were used to highlight any questions or difficulties regarding information collection.

Field Visits

A total of five field trips were made in the course of the study. One major trip was to the north (Tigray and Amhara Regions), another to the south (Borena Zone) and the center (North Shewa and Guraghe Zones), and a third to the east (East Hararghe Zone). In addition, day trips were made to Addis Ababa peri-urban areas and to North Shewa Zone. The objective of the field trips was to visit several field sites of each Cooperating Sponsor implementing potable water and sanitation activities. The overall schedule of field trips was set by the team, but the specific sites visited were based on suggestions by the Cooperating Sponsors. Important criteria for site selection was to include a range of different technologies and to visit projects representative of each Cooperating Sponsor's program of work.

A total of 19 days were spent in the field travelling and visiting project sites. Normal practice was to first visit the field office of the Cooperating Sponsor, discuss the water and sanitation program in that area and then to visit selected sites. Overall, the team visited 38 field sites implemented under Title II or, in a few cases, implemented by a Cooperating Sponsor in the Title II manner but using funds from another source. The types of technologies observed included ponds (4), springs (10), hand dug wells (10), boreholes (2), roof rainwater catchments (3), ground rainwater catchments (3), latrines (10), showers (2), clothes washing basins (3) and cattle troughs (9).

Without the close cooperation and strong logistical support of the Cooperating Sponsors, the above field visits could not have been accomplished. To minimize transport needs, the team traveled by air to each of the major field localities (north, south and east), where it was provided with transport and senior technical staff assistance while in the development area of each Cooperating Sponsor. Government officials from the regional water and health bureaus also participated in some of the field visits. Upon completion of field visits with each Cooperating Sponsor, the team with transport to reach the next Cooperating Sponsor.

Information Analysis

The compilation and analysis of information was carried both by the individual team members and by the entire team during frequent, but informal, team meetings. This practice took place both in Addis Ababa and in the field. After each day in the field, the team met to review the positive and negative aspects of each project and to identify potential mitigations. These discussions formed the basis of team consensus on program issues, impacts, conclusions and recommendations. Notes of the main points of these meetings were circulated among the team members.

Upon return from the field, the Team Leader met informally with each Cooperating Sponsor to give a frank assessment of the projects seen by the team. (As the technical representatives of REST are not stationed in Addis Ababa, a telephone call was used to give REST the above assessment.) These meetings provided an off-the-record opportunity for the Cooperating Sponsors to hear technical comments from the team that were not intended for the final report to USAID.

The above process of information assessment, site reviews and team discussions allowed the team to formulate preliminary conclusions and recommendations shortly after the completion of the field visits. These preliminary findings were presented at meetings with USAID and the Cooperative Sponsors before departure of the Team Leader from Addis Ababa on 2 December.

Report Preparation

Prior to the mid-point of the study, the team developed a draft outline of the final report as a means of highlighting the specific contributions expected from each of the team members. Overall progress was reported to USAID at a mid-study review meeting on 4 November, along with a description of study methodology, key issues affecting environmental protection and project sustainability, and proposals for the remainder of the study. Other issues discussed at this meeting included program philosophy, regulatory frameworks and the preparation of a training manual. USAID accepted the suggestion of the Team Leader that the training module comprise a descriptive outline for a one-week course addressing the key weaknesses in planning and implementing water and sanitation projects in the Title II program.

The team spent the final two weeks of the study in Addis Ababa completing information collection and interviews, revising conclusions and recommendations, preparing draft sections of the final report. A final debriefing on the findings of the study was held with USAID on 24 November and with the Cooperating Sponsors on 1 December. The following provisional information was presented at these meetings: report outline, major deficiencies in the program, environmental impacts, sustainability impacts, monitoring indicators, mitigation measures, recommendations and outline of the training workshop. The reaction of USAID and the

Cooperating Sponsors to these presentations was generally favorable, but concern was expressed regarding the implementation of some recommendations. Members of the team submitted to the Team Leader their draft reports before he left Addis Ababa.

Upon leaving Ethiopia, the Team Leader proceeded to Washington DC where he spent 8-10 December discussing the Ethiopian study and general issues of environmental protection with USAID and Winrock International. On 10 December, he presented the study and its findings to a meeting of the Environmental Working Group, which is a joint USAID and PVO group concerned with issues of food aid, humanitarian relief and development. The Team Leader then returned to his home in France and, with the assistance of several team members in Addis Ababa, prepared the first draft of the study report, which was submitted to USAID on 30 January 2000. This draft not only incorporated the findings and conclusions of the study team but also tried to take account of the comments and reactions of USAID and the Cooperating Sponsors during the various study review meetings.

Administrative Arrangements

USAID and the Cooperative Sponsors were highly supportive of the above process and often provided significant assistance to the team. In particular, SCF/USA provided an office for the Team Leader, a meeting room for team sessions and miscellaneous administrative and transport assistance in Addis Ababa. The EMPOWER Project, a USAID project managed by Winrock International, also assisted the study with administrative and financial management support to the consultants.

