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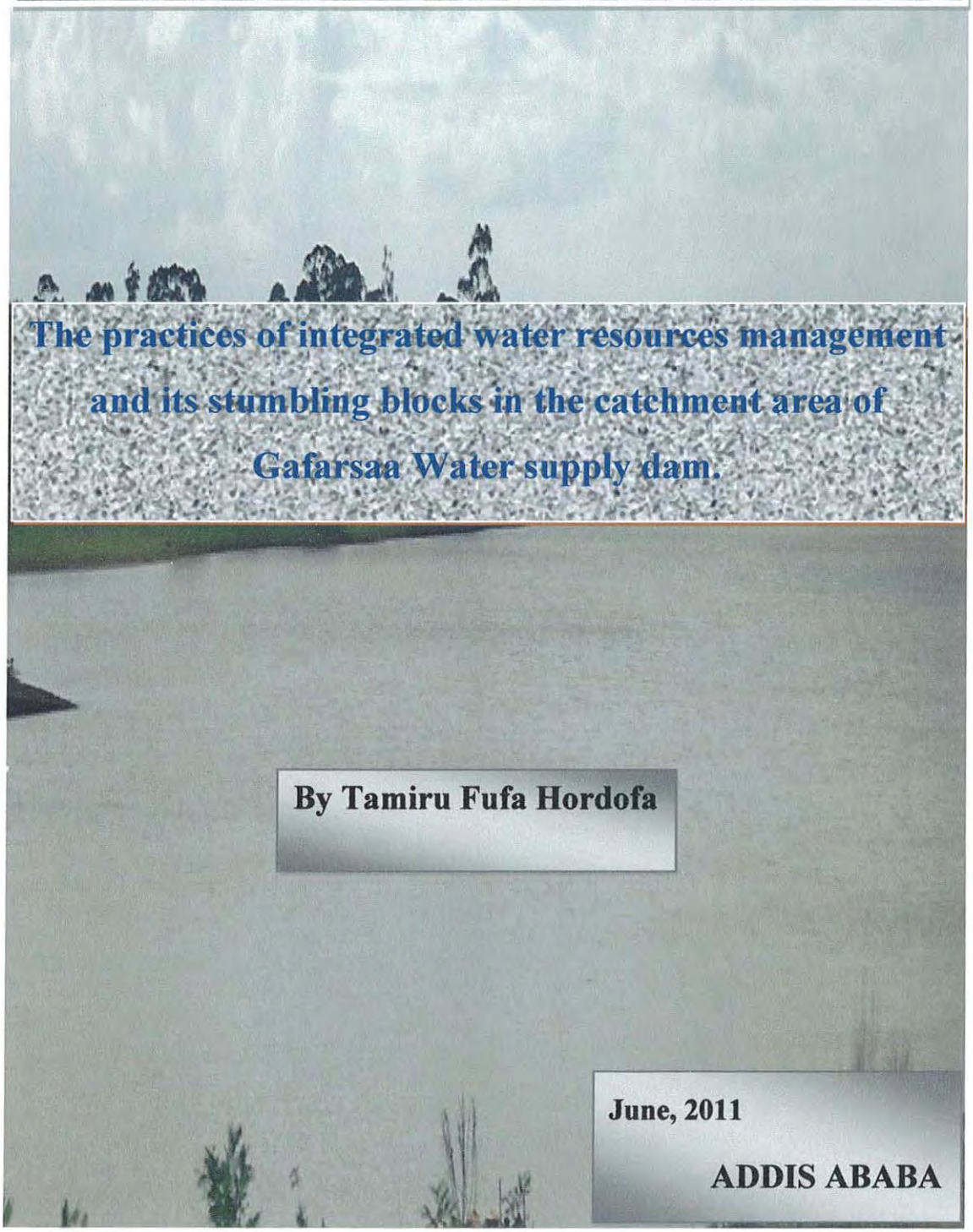

The practices of integrated water resources management and its stumbling blocks in the catchment area of Gafarsaa Water supply dam.

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ADDIS ABABA

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A thesis submitted to the college of Development Studies of Addis Ababa University in partial fulfilment of the requirements for the Degree of Master of Art in Water and Development (Water resources planning and Management)

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Title

The Practices of Integrated Water Resources Management and Its Stumbling Blocks in the Catchments Area of Gafarsaa Water Supply Dam

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Water and Development

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Table of Contents

Contents **Pages**

List of Tables

List of Figures

Acronym

AAWSA .....Addis Ababa Water and Sewerage Authority

BTA .....Burayu Town Administration

EIA.....Environmental Impact Assessment

FAO .....Food and Agricultural Organization

GCA .....Gafarsaa Catchment Area

GWP.....Global Water Partnership

GWSD .....Gafarsaa water supply dam

GWSDCM..... Gafarsaa water supply dam Catchment Management

GWTPS.....Gafarsaa Water Treatment Plant site

Ha.....hectare

HHs.....Households

ICWE .....International Conference on Water and the Environment

INBO..... International Network of Basin Organizations

IWRM .....Integrated Water Resources management

Max.....Maximum

Min.....Minimum

MWR.....Ministry of Water Resources

Ran.....Range

SD.....standard deviation

SPSS.....Statistical Package for Social Sciences

UN.....United Nation

UNCED.....United Nation Conferences on Environment and development

UTM.....Universal Transverse Mercator

WWAP.. .....World water Assessment programme

WAA.....Walmara Aanaa Administration

WSSD.....World Summit on Sustainable Development

WWF .....World Water Forum

Abstract

Geffersa water supply dam is one of the water supply dams of Addis Ababa city. It is located within the Burayu Town and Walmara Aanaa Administration in the special zone of Oromiyaa surrounding Finfinnee. Within the catchment areas of this dam there are very high anthropogenic activities that can affect the sustainability of water in the reservoir. Due to this, the study area is selected to be investigated under the study title "The practices of IWRM and its stumbling blocks in the catchment area of Geffersa water supply dam". The main objective of this study is to check whether there are integrations or not among the stakeholders of Geffersa water supply dam and its catchment area toward the practice of IWRM. It encompasses the specific objectives such as assessing whether IWRM is being practised or not in the catchment area, identifying the problems that hinder practicing of IWRM in the catchment area of Geffersa Water supply dam, recognizing compatible developmental activities appropriate to the catchment area and proposing alternative policy recommendation that help to guide implementation of IWRM in the catchment area. The research was conducted through mixed research method (qualitative and quantitative data collection methods) i.e. focus group discussion, questionnaires, direct field observation and document analysis. The relevant data was collected from different population group that interact within the catchment area. Purposive sampling was used to select head administrator of relevant sectors of Burayu Town and Walmara Aanaa Administrations, and Addis Ababa City Water Supply and Sewerage Service Authority and investors in the catchment area. Systematic sampling was used to select the farmers found in the catchment area. To get the necessary information about the land use changes of Gafarsaa catchment area starting from prior years of the dam construction for watershed analysis, the top five persons with highest age found around the dam were selected purposively for in-depth interview using semi-structured questions. The urbanized area that is approximately inhabited with 550 HHs was treated only by taking field observation and through focus group discussion with the representatives of BTA in order to gather information about the existing storm water control and sewerage disposal facilities. The relevant data sources were assessed in order to get information about land uses of the study area and national water resources policy. The human activities that threaten water in the dam are the land related activities proceeding within the catchment area such as agriculture, livestock rearing, deforestation, investments, uncontrolled waste disposal and urbanization. The miss uses of lands by the inhabitants of the catchment area emanate from lack of integration among the stockholders of the GCA. This shows that there is limited understanding of the concepts of IWRM. Hence, the study confirmed that the IWRM has not practiced in the catchment area of GWSD. Therefore, the catchment area of GWSD should have independent management unit in which all the stockholders should involve in IWRM from planning to implementation.

Chapter one

1 Introduction

The Metropolitan Area of Addis Ababa at present is supplied with water from three surface water sources (the Gafarsaa, Dirree & Lagadaadhii reservoirs) and ground water for municipal purposes.The surface water accounts 75 % of potable water for the city, while 25 % is from ground water sources. The three surface dams are located within Special Zone of Oromiyaa surrounding Finfinnee. At present 33,000 m^3 of water is produced at Gafarsaa treatment plant and 165,000 m^3 at Lagadaadhii-Dirree treatment plant per day (AAWSA, 2000).

1.1. Back ground

1.1.1. History of IWRM

The evolution of IWRM was related to scarcity of fresh water resources that have appeared throughout the world. As illustrated in (UN-Water/WWAP/, 2006) document, by taking Kenya as a case study, water is becoming scarce because of the limited natural endowment, changes in rainfall regimes, the growing needs of an increasing population, unsound use of water, catchment degradation and general weakness in the management and distribution of this vital resource. Due to this fact, the rationality and science of the enlightenment began to change the way people thought about water, starting from the late 19thCentury (ECC, 2006). As it was mentioned in the international conferences and multilateral agreements related to water, food and ecosystem the concern of water was perhaps discussed for the first time at international level in Mar del Plata, Argentina, 1977 in which the subject of discussion was about 'water resources, water use and efficiency' (FAO, 2004) .This Mar del Plata conference was certainly a major milestone in the history of water resources development for the 20th century and the conference has become an important benchmark in water resources management, mainly for IWRM (Rahaman and Varisa, 2005). In 1992 the discussion was made on 'efficient water use' on the International Conference on Water and the Environment (ICWE) at Dublin, Ireland to serve as the preparatory event, with respect to water topics, to the Rio United Nation Conferences on Environment and Development (UNCED) (Rahaman and Varis 2005). In this same year the issue of water was raised as 'protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources' on the UNCED held at Rio de Janeiro, Brazil in Rio

Marrakech in that the thematic focuses were 'water management, Global Vision for Water & Life and the Environment'. Similarly, at three years interval, the WWF was held in Hague, Kyoto, Mexico City and Istanbul; in 2000, 2003, 2006 and 2009, respectively. The thematic focuses were 'From Vision to Action', 'water as a driving force for sustainable development, environmental integrity, poverty and hunger', 'implementing integrated water resources management' and 'bridging divides for water', respectively. In December 2001 the International Conference on Fresh Water held at Bonn, Germany in which the thematic focus was 'good governance, funding gaps, capacity building, technology transfer, gender, participatory approach' (FAO, 2004). As it was depicted by Miznure et al (2005) another aim of Bonn conference was to make preparation for the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa, 2002, and third WWF in Kyoto, 2003. They also illustrated that this conference was successful in that it put IWRM at the top of international agenda.

Water by its nature creates network as far as it is linked to other natural resources- land, forest, biodiversity, etc and therefore it seeks the management approach that suite to this complexity nature of the aforementioned resource.

