ASSESSING PROGRESS OF COMMUNITY MANAGED GRAVITY FLOW WATER SUPPLY SYSTEMS USING RAPID RURAL APPRASIAL IN THE IKONGO DISTRICT, MADAGASCAR

By

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This report "Assessing Progress of Community Managed Gravity Flow Water Supply Systems in the Ikongo District, Madagascar" is hereby approved in partial fulfillment of the requirements for the Degree of MASTER OF SCIENCE IN ENVIRONMENTAL ENGINEERING.

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Preface

Inspiration for this report came from the author's experiences while serving as an Environment Peace Corps volunteer from 2003-2005 in rural Madagascar. After three months of training, I was placed in the rural village of Ikongo, spiritual home of the Antanala, a small ethnic group who lives in the southeastern part of the country. With support from the regional USAID projects, I was quickly integrated into ongoing development activities aimed at intensifying agriculture and improving public health in the region. Because of my background in environmental engineering, I developed a niche as a water and sanitation specialist providing support to multiple NGO's working in the region. During my three years of service, I was involved in many projects including latrine building, handwashing promotion and the construction of six gravity flow water systems; providing potable water to a population of over 5,000.

During this time, I was part a working environment with no regulatory oversight in which a group of men with little more than a hammer and a stamp could bid on (and sometimes win) projects in which they would be then responsible for the construction of gravity fed water supply systems in rural areas. These contractors had little regard for long term system sustainability. Due to budget constraints and shortsightedness when planning projects, little time was spent building community management capacity in villages that received water supply systems.

It is in this framework that I write this report. This is my attempt to give a voice to all those who now live in villages with broken water systems partly because their system was built by a inept contractor or whose community was were never properly empowered to manage their system. Also, to plead with the thousands who wait indefinitely for the chance to taste clean water, that when their time comes *we* will be there to empower and support them.

This report is submitted to complete my master's degree in environmental engineering from the Master's International Program in Civil and Environmental Engineering at Michigan Technological University.

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Special thanks as well to my parents and sister for their support during my PC service. Even though I was half way around the world, I never felt that far from home…

I must also thank Mark and Karen Shoemaker Freudenberger for their guidance and support during my PC service. Their belief in my abilities gave me many opportunities to grow both personally and professionally.

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No amount of thanks can rightfully expressed to the people of Ikongo who led me on a journey that I will cherish forever. Specifically, Alphonce and his family who adopted me as one of their own. Also, to my foreman, Morris and Indrina, who believed in my work long before I could speak their language well enough to properly explain it to them. Without their dedication and hard work none of my major projects would have been possible.

Farany, Tsy maintsy hanome fisorana manokana amin'ny Ranirisoa Andreas Annick aho. Tsy nety nahavita ny fanadhadihana momba ny fitanatanan fotodrafitra asa rano fisotro mdio raha tsy niaraka ahy isy. Nanome hery sy aina tamin'ahy isy naditra roa toana amin'ny indrindra tamin'ny io fanadihadihana io. Sady koa, fisorana amin'azy hanome fitiavana ahy, ny fitiavako koa aminao.

Abstract

The Ikongo district, Madagascar, has been the site of multiple development projects in recent years. Acknowledging the importance of access to potable water, the building of gravity flow water supply systems to provide potable water to isolated communities has been an integral part of these project's multi-faceted interventions. Since 1999 there have been 34 gravity flow water supply systems built in the Ikongo district.

This report documents the findings of a Rapid Rural Appraisal field study that took place in the Ikongo district between December 2005 – February 2006 critically analyzing the progress of gravity flow water systems in 28 villages in the region. Specific objectives of the study were to: 1) Assess potable water infrastructure: water quality, technical design, and current state of repair in all 28 villages that participated in the study; 2) evaluate the state of community management in all 28 villages that participated in the study looking specifically at maintenance, capacity to deal with repairs, organization of the water committee and systems of community funds collection; and 3) Compare results from the Rapid Rural Appraisal study to published literature of effective community management and offer recommendations to Non Governmental Organizations and others in charge of establishing and supporting communal management structures in rural Madagascar.

Results show that few water systems function properly and community water committees established to manage the infrastructure are ineffective. Problems with community management are multifaceted. Often, agreements that are drafted place management responsibilities in the hands of a village water committee that lacks the competency or community recognition to successfully carry out their mandate. Typically, little time is spent building leadership capacity within village water committees and issues such as cost recovery and maintenance requirements are not thoroughly understood by communities at the end of the project cycle. Few communities are currently able to independently sustain their water supply.

Despite the findings above, the author concludes that local capacity for managing rural water supply is strong in the Ikongo district. The fundamental reasons behind community abandonment of management responsibility lie with the many mistakes made by the development practitioners before, during and after project implementation. Communities accept their role and responsibility as the primary managers of community water supply but need to be trained and supported by a new dynamic approach.

List of Figures and Tables

Chapter 1 - Introduction

The essential role of local communities as the best primary manager for rural water supply systems as a strategy to reduce maintenance costs, make better use of local resources, skills and knowledge and empower local ownership of community infrastructure is now well documented. As a consequence, community management as a model for managing rural infrastructure, once confined to pilot tests and nongovernmental organization (NGO) projects is now being taken up by a number of countries as the national approach for managing rural water supply (Schouten and Moriarty, 2003).

In Madagascar (See chapter 3 for background information), community management is the adopted model for the management of gravity flow water supply systems (GFWSS) in rural communities with populations under 2,000 people. However, evidence from the field has shown that the effectiveness of community management of GFWSS's in Madagascar since the mid 1980's has been beset with problems, prompting a prominent government official to say that it is likely that over half of the existing infrastructure, both wells and piped water supply systems, installed in the rural countryside are not working properly (Rakotondrainibe, 2006). The international donor community, the primary builder of new rural water systems in Madagascar, in now fragmented in their approach to establishing management agreements within local communities at the time of system implementation. Often, agreements that are drafted place management responsibilities in the hands of a village water committee that lacks the competency or community recognition to successfully carry out their mandate. Typically, little time is spent building leadership capacity within village water committees entrusted with leading communal management systems and issues such as recurrent cost recovery and maintenance requirements are not thoroughly understood by communities at the end of the project cycle. Furthermore, the author's experience working in the water supply sector in rural Madagascar for three years as a Peace Corps Volunteer (PCV) has shown that the Malagasy government lacks government institution(s) with the capacity to act as a support mechanism to assist rural water user committees. The inadequacies in the current approach of establishing management agreements are evident in high failure rates of most gravity flow rural water systems in Madagascar; leading to only marginal changes in potable water coverage rates after years of international investment within the sector.

In response to this alarming trend, the United States Agency for International Development (USAID) funded Eco Regional Initiatives (ERI) project Fianarantsoa, Madagascar, commissioned a regional survey of all gravity flow water systems in the Ikongo district, Madagascar from December 2005 – February 2006 to investigate the progress of existing GFWSS infrastructure in the Ikongo region, Madagascar. The primary goal of the survey was to understand the community dynamics effecting management of GFWSS and the fundamental reasons behind the cycle of donor construction, subsequent neglect and malfunctioning of GFWSS common in the region. Accordingly, the three primary objectives of this research report were to:

1. Assess potable water infrastructure: water quality, technical design, and current state of repair in select villages with gravity flow water supply systems in the Ikongo district.

2. Use Rapid Rural Appraisal (RRA) to evaluate the state of community management in select villages with gravity flow water supply systems in the Ikongo district looking specifically at maintenance, capacity to deal with repairs, organization of the water committee and systems of community funds collection.

3. Compare results of the RRA study to published literature of effective community management and offer recommendations to NGO's and others in charge of establishing and supporting communal management structures in the rural countryside.

Chapter 2 of this report begins with a brief history of community participation and how this paradigm evolved into the concept of community management. This is followed by a literature review of the important topics that dictate the success of the community management model and a brief discussion of the components of community management that are the focus of this study. Chapter 3 introduces the reader to Madagascar, including a brief explanation of the government administration and the rural water supply sector. Important laws pertaining to management of rural water supplies are also clearly defined. Chapter 4 presents the methodology of the RRA research study critically examining the progress of community managed gravity flow water supply systems in the Ikongo District, Madagascar that is the basis of this report. Chapter 5 presents the results of the RRA research study, presented by theme as explained in Chapter 4. Finally, chapter 6 of the report offers conclusions and recommendations that can be used by all stakeholders within the rural water sector in Madagascar to improve the sustainability and continuity of the water-supplying infrastructure in the rural countryside.

This report is intended for policy makers at the regional and national levels as well as NGO's and government officials responsible for implementing and supporting rural water supply in Madagascar. This study is a conduit for the voices and opinions of rural communities who have been blessed with the gift of potable water supply and who have struggled to manage their infrastructure with little support from donors or government agencies. The author hopes that this report serves as a plea to policy makers to listen to the stories of villagers whose lives are shaped by their decisions before past mistakes made in implementing unsustainable gravity flow water supply systems are scaled up throughout the region.

Chapter 2 – Introduction into Community Management of Rural Water Supplies

2.1 Evolution of Community Management in the Rural Water Development Sector

Community management of rural water supply systems is now in its second decade as a leading paradigm for water supply development and management (Lockwood, 2004). Community management evolved from the concept of community participation that gained universal acceptance during the 1980's International Drinking Water Supply and Sanitation Decade (IDWSSD). McCall (1987) distinguishes between three levels of community participation as: 1) a means to facilitate the implementation of an external intervention; 2) a means to mediate in the decision making and policy formulation of external interventions; 3) an end in itself, the empowerment of social groups to gain control over resources and decision making. By the end of the IDWSSD, community participation within rural water projects had evolved to encompass this third level of involvement, including granting communities control over operations, maintenance and cost sharing (Lockwood, 2004). This also marked an important institutional policy change in international development towards basing the provision of services on *demand*, rather than the conventional supply driven model, and complemented efforts to create ownership of development processes on the part of local communities (Nicol, 2000). This was the birth of community management.

Today, community management is a reputable model for managing rural water supply because of an acceptance from multiple stakeholders within rural development circles with different agendas and priorities. Most influentially, "government's inability to build and maintain water supply infrastructure has been (one of) the major factors leading to the promotion of community participation"(Carter et al, 1999). Such is the case in Madagascar where community management became the only alternative after a total collapse of all non-essential government extension services in the mid 1980's. The community management model also gave the NGO and private donor community more leverage to bypass inefficient government institutions and work directly with local communities, thus institutionalizing their longstanding belief that local people have the capacity and to manage natural resources better than corrupt, bankrupt, central governments. Similarly, multi national lenders such as the world bank and USAID saw community management as a general transition from supply to demand-driven approaches, which also fits within broader trends towards decentralization of government services and transfer of responsibilities to lower levels of government and ultimately to communities themselves (Nicol, 2000).

2.2 Community Management in the Context of this Study

In practice, community management, like community participation, means different things depending on the level of decision-making power given to the community. Community management has been defined as being “about communities making strategic decisions: what level of service they want, how they want to pay for it, where they want it. The community may also be involved in day-to-day operation and maintenance, in collecting money from users and in buying spare parts, but they do not have to be. They may choose to hire a professional to do this for them. Community management is about power and control” (Schouten and Moriarty, 2003). The ultimate goal of community management of is not to maximize participation of users, but to optimize participation in order to achieve sustainability through human development (Narayan, 1993).

Effective community management of rural water supply, which culminates in the enabling of local communities to sustainable manage their water systems, is a complex model with many interconnected factors that influence succes**s.** Factors influencing community management can be broadly broken down into two categories, those factors that are internal or external to the community. The primary focus of this research study is to access progress of community management structures by investigating the development of those key factors that are within communities but directly influenced by those who implement rural water supply. More specifically, this report investigates 4 four major factors (See Table 2.1) influencing the evolution of community managed GFWS in rural Madagascar. A brief literature review of these four themes is provided in the sections below. For more in-depth information on the history and evolution of community management of rural water supplies See the International Water and Sanitation Center (IRC) website, www.irc.nl

Table 2.1: Important Factors Affecting the Achievement of Equitable, Sustainable Community Management; (Adopted from Schouten and Moriarty, 2003)

Community Dynamics	• Quality of leadership within the community • Gender divisions and inequality within the community • Social cohesion within the community • Management capacities within the community
Ownership: Rules, Regulations and Enforcement	• Enforcement of rules • Community sense of ownership
Operation and Maintenance	• Properly trained technicians who are capable of making repairs • Local supply of spare parts • Clearly defined rules of operation
Recovery of Costs	• Ability and willingness to pay • Transparency, knowing where money is kept and how money is spent • Method of funds collection

2.2.1 Community Dynamics

Because the community management model evolved from the idea that communities must be intimately involved in the decisions that effect their water supply, it is unsurprising that the existence of a dynamic, well organized, management structure within communities is essential for this model to succeed. This structure is most often realized through the presence of a community water committee. In theory, water committees are the local forums where all decisions dealing with the running of the water system should be made. In most instances water committee are democratically elected and should include a cross section of all inters within the community. There can be a varying number of members with different roles within a village water committee. Usual tasks of the village water committees are summarized in Figure 2.1 below.