Annex E: Study Schedule of Activities

Activity		October 1999			November 1999					December 1999				January 2000					February 2000			
	Date	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28
Recruitment of team	11-18	xxx																				
Team Planning Activities	18-23		xxx																			
Field visit: Addis (CARE)	22		x																			
Fly to Makelle	25			x																		
Field visit: Tigray (REST)	25-26			xx																		
Field visit: Welo: Michew, Wadla (EOC)	27-28			xx																		
Field visit: S. Gondor: Lay Gaynt, Tatch Gaynt (FHI)	29-30			xx																		
Fly to Addis from Bahar Dar	31			x																		
Team discussions	1-6				xxx																	
Field visit: Nazareth (CARE)	3				x																	
Mid-study review with USAID	4				x																	
Fly to Negelle	7					x																
Field visit: Liben Woreda: Jidolo, Hadessa, Mucho (SCF)	8-10					xx																
Drive to Awassa	10					x																
Drive to Nazereth: field visit: Adama Woreda (WVI)	11					x																
Drive to Tiya; field visit: Tiya (WVI); return to Addis	12					x																
Report preparation	13					x																
Fly to Dire Dawa	15						x															
Field visit: E. Hararghe: Dire Dawa, Harar (CRS)	15-16						xx															
Field visit: E. Hararghe: Garamuleta, Grawa (CARE)	17						x															
Fly to Addis Ababa	18						x															
Report preparation	19-27						x	xxx														
Debriefing for USAID	24							x														
Debriefing for Coop. Sponsors	1								x													
Team leader depart Ethiopia	2								x													
Visit to AID/W; present preliminary draft report	8-10									xx												
Prepare first draft report	15Dec-										xxx	xxx	xxx	xxx	xxx	xxx	xxx					

Activity		October 1999			November 1999					December 1999				January 2000					February 2000			
	Date	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28
	30Jan																					
Submit first draft report	31																					
USAID review and comment	1-13																	xx	xx			
Submit second draft report	12																					
USAID review and comment	14-26																			xx	xx	
Submit final report	29																					

Annex F: Team Activity Log

Date	Activity
09/10	Team Leader arrives in Ethiopia
10/10	Initial contacts with USAID and potential team members
11/10	Discussions with potential team members and SCF/USA
12/10	Recruitment of team members (cont.)
13/10	Meeting with USAID (T. Shortley and D. Panther); visit EMPOWER office
14/10	Meeting with Ministry of Health; recruitment of team members (cont.)
15/10	Meeting with Cooperating Sponsors; complete recruitment of team members
16/10	Prepare team materials; review documents
17/10	Prepare team materials; review documents
18/10	Team planning meeting
19/10	Review documents; prepare study schedule
20/10	Team planning meeting; meeting with Cooperating Sponsors
21/10	USAID contracts office; team planning meeting
22/10	Field visit to CARE sanitation activities in Addis Ababa; team review of work to date
23/10	Discussions with team members; prepare for field trip
24/10	Review documents; prepare for field trip
25/10	Fly to Mekele; meetings with REST, Bureau of Water and Bureau of Health
26/10	Field visits to REST sites in Degna Tembene Woredo (dug wells and protected spring) and Abergel Woreda (borehole)
27/10	Drive to Waldiya; visit to EOC office in Michew and field site in Endamehoni Woreda (protected spring and cattle trough)
28/10	Drive to Lalibela; visit to EOC office in Waldiya and field site in Wadla Woreda (protected spring)
29/10	Drive to Nefas Mewcha; visit to FHI office and field sites in Lay Gyint (protected springs, school latrines and household latrines)
30/10	Drive to Bahar Dar; visit to FHU field sites in Lay Gyint Woreda (dug wells and school latrines) and Tach Gyint (sanitation compound with public showers, latrines and washing basins; dug well and other sanitation facilities)
31/10	Fly to Addis Ababa
01/11	Team meeting to review field visits, prepare mid-study review for USAID and plan remaining field trips
02/11	Team meeting to plan final report and training module; meeting with FHI to review field visits
03/11	Field visit to CARE project office in Nazereth and field sites in Bosset Woreda (ground rainwater catchments)
04/11	Team meeting on study progress; mid-study review with USAID
05/11	Meetings with ESRDF and UNICEF
06/11	Review documents; prepare for field trip
07/11	Fly to Negelle
08/11	Field visit to SCF field site in Liben Woreda (Jidola rehabilitated pond); meetings with SCF, Zonal Health Dept and Zonal Water Dept
09/11	Field visit to SCF site in Liben Woreda (Hadessa rehabilitated well); meeting with SCF
10/11	Drive to Awasa; field visit to SCF site in Liben Woreda (Mucho rehabilitated well)
11/11	Drive to Nazereth; visit to WV office and field site in Adama Woreda (Alen Kabete pond)
12/11	Drive to Tiya and Addis Ababa; visit to WV office and field sites in Tiya PA (borehole, distribution system, latrines, pond, roof rainwater catchment)
13/11	Review notes, prepare for field trip
14/11	Review notes, prepare for field trip
15/11	Fly to Dire Dawa; visits to HCS office and field sites in Legeoda Mirga PA (protected springs, dug wells and cattle pond)
16/11	Field visit to HCS sites in Jarso Woreda (protected spring) and Harare Region (roof rainwater catchment)
17/11	Visit to CARE project office in Dire Dawa and field sites in Garamuleta (protected spring, latrine, dug well and roof rainwater catchment)
18/11	Meeting with CARE project staff in Dire Dawa; fly to Addis Ababa
19/11	Report preparation; meeting with CARE to review field visits
20/11	Report preparation
21/11	Report preparation
22/11	Team meeting on findings, conclusions and recommendations; meeting with EPA
23/11	Report preparation
24/11	Study de-briefing with USAID
25/11	Report preparation; meeting with CRS to discuss field visits

Date	Activity
26/11	Meeting with WVI to discuss field visits; meeting with Ministry of Agriculture
27/11	Report preparation
28/11	Report preparation; discussion on report chapters
29/11	Report preparation
30/11	Report preparation; meeting with EOC on field visits
01/12	Study de-briefing with Cooperating Sponsors; meeting with WHO; telephone call with REST to discuss field visits
02/12	Meeting with SCF to discuss field visits; final inputs from team members; team leader depart Ethiopia