1.1.2. Statement of the Problem

Fresh water is finite resource, which needs appropriate attention of all stakeholders. Especially, the water resources used for household and public purposes in Metropolitan Areas like Addis Ababa should be inevitably sustained in terms of its quality and quantity; -even though this is true for all communities-. According to Chin and Hung (2010) the issues of water scarcity, river pollution, soil erosion, insufficient participation of stakeholders in water resources use and management, as well as centralized water planning and management system have created difficulties for sustainable development of a watershed. Sustainable utilization of water needs the attention of all stakeholders that engage in different activities in the catchment areas of dams. The catchment area with such complex human activities call for special management policies like integrated water resources management (IWRM). The current Gafarsaa water supply dam catchment conditions are by far different from when the dam was constructed. Recently a number of anthropogenic activities are in progress in the catchment. These activities have positive and negative impacts on the quantity and quality of water in the reservoir. Thus, considering the application of special management policies is crucial for sustainable water resources utilization. To this end, the practices of IWRM GWSD need to be investigated. The rationale behind is an integrated approach has to be taken to water, land use and environment to secure an optimal use of water resources. All the activities

in the catchment that have direct or indirect effects on the stored water should be analyzed to put the policy and/or strategic approach that can alleviate the problems observed in the catchment area.

1.1.3. Objective of the study

The main objective of this study is to check whether there are integrations or not among the stakeholders of Gafarsaa water supply dam and its catchment area toward the practice of IWRM.

The specific objectives of the study are:-

- To assess whether IWRM is practised or not in the catchment area.
- To identify the problems that hinder practicing of IWRM in the catchment area of GWSD.
- To identify compatible developmental activities appropriate to the catchment area.
- To propose alternative policy recommendation that help to guide implementation of IWRM in the catchment area.

1.1.4. Research questions

In order to attain the stated research objective, the solution was tried to find for following research questions through this study.

1. Is IWRM being practised in the catchment area of Geffersa Water supply dam?
2. What are the stumbling blocks that hinder the application of IWRM?
3. Are the existing policy and legal frameworks encouraging for the integration of all stakeholders to exercise IWRM?
4. What developmental activities shall/shall not be carried out in the catchment area?
5. Do we need to formulate a new policy guide?

1.1.5. Scope and Limitation of The study

The study did not employ the detail laboratory technique of the raw water in the reservoir. The issue of groundwater was also not included in the study, even though groundwater is an integral part of IWRM. These limitations are important in order to stay within the scope and focus of this study.

Chapter Two

2 Literature Review

2.1. Definition and principles of IWRM

The Global Water Partnership (2002) defines IWRM as:

> "a process, which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" .

In the context of this study, the integration of water resources management was used in order to view the integration of:

- AAWSA and water-related sectors of Burayu Town Administration and Walmara Aanaa
- Water use and all developmental activities in the catchment area of the study area

It is obvious that the lack of integration of all stockholders engaging in the utilization of a given water resource and its related natural resources can deteriorate its quality and quantity. As the study done by Ramachandraiah et al. (2007) on the Osmansagar and Himayatsagar water supply dams of Hyderabad city of India which were constructed across the Musi River revealed that lack of integration in the catchment area brought in degradation of the catchment of Musi in the upstream area because of:

- Building of thousands of check dams within the catchment area regardless of the government rule
- Wholesale plotting of the catchment area by the real estate players
- Changing land use and agricultural practices like converting fallow lands to agriculture, and shift from rain fed crops to irrigated crops etc.
- Quarrying in the catchment area is known to have diverted some of the feeder channels. In addition, at the end of the researchers concluded that the water in the two reservoirs might dry up completely in future: Himayatsagar in 2036 and Osmansagar in 2040. Since the same fate may encounter the Gafarsaa dam in the near future this study is expected to reveal the problem existing in the Gafarsaa catchment area with corresponding solutions.

The concept of integrated water resource management has been built up on the four Dublin principles, which help to gain a greater understanding of the key issues that define IWRM. These Dublin principles are:

1 Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2 Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
3 Women play a central part in the provision, management and safeguarding of water.
4 Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources

These principles have been interpreted by Rahamachandraiah (2007) as follows:

- The first principle help to recognize the finite and vulnerable nature of the world's freshwater resources that calls for the establishment of a holistic institutional framework that should take account of all characteristics of the hydrological cycle which results in coordination of :
    - Natural and human systems.
    - Governmental organizations and stakeholders of fresh water users.

However Funk et al (2007) also realized that there are substantial challenges to bring this theory in to practices particularly in developing countries which are often overwhelmed by a lack of skilled man power.

- The second principle needs real participation of stakeholders in the decision-making process, as water is a natural resource in which everyone is a stakeholder. Hence governments have the assignment to create suitable mechanism for stakeholders' consultation at all levels and need to pay attention on enhancing the capacity of marginalised groups to participate in decision-making processes (GWP, 2000).

According to Funk et al (2007) this principle is currently becomes prominent issue in the South African context as the National Water Act of 1998 calls for the compensation of past inequities in terms of access to water resources and the benefits derived from such access. Here again the participation of all stakeholder is viewed as a huge challenge to put theory into practice. As Hall (2006) cited in Funk et al (2007) the reason is due to the fact that participation of all stakeholders is slow and costly process and can easily be distorted by special interest groups. The study done in Samoa revealed that excluding the households from the water resources management threaten the sustainability of water resources in the Vaisigano-Fuluasou catchment (Taua'a, 2008).

For instance, the research done by Tefera and Stroosnijder (2007) on environmental and socio-economic changes induced by a reservoir in Fincha'a watershed reported that the lack of participation of stakeholders in water development like construction of dams are planned from a top-down which results in:

- Displacement of people against their will in the catchment area of the dam without sufficient compensation for the land they lost.
- Haphazard land-use without environmental protection measures such as land-use planning and soil and water conservation which can affect the water in the reservoir.
- Revenues generated from hydropower and water supplies often benefit urban dwellers, or the national economy, at the expense of rural inhabitants in watersheds.

➢ The third principle relates to the importance of involving women in decision-making in water management, seeing as women play an important role in the provision, management and safeguarding of water. Therefore, there is an urgent need to search different mechanisms for increasing the access to and participation of women in decision-making and other activities related to IWRM (GWP, 2000).

Here again the fear is that women may still have a much less influential role than men when it comes to decision-making relating to water resources. And therefore this need a radical shift to change the perceptions of considering women as people of secondary importance and this need a long time struggle to bring the necessary transformation Funk et al (2007).

➢ The fourth principle, refers to valuing water as an economic good, encompasses the two antagonistic concepts (if applying one can trade off the other). The first one is attaching value to a water resource in order to prevent it from being used unwisely or wastefully. The second one is charging for water can harm economically marginalised people who unable to pay and this in turn violate the human right to have clean and safe drinking water Funk et al (2007) .

Therefore, the researcher intended to view the practices of IWRM in the framework of these principles and pick out the obstacles hinder the implementation of IWRM to investigate the possible solution.

2.2. Why is IWRM necessary?

In the world with very limited amount of fresh water, the supply of this scarce resource has far fall behind its demand as population have grown, production has increased, economic activity has developed and societies have become wealthier (UN-water, 2008). The recent International consensus on IWRM is the consequence of a reorientation after a century of development in which the water sector was faced with a number of serious problems (Hartje, 2002); Fischnder,I and Heikkila, T., 2010). The deterioration of the water resources, the ineffectiveness of the solution to the problems and the economic wastes of resources, ignoring social dimensions of the water sector and the lack of awareness of the limits of the resources itself were the major problems that were emerged as a result of traditional water management. The water sector expanded during the last century in the industrialized countries and from the sixties onward in the developing countries by augmenting the supply of water for different increasing uses result in the scarcity of the resources. Xie (2006) also illustrated that the traditional approaches of water resources management (WRM) are inadequate for the global water challenges due to the fact that the approaches are mostly fragmented where each sector (domestic use, agriculture, industry, environmental protection, etc.) has been managed separately, with limited coordination between them.

The traditional approach of water management is also distinguished in its top-down approaches of management, supply augmentation over demand management and subsidization in delivering water services. This approach has caused negative externalities, making the opportunity cost of water to rise to unsustainable levels, inefficient operations and low quality of service, limiting the service providers' ability to maintain infrastructure effectively and causing service quality to decline (Xie, 2006).

Where upstream water and land practices impact directly the quantity and quality of water in downstream areas in a given basin or catchment/watershed area, many uses of water have spill over effects on other uses, and water development projects have unintended social and environmental consequences (Xie, 2006). The birth of new water management paradigm was therefore related to water scarcity experiential throughout the world (in developed and developing countries). The way water experts think about water resources was changed and resulted in the origin of new water policy management i.e. IWRM. This new policy for water resources management need the recognition of the interdependencies between agencies, jurisdictions, sectors and geographical areas for the effective management of the resource (Xie, 2006). Unless changes are made in the water management, a water crisis facing the present world will be escalated in the future (Suchorski, 2007). Without a considerable shift in

the way water resources are managed and water services are provided, the current water crisis will be aggravated. Given the above shortcomings with traditional WRM approaches, Integrated Water Resources Management (IWRM) has emerged as a means of addressing the global water problems and working toward a sustainable future for water management (Xie, 2006). According to Suchorski, (2007) IWRM system sees that all uses are met and balanced in the most sustainable manner possible, without compromising certain functions of water at the sake of others. Therefore, IWRM is necessary due the finite nature of (fresh) water, and the increasing pressure that the human population is placing on this irreplaceable resource. Butterworth and Soussan (2001) also pointed out that the multiple natures of water resources and their uses is reflected in a move away from traditional sector approaches to IWRM.

2.3. THE IWRM AND ITS CRITICISMS

Even though the importance of IWRM is put on the top agenda of most countries of the World, there are many opponents who condemn IWRM for its feasibility. For instance Jeffrey and Gearey (2006) criticise IWRM for the gap seen between its theory (policy statement) and practice (policy tools/mechanisms) due to the nature of the science which has informed its development and its schizophrenic character as part modernist and part post-modernist paradigm. Likewise, Biswas (2004) also claimed the implementation of IWRM is completely impossible because of its limited implementation potential and cultural, social and physical diversification of the world. He also pronounced the difficulty of implementation of IWRM due to the lack of investment funds, management capacities, and appropriate institutional arrangements.