An important concept is successful community management of rural water supply is the understanding that communities are complex, non homogeneous compositions. As such, for village water committees to be effective they must represent a cross section of the.

community and be empowered to evolve into a dynamic, multi-faceted group that can change over time. Also, the importance of gender equality in community management has been well documented. Women, because of their traditional role in most societies as water fetcher, cook and leader of the household play critical roles and must have significant input in decision making of village water committees.

Figure 2.1: Typical Roles of a Community Water Committee (Adapted from Bolt and Fonseca, 2001)

- Responsible for structuring community decisions around system management
- Organize contributions and control finances
- Make sure community is informed
- Act as a liaison when dealing with water users
- Ensure proper operation of the water system
- Oversee technicians; coordinate maintenance and replacement of parts

2.2.2 Ownership: Rules, Regulations and Enforcement

Successful community management requires that clear ownership of the water systems be defined. Ownership issues lie at the heart of the seeming paradox that communities with long histories of internal water resource management for natural system such as irrigation systems are often not successful at managing water supply systems (Schouten and Moriarty, 2003). Such is the case in Madagascar, where small streams used for irrigation of lowland rice fields have been sustainably shared amongst communities for generations but most improved water sources have fallen into a state of disrepair.

Creating ownership within communities is difficult. Some experts working development question if ownership is possible without payment, thus giving communities financial autonomy from external projects. Ownership sometimes requires that legal documents be drafted outlining rights of both the community and government to the infrastructure. Ceremonies common at the conclusion of construction of rural water supply systems meant to “hand over” rights to rural community often lack the supporting legal document to make this transfer binding.

Common to the management of all common property resources and tied to a sense of communal ownership are the inclusion of rules and regulations needed to regulate the behavior of the water users and also the behavior of the management committee (Schouten and Moriarty, 2003). Enforcement of rules and regulations is usually the responsibility of the water committee, through the levying of some sort of social sanction or fine.

2.2.3 Operations and maintenance

Operations and Maintenance agreements ensuring the longevity and proper running of rural water infrastructure is critical in successful community management. Operation and Maintenance as defined by Lockwood (2004) is presented in Figure 2.2.

Figure 2.2: Definition of Operation and Maintenance as it the Context of Community Managed Water Supply (From Lockwood, 2004)

Operations

Operation refers to the everyday running and handling of a water supply. This includes the correct handling of facilities by users to ensure long component life, e.g. the use of taps at a tapstands. The proper operation of a supply results in its optimum use and contributes to a reduction in breakdowns and maintenance needs.

Maintenance

Maintenance refers to the activities required to sustain the water supply in a proper working condition. Maintenance can be divided into:

- Preventive maintenance - regular inspection and servicing to preserve assets and minimize breakdowns.
- Corrective maintenance - minor repair and replacement of broken and worn out parts to sustain reliable facilities.
- Crisis maintenance - unplanned responses to emergency breakdowns and user complaints to restore a failed supply.

Ensuring proper maintenance of community water supply is usually placed in the hands of trained local technicians who have access to tools and spare parts needed to fix the water system. For all but the most major repairs, these technicians should be self reliant to maintain the system.

Agreements concerning system operations are usually closely related to the rights and responsibilities mentioned in the section above. In rural water supply, proper operations often means that the users agree to turn he faucet off after taking water and are not allowed to wash clothes or bathe at public tapstands.

2.2.4 Cost Recovery and Managing Finances within the community

The Management of communal funds an important litmus test for assessing progress of community managed rural water systems because "cost recovery is still today one of the major obstacles to achieving a sustainable drinking water supply in developing countries" (Brikké and Rojas, 2001). Functioning mechanisms of communal funds recovery are evidence that a water system is demand driven and has tangible economic value to rural communities. It well documented that successful community management cannot be attained if a system of recurrent cost recovery is not properly created and followed by the community during the life of the system.

Decisions that need to be made when designing a system of cost recovery include deciding on appropriate rate and type of tariff to apply to water users. Tariffs can be set per volume of water consumed or standardized as one uniform price paid by all members of the community regardless of usage.

The uses of community funds must also be defined. In most rural GFWSS, communities are responsible for ongoing maintenance costs and parts replacement. Capital cost of system implementation and future extension of the pipe network to meet growing demand are typically paid for by a party outside of the community. A method of periodic funds collection must also be clear including: who, where and when monies will be colleted.

Finally, transparent accounting of community funds is essential in effective cost recovery schemes. Typically, communities have cask books that show all income and expenditures for maintaining the water system. Names of those who have paid and their contribution amount is written in these books to make public who has contributed and insure equity among the community.

Chapter 3 - Madagascar

3.1 Demographics and Rural Water Statistics

Madagascar, the fourth-largest island in the world is located off of the Southeast cost of Africa. It has a surface area of 587,000 and population of 18.1 million (CIA, 2006). 70% of the population, or about 13 million inhabitants, live in rural areas. Formerly an independent kingdom, Madagascar became a French colony in 1896, but regained its independence in 1960 (CIA, 2006). The Malagasy economy, which is dominated by subsistence agriculture, falls in the mid to lower range of African nations; with a per capita income of US$ 290 (World Bank, 2004).

Figure 3.1: Map of Madagascar (Source: CIA, 2006)

Recent data regarding coverage rates for improved water supply in rural Madagascar are not entirely consistent. Upper estimates are that as much as 40% of the rural population has access to improved water supplies (INSTAT, 2004). Improved water supply includes all infrastructure providing access at 500 meters or less of a residence, including handpumps, public standpipes, yard taps and household connections. The British NGO, Water Aid, has reported a less optimistic figure of 12% (Rasolofomanana, 2005). Biased on the author's experience, it is likely that the 40% upper value is inaccurate because the INSTAT health survey placed emphasis on the presence of infrastructure rather than real improvement in water quality. In fact, poor management and subsequent failure of existing structures have lead many communities to abandon improved water points and return to traditional, unimproved water sources. This, combined with poor sanitation and unsafe water handling and hygiene practices in the home makes it likely that the percentage of the population with daily access to potable water in rural areas is closer to the 12% statistic published by Water Aid.

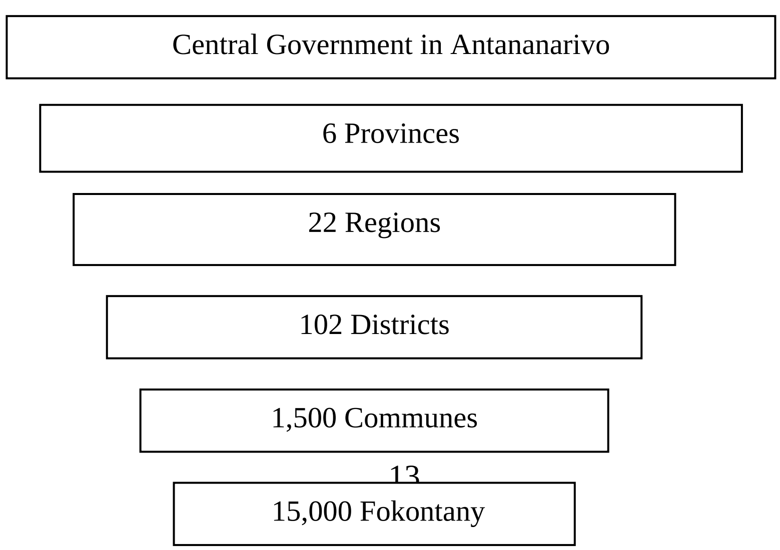
The desperate water and sanitation situation in Madagascar was first brought to the forefront in July 2002 with the publishing of the advocacy document entitled *Sanitation – The Challenge* by UNICEF, Water Aid and the Water Supply and Sanitation Collaborative Council (WSSCC). This document estimated that the lack of proper sanitation throughout the country cost Malagasy children 3.5 million lost school days per year. Furthermore, it was estimated that Malagasy workers had lost 5 million working days per year because water and sanitation had been largely neglected in development activities. When combined, the economic value of these two losses was estimated to be 300 times greater than the amount of public money being spent on water and sanitation (UNICEF, 2005). In 2006, the percentage of GDP spent on the drinking water sector was approximately 3% or 20 million U.S. dollars (Rasolofomanana, 2005). If this analysis is accurate this means that the annual economic value of poor water and sanitation in Madagascar could exceed $6 billion.

3.2 Government Structure and other Prominent Actors Involved in Implementing Rural Water Supply

The administrative structure of the Malagasy government is shown in Figure 3.2. While strides have been made in recent years to delegate power to increasingly local levels of government, real decentralization of authority and financial resources to the communal level is still far from a reality. Until 2004, the 1,500 Communes in Madagascar received just €3,300 (approximately $6,000) per year, per commune from the central government; not enough to cover basic running costs (Rasolofomanana, 2005). Competence of local government officials is still very low in most rural communes. Corruption, including giving favors, taking bribes and extortion of public funds is also not uncommon in Madagascar.

Water supply and the management of water resources in Madagascar is primarily the responsibility of the Department of Water Development within the Ministry of Energy and Mines (MEM). The MEM has offices in all regional capitals and is responsible for oversight of water resources and drinking water supply in urban and rural areas. Human capacity exists at provincial levels of the MEM but staff lack personal transportation or motivation to work in the rural countryside. Limited budgets and lack of engagement from NGO’s implementing water supply projects of MEM staff often confine technicians to their decaying regional offices. A sad reality is that many water systems have been built in rural areas without officials at the regional MEM office being informed, leading to further disconnect to needs in the countryside.

Figure 3.2: Administrative Structure of the Malagasy Government



In Madagascar, the World Bank, UNICEF and some International NGOs like Water Aid, CARE, ADRA and MEDAIR are the main financers of water supply projects in rural areas. National NGO's like FIKRIFAMA, TARATRA, and *Voahary Salama* partners are generally the implementer of these projects. FIKRIFAMA, in particular, was the primary implementer of the World Bank funded PAPAEAR () program that financed the building of hundreds of gravity flow water supply systems throughout the country between 1999 - 2003. As shown in the results section of this report, their participatory approach to development was shown to be effective strategy for building technically sound infrastructure while fostering management capacity within communities.

3.3 Legal Framework Regulating Rural Water Supply

The Malagasy governments implementation strategy and organization of the water and sanitation sector has gone through an admirable transformation during the past 12 years. Changes began in 1994 with the publication of the document entitled *Sector Strategy and Action Plan* (SSPA) which highlighted the sector's numerous inefficiencies including: 1) lack of coordination, 2) many institutions with overlapping activities and 3) inefficient institutional organization marked by major state involvement resulting in low coverage rates for potable water and sanitation (Rasoanandrasana and Rakotondrainibe, 2006). The SSPA called for discussions with all stakeholders including governmental organizations, NGO's and the private sector to design new policies for the sector. These discussions resulted in the publication of the *Code d'eau* or "water code" in 1998. This set of laws transformed the regulatory framework of the water and sanitation sector, clearly emphasizing that water is a commodity that must be paid for and opening up the sector to private investment. The law states that communes are responsible for the management of community water supply within their boundaries (Ministry of Energy and Mines, 1999). The *Code d' eau* also specifies that it is obligatory for any water supply infrastructure to have a system of management placed under the responsibility for a manager, to ensure the effectiveness and durability of the infrastructure. Management of the systems can be delegated to managers, by management agreement, of leasing, or of concession, or to be carried out, in exceptional circumstances, by the owners in direct control. It is this final situation that sets the legal framework for community management in Madagascar.

The recently published (October 2005) *Manual de Procedures* (Procedures Manual) is an important document which aims to standardize all activities within the water sanitation sector. The stated goal of the manual is "to ensure universal access to water and sanitation and harmonize the activities of the multiple actors working in the sector" (Organization TARATRA, 2005). This manual specifies proper procedures of site identification, development, execution, control, follow-up and evaluation of potable water and sanitation projects. In regards to community management, the manual is very explicit and presents a procedural method for how a community management structure must be established. It is now Malagasy law that the application of guidelines in this handbook must be followed when implementing drinking water and sanitation projects.

3.4 Community Management in Madagascar Today

Even with the improvements that continue to be made, the institutionalization of community management as a model for managing rural water supply in Madagascar is far from complete. There remains a great disconnect between the happenings in the rural countryside and laws that are passed by the central government and National Assembly in Antananarivo. New laws have either never been explained or are not well understood by those in rural areas who now bear the responsibility for enforcement. Communes, who are now in charge of overseeing management of rural water supply, do not understand their responsibility nor have any real connection with rural villages within their jurisdiction. The reality is that few, if any, of the mayors in rural communes understand their role in the management of rural water supply. Furthermore, communes lack both the funding and the staff to effectively monitor and support rural water supply. The sense that access to water is an intrinsic right and should be free for the taking remains strong in rural areas.

It is also a fallacy to assume that local government authorities or implementers of rural water supply systems will follow their responsibilities as stated in the *Manual d'*

Procedures. Small-scale projects are often under tight monetary and financial constraints when implementing projects leaving monitoring activities noticeably absent from project budgets. In today's "quantifiable results" orientated development world, combined with the inability of the MEM to monitor the building of community water supply, is highly unlikely that the standards written in the *Manual d' Procedures* will be actualized in practice.