Unlike the above opponents, Butterworth et al (2010) argued that some of the weaknesses seen in IWRM could be overcome through a much greater focus on locally rooted, pragmatic and adaptive use of its ideas in implementation. He suggested that instead of trying to implement the concept of IWRM in one piece, which seems an ideal to be of practical value, it needs continuous adaptation to the specifics of local reality. Rather than throw away the ideas of IWRM wholesale, it is had better to experiment, check and learn what works in different contexts. The author further recommended that taking due cognizance of the possibility that existing local arrangements are captured by local elite, building on effective existing local arrangements is more likely to succeed than starting from scratch at the catchment level. For instance according to (Mostert,2006) in the Netherlands, the IWRM idea emerged in a particular water management context, was interpreted and used in that context and in turn exerted some influence on the context. The same will be true in other countries. As a result, IWRM cannot be evaluated separately from its context. Billib et al. (2009)

pointed out that the application of IWRM should not be rigid for new development, easy to apply to non-expert users, integrates different viewpoints, and should have a structure focused on practical solutions. As it was revealed by Dzwairo et al. (2010) even though operationalizing IWRM is the huge challenge, systems thinking approach (more participatory and process-oriented approach) and incorporation of socio-economic dynamics (analysing the biophysical relationships like interactions in a basin between water, the human population and settlements) make its implementation easier.

The following table (table 1) shows some shortcomings of IWRM and highlighted the potential for alternatives, strategies and entry points to arrive at a more practical IWRM.

Table 1 Summary of common criticisms of IWRM and possible ways out

IWRM criticisms/problems	Solutions or ways forward presented in the paper
• Vagueness of IWRM concept. • No agreement on fundamental issues such as aspects to be integrated, how, by whom, or even if such integration in a wider sense is practically not possible. • IWRM is not sufficiently people-centred. • IWRM does not adequately incorporate adaptive management principles. • Concept is unwieldy. • Packages of IWRM reforms do not include local IWRM • River Basin Organisations or catchment agencies may struggle to establish	• IWRM should be considered more as a philosophy than as a 'package of reforms'. • IWRM principles should be built into projects and programmes. • Local laws and customary institutions should be an entry point for IWRM. • Better linkages should be built with local government and its planning processes. • IWRM should be built from bottom up. • IWRM reforms need to build upon existing mechanisms for participation and organisation of stakeholders around water management, even if this means building upon 'sectorality', rather than a complete overhaul. • 'Light' approaches that aim to apply IWRM principles at all stages of the project cycle (e.g. visioning, assessment, planning, implementation, monitoring and evaluating, etc) are more likely to be good entry points. • Supporting the existing local arrangements should be encouraged as a form of local IWRM

legitimacy. • RBOs or catchment agencies often lack the capacity to fulfil even basic functions. • IWRM activities ignore politics. • Levels of participation in IWRM are low.	in itself and is more likely to succeed than starting from scratch at the catchment level. • Although local IWRM initiatives often have limited scope, they can still contribute to the development of IWRM at basin scale and, as such, serve as important entry points for applying the IWRM framework. • Forging better links between the water, sanitation and hygiene (WASH) sub-sector and IWRM is another way to strengthen grassroots participation in IWRM. • Responding to wider 'domestic' needs of many consumers, such as for small-scale productive uses of water, is another way to implement IWRM.

Source: Butterworth et al. (2010)

In this study, the researcher's opinion is to insist on IWRM approach to bring the paradigm shift of thought in water resource management as far as other best management strategy is not proposed by those opponents.

2.4. The Elements of IWRM

The GWR (2000) sets the IWRM framework in which the three elements are recognized as important complementary elements of an effective water resources management system. These complementary elements are described as follows and illustrated in fig.1.

- *The enabling environment* – the general framework of national policies, legislation and regulations and information for water resources management stakeholders;
- *The institutional roles* and functions of the various administrative levels and stakeholders; and
- T*he management instruments*, including operational instruments for effective regulation, monitoring and enforcement that enable the decision-makers to make informed choices between alternative actions. These choices need to be based on agreed policies, available resources, environmental impacts and the social and economic consequences.

Similarly, the report done by UN-Water (2008) the progress of the implementation of IWRM of the developed and developing county was illustrated as following. According to the report the developed countries have advanced on almost all major issues, however, there is still many gap for further improvement.

- Of the 27 countries responding to the UN-Water Survey only 6 claim to have fully implemented national IWRM plans; a further 10 of those countries have plans in place and partially implemented.
- The Report indicates that developed countries need to improve on public awareness campaigns and on gender mainstreaming.

The Developing countries has been some recent improvement in the IWRM planning process at national level but much more needs to be done to implement the plans.

- Of the 53 countries for which comparison was made between the GWP and the UN-Water surveys (conducted approximately 18 months apart), the percentage of countries having plans completed or under implementation has risen from 21% to 38%. On this measure the Americas have improved most – from 7% to 43%; the comparable changes for Africa were from 25% to 38% and for Asia from 27% to 33%. However, some of the change may be due to differences in the questionnaires.
- Africa usually lags behind Asia and the Americas on most issues, however it is more advanced on stakeholder participation and on subsidies and micro-credit programs;
- Asia is more advanced on institutional reform and yet lags behind in institutional coordination.

2.6. The stumbling blocks of IWRM.

A case study in the Paraiba do Sul River Basin in the South-eastern region of Brazil shows the multiple stumbling blocks to the right integration of socio economic aspects into the sustainable management of water systems. The opportunity to progress environmental conditions and to take on local stakeholders have been frustrated by the contradictory direction of regulatory reforms. On one hand, IWRM-informed policies have initiated flexible mechanisms of water directive and pushed for the restructuring of the river basin committee. On the other hand, the focus has been limited to technical and managerial solutions that tend to discount the influence of social inequalities and political asymmetries and, as a consequence, undermine water sustainability (Iros, 2008).

The report presented on fourth World Water Forum realised that the main obstacles obstructed institutional reforms and IWRM implementation show to be limited capacity, low

public awareness, poor political support, and inadequate funding which have consecutively resulted often in a formulaic approach to the preparation of national plans, poor adaptation of plans and principles to local conditions and time-consuming implementation (UN-Water/WWAP/, 2006). As it illustrated in the handbook of integrated water resources management of basin prepared by GWP and INBO (2009) it is difficult to put the IWRM approach into practice where there is no transparency or accountability, where those affected are excluded, or where corruption is endemic. Kidanamariam (2009) in his study at pilot test of the implementation of IWRM at Berki project in Tigiray Region (Ethiopia) divulged the following stumbling blocks against the implementation of the principles of IWRM.

- Lack of clear national water policy awareness among interesting groups
- Lack of common consensus how to use the shared water resources among all the stakeholders.
- Lack of coordination among different government institutions that have various mandates/interests in managing water and related resources of Berki catchment
- There was no plan to use Berki water resource for multiple and integrated uses. .
- Water is scarce in Berki catchment, and there are various water resource management problems, including conflicts among upstream and downstream communities and between administrative authorities.
- The different water use activities have put heavy pressure on water availability for different purposes, especially for far downstream users.
- Inefficient use of water, including wasteful technological selections, was also common practices.

This study also has been proposed to investigate the stumbling blocks that exist in the Gafarsaa dam catchment area as much as possible to develop the policy direction help to carry out the development that fit with the water uses of the reservoir.

2.7. Catchments as Water Resources Management Units

Catchments are arbitrary units, varying greatly in size and whose boundaries do not coincide with traditional cultural, religious, political and ethnic boundaries (Green, 2002). They are subject to dynamic disturbances and responds accordingly. The functioning of a catchment is a dynamic system in which there are exchanges and movements of sediment, water and pollutants between the land and water bodies that make up the catchment. Some of those disturbances are natural and others are induced by human beings as a result of land use changes across the catchment (Green, 2004). Hence, the watershed area became the appropriate spatial integrator unit for managing land and water resources and to take into

account the upstream-downstream relationships (Bahri, et al., 2008). According to Butterworth and Soussan (2001) the catchment is recognised as the basis for IWRM and in particular it provides a structure within which the relationship of water supply and sanitation and other aspects of water resources management that can be understood within the dynamic of hydrological processes within it. Any human activities changes to hydrological processes in any one place of a catchment has potential impacts to all downstream (and in some instances upstream) users.

2.8. Practices of IWRM in Ethiopian Context

At moment Ethiopian water sector policy and strategic plan addresses the IWRM approach undoubtedly. According to MoWR (2001) Ethiopian water sector policy has set the following six fundamental principles of water resources management policy; these are:-

1. Water is a natural endowment commonly owned by all the peoples of Ethiopia
2. As far as conditions permit, every Ethiopian citizen shall have access to sufficient water of acceptable quality, to satisfy basic human needs.
3. In order to significantly contribute to development, water shall be recognized both as an economic and a social good.
4. Water resources development shall be underpinned on rural-centred, decentralized management, participatory approach as well as integrated framework.
5. Management of water resources shall ensure social equity economic efficiently, systems reliability and sustainability norms.
6. Promotion of the participation of all stakeholders, user communities; particularly women's participation in the relevant aspects of water resources management.

These principles of Ethiopian water resources management policy are clearly derived from Dublin principles of IWRM and therefore the water resources management of the country should be viewed in this new management approach.

According to Kidanemaraim (2009) "the IWRM pilot project in the "Berki" watershed (Ethiopia) has shown that IWRM involves many changes to the existing system through a step by Step approach that creates a sense of ownership amongst all stakeholders". But the sustainable use and management of the Berki's water resources for all interested groups, in an equitable and sustainable manner is the biggest challenge that was observed at the study area. Likewise, the practices of IWRM that exist in the Gafarsaa dam catchment area will be assessed in order to investigate its success and challenges which in turn helps to suggest the policy direction useful for developmental activities in the study area and other similar cases.

2.9. Hydrology of Geffersa Dam

From the hydrologic point of view, the runoff from a drainage basin may be considered as a product of the hydrologic cycle and a result of a compound interaction of meteorological and physiographic factors (Kuchment, 2004). Thus, the source of water stored in the Geffersa dam is clearly the product of hydrological cycle that occurs in its catchment area. Catchment in the sense of this study implies that the area of land which intercepts rainfall and contributes the collected water to the reservoir. According to Chanson (1998) a reservoir and its catchment is a complete system, consisting of: structural features, hydraulics, hydrology, sediment transport, catchment erosion and catchment management policy. Therefore, any human interference (land use activities like cultivation, construction, overgrazing, deforestation, human settlement and so on) in the catchment areas inevitably has direct and indirect effects on the quantity and quality of water sources. Land cover and land use affect hydrological responses through canopy and litter interception, infiltration rainfall into the soil and the rates of evaporation and transpiration of soil water from the soil (Calder, 2004). Moreover, changing hydrologic behaviour triggers a chain of reactions in other processes such as soil erosion, nutrient leaching, water quality, and spatial and temporal distribution of water (Elkaduwa and Sakthivadivel, 1999). Owing to this fact, they realized that through watershed analysis method it is possible to find how to conserve and manage the natural resources in a given hydrological unit like river basins, catchments or watersheds. Watershed analysis is used for countries with little or no experience in hydrologic modelling and provides a simple, yet appreciable decision support tool that could be quickly applied with a limited set of data. The forest condition of the GCA prior to the construction of the dam was gathered from local residents who have long history with the construction of the dam and the current condition of the human activities observed through field survey were used to predict about the destiny of the water stored in the reservoir.

2.10. The effect of land use in a catchment to the water resources in a dam

According to Rhode Island Department of Administration (2005) within a watershed/ catchment, the quality and quantity of water resources is directly related to land use activities. As development increases, the quality of water is affected due to the loss of the filtering capacity of forests, the potential for failed septic systems and other pollution sources, and degradation of riparian buffers. Some of the impacts of land use to water resources include loss of storage capacity of reservoir due to silt deposition and reductions in available water during dry seasons. Development that increases impervious surfaces like road construction can also affect the quantity of water available within a watershed. In Ethiopia the report of

managing water resources to maximize sustainable growth by the World Bank (2006) revealed that land use changes like deforestation causes the sedimentation of water resources that compromises productivity and shortens the lifespan of water infrastructures such as municipal water supply dams. To overcome such kind of problems some countries have planning permit applications in open, potable water supply catchment areas. For instance, the Victorian Government (2009) follows the following planning permit application in a catchment to keep the water sources used for water supply. These are:

- Determining the density of dwellings in the catchment
- Effluent disposal and septic tank system maintenance i.e. all developments generating wastewater must be connected to a reticulated sewerage system or onsite wastewater or septic tank systems must be used to collect, treat and dispose of or reuse the wastewater they generate.
- Vegetated corridors and buffer zones along waterways should be left around the reservoir in order to maintain the natural drainage function, minimise erosion, reducing polluted surface run-off, sediment and nutrient loads.
- Buildings and works are permitted based in such away in order not to bring harmful effect to water sources in the catchment
- Agricultural activities-where a planning permit is required to use land for agriculture, consideration should be given to including a condition on any permit granted specifying a maximum stocking rate.

CHAPTER THREE

3 METHODOLOGY

3.1. Site Description

Gafarsaa water supply dam is found at 18 km West of Addis Ababa city, in the Burayu Town Administration. According to the final report of AAWSA on bathymetric survey of the reservoirs and master plan study for Dirree-Lagadaadhii and Gafarsaa catchment areas (AAWSA 2000), Gafarsaa water supply dam was constructed in 1943 and upgraded in 1955 to the capacity of 6.2 million cubic metres (MCM). Later on, in 1966 the storage capacity of the reservoir was increased by constructing a small dam at the back of the main reservoir. It is used as "silt trap" keeping the quality of the water in the main reservoir. The surface area covered by the main reservoir and the silt trap is 1.3Km^2 and 1.17Km^2, respectively. The catchment area that drains water towards Geffersa dam covers 55.56 km^2 (5,556ha). It is located between UTM grids 453,300 km to 466,600 km E and 997,000 km to 1,010,000 km N. The altitude of the catchment area ranges from 2580 to 2940 meters above mean sea level (AAWSA 2000).

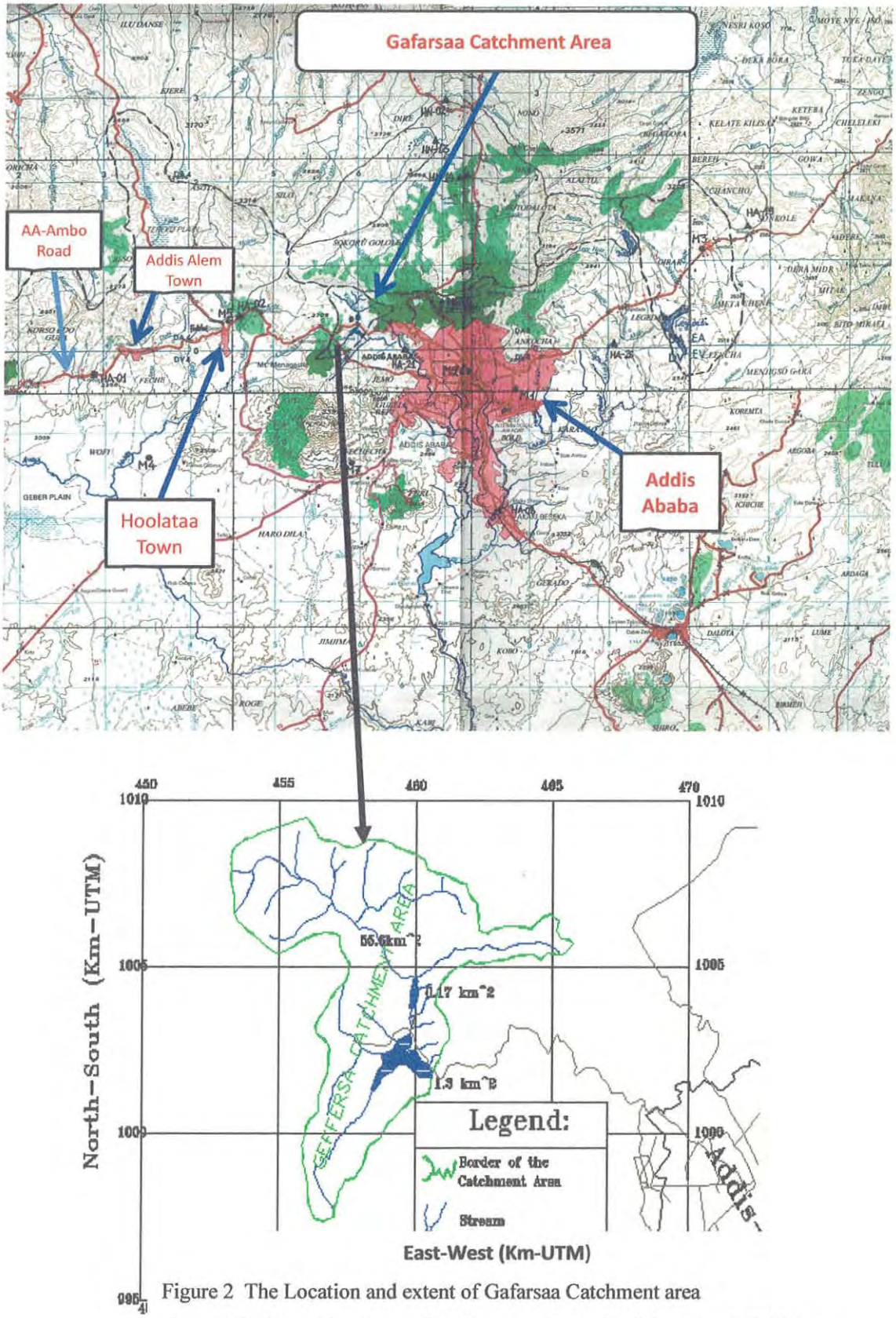

Figure 2 The Location and extent of Gafarsaa Catchment area

Source: Bathymetric survey of Gafarsaa and Lagadaadhii reservoir (2000)

3.2. Climate of GCA

Figure 3 shows 2009 and 2010 mean annual rainfall recorded at GWTPS is 1492.2 and 1744.11 respectively. The average annual surface water potential of the Geffersa water supply dam catchment area is estimated 25 MCM/year (AAWSA 2000).

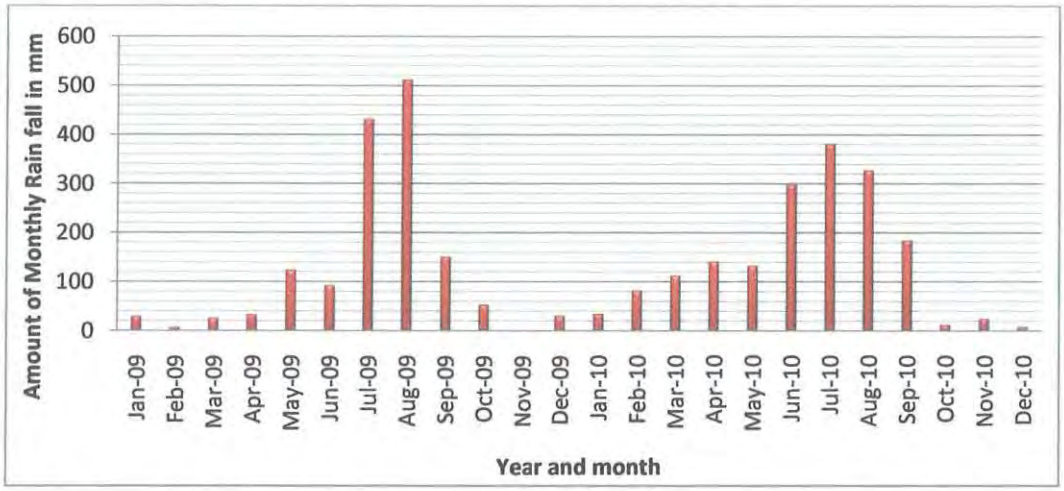

Fig. 3 Rain fall of GWTPS

Source: AAWSA Metrology Department

According to the data accessed from GWTP mean Maximum and Minimum temperature of 2009 is 20.38 ^{0} C and 8.75 $^{\circ}$ C while that of 2010 is 22.52 ^{0} C and 11.66^{0} C, respectively (figure 4). The break in the figure shows the metrological data at GWTPS in May 2009 was not recorded.

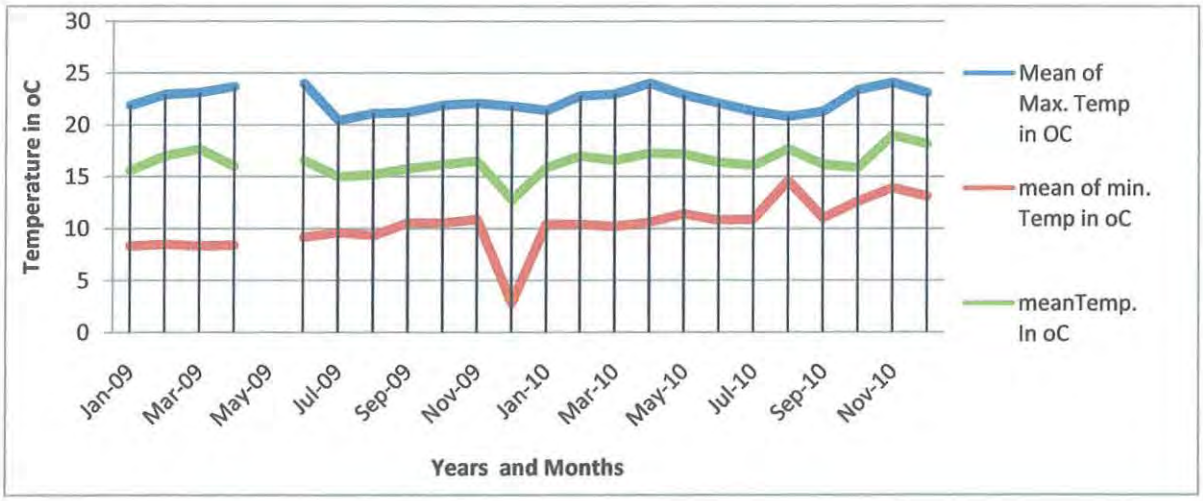

Figure 3 Temperature of GWTPS
Source: AAWSA Metrology Department

The catchment area of Geffersa dam is encroached with different anthropogenic activities that can affect the sustainable utilization of the water in the reservoir. These activities include urban settlement, private investment firms, government institutions like school and health centre, and farming and livestock rearing activities.