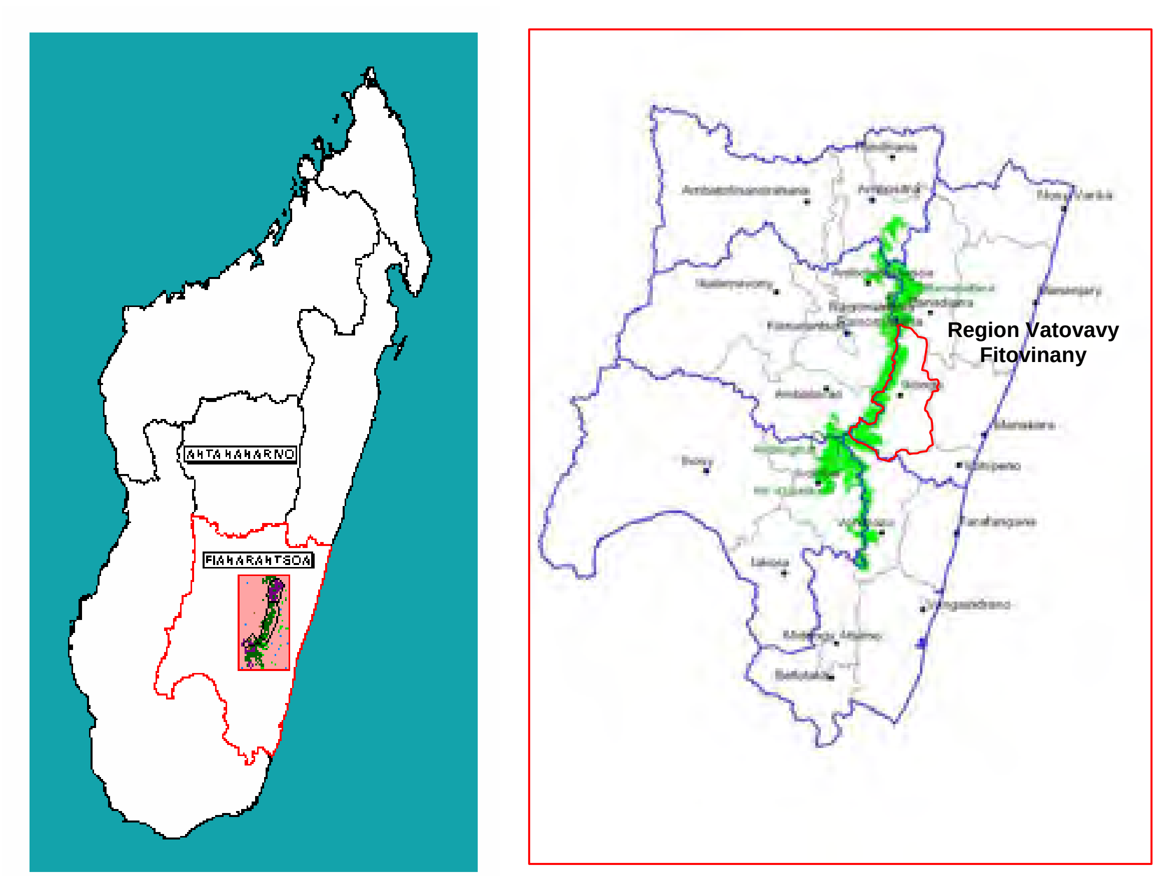
Finally, a careful examination of chapter 7 from the *Manual d' Procedures* regarding community management revels that, in many ways, it is a cookbook approach to establishing management with communities. Among other things, the document makes no mention of a formal mechanism to transfer legal rights of system ownership to rural communities, or specifically what roles the commune's have in supporting systems within their jurisdiction (and penalties for not doing so). This author feels that, while this chapter is a giant step in the right direction towards standardizing community management in Madagascar; it neglects the essential precepts of the approach, that communities are dynamic and need to be empowered to make their own decisions when managing village water supply. These facts are mentored only to raise important questions as to how this new policy will yield any better results than the disorganized ambiguous approaches used by implementers in the past.

Chapter 4 – Research Methodology for Evaluating Progress of Community Managed Gravity Flow Water Supply Systems in the Ikongo District, Madagascar

4.1 Introduction

The Ikongo District, located in the Fianarantsoa Province, Region Vatovavy Fitovinany, along the eastern side of the Ranomafana – Andringitra moist forest corridor (Figure 4.1) has been the site of multiple rural development projects in recent years. Specifically aimed at reducing human impact on the forest corridor, development activities have focused on intensifying agriculture while improving health services and transport systems within the region. Acknowledging the importance of access to potable water, the construction of gravity flow water systems to supply clean water to rural villages has been a cornerstone of this integrated approach.

Figure 4.1: The Fianarantsoa Province in Southeastern Madagascar (left); highlighting the Ikongo District along the eastern side of the Ranomafana – Andringitra moist forest corridor



There are now 34 gravity flow water supply systems in the Ikongo district. The majority of these systems were built between 2002 – 2005 through funding from the World Bank, USAID and other international donors. Alarmingly, a cursory visit by this author to many sites with gravity flow water supply systems show that these systems have not been properly maintained or in some cases are not working at all.

In response to this disturbing trend, the USAID funded Eco Regional Initiatives (ERI) project commissioned a regional survey of all gravity flow water systems in the Ikongo district to investigate the fundamental reasons behind the cycle of donor construction, subsequent neglect and abandonment of rural water systems. This survey was carried out from December - February 2006 by a two-person research team (including this study's author) using the Rapid Rural Appraisal (RRA) approach to community analysis.

4.2 Intellectual Framework of Participatory Social Research

Participatory social research techniques emerged in the late 1970s within the agricultural development sector searching for an alterative method to accurately assess rural situations and tap into the rich, indigenous local knowledge base (World Bank, 2004). Participatory research represented an alternative to traditional social research focused on "top down" analysis from a group of experts from urban areas assessing the needs of rural communities. In contrast, participatory research emphasizes a "bottom-up" approach with a focus on locally defined priorities and local perspective (Cornwall and Jewkes, 1995). Participatory methodologies are often characterized as being reflexive, flexible and iterative, in contrast with the rigid linear designs of most conventional science (Cornwall and Jewkes, 1995). Today, participatory social research has come full circle. Many development and research funding agencies have now absorbed participatory research techniques specifically, Rapid Rural Appraisal (RRA) ands Participatory Rural Appraisal (PRA), as elements of their institutional culture (Richards, 1995).

However, participatory methods have not evolved in a vacuum and have received harsh criticisms by many who feel the techniques are over utilized in rural development circles and lack a theoretical framework grounded in established social theory. Important complaints include that: 1) Participatory methods (i.e. PRA and RRA) assume that there is a clear split between structure and action, where structure takes precedence over action (Richards, 1995); 2) Participatory techniques have a difficult time breaking free from local politics and gender basis (Richards, 1995); and 3) Trainings associated with participatory research focus too much on methods rather than emphasizing principle, leading to a mechanical application of methods (Leurs, 1997).

4.3 Rapid Rural Appraisal (RRA)

Rapid Rural Appraisal (RRA) is a survey methodology that uses local knowledge to create, design, or monitor rural development projects. Typically preformed by a multi disciplinary team, RRA seeks to gather information as to the reasons why a situation has progressed in a certain way by understanding the social dynamics within a community. Data are collected through the use of participatory tools, taking perspectives from multiple stakeholders in a community and filtered through the perceptions of the research team (Freudenberger, 1999).

The concept of triangulation is the core principle behind RRA research. Triangulation refers to “the diversification of perspectives that comes from using a diverse multi-disciplinary team using multiple tools and techniques, with individuals and groups of people who represent the diversity of the community” (Freudenberger, 1999). Triangulation is a strategy to minimize bias both from the researcher and informant. Triangulation increases the quality and validity of the information gathered. Local perceptions of a problem differ widely biased on education, socio economic status, age, and gender. Therefore, all strata of society should be involved in proper RRA data collection.

4.4 The Use of RRA to study Progress of Gravity Flow Water Systems in the Ikongo District, Madagascar

Participatory research techniques were chosen for application in this study because of the author’s experience that traditional questionnaire type, yes-no-answer, surveys would be ineffective in the region because of high illiteracy rates (especially among women) and a sense of local disenchantment towards development projects. After two years of working in the region, the author was aware of these feelings and choose to utilize a research methodology that stressed participation, thus letting local opinions be heard. Furthermore, RRA research methodology provided a proven participatory research technique to monitor progress in rural water projects by gathering social data from different groups of the community in a short period of time.

To implement the RRA approach, village workshops were organized in all 28 communities that took part in the research study (See section 4.9). Multiple letters were sent to the communities ahead of each workshop so that the community understood their role in the study and could prepare for the research teams arrival. Village water committees, local technicians and women were asked to make time available to attend the community workshops or participate in semi structured interviews during the site visits. These groups were chosen because of their involvement in system management as established when the water system was built. Also, families from the countryside were asked to participate to provide a perspective from community members who did not use the water supply daily. Lunch was served at each workshop to attract the full participation of the community. Figure 4.2 is a photograph taken from a typical village community workshop.

All information presented in this report was gathered from these village workshops. In this study, triangulation was achieved by using five interactive RRA tools with multiple groups of informants from each community (see section 4.7). Some quantitative data, not normally the focus of RRA research, was collected as well to better understand decision-making trends and common assumptions made by development practitioners that implement community water supply.

Figure 4.2: A Typical scene from the RRA community workshops

4.5 Research Team Members

The research team was made up of two members, one man and one woman with different cultural and academic backgrounds. Table 4.1 defines the background and responsibilities of each team member.

4.6 Themes investigated during RRA Workshops

The first step in developing an RRA research strategy is creating a list of essential priorities or themes to be examined during the study. These themes dictate what tools will be chosen to extract information and promote discussion from the community. In RRA research, themes are unique to the specific goals defined for each study. Table 4.2 shows the six primary themes that were investigated during this study. Tools were then chosen to match the selected themes (See section 4.7 for a description of the tools used in the study). Themes were then broken up into checklists, giving the research team a broad outline of what information they were seeking to gather from each tool. See Appendix I for the typical program schedule that was followed during each village RRA workshop, including order of tools and detailed checklists for each activity. It is important to note that the RRA schedule presented in Appendix I was loosely followed at most sites, but in some villages the program was modified because of bad weather, a lack of participants or time constraints. Throughout the village workshops, the research team was as flexible as possible, allowing deviation from the daily program if the community was leading the discussion in a different direction. This flexibility, essential in RRA research, was the fundamental premise to the team's approach.

Table 4.1: Description of the Research Team

Team Member	Responsibilities
Jonathan Annis – Environmental Engineer; Peace Corps volunteer; Maters candidate in environmental engineering, Michigan Technological University.	• Lead research team • Create field study methodology, objectives and program activities • Take GPS readings at all spring, dam sources • Inspect infrastructure for in errors in design, construction • Assess capacity of local technicians to repair system without outside support • Write final report
Annick Andreas Ranirisoa – B.S. Mathematics, Information, Social science from the University of Fianarantsoa; Communication specialist	• Assist in creating study methodology, objectives and program activities • Lead village RRA workshops • Evaluate the competence of community management systems • Evaluate sanitation and hygiene situation in villages • Compile individual site reports from all villages in the study • Assist in preparation of final report

4.7 Description of RRA Tools used During Workshops

Within RRA methodology, there are multiple tools that are used to facilitate dialog and information gathering during community assessments. Typical RRA tools include: semi-structured interviewing, focus groups, community mapping, wealth ranking, preference ranking, Venn diagrams, seasonal calendars, household sketches and pocket voting (Bolt and Fonseca, 2001).

Table 4.2: Major Themes Investigated in village RRA workshops

Theme	Check list of important points within each theme	Tool	Informants
1- Communities profiles	• Geography, including location and number of users • Community involvement in system implementation • Economy: specifically understanding the seasonal migration patterns of the community between the town center and agricultural lands • History of water system, description of infrastructure	Community Mapping, Seasonal Calendars	Entire Community
2 - Physical functioning of water systems	• Water quality, water quantity at different times of the year	Transect Walk, Seasonal Calendars	Technicians, Women
3 - Typical Maintenance and cleaning arrangements	• Defining individual responsibilities • Adherence to cleaning schedules	Venn diagram, semi-structured interview	Entire community, water committee(s)
4 – Technical capacity; including the competence of local technicians and existence of a local supply of spare parts	• Existence of trained local technicians • Assessment of capacity do deal with repairs • Past successes or failures with parts replacement	Venn diagram, semi-structured interviews, transect walk	Technicians
5 - Community Management schemes for the water systems	• Defining roles of all actors involved in management of the water system • Existing legal documents binding water management • Defining individual, communal, governmental reasonability • Assessing local competence to manage	Venn diagram, semi-structured interviews	Water committee, individuals who were defined as important during community discussion
6 - Understand existing systems of funds collection and identify constraints to the adoption of a reliable method of funds collection	• Trust, transparent accounting • Cost, amount of payment • Method of collection, time of collection • Acceptance of all members in the community • Other problems	Venn diagram, semi structured interviews	Treasure of water committee, people from outside of the community, women

These tools are not a formula for guaranteed success during data collection and can be modified depending on their application. Similarly, this list of common RRA tolls is not all-inclusive. Experienced RRA practitioners are able to create new tools to fit the unique needs for a given study. For this RRA study, five common tools including: participatory mapping, seasonal calendars, Venn diagrams, transect walks, and semi structured interviews were used during the workshops. These tools were chosen because they best fit the principle themes investigated during the study. See Appendix II for examples of maps, seasonal calendars that were completed during RRA workshops as part of this study.

Participatory Mapping – Members of the community were asked to draw a village map to provide the research team an introduction to important village landmarks. Scale is not important in community mapping, rather it is more important to show the spatial relativity and layout of the village. At the end of the mapping exercise the community should have located the position of the traditional water source, the new water source, all tap stands, all latrines (both public and private), and traditional areas of defecation. The community mapping exercise also serves as an effective icebreaker to get the community comfortable with the researchers and in their participatory mode.

Seasonal Calendars – Seasonal calendars are used to evaluate how things change within a community during different seasons throughout the year. For this study, one calendar charting three seasonal events was completed with the community. The horizontal axis listed the 12 months of the year and the vertical listed the three themes being investigated: diarrhea, migration patterns, water quality/quantity. These calendars included a quantitative aspect of ranking the different phenomena on a scale of one to three (three being the most prevalent) to differentiate severity within different months throughout the year.

Venn Diagram – A Venn diagram is type of community map used to expose how a community is organized and how decisions are made within a group. Venn diagram's were used to analyze how the community was managing their water system and who specifically was responsible for certain tasks. In communities where multiple users groups were organized, smaller Venn diagrams are drawn for each tap stand committee. Venn diagrams were the primary tool for investigating the interworkings of the village communication, measuring existing community management capacity and assessing problems with cost recovery.

Transect Walk – A transect walk is a mobile interview technique where a researcher goes through the community with "guides" from the village. The transect walk, with the local technicians as guides, was used to visually inspect the source, reservoir and all of the tap stands. A second transect walk, with the women of the village as guides, went house-to-house and investigate daily water usage, hygiene and sanitation in different parts of the community.

Semi structured Interview – A semi-structured interview is a participatory technique in which the researcher interviews in more detail a key informant, or groups of informants from the community. Both members of the research team used this technique at different times during the community workshops when people of the community were implicated as essential members of the existing community management or cost recovery systems (e.g. the president of the water committee, treasurer, local technicians).

4.8 Constraints of the Study

Every effort was made to limit bias during this study. However, there were some inherent constraints that limited the proper application of RRA techniques. This is important because "a key element of participatory research lies not in methods but in the attitudes of researchers, which in turn determine how, by and for whom research is conceptualized and conducted" (Leurs, 1997).

An important part of ensuring triangulation is that the research team performing an RRA study is multidisciplinary. This typically means that four to five team members; both men and women, with various backgrounds will participate in a study. Budgetary constraints dictated that only two researchers took part in this study. Furthermore, the researchers had no previous experience conducting RRA research though both were intimately familiar with the region being studied. Also, typical RRA studies are not done in four-hour sessions as is presented here, but is instead preformed over a two to three day period in each community. Due to the inaccessibly of the Ikongo region, large geographic study area and time constraints of the study that required quick production of results, more in-depth studies could not be preformed.

Often, because of the long distances traveled on foot (e.g. up to 20km to the most remote sites) and lack of proper lighting at night in rural areas, daily site reports could not be recorded in the nights following some village workshop. There would often be three of four days in between the completion of a workshop and when the final site report was written. This delay inevitably caused some information to be forgotten by the research team, adding an additional “selective memory” bias to the site reports.

4.9 Site Selection

A preliminary site visit to all 15 communes within the Ikongo district confirmed the existence of 34 gravity flow water systems, within 33 fokontany serving a total of 36 villages (see Table 4.3). GPS readings were taken at the source water collection points (i.e. spring or dam) of all 34 water systems for inclusion into a national database being compiled by the Ministry of Energy and Mines (See map in Appendix III).

Originally, it was assumed that RRA workshops investigating the dynamics of a community management would be carried out in all 36 villages having access to a rural water supply system. However, after the preliminary site visits it became apparent that the large commune centers of Ikongo and Tolongoina were not similar to the rest of the villages in the study. These towns have large (over 2000 people), economically diverse populations that do not fit the profile of the poor, small, economically homogeneous villages that are the primary focus of this study. Also, these towns water supply systems provide water simultaneously to two fokontany and are thus technically and managerially different from the rest of the villages in the region with autonomous water supply systems. For these reasons, the community dynamics influencing community management of at these four fokontany requires a more through investigation than could accurately analyzed these RRA community workshops. Thus, the source structures at these sites were visited for inclusion in the regional map sowing the location of all existing water sources in the Ikongo District but *not* included in the RRA study investigation the dynamics of community management.

Table 4.3: Location of all Gravity Flow Water Supply Systems Identified in the IKONGO District

Commune Name	Population	Total # of fokontany per Commune	Total # of fokontany w/ GFWSS per Commune	%	# of systems per commune in the Ikongo District
Ikongo	28,575	34	10	29.4	10
Ambolomadinika	18,834	12	3	16.7	3
Ambatofotsy	24,251	11	5	45.5	5
Maromiandra	13,425	9	3	33.3	3
Belemoka	15,255	10	0	0.0	0
Manampatrana	10,773	10	2	20.0	2
Ambinanitromby	13,678	6	0	0.0	0
Tolongoina	20,555	15	5	33.3	5
Ambohimisafy	13,205	9	1	11.1	2
Ifanirea	20,925	11	1	9.1	1
Sahalanonana	24,911	9	0	0.0	0
Antanakambana	13,650	8	0	0.0	0
Ankarimbelo	14,334	9	2	22.2	2
Antodinga	20,882	13	1	7.6	1
Kalafotsy	15,893	10	0	0.0	0
TOTALS	**269,146**	**176**	**32**	**18.2**	**34**

It was also decided that the village of Mandritsara, fokontany Ambodiara–Dihy, commune Ikongo, was not consistent with the other villages in the study because the community has only one, faucet-less tap stand and lacks a defined community management structure.

Likewise, the village of Ankarefebe, commune Ambolomadinika was an outlier due to the provisional nature of its water system. Similarly, RRA workshops were not carried out in the other two fokontany in the commune of Ambolomadinaika, because in these villages community management agreements were still being implemented at the time this study took place. Thus, after excluding eight fokontany, highlighted in table 4.4, RRA community workshops were carried out in the remaining 28 villages in the Ikongo District with gravity flow water supply systems.

Table 4.4: All fokontany that were excluded from the RRA study and reasons for their exclusion

Name of Commune / Fokontany	Reasons for Exclusion from RRA study
Ikongo / Ambodirihana and Ikonogo	• Large population > 2000 people • Economically diverse; large disparities between rich and poor • One System supplying two fokontany
Tolongoina / Tolongoina and Tsimahabo	• Large population > 2000 people • Economically diverse; large disparities between rich and poor • One System supplying two fokontany
Ikongo / Mandritsara	• One, continuously flowing tap stand; lack of existing community management structure
Ambolomadinika / Tsarakianja Sud and Ambolomadinika	• Water system recently built during time of study, management systems not yet established
Ambolomadinika / Ankarfobe	• Provisional nature of water system, no existing management structure

Chapter 5 Results from the 28 Rapid Rural Appraisal Community Workshops Organized per Theme

5.1 Geographic and Cultural Context

The Ikongo district, region Vatovavy-Fitovinany, province Fianarantsoa is located along the eastern side of the Ranomafana – Andrigitra moist forest corridor in the Antanala region of Madagascar. The district headquarters, seated in the rural commune of Ikongo, has jurisdiction over 15 communes, including 134 *fokontany*. The 2006 estimate population of the Ikongo district is 269,000 (Office of the Chef d' District Ikongo, 2005).

The term Antanala literally means "people of the forest"; so named because the narrow band of land in which they inhabit in the southeastern part of the country was once blanketed by a dense moist forest separating the costal lowlands from the high plateau. Today, due to dependence on slash and burn agriculture, all that is left of this once vast forest is the Ranomafana – Andringitra moist forest corridor; a narrow band of low, medium, and high altitude tropical forest valued by conservationists for its many biological treasures and extraordinary level of endemism.

The Antanala are rural, agrarian people whose primary economic activity is upland coffee and paddy rice production. Secondary crops include manioc, corn, and fruit trees. Rice production, the staple of the Malagasy diet, is limited in the region because the scarcity of lowland rice fields. As a consequence, most families cannot grow enough rice to provide adequate food supply throughout the year. Benefiting from high international coffee prices in the 1970's and 1980's, the Antanala region was once one of the most prosperous in the country. Since the crash of the international coffee market in the mid 1990's and subsequent collapse of the local coffee dependent economy, the region has been swept by widespread hunger and the onset of extreme poverty (Freudenberger, 1999).

The Antanala people are a semi-transient society. Settlement patterns are dispersed as most families do not permanently live in a village center but rather live close to their fields. These families, sometimes comprising over 90% of households within a village community, will come into the town center only to buy basic supplies and attend funerals or other celebrations. As clearly shown in seasonal calendars completed as part of the community RRA workshops, the duration of time spent by these families in a village center is on average less than two months per year.

Figure 5.1: (a) View of the mountainous terrain, and (b) A typical rural village found in the Ikongo Region.

(a) **(b)**

Mountains with steep slopes separated by wide valleys characterize the topography of the Ikongo district. The region is bordered on the western side by a steep north-south escarpment that separates the costal lowlands and the high plateau. Much of the area is inaccessible by car, making transport arduous and time consuming at any time of the year.

The region's climate is tropical, with high humidity and abundant rainfall. The wettest months are January through April. The dry season is September to November, but afternoon showers are still frequent during this time.

Surface waters including large rivers and small streams that bisect the region are the traditional places of water collection. Traditional water sources are very close to village centers; often less than a 10-minute walk to fetch water. Due to the abundance of rainfall and traditional place of defecation in coffee groves surrounding village centers, traditional water sources are polluted often with fecal and other forms of organic contamination.

Even with the copious amounts of rainfall in the region, very few houses harvest rainwater for domestic use. Reasons for this include that houses are traditionally made of thatched roofs, making rainwater harvesting difficult and homes lack the capacity to store large quantities of water. Due to the mountainous topography and abundance of rainfall, small artesian springs emanating from hillsides are common making the Ikongo district an ideal setting for the implementation of gravity flow water supply.

5.2 Community Profiles

Before 1999 there were no villages in the Ikongo District with modern gravity flow water systems[1]. Beginning that year, the USAID-funded Landscape Development Initiatives (LDI) program began working on both the eastern and western sides of the Ranomafana – Andringitra moist forest corridor. Activities on the corridor's eastern side were focused in the Ikongo district. Rapid Rural Appraisal (RRA) activities carried out in select villages within this region identified the acquisition of potable water in rural communities as an urgent priority within an integrated package of complementary health and agriculture intensification activities. In response to this need, the LDI project whose 5-year contract ended in 2003, and the ongoing Eco Regional Initiatives (ERI) program that is also funded by USAID, have been influential in enticing substantial investment in the potable water sector despite the operational and logistical obstacles inherent to working in the region. Table 5.1 shows the evolution of system implementation in the district per contractor since 1999. The majority of these systems were built between 2003 – 2005 with financing from the Packard Foundation or the World Bank.

[1] During and shortly after the colonial period that ended in 1960, a limited number of gravity flow water systems were built in prominent commune centers (i.e. Ikongo, Ambatofotsy, Voninkazo) in the Ikongo district. These had all been abandoned by the late 1980's.

Table 5.1: Construction history by year and contractor of Gravity Fed Water Systems in the Ikongo District, Madagascar. The numbers in parenthesis indicate systems built with dam intakes.

Contractor	**1999**	**2000 – 2001**	**2002 – 2003**	**2004 – 2005**	**Total**
Caritas		2 (1)	2		**4 (1)**
FIKRIFAMA	1		2	9	**12**
Peace Corps			1	5	**6**
Red Cross		1 (1)	2 (2)		**3 (3)**
ASTUCE				2	**2**
AFVP		3 (2)			**3 (2)**
FID	2 (2)				**2 (2)**
Other	1 (1)			1	**2 (1)**
Total	**4 (3)**	**6 (4)**	**7 (2)**	**17**	**34 (9)**

There are currently 34 gravity flow water systems, within 33 fokontany serving a total of 35 villages in the Ikongo district. While the evolution of completed GFWSS projects in the region is encouraging, potable water coverage in the Ikongo district remains limited to just under 20% of the total fokontany in the district. Three fokontany have two water systems within their boundaries. In two cases, two fokontany are being supplied by one water system.

An examination of the map found in Appendix III shows that most systems have been built adjacent to the only drivable road in the district, National Route 14, that runs north to south from Ifanadiana to Ankarembelo. Today, this road is only travelable by car/truck until the village of Ikongo. All transport to communes south must now be done on foot or in some cases by ox cart. The five most isolated communes in the district, according to their distances away from RN 14, have no gravity flow water supply systems within their boundaries (Table 5.2). The authors experience is that many builders have been hesitant to work off of the main road even though there is little change in overhead costs for building systems in remote, inaccessible villages. Generally, the only differences in implementation costs in remote villages are the added expenses needed in transporting materials to the project site. Contractors rarely pay this cost because transporting non-local materials is almost universally part of the community's required contribution.