3.3. Method of the study

The research method employed for this study was the mixed research method in which the survey questionnaire, FGD, field observation and interview techniques were carried out in order to assess the practises of IWRM and its stumbling block in the catchment area of GWSD.

3.4. Sources of data

In the study, the relevant data were generated from;

- Addis Ababa Water Sewerage Authority
- Sectors of Burayu Town Administration
- Walmara Aanaa Administration
- Households found in catchment area and
- Public and government institutes encompassed in GCA.

3.5. Sampling Procedure and sample size

The sampling technique employed to determine the households to be investigated was simple random sampling while the participants of FGD and respondents of interview were purposively selected. Within the catchment area of GWSD beside its inhabitants, there are a number of stakeholders that should involve directly or indirectly in its IWRM. To find out the practice of IWRM and its stumbling blocks GWSCA the data was collected from AAWSA, sectors of BTA and WAA, households found in catchment area and government and private institutes. The total number of households that lead the rural life mainly involving in farming and animal rearing activities of the study area were registered, excluding the urbanized area. To get the necessary information about the land use changes of GCA starting from the prior years of the dam construction, the top ten elders with highest age were proposed for in-depth interview. Only five elders purposive were interviewed out of these due to the reiteration of the idea after the first two elders were interviewed. These elders were purposively selected from households registered in the catchment area. Out of 1138 households registered for survey questionnaire 196 households were identified using the sample size determining formula. Since training was given for farmers that focus on the natural resources conservation and catchment management activities, it is assumed that the households living in the GCA are

knowledgeable about the activities related to IWRM. Moreover, the mass media of the country is also playing its role in awareness creation on the catchment protection. These households were selected through simple random sampling method.

According to Zikmund (2003), the formula that was used to determine the sample size is:

$$n = \frac{Z^2pq}{E^2}$$

Where; n= the size of the sample

p= the estimation of the population assumed to be knowledgeable to involve in IWRM

q= the estimation of the population who do not have information concerning the IWRM.

Z= standard value corresponding to a confidence level

E= acceptable magnitude of error

Considering the issue of IWRM is new for the study area, fewer than 15% of population assumed to have information about IWRM. Hence, the value of p is equal to 0.15 and q (1-0.15) is equal to 0.85. When parameter in population is assumed to be over 85% or under 15% the 95% confidence level has standard value Z, 1.96 implies that the sampling error is not greater than 5%. Therefore,

$$n = \frac{Z^2pq}{E^2}; \quad n = \frac{(1.96)^2 \times 0.15 \times 0.85}{(0.05)^2}; \quad n = 196$$

Out of 196 respondents intended to be visited for face-to -face survey questionnaires 194 were surveyed at their home by the help of enumerators. Hence, in this study the response rate was found to be 98.98 percent for the household questionnaires survey.

The urbanized area that inhabit approximately 550 HHs was treated only by taking field observation and through focus group discussion with the representatives of BTA in order to gather information about the existing storm water control and sewerage disposal facilities. Three FGDs were carried out with the respondents purposively selected from AAWSA, BTA and WAA. The participants from AAWSA were Surface water and catchment manager, two site managers (Dirree-Lagadaadhii and Gafarsaa), a sociologist and environmentalist. The participants FGD of BTA came from Land use and Environmental protection Office, Water and Sewerage Service Office, Health Office, Investment Office and Urban Infrastructure and Design Assurance Office. Likewise, the FGD from WAA consisted of the participants that came from Agriculture Office, Water, Mineral and Energy Office, Health Office and Land and Environment Protection Office. The data was collected from head administrators/representatives of the six private and four government institutions through structured questionnaire. It was not possible to collect data from four other private

organizations as they cease to function within the catchment area of Geffersa water supply dam.

Finally, in order to get the accurate figures about the land holding of investors and relevant information the document containing the profile of land occupied with investments were assessed. The field observation was also carried out within catchment area and the necessary information was recorded and photos that display the activities of the area were taken during the field works.

3.6. Instruments of Data Collection

The followings instruments were employed for data collection while the study was going on:

- Questionnaire
- Interview checklist
- Direct field observation
- Focus group discussion checklist
- Document analysis

3.7. Method of Data analysis

The collected data from different sources were coded for tabulation and interpretation based on its nature. Qualitative data was analysed according to its nature whereas the analysis of quantitative data was carried out using different statistical methods by the help of spreadsheet and/or SPSS. Here, using relevant computer software like SPSS is helpful for the certainty of data analysis as far as SPSS is among the most widely used programs for statistical analysis in social sciences. Originally, it was released in its first version in 1968 after being developed by Norman H. Nie and C. Hadlai Hull (http://en.wikipedia.org/wiki/SPSS).

CHAPTER FOUR

4 RESULT AND DISCUSSION

This chapter is concerned with the analysis and interpretation of data collected through questionnaire, interview, direct field observation, focus group discussion and document analysis. The analysis dealt with pieces of information gathered through these data collection instruments to draw the relevant conclusion about the practice of IWRM and its obstacles GCA.

4.1. Respondents' Back Ground Characteristics

Age: Characteristics in terms of age are demonstrated in table 2. About 75.8 percents of the respondents are within the age group of 18-60 years, which indicates that very high percentage of total sample size have high rate of fertility and to have many children as a consequence through long period of time unless corrective measures will be taken, contributes to high population growth. This has its own implication in term of environmental degradation, which in turn has negative impacts on water resources (deteriorates water in terms of quantity and quality).

Table 2 Age of households

Age	Frequency	Percent	Cumulative Percent
18-29	28	14.4	14.4
30-60	147	75.8	90.2
61 and above	19	9.8	100.0
Total	194	100.0	

Source: Author's field survey (March, 2011)

Sex: As indicated in table 3 the sample households that are subjected to the survey questionnaires in terms of sex, male are 77.8 percent and females are 22.2 percent.

Table 3 Sex of households

Sex	Frequency	Percent	Cumulative Percent
Male	151	77.8	77.8
Female	43	22.2	100.0
Total	194	100.0	

Source: Author's field survey (March, 2011)

Household size: The member of household could be relatives living within the households for an extended period. The survey result in table 4 shows that the household size ranges from one to 17 with average of 5.56 and SD of 2.445.

Table 4 HH size of respondents

		Sum	N	Mean	SD	Min	Max.	Ran.
Sample HHs' size	M	559	194	2.88	1.479	0	8	8
	F	519	194	2.68	1.545	0	9	9
	T	1078	194	5.56	2.445	1	17	16

Source: Author's field survey (March, 2011)

Marital status: Among households surveyed 84.0 percent are married, 3.1 percent were single, 6.7 divorced or separated and 6.2 percent widowed/widower (table 5).

Table 5 Marital status sample HHs

Marital status	Frequency	Percent	Cumulative Percent
Married	163	84.0	84.0
Single	6	3.1	87.1
Divorced	13	6.7	93.8
Widowed/er	12	6.2	100
Total	194	100.0	

Source: Author's field survey (March, 2011)

Education: Illiteracy is one of the features of the country and hence the educational level of the sample households illustrates this fact. Table 6 shows that about 60 percent of the respondents are illiterate, 31.4 percent have received primary education, 5.2 percent have attained the secondary school education and 3.6 are certificate and above. The awareness creation activities like environmental rehabilitation programmes and natural resources' conservation are affected by education level of a society. Therefore, for the long-term utilization of water resources in the GCA, educating people should get high attention.

Table 6 Educational of sample HHs status

Education Status	Frequency	Percent	Cumulative Percent
Non-literate	116	59.8	59.8
grade 1-4	28	14.4	74.2
grade 5-8	33	17.0	91.2
grade 9-12	10	5.2	96.4
certificate & above	7	3.6	100.0
Total	194	100.0	

Source: Author's field survey (March, 2011)

Duration of resident: Now a day the migration of people from rural area to the urban area in Ethiopia is common in order to find job. Hundred percent of respondents in Walmara Aanaa are living in the study area since birth i.e. all respondents are home grown. As illustrated in table 7 among the respondents of Burayu Area, which live near the Gafarsaa dam, 81.80 percent are indigenous while 18.20 percent are migrants. Therefore, through long period the catchment area in Burayu town will be changed to illegal settlements that will endanger the water quality and its utilization of the dam.

Table 7 Duration of resident of respondents in the area

Resident Area	Number of Respondents	Duration of Residence	Frequency	Percentage
Burayu Town	154	Since Birth	126	81.80
		Migrant	28	18.20
Walmara Aanaa	40	Since Birth	40	100
		Migrant	0	0
Whole Catchment	194	Since Birth	166	85.57
		Migrant	28	14.43

Source: Author's field survey (March, 2011)

Occupation: With regard to occupation, 60.8 percent of the respondents engage on crop production, 23.2 percent are daily labourers, 12.4 percent are government and private organization employees and the remaining 3.5 percent are others (table 4.7). The occupation of the respondents is correlated to their residence areas. 97.5 percent of the sample HHs surveyed from Walmara Aanaa subsist on crop production where as only 2.5 percent are daily labourer. Among the sample HHs studied from Burayu Town 52.60 percent are farmers, 15.58 percent are employee, 28.57 percent are daily labourer and 3.25 percent depends on different activities (table 4.6). This implies that those respondents came from other places and original landless dwellers engage in different activities in order to survive. Such kind of informal settlements and unemployment can impose the environmental degradation, which have high potential to deteriorate water resources in terms of quality and quantity wise.