Table 5.2: List of communes in the Ikongo district who have no GFWSS including populations and approximate distance of closest drivable road.

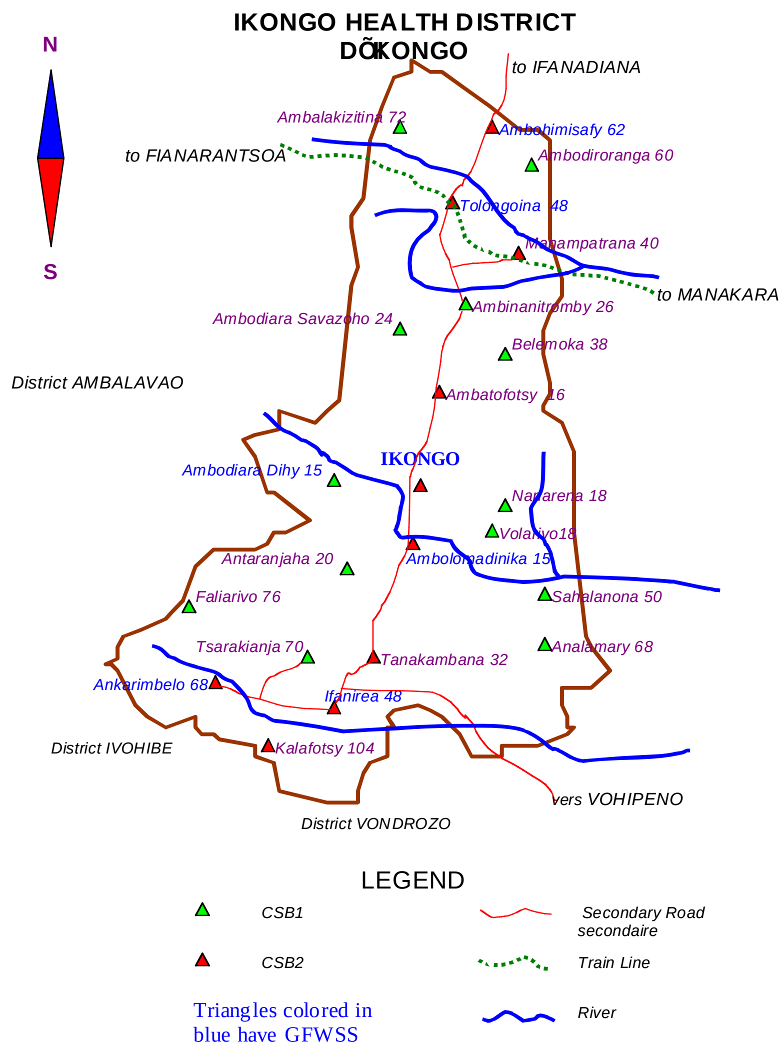
Name	Population	Distance from drivable road (km)
Belemaka	15,255	20
Sahalanonana	24,911	25
Ambinanitromby	13,678	0
Antanakambana	13,650	8
Kalafotsy	15,893	30

There is also a large variation when building trends on the east west axis of the RN 14 as well. Because conservation of the Ranomafana Andrigitra forest corridor is the primary goal of all development activities in the region, those fokontany on the eastern side of the road, adjacent to the forest are a higher priority for development. This is clearly demonstrated on the map by only three towns west of the RN 14, represented by location of their water sources, having been choose to receive a GFWSS.

Semi structured interviews with mayors in the Ikongo District revealed that little has been done to include local political leaders in the decision making process as to where new systems are to be built. Some mayors expressed to the research team that communities with higher local proprieties were bypassed to build water supply systems in more remote, sparsely populated areas whose location is close to the corridor. Some effort has been given to communities with a history of deadly outbreaks of diarrhea disease. One example is the village of Ambatolampy, which was marked as a priority after an outbreak of dysentery in the community killed nine people, including seven children, in 2003.

Alarmingly, little priority has been given to villages with health clinics though immediate access to potable water has been shown to significantly increase the incidence of hand washing by clinic staff, a practice critical to prevent the spread of disease in a hospital setting. Of the 23 health clinics in the Ikongo district, only 7 currently have access to gravity flow water supply (Figure 5.2). A few health clinics have been retrofitted with rainwater catchments systems such as in the village of Ambodiara-Dihy, commune Ikongo. This technology is a good example of a robust, inexpensive intervention that can provide potable water before a more permanent solution can be built.

Figure 5.2: Sketch showing all health clinics in the Ikongo district and their access to potable water



The Antanala are a transient population who live most of the year on their agricultural lands. Table 5.3 shows the estimated percentage of the total population using water from gravity water supply systems daily per commune. Population figures presented here are estimates proposed by each community during the RRA workshops. These numbers are not official population figures for each fokontany. However, the importance of this data is to compare the magnitudes of the population using the infrastructure daily to the total population of the village. For this type of proportional analysis, local estimates of these numbers can be considered an accurate representation of the transient nature of the community.

Table 5.3: Population estimates of the 28 sites that participated in RRA workshops, per commune and the number of the population estimated to be using the water systems daily

Commune	# of systems	Total Population of fokontany's with GFWSS	Population using water system daily	Percentage (%) of total population using water systems daily
Ambatofotsy	4	7,122	2,134	30
Manampatrana	2	1,592	654	41
Maromiandra	3	3,585	1,795	50
Tolongoina	5	3,246	950	29
Ambohimisafy	2	1,942	246	13
Atodinga	1	1,800	210	12
Ankarimbelo	2	4,660	600	13
Ikongo	8	6,327	2,230	35
Ifanirea	1	2,842	-	-

The practical repercussions of the data presented in Table 5.3 are enormous. Table 5.3 shows that in no cases in the Ikongo district is more than 50 % of the target population consistently using the village water supply. Thus, when potable water infrastructure is built in rural village centers it provides clean water to a much smaller fraction of the intended population than initially believed.

5.3 Physical functioning of Gravity Fed Water Supply Systems

Gravity flow water supply systems (See Appendix IV for background information explaining the basics of gravity flow water supply systems including brief explanations of all system components) in the Ikongo district range in magnitude from a single continuously flowing tap stand to configurations with multiple branches feeding 12 public taps. A typical system has between 4 and 7 tap stands.

Artesian springs are the sources for most gravity flow water systems within the Ikongo district. In these cases, a spring box is constructed around the mouth of the spring effectively channeling water into the transmission pipeline. In a few communities multiple spring boxes or seepage collection systems are used to collect water from multiple points. Spring boxes are constructed out of steel reinforced concrete or stone masonry.

Spring outputs were reported to be insufficient during the dry season in a small number of communities. In two of these villages, water shortages were caused by lack of maintenance rather than insufficient output from the spring. In both cases, the author visually inspected the infrastructure as part of the field assessment and identified the problems prohibiting proper functioning of the systems. These problems were easily corrected causing the water to flow again, in one village after six months of discontinued service.

The other types of intake structures found in the Ikongo district are dams with collection boxes built across small streams. There are 9 communities in the district whose water system is fed from this type of configuration. In all cases dams have been constructed out of steel reinforced concrete.

All sites with dammed intakes have simple sedimentation chambers located after the intake structure. In no cases were sedimentation chambers properly designed to induce effective sedimentation. None of the chambers were effective in removing all sediment from the turbid streams. In no cases was a filtering medium (i.e. sand, charcoal) being used to treat the water in rural village.

Without exception, communities reported sites with a spring box intake system as being potable. Visual inspection of water emanating from these sources by this study's author proved that the water was very clean, cold and visibly free from sediment. It is now stated in the *Manual d'Procedures* that water quality test conducted by a lab qualified in the capital must accompany the selection of all sources to be used for community water supply. However, *no* project appears to have completed water quality tests to confirm drinking water quality in accordance with national or international standards for piped water supply. Water quality testing was not in the scope of this study, rather gauging local perceptions of water quality at different times of the year to understand community satisfaction with the water supply and any connection between water quality and community management.

Water quality, biased on local standards of turbidity or water discoloration, was reported to be much poorer in villages with dams as intake structures and in no cases did the communities feel that the water coming from these sources was potable. All communities reported the water from these sources being brown during the months of January – March that coincide with seasonal rains.

There was an unmistakable correlation between the choice of contractor and the type of intake system that was installed. Contractors including; FIKRIFAMA, Peace Corps, ASTUCE built water systems that all sites have spring boxes as intake systems, making contamination virtually impossible. The other contractors listed in table 5.1 have in most cases opted to build a dam intake system. The research team consistently noticed that the mintaince of infrastructure at of systems with dam intakes was found to be much worse state of repair that those of a protected spring. These communities often compared the water quality of their system to that of a neighboring village whose source was a spring box. Not surprisingly, when communities felt that a new water source as no cleaner than the traditional source, there is little motivation to maintain the infrastructure. Figure 5.2 shows an example of this trend. When the research team visited the water source in Maromiandra, cow manure was found less than one meter from the unprotected source pond (Figure 5.2). The community then explained that the intake system was built by the French in the late 1960's and only retrofitted when the modern water system was built in 1999.

All reservoirs have been built of steel reinforced concrete. Reservoirs built by FIKRIFAMA and AUSTUCE were circular because these companies had access to a prefabricated steel form needed in circular concrete construction. The remaining reservoirs were square or rectangular depending on their size. Most reservoirs were well constructed and were found to be in good condition with the notable exceptions of the villages of Ambinaninony and Voninkazo. In the first case, the placements of the entrance and washout pipes were interchanged causing turbid water to be piped into the community. In the second, the reservoir was built in a riverbed causing gradual erosion and eventual failure of the foundation. See individual site reports for further details on construction.

Figure 5.2: (a) Schematic Showing Cow Manure on the Edge of an Unprotected Water Source in Maromandia, Ikongo. (b) Subsequent disregard of system maintenance by community because the water quality did not meet local standards.

(a)

(b)

Public tap stands are designed in many different ways depending on the builder. All tap stands are fenced at the time of construction. In general, drainage from public tap stands is not well designed. When pipes are used to drain excess water they are often too short causing puddles in town centers. Soak pits, areas designed to allow infiltration of excess water, were not installed at any sites. It is the author's opinion that the design of the

FIKRIFAMA model tap stand is the best in the district because their design has a large splash area and ample space around the tap stands for multiple users to access the faucet at the same time.

Analyzing the pipeline configurations of most of the systems showed that trained technicians, who specialize in this type of construction, likely preformed the necessary hydraulic design and engineering analysis needed in proper construction of gravity flow water systems. Mistakes have been made though, as in the error made in calculating the hydraulic profile in one FIKRIFAMA site that has caused a pipe to rupture multiple times due to the pressure in the pipeline exceeding the pressure rating of the pipe. PEHD is the piping material used in all systems with the exception of those built by the Red Cross, which installed PVC (See Appendix II for brief descriptions of PEHD and PVC pipes). Most pipelines were properly buried to a depth of at least 50 cm.

5.4 Typical maintenance and cleaning agreements

In general, communities have a cleaning schedule that was agreed upon at the time of system construction. This typically ranges between three and six months for the spring box, and reservoir. Dam intakes require more frequent cleaning than do spring boxes. Design problems with the sedimentation chambers cause these structures to clog easily after hard rains. Cleaning both types structures consists of draining all water, scrubbing the walls with a brush, soap and water and in the cases of the spring box and reservoir re-sealing the manhole with a thin layer of mortar.

Communities participating in RRA workshops reported that cleaning is usually the responsibility of local technicians who were chosen by the community at the time of construction. However, as was the case in Ambodiara-Dihy, commune Ikongo, this was the responsibility of a local women's group. The consistency to which cleaning schedules are followed depends on many factors including the motivation of technicians within the community and the emphasis placed on routine maintenance by the builder who installed the system. In most cases communities it was clear that maintenance did not take place until major system failures occurred. Figure 5.3 shows two pictures that were taken at sites where RRA workshop exposed that the communities had not cleaned the spring boxes for more than one year. During the transect walk portion of the RRA workshop the male researcher then asked the communities to open both spring boxes to examine the consequences of not maintaining the system. These pictures clearly show the importance of preventive maintenance. However, this survey repeatedly uncovered that preventive maintenance is not a priority in most communities.

Some local technicians mentioned not being able to clean the reservoir because they lacked the tools (i.e. pipe wrench) to open the clean out valve, allowing water to drain from the system. For this reason, one village had not cleaned their reservoir in five years. Manholes to the spring boxes are rarely re-sealed with cement after cleaning.

Figure 5.3: (a) Mud silt found in the bottom of a spring box in Ambatofaritana, Manampatrana (notice water still flowing on the left side of the muck) and (b) Roots clogging the intake pipe inside a spring box in Ankarembelo, Ankarembelo (notice the intake pipe in the spring box on the right of the picture).

(a)

(b)

Women are usually in charge of the tap stand maintenance including the fixing of fences, washing algae from the base of the stand and keeping the fenced area free of weeds. Most tap stands, while still functional, had algae growing around the base and fences were in a state of disrepair.