Table 8 Major Occupation of sample HHs

Area	Major Occupation	Frequency	Percent
Burayu Town	crop production	81	52.60
	Government or private Employee	24	15.58
	Daily Labourer	44	28.57
	Others	5	3.25
	Total	154	100
Walmara Aanaa	crop production	39	97.5
	Employee	-	
	Labourer	1	2.5
	Others	-	
	Total	40	100

Source: Author's field survey, (March, 2011)

4.2. The practices of IWRM in the Gafarsaa water supply dam catchment area.

The FGD with AAWSA find out that the Addis Ababa city uses two catchment/watershed areas as a surface water sources; namely Dirree-Legadadhii and Gafarsaa catchment areas. The participant of the focus group discussion explained that IWRM in the context of their sector is involving all stakeholders in to the water resources management. The participants of this FGD pointed out that:

> Even though the bathymetric studies of these catchments were completed in 2000 and the catchments were ready for the independent catchment management, still it is not implemented. According to these participants, the main factor for the malfunctioning of the bathymetric study of the catchment areas of the surface water sources is the two administration bodies (AAWSA and Oromiyaa Regional state) cannot reach upon agreement for the implementation of the study. Especially, for the Gafarsaa water supply dam the independent catchment management is restricted to the greenbelt (the buffer area) of the dam. The activities performed in the buffer area are planting trees and fencing around the dam.

The field observation of this study shows that the fencing wire of the dam is stolen and the animals and community move freely in and out of the reservoir i.e. livestock drink the water and community wash their closes using the water in the reservoir (see fig.5 and 9).

Figure 4 A woman washing clothes in the Gafarsaa Dam
Photo: Author's field survey (March, 2011)

AAWSA as water user organization has studied how to manage water resources at catchment level through community participation and involvement of all stockholders owing that catchment management should take place at the households' level (AAWSA, 2000).

However, the FGD result indicates that the type of water resources management strategy practiced in AAWSA at the catchment level is the traditional i.e. there is no community and other stockholders participation in the catchment area for the water resource management. This shows that the bathymetric study of catchments remained at planning stage; and until now, it is not feasible.

4.2.1 The Integration of Land and Water Resource Utilization in Gafarsaa Catchment Area

The sustainability of water resources utilization depends on the land using activities of a given area. Hence, in this section based on the data collected through different techniques the land use features, land use pattern of inhabitants, the expansion of investments and urbanization in the GCA were discussed.

4.2.1.1 Land Use Feature of Gafarsaa Catchment Area

Data on land resource utilization were collected from sample households, participants of focus group discussions, interview, and field observation throughout the catchment area. The information obtained through this study is important to understand the whole activities taking place in the study area that have impact on the water in the reservoir. The land use system observed in the catchment area does not take into consideration about the water resource use in the dam. The main land related activities observed in the catchment area are cultivation, livestock rearing, growing eucalyptus trees, construction of new buildings because of urbanization and the investment activities. Moreover, the expansion of infrastructures like construction of new roads, schools, health centres and public service institutes is practiced in the study area.

4.2.1.2 The Land Use pattern of inhabitants found in the Gafarsaa Catchment Area

The land use pattern of the inhabitants of the catchment area is assessed from the sample households through survey questionnaire illustrated in table 9.

The sample households use their lands for cultivation of crops, grazing animals, growing trees and animal fodder and others. Accordingly, the land used for cultivation, fallow land, woodlot, homestead, grazing and growing hay of the sample households of the catchment in Burayu area is 64.94, 40.90, 39.61, 92.88, 33.12, and 5.19 percents, respectively. Likewise, among the respondents of Walmara Ana 97.5 percent respondents have cultivated land, 82.5 percents have fallow land, 67.5 percent have woodlot land, 95 have homestead land, 97.5 have grazing land and 5 percent have hay land. This indicates that the land possession pattern of the two areas is not similar i.e. in Burayu area it is relatively smaller in size and more

fragmented. The in-depth interview with one elder found out that the dwellers under Burayu town administration are in fright about put out of place because of the dam and their land may be taken by municipality so as they are illegally transferring to other persons. Similarly, the FGD with BTA revealed that after three/four years because of illegal settlement, many squatter houses were constructed near the dam that is detrimental to the water utilization of the dam.

Table 9 Land use type by Sample households

Area	Land use type	Land use in ha	N	Frequency	Percent
Burayu Town	Cultivation	64.00	154	100	64.94
	Fallow Land	52.75	154	63	40.90
	Woodlot	28.09	154	62	40.23
	Homestead	14.04	154	143	92.88
	Grazing land	30.50	154	51	33.12
	Hay Land	2.50	154	8	5.19
	Total Land use	192.89			
Walmara Ana	Cultivation	53.00	40	39	97.5
	Fallow Land	40.00	40	33	82.5
	Woodlot	6.32	40	27	67.5
	Homestead	9.88	40	38	95
	Grazing land	19.51	40	39	97.5
	Hay Land	2.30	40	4	97.5
	Total Land use	131.10			

Source: Author's field survey (March, 2011)

Cultivation of land:

Agriculture is one of the human activities that has negative impact on reservoir in silt deposition and contribution of harmful chemicals to the water resources. Within the catchment area of Geffersa water supply dam, the rural livelihood is practiced at large and thus the cultivation of the crop is common. The survey result indicated that the farmers in this catchment area use chemical inputs like industrial fertilization and herbicides. The amounts of DAP and UREA used by the farmers is 13,900 kg while the amount of herbicide, insecticides, and fungicides is 102.10 litres as described in table 10 and table 11, respectively. These chemicals are highly soluble and easily washed away from farmland when raining and enter the dam with surface runoff where it can cause the pollution of the water resources in the reservoir.

Table 10 Fertilizer used by sample households

Type of Fertilizer used	Sum	N	Mean	SD	% of Total Sum	% of Total N	Min	Max	Ran
Dap in kg	7200	111	64.86	34.11	100%	100%	25	200	175
UREA in kg	6700	109	61.47	49.36	100%	100%		500	500
Total	13900								

Source: Author's field survey (March, 2011)

Table 11 Herbicide, insecticide and fungicide used by sample households

Type of chemicals Used	Sum	N	Mean	SD	% of Total Sum	% of Total N	Min	Max	Ran
Herbicide in litre	96.80	111	0.87	0.39	100%	100%	.25	2.00	1.75
Insecticide in litre	0.30	1	0.33		100%	100%	.33	.33	
Fungicide in litre	5.00	8	0.63	0.40	100%	100%	.25	1.00	.750
Total	102.1								

Source: Author's field survey (March, 2011)

Siltation is another impact of agriculture that can shorten the life storage capacity of the dam, unless the necessary measure is taken to minimize the problem. Fig.6 and 7 show the cultivated area near dam and its tributary. The soil is taken by erosion easily during the rainy period from cultivated areas and deposited into the reservoir and finally decreases the storage capacity of the reservoir. Moreover, it increases the water treatment cost.

Figure 5 Cultivated area near the dam (*Dhaye** Area)

Figure 6 Cultivated land near *corristu** river

*Dhaayee and Corrisaa are local names found around the dam.

Vegetation:

The vegetation type grown by the sample households in the GCA is eucalyptus tree. As illustrated in the bathymetric survey of Lagadaadhii and Gafarsaa reservoir (2000), the land covered by plantation like eucalyptus trees have high potential to protect soil from being

washed off. The sample households use these plants for different purposes such as firewood, construction and selling. Table 12 shows that out of 89 households, which have own woodlots, 93.3 percent are using it for firewood, 88.8 percent for construction and 68.5 for selling. All of the respondents that have their own plants are willing to preserve these plants through planting new trees and/or conserving the existing plants (table 13).

Table 12 The use of plants by sample HHs

Use of wood planned by HHs		Frequency	Percent	Cumulative Percent
Firewood	Yes	83	42.8	93.3
	No	6	3.1	100.0
	Total	89	45.9	
Construction	Yes	79	40.7	88.8
	No	10	5.2	100.0
	Total	89	45.9	
Selling	Yes	61	31.4	68.5
	No	28	14.4	100.0
	Total	89	45.9	

Source: Author's field survey (March, 2011

Table 13 the willingness of sample HHs to preserve their own plants

	Planting New trees			Conserving the existing vegetation			Both		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Willingness of the respondents to preserve their own plants.	65	25	90	79	11	90	57	33	90

Source: Author's field survey (March, 2011)

Today Eucalyptus tree is the dominant plants observed throughout the catchment area. These Eucalyptus plantations belong to farmer's association, government's and belongs to individual houses holds.

A

B

Figure 7 Eucalyptus plantation A. Eucalyptus tree around Diimaa River B. Eucalyptus plants around the dam

Photo: Author's field survey (March, 2011)

The in-depth interview with the elders living around the Gafarsaa dam revealed that prior to the construction of the dam the catchment area was covered with natural forests.

Homestead of the respondents

The activities taking place within the homestead of households have high possibility of affecting the quality and/or quantity of water resources of a given watershed. From table 14, 183 households (94.33 percent) have their own homestead land wherein only 142 sample households use either pit latrine and/or dry and animal waste disposal holes and the remaining 41 sample HHs do not have waste treatment facilities in their home. The waste disposal

treatment mechanism that is being used in the rural area is not this much trustworthy and even in the urban settlements the latrines used by the community are not fit the standardized type. One of the participants of FGD from Burayu Town Administration explained this condition as:

> The latrine used by our community is bellow the standard so that the sewerage can easily overflow to the surface and carried away with runoff or discharge with the nearby streams and gets into the dam.

Another participant of focus group discussion from BTA described that:

> For the condominium houses newly built at extreme end of the catchment to ward east of the dam, the collection boxes of liquid waste material have been prepared. Nevertheless, in the future, where the waste material absorbed from these collection boxes to be disposed is not clear and it needs pre hand plan not to damp it in the catchment area.

One of the participants of FGD from AAWSA also raised similar idea with other participants of BTA said that:

> The Latrine used by dwellers of newly urbanized area around Burayu within the GCA, if it is below quality the waste material is spill over it and washed with flood and in the end go into the dam.