5.5 Technical capacity; including the competence of local technicians and existence of a local supply of spare parts

Most communities have a team of local technicians who were trained at the time of system implementation. The exceptions to this are the villages whose systems were built by the Red Cross and the AFVP. At these sites, no technicians were trained to repair even the most minor of problems. Not surprisingly, all but one of these systems is now in a state of complete disrepair and the communities have returned to the traditional water source.

The technical capacity and competence of local technicians varies by community. Most FIKRIFAMA villages have well-trained, confident technicians who have been capable of handling all problems including pipe replacement. In all other communities, technicians are timid, under trained and admitted during interviews to being incapable of performing major system repairs. However, most communities could rely on indigenous knowledge for a simple faucet repair. While some technicians would like to receive payment or another form of compensation for their services, the majority is content to perform their jobs without pay.

The resourcefulness of local technicians is quite remarkable. In many cases cracked pipes were found being held together with bicycle tire inner tubes and other non-traditional means were being utilized to keep a system functional. In one instance, a village asked a technician from a neighboring village to assist in rebuilding faucets. The visiting technician successfully repaired four tap stands using a hodgepodge of spare parts and was paid for his services.

Local spare parts supply

Spare parts for the repair of GFWSS are not available in the Ikongo district. Parts are now bought from Fianarantsoa or in the cases of the southern most communes, Manakara. Especially in the cases of the most isolated communities, this incontinence is a major obstacle to suitability. Often the cost of public transport to and from the village is more than the cost of the part itself. This inconvenience inevitably leads to increased breakdown times and the dependence on others outside of the community to purchase replacement parts.

Apart from technical competence, a common obstacle to achieving a sustainable system of maintenance for rural water systems is the lack of tools or easy access to replacement parts needed to fix the system. Most communities were told after construction to purchase a pipe wrench using communal funds but few have done so. In only a few isolated instances were the random spare parts remaining after construction left in a community. The mechanism for acquiring spare parts is also not clear. No communities were left with a detailed explanation of how or where to obtain spare parts. For most of the Ikongo district, the closest parts supplier is over 200 km away in Fianarantsoa, a journey of 10 or more hours by foot and unreliable, expensive public transportation.

The standardization of a spare parts supply and a list of references of needed parts is lacking in all communities. Most people in these communities cannot read and write in their native language, Malagasy. To compound this obstacle, parts names in Madagascar are referred to in French, meaning ordering the correct part would be a challenge in instances where the part being replaced could not be brought into the hardware store. In no cases were maps or detailed lists of materials used in construction left with the community or commune office for reference when negotiating parts replacement.

5.6 Understanding Existing Community Management Agreements

5.6.1 Pre-construction

A discussion of community management must begin with the community's organization and assistance during system construction. After a community is chosen to receive a water system, a community contribution is decided upon with the builders. This community contribution is almost always in the form of labor (i.e. daily laborers to help technicians and dig ditches) and providing local materials for concrete construction (i.e. sand, gravel). Transport of non-local materials from the nearest accessible road to the village is almost universally the responsibility of the community. FIKRIFAMA also required communities to pay the cost of transporting materials via truck from the capital, Antananarivo, to the project site as well as supply food for the FIKRIFAMA technicians during the duration of construction. In special circumstances, when the communities could not pay these costs other donors such as LDI covered them.

Community contributions are collected through traditional mechanisms or through the election of a temporary water committee solely created for this purpose. In many cases a system of funds collection in the form of money or in kind (i.e. rice), is organized per household. Both men and women assist in materials collection. Typically the women collect the sand and the men the gravel. Men in the community are always responsible for daily materials transport and canal digging.

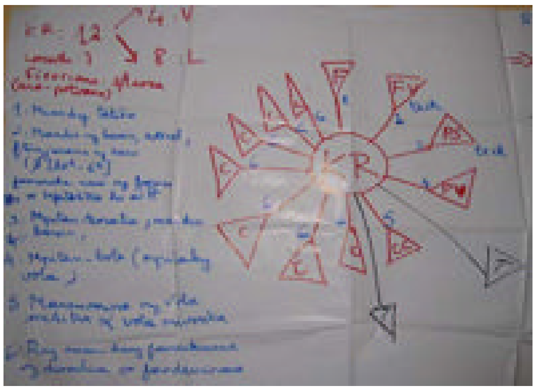
5.6.2 Post-construction

After system construction some type of communal management structure was established in all communities visited during the survey except in the village of Voninkazo, commune Ikongo, where no management system was established after system construction. The evolution of these management structures and repercussions on system functioning varies widely from site to site. With the exception of communities with systems installed by the Red Cross and the AFVP, water committees have functioned with varying degrees of success and continue to wield some, albeit limited, control over the systems. In the Red Cross and AFVP cases, all structure and semblance of community management have deteriorated to the point that now the systems are not being managed and are in a state of neglect and disrepair.

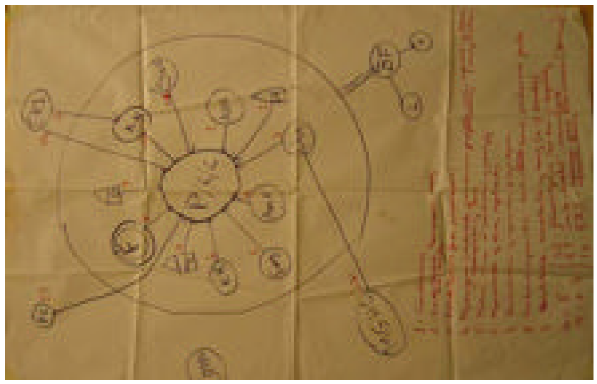
Typically, management of the community water supply is placed in the hands of a village water committee or "*Komity Rano*" (KR). The typical KR has 6-10 members and includes at least a president, vice president, secretary, treasure (See figure 5.3). KR were either elected by the community after construction or, in some cases, were the remnants of the committee elected to oversee construction. Those chosen to lead the KR are often elders from the community who lack the aptitude to effectively lead the committee because they live outside of the village center or are uncomfortable enforcing such as payment of funds.

Venn diagrams carried out with each KR exposed the malfunctioning of these structures in almost every community. Often, KR's have too many members who lack clearly defined roles within the committee. When asked to explain individual members' roles, the most common responses were "to watch over the water system". For instance, treasurers had often never managed any money and secretaries had never taken notes at any meetings. In the majority of communities the water committees are not dynamic and the communication between members is poor. In three cases, committees had members who wanted to relinquish their roles but felt trapped in the original structure.

Figure 5.3: Example Venn diagram's from RRA community workshops showing: (a) members of a typical water committee and defining roles for each; (b) the responsibilities that the community felt to some stakeholders outside the community were for the water system; (c) the existence of individual tap stand committees independent from the larger village water committee.



(a)



(b)

(c)

In a few communities, completing Venn diagrams exposed that actors living outside the community were involved, or thought to have involvement, in the management of the water system. Such was the case in Voninkazo, commune Ikongo where the village put the financial burden of parts replacement on a wealthy descendent of the village now living in France. NGO's were also implicated in systems management. A Venn Diagram done in a village that this author had lead the construction of a GFWSS identified that the community still implicated him having some in management of the system (See figure 5.3.b)! This was common at other sites as well, especially in communities that had been bailed out of paying for a tap replacement or other repair by an NGO or other benefactor.

In all systems built by FIKRIFAMA, CARITAS and ASTUCE there are also independent, tap stand committees established to manage each water point. These committees always consisted of two members, typically a man and a woman, who oversee the maintenance and funds collection for each public tap stand (See figure 5.3.c). Again, the effectiveness of these structures varies from tap stand to tap stand. In general, tap stand committees operate no more cohesively than do their KR counterparts. Also, internal communication between these structures and the larger KR was disjointed.

Both the villages of Tsarakianja, commune Tolongoina and Ambohimalaza, commune Manampatrana have had their KR made official by the government. This is a simple process of making the committee recognized as an official *fikambanana*[2]. Status as a *fikambanana* is *not* an official transfer of power or ownership of the infrastructure to the community. However, to achieve this designation the community must have a charter document explaining its purpose. In Madagascar, a community *Dina* or traditional agreement are also needed to have a *fikambanana*. In the case of the two water committees, Dina's included a clear outline of the responsibilities of systems users, rules for proper system use and sanctions for noncompliance.

Further investigation of the effects these agreement had on community management clearly showed that there was a positive correlation between official recognition of the village water committee and proper system management. In both cases mentioned above, the KR's of these villages have been more dynamic and successful in implementing the

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[2] *Fianbanana* – officially recognized community groups in Madagascar. Common types of fikambanana include: sewing groups, farmers groups, and women's groups…)

community management model than the other 26 villages in the study. Ambohimalaza, the first community in the Ikongo district to receive their water system in 1999, has flourished and evolved in the most successfully managed water systems in the region. This community has been able to successfully replace multiple broken faucets and established a unique method of sustainable funds collection.

With the exception of these two officially recognized KR's, all other water committees in the Ikongo district have not been made official by the government. These KR have no written structure or set of agreements that guide management of the system. Most communities recognized that some verbal agreements outlining rights, responsibilities and sanctions were decided upon after system construction but that these agreements have been ineffective in providing clear guidelines for maintenance of the system. It was clear that those communities whose management agreements were written down and kept were much more successful that those with verbal, informal agreements.

Venn diagrams and semi structured interviews with key informants in the communities reflected that women are respected in the communities and often are implicated in the management of the water system. Women's roles are typically treasure, secretary or tap stand attendant. In only two villages was a woman the president of the water committee. In some communities, few women vocally participated during the RRA activities preformed with the entire community; but were candid about the difficulties of system management, specifically in their role as tap stand attendant, during the home interviews with the female researcher.

In no cases have long-term monitoring and evaluation activities continued in these villages. A man in the village of Ambodimaranga, commune of Ankarembelo told us that we were the first to return and inquire about the functioning of the water system in the six years since system instillation. Unsurprisingly, the research team found no functioning community management structure and the system in a state of disrepair.

Even with the grim management situation described above, there is a strong tendency and ability for these communities to manage their water systems through traditional mechanisms that have been used to manage shared community resources for generations. One such example is the use of the “tranobe”. The *tranobe* is the traditional village structure found among families in Antanala villages. The *tranobe* has been used for generations to solve problems, collect monies or settle land disputes in Antanala societies. In one village the research team was told that the following an externally designed foreign management structure for the water system was not a priority for the community because the *trano be* structure was effective in mobilizing needed funds and organizing the community when needed.

5.7 Understand existing systems of funds collection and identify constraints to the adoption of a reliable method of funds collection

After the initial capital investment has been made, rural water supply systems require additional financial resources to ensure longevity and proper system functioning. To meet this challenge, an effective system of community funds collection must be implemented and followed over the lifetime of the system. Implementing and maintaining a sustainable system of funds collection in rural communities has proven difficult throughout the world. Many dynamics within the community need to be evaluated before a system of cost recovery can be agreed upon. These include but are not limited to: willingness and capacity to pay, financial management of collected funds, a method of fees collection and enforcement of payment (Schouten and Moriarty, 2003). Also, the innate idea in many rural areas that water is a free commodity can reduce participation in a community cost recovery scheme.

In 27 of the 28 villages in this survey some rudimentary system of cost recovery was discussed with the community after system implementation. Only in the case of Ambohimalaza, commune Manampatrana has the system of cost recovery proposed after construction evolved to a sustainable system that is followed annually by over 90% of the households in the community. In all other communities the cost recovery system has been only partially followed or not followed at all since system implementation.

In most communities, funds collection is the responsibility of the tap stand committees. All collected monies are then given to the treasurer of the KR. In *no* villages was this type of collection system being followed. Most treasurers had never handled any of the money collected within the community nor have any idea where or how much remains in the hands of the tap stand committees.

Other problems with sustainable funds collection include: lack of a fixed time schedule for dues collection and the lack a list of names of all those who should participate in funds collection. When monies are collected, individual contributions were written down in a journal. But, this list is never compared with a global census of all who should pay. All communities complained that those who live in the countryside rarely participate in funds collection. In most villages this causes those who live in the village center to feel they are paying too much and being taken advantage by the free riders. After one cycle they cease payment and the entire cost recovery scheme is abandoned.

Seven years of successful Cost recovery

The village of Ambohimalaza, commune Manampatrana has proven that community funds collection can be sustainability implemented in even the most remote villages. After system construction in 1999, the village decided on a system of cost recovery that payment was done in the form of un-hulled rice, twice a year after the two annual harvests. All rice is stored in a storage house specifically built for this purpose. They have used this money to replace multiple faucets, buy tools and build community showers and latrines at every tap stand.

Communities have no problem safeguarding collected funds in the village with the local treasurer. Poor accountability and the transparent use of funds was rarely mentioned as an obstacle to payment. Though, in a few cases, it was noted that the communal cost recovery system fell apart only after finding money missing from the treasury.

In some situations where the water system has needed a sudden part replacement communities have been able to come up with money for replacement parts using traditional means such as the *trano be*. This is a strong mechanism of traditional money collection that should be analyzed and possibly adopted to encourage more participation in community funds collection covering recurrent operations and maintenance costs of the water system.

A common theme from all site visits was that not enough time and detail was given to establishing a unique, dynamic system of cost recovery within each community. On the contrary, rather than spending the time and resources needed to build a sustainable system of cost recovery through a participatory process, fear and mild intimidation has been used to force communities into accepting fees and collection agreements. For example, one builder insisted in many communities that each member of the community over 18 years pay 2000 Ariary per year. Many communities complained that this price was too high for most in the community to bear, but were told that this was the law and they were required to comply. There is currently no flat rate tariff that must be collected from rural water supply systems. While it is clear that water must be paid for, the amount of this tax is dependent on the community's ability to pay.

Unsurprisingly, without meeting to bring the fee down to an appropriate level, they have chosen not to pay. Some communities were grateful to learn that no legal impediments hinder the changing the price of the water tariff. In an exceptional case, the mayor of one commune threatened the villages with closure of the water system if tariffs are not paid. This threat has not materialized after two years of non-payment. Tactics such as these contribute to the feeling in most communities that the water system is not theirs.

Chapter 6 Conclusions and Recommendations

6.1 Conclusions

The three primary objectives of this research report were to:

1) Assess potable water infrastructure: water quality, technical design, and current state of repair in select villages with gravity flow water supply systems in the Ikongo district.

2) Use Rapid Rural Appraisal (RRA) to evaluate the state of community management in select villages with gravity flow water supply systems in the Ikongo district looking specifically at maintenance, capacity to deal with repairs, organization of the water committee and systems of community funds collection.

3) Compare results of the RRA study to published literature of effective community management and offer recommendations to NGO's and others in charge of establishing and supporting communal management structures in the rural countryside.

Results gathered from the 28 RRA community workshops held in rural villages in the Ikongo district, Madagascar clearly show that there is locally recognized, tangible value to potable water projects and that communities acknowledge their responsibility as the primary managers of local infrastructure. Furthermore, it is clear that the fundamental reasons behind community abandonment of management responsibility, lies primarily with the many mistakes made by the implementing agencies before, during and after project implementation including not clearly defining rights, responsibilities, boundaries and sanctions critical in the effective management of a common property resource.

Summaries of these results (See Chapter 5) have highlighted the wide range of setbacks encountered by communities during the evolution of community management structures for gravity flow water systems, as well as shared success stories and experiences from within these communities so desperately trying to maintain their precious water supply.

The crux of what the research team has learned is summarized as eight central lessons (presented in order as they were discussed in Chapter 5).

Lesson 1: Site selection – Selection of villages that have received Gravity Flow Water Supply Systems (GFWSS) has been predominantly based on macro scale regional development strategies or convenient truck access form the only drivable road in the region. Some community leaders expressed discontent that local priorities such as population size and existence of rural health clinics were not considered when placing GFWSS in the region.

Lesson 2: Few Beneficiaries from Piped Water Supply Projects - The dispersed settlement patterns of the Antanala people have not been considered when deciding on appropriate technologies to provide potable water in the region. Only a fraction of the total population of most villages uses the water supply daily. This minority cannot afford to provide the necessary monetary contribution needed for routine maintenance and parts replacement.

Lesson 3: Choice of Contractor - The choice of competent contractor can greatly increase sustainable functioning of gravity flow water systems. Ensuring technical competence in the implementing company cannot be overemphasized. FIKRIFAMA, Caritas, ASTUCE and Peace Corps have built systems that are structurally sound, designed properly and provide *potable* water. In all other cases, specifically those systems built with dam intake systems; water quality (as determined locally by presence of turbidity during the rainy season) is unacceptable, particularly during the rains. When infrastructure is designed improperly or the community recognizes that the system provides water of poor quality it inevitably starts a vicious cycle that ends in neglect and disrepair.

Lesson 4: Technical Capacity Exists - When trained properly, local competence exists to diagnose and fix system failures without external influence or support. Properly equipped local technicians have proven proficient at all types of repairs including pipe replacement. In these situations, the major obstacle to achieving sustainability is a lack of simple tools and local spare parts supply.

Lesson 5: Cookie-Cutter Water Management Approaches - There is a noticeable lack of unique, indigenous community management structures customized to appease the complex internal dynamics found within individual communities. Assuming that all communities are the same, a "cookie cutter" approach to erecting community management schemes has been imported and replicated throughout the Ikongo district. This top down approach, where builders have coerced communities into electing puppet water committees with no real mandate or legal rights to manage their water supply has created a dysfunctional collection of pseudo water committees unable to respond to local needs.

Lesson 6: Rights and Responsibilities Unclear - An explanation of communal responsibility for the management of a community water supply in rural areas as stated in Malagasy law has never been included during the establishment of a community water committee. Neither the local authorities nor community water committees understand their respective boundaries, rights and responsibilities under Malagasy law. Currently most water committees have too many members whose roles are unclear and overlapping. With few exceptions, written agreements granting legal management responsibility for rural water systems to communities have not been put in place. Time and time again water committees complained that members of the community did not respect verbal agreements governing proper use of the tap stands and their inclusion into a system of recurrent funds collection. These attitudes are unsurprising when no formal boundaries, rights, responsibilities and sanctions for breech of communal management contracts have been formally written and made legal by the commune. A noticeable consequence of this is that most communities have little sense of ownership for their water system.

Lesson 7: Lack of Monitoring and Evaluation - Projects implementing gravity flow water supply have been shortsighted, neglecting to include ongoing monitoring and evaluation activities in program budgets. Neither donors, builders nor government officials have visited most villages since project implementation. This lack of institutional support assisting immature community management associations has undoubtedly doomed many communities genuine attempt at achieving sustainability. It is in this isolated environment that community management breaks down, beginning the vicious cycle of neglect and disrepair.

Lesson 8: Dysfunctional Funds Recovery - Contractors have either neglected to implement systems of cost recovery or set tariffs too high for the average household to bear causing most in the community to forgo participation. Where existing, sanctions to limit free riders that take water without payment are poorly defined and rarely enforced**.** Cultural pressures make it difficult for deny water to those who do not pay. Collection of funds from those living in the countryside is a recurrent problem throughout the region.

6.2 Recommendations

In response to the eight conclusions presented above, Table 6.1 presents eight recommendations that can be used by development practitioners in Madagascar to improve sustainability of community managed rural water supply. Many of these recommendations coincide with statements already written in the *Manual de Procedure*. They are included here to provide concrete examples as to why a thorough understanding and adherence to the guidelines in this manual by all involved in implementing rural water supply is vitally important if sustainable progress is to be made in the sector.

Recommendation 1: Alternative Approach to Site Selection - The placement of water systems must be determined by other factors than strictly location of a village within a donor's zone of intervention or accessibility along a passable or all-weather road. Such factors could include the existence of a rural health clinic or large permanent population in a village center. This implicates a better synergy between the government, donor groups and NGO's when choosing sites. Multiple stakeholder priorities should be balanced before new systems are implemented. Existing forums such as the Fianarantsoa

Eco Regional Alliance and the Fianarantsoa regional DIORANO WASH committee are ideal for prioritizing potential new sites in the region.

Table 6.1: Eight recommendations corresponding to the eight major conclusions of the RRA study

Conclusion	**Recommendation**
Site Selection	Alternative Approach to Site Selection
Few Beneficiaries from Piped Water Supply Projects	Investigating alternative technologies for scattered populations in the rural countryside
Choice of Contractor	Certification of contractors who specialize in Implementing Gravity Flow Water Supply
Technical Capacity Exists	Establishment of Regional Spare Parts Supply Centers
Cookie-Cutter Water Management Approaches	Improving Community Participation during Project Development
Rights and Responsibilities Unclear	Disseminating Laws Outlining the Tenants of Community Management to Local Authorities and Water Committees
Lack of Monitoring and Evaluation	Investing in Support
Dysfunctional Funds Recovery	Innovative Approaches to Community Funds Collection

Recommendation 2**: Investigating alternative technologies for scattered populations in the rural countryside -** Alternative technologies including rainwater harvesting, household sand filters or spring capping should be investigated for use in the rural countryside where population densities make piped gravity flow water systems too costly. These technologies require little maintenance and need no community cohesion to work effectively.

Recommendation 3**: Certification of contractors who specialize in Implementing Gravity Flow Water Supply -** Competent builders, specifically FIKRIFAMA, ASTUCE or an equivalent should be chosen to implement all new gravity flow water systems. While not without error, these builders' professional approach and experience in the field have proven the most likely formula to establishing and maintaining sustainable rural water supply. A certificate system could be established in collaboration with the national DIORANO-WASH campaign. This certificate would insure builder competence and eliminate unqualified contractors whose sole purpose is profit from bidding on potable water projects.

Recommendation 4**: Establishment of Regional Spare Parts Supply Centers -** To alleviate the problem of limited access to spare parts, parts centers must be established in all commune centers with GFWSS. This could be done in connection with established Koloharena *Centre d'Approvisionnement* agriculture centers common in the region (i.e. Tolongoina, Ikongo, Manampatrana). The centers should stock a minimum of replacement faucets, washers common. Tool kits, including a pipe wrenches, screwdriver, metal brush and a pipe saw should be available for rent for communities that do not have these tools. Initial tools and parts supply could be supplied through a revolving fund that was repaid over time by usage fees. Also, a repair manual with pictures and simple instructions needs to be compiled and given to all water committees. Additional technical trainings should be organized as requested by the community

Recommendation 5**: Improving Community Participation during Project Development -** Simple RRA or PHAST (Participatory Hygiene and Sanitation Transformation)[3] studies should be done in all communities chosen to receive rural water supply. The results of these studies will help implementers better understand the internal dynamics within a given community and will greatly assist in questions such as establishing a sustainable method of funds collection and successful system of community management. Results from these studies must include an evaluation of all possible technical solutions for solving communities' water needs. These options will include technologies that reach the most rural, poor, and vulnerable populations (including members who do not permanently live in the village center).

Recommendation 6**: Disseminating Laws Outlining the Tenants of Community Management to Local Authorities and Water Committee -** Meetings reporting the findings of this study should be organized in each commune in the Ikongo District. These meetings should include a thorough explanation of the precepts of community management as stated in the Manual d' Procedure as well as explaining both the Ministry of Energy and Mines and ANDEA's roles in supporting rural water supply. It is

[3] PHAST is an innovative community approach designed to promote hygiene behaviors, sanitation improvements and community management of water and sanitation facilities using specifically developed participatory techniques.

imperative that Malagasy laws regarding the management of rural water supply systems be explained to all local government authorities and rural communities with existing water systems.

Recommendation 7: **Investing in Support -** International donors, implementing NGO's, construction companies, and the regional government must devise a common method of periodic monitoring and evaluation of rural water systems. An important part of this study was the taking GPS readings at all water points in the Ikongo district to be included in a national database of all water points in the country. Once this database is complete it is imperative that regional government and donor community use this information to formulate a strategy to monitor and support rural water supply. Investing in an institutional support mechanism for the monitoring of existing rural water supply systems is as critical as scaling up the construction of new infrastructure.

Recommendation 8**: Alternative Approaches to Community Funds Collection -** To increase participation, dynamic approaches to rural community funds collection need to be investigated. Suggestions include systems of providing rice or other agricultural products that can be exchanged for paper money or different tariffs for those living in the countryside and the village center. Villages must be engaged at all levels of the design of their cost recovery system. In the Antanala region, exploring the use of the *trano be* as a traditional structure of funds collection should be explored.

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Appendix I - Program Schedule and Checklist for RRA Community Workshops Assessing Progress of Community Managed Gravity Flow Water Systems in the Ikongo District, Madagascar

The following is the program schedule that was *loosely* followed at each village RRA workshop.

Introduction
Time: 15 min

Introduce the researchers and the goals of the study. Give a brief introduction to the RRA methodology and explain what will happen during the study. Emphasize the importance of community participation in the research. Discuss why the information is being gathered and how it will be used.

Community Profile
Tool: Community mapping
Participants: Mixed community
Time: 20 min
Checklist:

- When was system built? Who built the system? How was it funded?
- Location of schools, health clinic, churches, other.
- Location of water source, reservoir, tap stands
- Location of WC's
- Community satisfaction with location of tap stands
- Location of previous water source

Community Profile
Tool: Seasonal calendars
Participants: Mixed community
Time: 20 min
Checklist:

- Seasonal Migration Patterns
- Frequency of diarrhea throughout the year
- Quantity of water throughout year
- Quality of water throughout the year

Understanding the current management/maintenance strategy for water system and identifying problems in the current approach
Tool: Venn diagram
Participants: local water committee
Time: 45 min
Checklist:

Maintenance

- Is there a set of O&M regulations for the water system?
- Did the people of the community negotiate these agreements?
- Do they accept their roles and responsibilities for O&M?
- Define the roles for the community and outside agencies?
- Are theses regulations enforced, How? By Whom?

Continuing Management

- Was a community management agreement established at the time of system construction?
- Who are the parties involved in carrying out the agreement, what are their roles?
- Is there a village water committee?
  - If yes, is this an official village association registered with the district, region?
  - If yes, than how many members, # of women, # of men

Competence to Manage

- What are the roles of women in system management?
- Does the community show the ability to take corrective action and solve problems?
- Do members of the community perceive themselves as competent to carry out the management of the water system?