Table 14 The sample households using different waste disposal mechanism

	Pit Latrine		Total	Dry and animal waste disposal hole		Total
	Yes	No		Yes	No	
The existences of waste treatment facility in homestead land	139	3	142	94	48	142

Source: Author's field survey (March, 2011)

Grazing Land

Some of the sample households of the study area also use their land for grazing of animals. Table 9 shows that about 50 ha of the land belongs to the households under this study is used as grazing area of the animals. The total animals grazing on this field is illustrated on the table 15 as follow:

Table 15 statics of grazing animals of sample HHs

		Number of cattle	Number of horse /donkey/mule	Number of goat	Number of sheep
N	Valid	132	88	4	75
	Missing	62	106	190	119
Mean		6.09	1.44	4.25	5.25
Minimum		1	1	1	1
Maximum		35	4	6	18
Sum		804	127	17	394

Source: Author's field survey (March, 2011)

The ways community use this grazing land for their animals determine the degradability of the catchment area and consequently affect the water use in the reservoir. If the number of grazing animals is beyond the carrying capacity of a given area, bare soil is eroded during rainy season that results in silt accumulation to the dam and hence shortening the live storage capacity of the dam. If the community grow animal fodders like hedge plant it has twofold functions- protect soil erosion and fits households' animals feeding. When the respondents were surveyed how they use their grazing land, they replied as illustrated in table 16. Sample households growing hedge are 20.6 percent, limiting the number of grazing animals to the carrying capacity are 30.4 percent and using the mechanism of shifting grazing area animals are 4.6 percents. This shows that the conservation practice of grazing land is low in the study area and needs the attention of all concerned bodies to take the necessary measures toward the correction of this problem.

Table 16 conservation practices of sample HHs' grazing land

Conservation practices of grazing land			Frequency	Percent	Valid Percent	Cumulative Percent
Growing hedge	Valid	Yes	40	20.6	49.4	49.4
		No	41	21.1	50.6	100.0
		Total	81	41.8	100.0	
	Missing		113	58.2		
	Total		194	100.0		
Limiting grazing animals to carrying capacity	Valid	Yes	59	30.4	72.8	72.8
		No	22	11.3	27.2	100.0
		Total	81	41.8	100.0	
	Missing		113	58.2		
	Total		194	100.0		
Shifting Grazing Location	Valid	Yes	9	4.6	11.1	11.1
		No	72	37.1	88.9	100.0
		Total	81	41.8	100.0	
	Missing		113	58.2		
	Total		194	100.0		

Source: Author's field survey (March, 2011)

The problem related to the livestock of community around the dam is not only over-grazing but also it was observed that during field survey the animals drink directly from the dam and graze in the grassland of the buffer area without restriction (fig. 9). This problem arises as a result of broken fence of the buffer area of the dam. Out of the buffer area of the dam, many livestock were observed grazing in the very wide fields found in the catchment area. It is obvious that the livestock urinate and deposit their dung in the water when drinking from the reservoir and result in pollution of the raw water. The livestock droppings may be carried into the reservoir during the rainy periods from the buffer area and the nearby fields.

A 

B  C 

Figure 8 Cattle drinking from the dam and grazing in the buffer area and field around the Gafarsaa dam A. Cattle Drinking from the Geffersa Dam B. Cattles in the *Bofataa** field. C. Cattle grazing in the Buffer area of Gafarsaa Dam.
Photo: Author field survey (March, 2011)

*Bofataa is the wide field to the south extreme of the catchment.

4.2.1.3 The expansion of investments in the Gafarsaa Catchment Area

Through this study within the Walmara Aanaa, there is no any investment activity. However, in the Burayu area of Gafarsaa water supply dam watershed many investment activities are noticed. The document analysis of Burayu Town investment office shows the expansion of private investments and public institution in the catchment area. Table 17 shows the lists of private investment and public institutes located within Gafarsaa Catchment area in Burayu town.

The interview with the owners or the representatives of these institutes divulged that all the private investments and public sector institutes were established without the recognition of AAWSA. They also didn't prepare EIA before investing in the catchment area. Especially, the huge investment like Ethio Resort Hotel, Oil station and the mental rehabilitation centre have high potential of polluting the environment unless special care will be taken. Ethio resort Hotel is confined on a very large area close to the dam. The distance of the Hotel from the Buffer area is about 20 m. The oil station in addition to selling oil fuel it also gives car wash services. The interview result with Gafarsaa mental Rehabilitation centre revealed that the centre is on the way of upgrading to Hospital. In addition to treat people with mental problem, the centre has its own dairy and farm areas. Since it is very close to the dam the potential problem this centre has to the service of the dam should get attention.

The problems related to the development seen in the GCA also illustrated by the participants of focus group discussion from AAWSA as:

> Since AAWSA is not taking part in decision making to determine the type of investment in Burayu area, most of the time the problems related to the dam is distinguished after it has already happen. For instance, when Addis Ababa-Ambo road was constructing the latrine sewage was pumped to the field found around the camp of

workers of the road. According to this participant, the problem was over came by the interference of federal policy after reporting to the concerned body. Similarly, the same participant pointed out that from Geffersa Mental health rehabilitation centre the animal manure was released to the field nearby the dam where it pollutes the water resource easily. This problem was also over come after the interference of AAWSA.

One of the participants of FGD from BTA explained the lack of involvement of all stakeholders in deciding the compatible development with the catchment as follows:

> Most of the problems related to the development taking place in the area arise from the lack of coordination with all stakeholders. The environmental impact of an investment is differentiated after the problem is already occurred and tried to overcome the problem.

The interview with investment owners or the managers of institutes in the catchment also revealed that, out of ten interviewees five of them do not know whether their institute is confined in the GCA and therefore do not care for the waste materials released from their institutes. Furthermore, four respondents do not have awareness of the impact imposed by their institution to the water in the Gafarsaa dam. Even though most of the interviewee replied positively to act according to the correction measures that will be taken in the future, only two respondents are uncertain to accept the idea because of the capital they invest is very high. Those positively replied to act according to the correction measure told that as they expect compensation from the government instead of their land and lost asset if it will happen. Therefore, as more and more investment and other developmental activities are taking place in the catchment areas, the water in the reservoir gets more and more deteriorating and its treatment cost will become higher and higher.

A 

B 

C 

D 

E  F 

Figure 9 Some investments in GCA .A) Furniture Work B) Oil station C) Kedir IbirahimRecreation Centre D)Ethio Resort Hotel E) Sinohydo Head office Burayu branch F. Gafarsaa Corrisaa Elementary school.
Photo: Author's field survey (March, 2011)

Table 17 Private Investments and Public Institution in the GCA

Name of the institute	*Year of establishment*	*Land permit*	*Area*
Ethio Resort Hotel	*2008*	*BTA*	*1900 m^2*
Kadir Ibirahim Recreation Centre	*2007*	*BTA*	*3623 m^2*
Yonatan Bit (Furniture work)	*2010*	*BTA*	*35000 m^2*
Robera Recreation (Golf)	*1992*	*BTA*	*31,000 m^2*
Sinohydro head office Burayu branch	*2002*	*BTA*	*38205 m^2*
Abebe Abiy and Hirut Bira Hotel	*2010*	*BTA*	*1500 m^2*
Alemu Dibaba Hotel	*2008*	*BTA*	*1500 m^2*
Hailu Beyene Recreation	*1996*	*Own land*	*8500 m^2*
Geffersa Guje Health Center	*2010*	*BTA*	-
Geffersa Corrisa Elementary school	*2003*	*BTA*	*35000 m^2*
Awuraris and Gissila Oil station	*2006*	*BTA*	*3623m^2*
Geffersa Mental health rehabilitation centre	*Early 1980s*	*During Dergi Regime*	*27 ha*
Gypsum Factory*	-	-	-
Ganda Geffersa Guje office	*2006*	*BTA*	*7500 m^2*

Source: Author's field survey (March, 2011)

*The gypsum factory was established during emperor Haileselasie I. Its information is not available at Burayu Town Investment office.

4.2.1.4 Urbanization in the Geffersa Catchment Area

Currently, a rapid expansion of urbanization is seen in the GCA (particularly in Burayu area) has high impact on water in the reservoir. Urbanization as land cover, in the form of built-up or paved areas is characterised by very rapid runoff. The field survey in the urbanized area of GCA (Burayu area) realized that in the area, the storm water does not have sewerage system. Because of these, the liquid wastes generated from the area and roads directly sewer in to the dam through the open channel and in the end it pollutes the water. Moreover, the land degradation related to the urbanization and infrastructure construction contributes to the siltation of the dam (see fig 11). Figure a- f show the newly constructed houses in the catchment area because of urbanization. Similarly figure g-n indicate the roads in town direct toward the Gafarsaa Dam. L to N shows runoff from the town following the asphalt road and enters the dam; O & P new road constructed to join the rural *gandaas* (lowest management unit) with asphalt around dam III.

A 

B 

C 

D 

E 

F 

4.2.2 The Integration of AAWSA with the Stockholder sectors of BTA and WAA

All the data collection technique employed in this study verified that there is no integration among the stockholders of GCA. From the table 18 the survey questionnaire shows that 96 percent of the respondents answered that no integration is seen among the different stockholder sectors of the catchment area.

Table 18 the response of sample HHs on the integration of different sectors for sustainable water utilization

Choices	Frequency	Percent
Yes	8	4.1
No	186	95.9
Total	194	100.0

Source: Author's field survey

As discussed under section 4.2.1the misuses of lands by the inhabitants of the catchment area like unplanned human settlements, over grazing of the lands and lack of proper waste treatment facilities witnessed the lack of integration among the stockholders of the GCA. The discussions carried out with the three groups substantiated that there is no collaborative catchment management among all stockholders of GCA. Thus, concerning the integration of stockholders a participant from AAWSA said that no sufficient work is done toward involvement of the community and relevant sectors found in the catchment area. According to this participant, in principle the catchment management needs the integration of all stockholders from planning to implementation; but in reality there is no integration in GCA at all. Another participant from WAA said that last year (in 2010) AAWSA made a meeting with the community and relevant sectors of Walmara Aanaa to aware about the Gafarsaa dam and then after no one never come back to go ahead to make it practical.

The participants further continue in giving idea on the focus group discussion as follows. AAWSA, as a stockholder sector of GCA, does not take part in decision making for the land related developments in the area. There is no regular meeting time with BTA and WAA to deal on the issues of land developments in the catchment area. AAWSA has no right to prohibit BTA and WAA using the land encompassed in the catchment area so that these local administration can apply their plan without refraining.

For dams that are used for drinking water supply there should be guideline of planning permit application for use and development of land. In order to check whether planning permit guideline is practised or not, the question is raised for the participants of the FGD from AAWSA. The responses of the participants show that there is catchment area management guideline for the surface water supply dam of Addis Ababa city. The master plan of the

catchment area clearly shows the land development type, which is compatible with water use of the dam. The guideline does not allow the construction of factories, industries, dairy, butchery, and other investments discharging waste materials to the environment. On the other hand, the guideline encouraging activities like changing the area into greenery such as covering the catchments with natural and environmental friendly exotic plants. Furthermore, it promotes the farmers to change their way of cultivation (shifting from crop production to vegetation and highland fruits like apple production). Leaving alone to permit those activities that can harm the water resources in the dam, the catchment management guideline encourages the inhabitant farmers to apply the environmental conservation practices in addition to change the style of farming.