Understand existing systems of funds collection and identify constraints to the adoption of a reliable method of funds collection

Tool: Venn diagram

Participants: focus groups of both men and women who live in and outside the village

Time: 45 min

Checklist:

- Does the community have a system of recurrent cost recovery?
  - If yes, who pays?
  - How much?
  - How often?
  - Who handles the funds that are collected?
- Are there effective community rules for collection, management, and use of the collected monies?
- Is there a transparent accounting and financial management system with which the community is satisfied for the collection of funds.
  - Are there books that record funds collection?
- Where are the communal funds kept?
- Has the cost recovery system been followed since system inception?
  - If no, what are the obstacles to payment?

- Does the community feel that the per capita unit costs are appropriate to the level and quality of service?
- Are the monies collected adequate to cove recurrent O&M costs?
- Are government buildings (ie school, hospital) being supplied with water? If so, are there agreements for collecting contributions from these sources

Exposing the current and historical functioning of water system. Assess sanitation and hygiene practices in the community, specifically hand washing, latrine use and water storage

Tool: Transect walk
Participants: local technicians, women
Time: 1 hr
Checklist:
Community involvement in System implementation

- Describe community involvement in construction of water system
- What was the community contribution
- Were they paid for labor?

Description of existing infrastructure

- Spring box or barrage
- Sand filter, Sedimentation
- Reservoir
- Number of tap stands

Quality of water at source

- Type of source (spring, stream)
- Is the water visibly clean at source
- Is the water perceived as clean by community members

Number of facilities in working order

- Is the water currently running to all taps
- Problems with the pipeline
- Does the source provide enough water to meet existing demand?
- Does the water run all year round? Are there seasonal variations in water quantity? If so, when are the shortages?

Maintenance

- Are there local technicians trained in routine maintenance and repairs?
- Do local technicians feel competent to carry out their O&M requirements?
- Do local technicians have the necessary incentives (ie monetary, other) to undertake maintenance tasks and repairs?
- Is there a supply reliable, affordable source of spare parts?
- Are the proper tools available within the community for simple maintenance?

Identification of priority strategies to improve system functioning
Tool: group discussion
Participants: All workshop participants
Time: 30 min

- Review of what was uncovered during the community workshops
- List of problems that need to bee addressed to improve system functioning
- List of actions that need to be taken to combat those problems
- List of those responsible for completing those tasks outlined above

Closure of visit
Time: 15 min

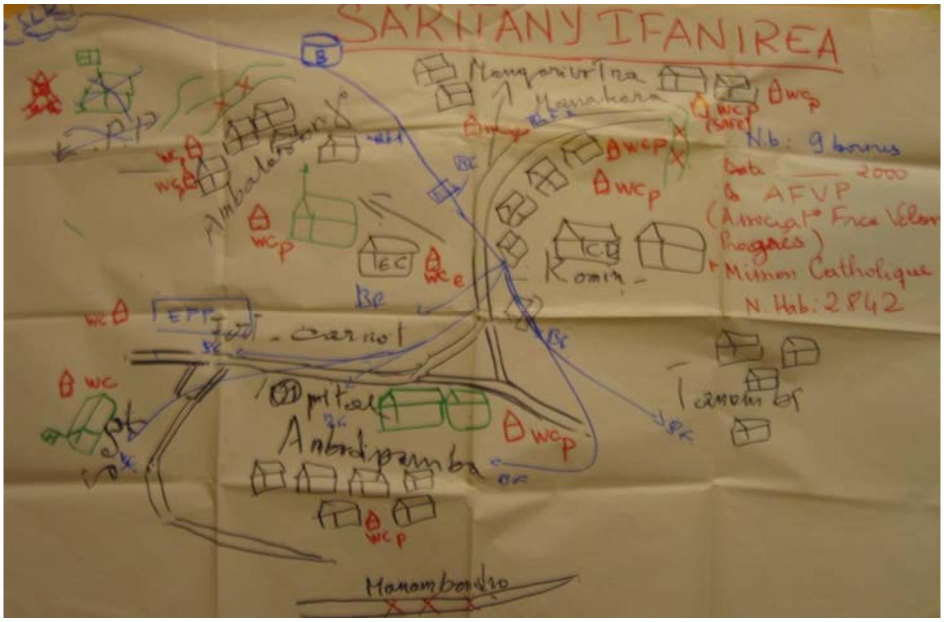
Summarize major findings from the study and present the findings to the community in story form. Encourage the community to share final thoughts and immediate reactions from the study. Thank the community for their time and participation.

Nightly Analysis

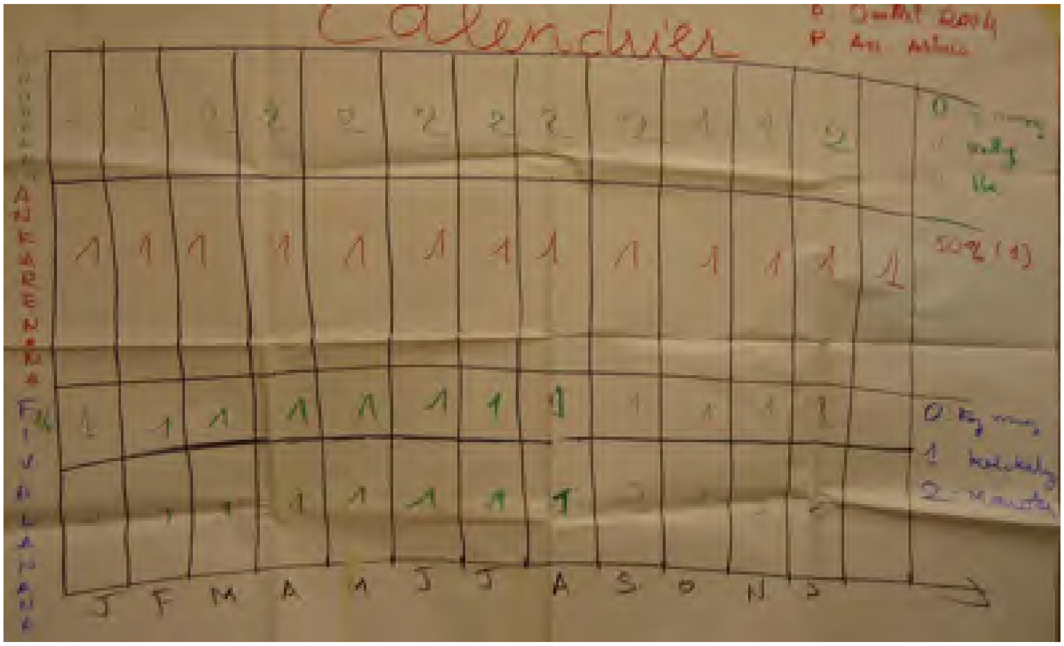
Each night after a site visit the team will review the objectives of the study and reflect on the information that was gained. All tools will be re examined or "interviewed" for completeness. Brief reports summarizing and organizing the researchers notes will be compiled.

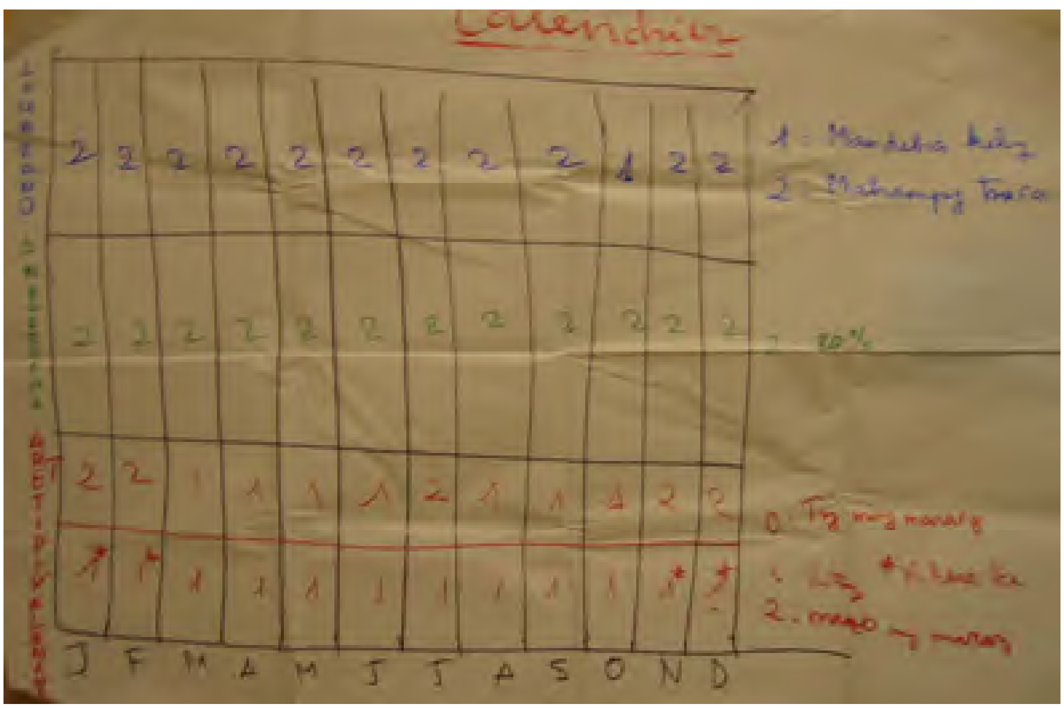
Appendix II – Examples of Flip Charts from Community Workshops Showing RRA Tools that were completed with Communities:

Participatory Mapping



Seasonal Calendars





Appendix III – Map Created using Arc View Software Showing the Locations of all Gravity Flow Water Supply Systems in the Ikongo District, Madagascar as of February 2006.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Appendix IV - Overview of Gravity Flow Water Systems[4]

Types of water sources

Springs

Springs are usually located in hilly terrain as a result of a shallow water table percolating to the surface. Depending on the water table, springs can be very reliable and provide a safe, potable water source throughout the year. Technically this is the best choice for a source of potable water supply because contamination is unlikely even if human activity continues in above the source. Care must be taken when selecting a spring to avoid developing one that will dry out during the dry season. Surveying the community nearest to the spring about seasonal variations in spring output helps in determining this.

Springs are typically the cleanest source of water available because the various soil textures in the water table act like a sand filter removing bacteria and viruses in the water before surfacing at the mouth of the spring. However, there can be problems with mineral or salt content depending on what type of soil the water is filtering through. Most causes of pollution from these sources occur at the mouth of the spring from poor spring box construction.

Rivers and Streams

In situations where a permanent spring either cannot be found or will not provide the needed volume of water required by a community throughout the year, rivers or streams can be dammed and used as sources of gravity flow water systems. Water quantity is usually not a problem at these sites. However, water quality tends to fluctuate greatly throughout the year depending on seasonal rains and human activities upstream. If this type of source is selected there is usually some form of filtration, settling or chemical treatment installed after the collection point.

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[4] For a complete introduction into designing, surveying, and building gravity flow water systems see *A Handbook of Gravity Flow Water Systems* by Thomas D. Jordan Jnr. UNICEF 1980.

System Components

Spring Box or Dam

When a spring is used as the water source, a simple spring box is typically built to protect the spring eye from agricultural and human wastes. Spring boxes, made of either steel reinforced concrete or dry stone masonry enclose the spring source effectively preventing outside contamination.

Dams are simple structures built across small rivers or streams. These structures trap water behind a retaining wall causing an ever-present pool that is piped into the water system. Due to issues with water quality, dams should have a sedimentation tank or sand filter immediately following the entry point into the pipeline.

Mainline

The Mainline is the pipe that runs from the spring(s) to the reservoir. It is generally designed not to flow full in which case it acts like an open channel canal.

Reservoir Tank

Reservoir tanks collect and store water during nights and low use periods. Especially when designing a system with a spring source, calculation the reservoirs volume capacity is critical to avoiding unnecessary losses causing water shortages during peak use hours. A reservoirs capacity is designed considering the village population using the system and daily output of the spring. Tanks are watertight with an access hole and washout pipe for cleaning.

Distribution Network

The distribution network is the sequence of pipes leading from the reservoir to the tap stands. To avoid air pockets in the pipeline and save money on unneeded pipe capacity, pipe sizes should be sized from largest to smallest starting at the reservoir. To avoid mistakes in pipe design that will lead to frequent disruptions in service, it is important that an engineer or experienced technician design the distribution network.

Tap Stands

Tap stands are the public areas where the piped water is available to the community. On average one tap stand can support 150 users per day. Tap stands are usually made of reinforced concrete but can also be made of dry stone masonry. Models vary widely depending on the builder. It is important that tap stands be made with proper drainage to prevent stagnant water from collecting close to the tap stand.

Piping Materials

PEHD - or Polyethylene High Density Pipe is flexible and is sold in 100m roles. Inner diameter pipe sizes are available in 25, 32, 40, 50, 60 mm. Pipes are joined together using fasteners that mechanically fuse adjoining ends of the pipe. This is the standard pipe used in potable water supply in Madagascar.

PVC - pipe is the older type of piping material used in potable water supply. It is sold in 6m lengths in similar diameters as mentioned above for PEHD. PVC pipe is brittle, inflexible and joined together using glue. This type of pipe is not recommended for long distances due to the likelihood of joint failure and difficulty of installation.