One participant from AAWSA stressed that the investment office of BTA and WAA should allow the investments that do not have negative impact on the water in the dam. Before any investment is allowed, EIA should be prepared and permitted accordingly.

According to the result of FGD and interviews, the contradictory thing is going on in the catchment area. The construction of the hotels, recreational centres, urbanization, health centre, oil station, dairy, etc become common in the catchment area.

In general, the FGD, interviews and the survey questionnaires show the lack of IWRM in the GCA and it results in misuses of the land within the catchment area.

4.2.3 Community participation

Community participation in natural resource management ensures the sustainability of the resources. Therefore, the water resource harvested in the Gafarsaa dam as a natural resource needs the community participation for its conservation. In other hand, the lack of community participation on watershed management will have negative consequence on the water utilization of the dam. Thus through this section, the community participation in catchment management from getting information to implementation stage is assessed.

4.2.3.1 The knowledge of the community about catchment management

When the households' awareness about the land use impact on water resources is surveyed, 124 (63.9 percent) of respondents are aware of the land use impact on the water resources but the remaining 70 (36.1 percent) do not have awareness about it. From table 19 among these respondents 55.6 percent know as the land using practices cause sedimentation of the dam, 9.7 percent respond that using large quantity of water and 79 percent said the releasing of waste material are the consequence of land use impact on water resources. For the sustainability of the water in the Gafarsaa dam, all the dwellers of the catchment should have

full awareness about the land use impacts on the water resources. However, the study shows that the significant number of population still lack this information.

Table 19 the impacts of land uses on water resources

Impacts of land uses on water resources			Frequency	Percent	Valid Percent	Cumulative Percent
Sediment Load to the water sources	Valid	Yes	69	35.6	55.6	55.6
		No	55	28.4	44.4	100.0
		Total	124	63.9	100.0	
	Missing		70	36.1		
	Total		194	100.0		
Using Large quantity of Water	Valid	Yes	12	6.2	9.7	9.7
		No	112	57.7	90.3	100.0
		Total	124	63.9	100.0	
	Missing		70	36.1		
	Total		194	100.0		
Releasing waste material to the water resources	Valid	Yes	98	50.5	79.0	79.0
		No	26	13.4	21.0	100.0
		Total	124	63.9	100.0	
	Missing		70	36.1		
	Total		194	100.0		

Source: Author's field survey (March, 2011)

Among the sample households know about land use impacts to the water resources, 24 percent got the information from mass media, 1 percent from news letter, 31 percents from developmental agent, 2 percent from NGOs, 2 percent from education, 4 percent from other people and 4 percent from own experience (fig. 12). This figure reveals that most respondents do not have access to sources of information like newsletter and mass media. The involvement of NGOs to aware the community in land use system is insignificant. The percent of households got information through development agents is relatively high. The community in the catchment area do not have sufficient information about the impacts of land uses on water resources and hence the misuse of lands may emanate from this fact.

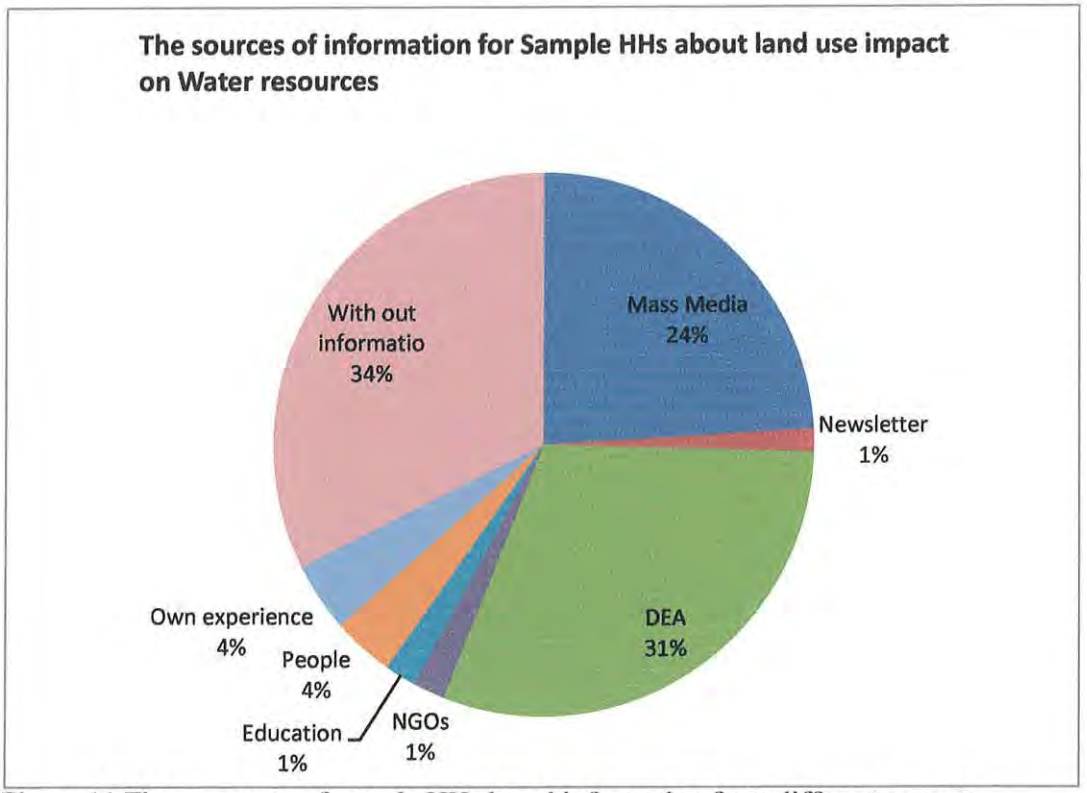

Figure 11 The responses of sample HHs heard information from different sources
Source: Author's field survey (March, 2011)

The sample households believe in the importance of knowing the impact of land use on water resources are 86.08 percent (167 HHs) while 13.92 (27 HHs) do not. Out of 167-sample HHs trust in the importance of knowing the impact of land use on water resources, 18.55 percent wants to participate in planting tree, 5.67 percent in soil conservation and 9.79 percent in changing way of cultivation. Among this group of the respondents 34 percent want to participate in all methods (planting trees, soil conservation and changing way of cultivation), 11 percent planting trees and soil conservation and 5 percent planting and changing ways of cultivation (fig.13).

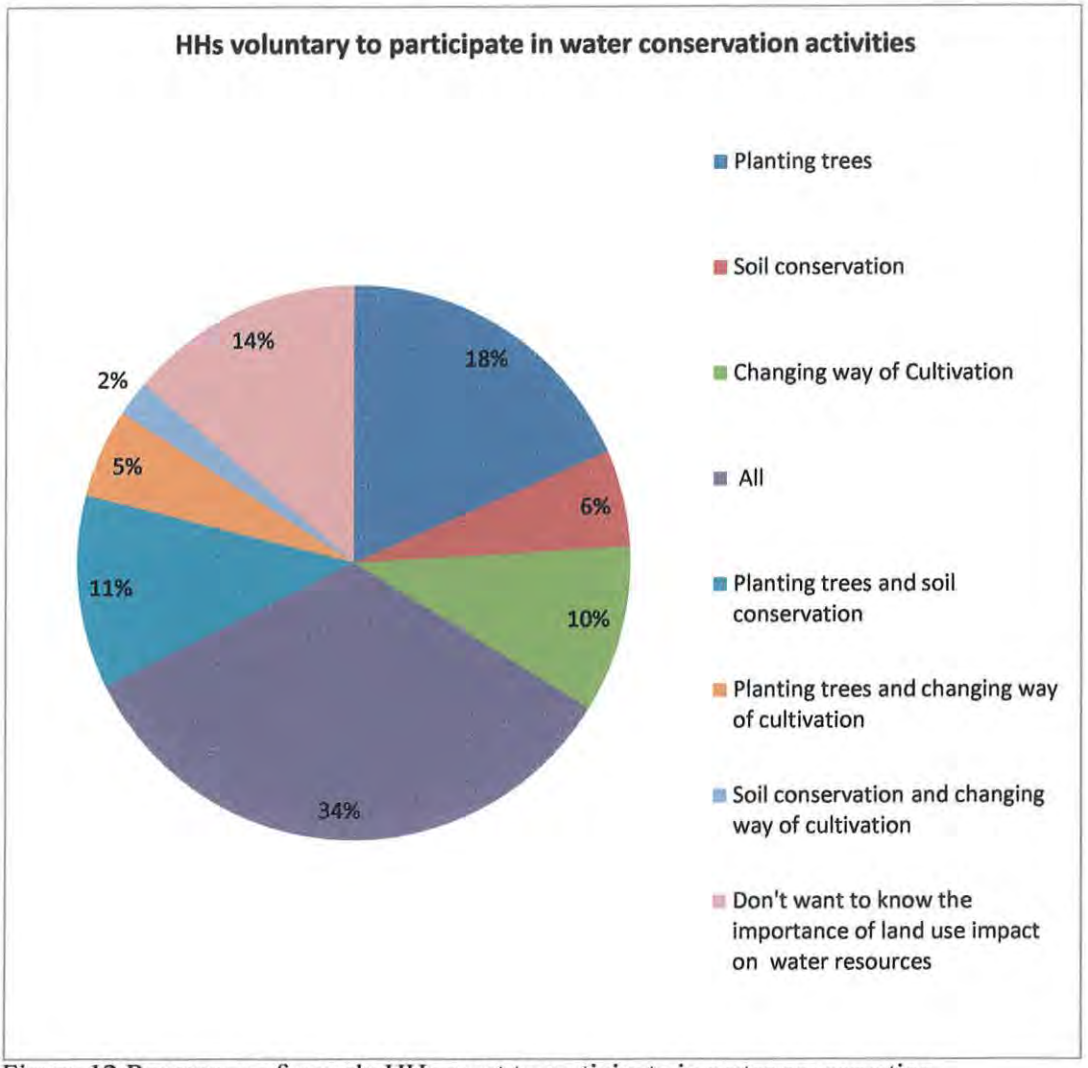

Figure 12 Responses of sample HHs want to participate in water conservation.
Source: Author's field survey (March, 2011)

The respondents were asked whether they know their living area is encompassed in GCA or not. About 82 percent of the respondents know GCA encompasses their living area where as the remaining 18 percent do not know. The survey result shows that sources of information for the respondents are: 6 percent AAWSA, 38 percent local administration, 2 percent NGOs, 24 percent know from their own experiences and 12 percent are heard from other people (fig.14). This result indicates that the local administrations (BTA and WAA) played more role than AAWSA as both of them are the stockholders of the GCA. Similarly, the findings of interviews, field observation and FGD confirms with this idea. The land development activities seen in the catchment, which are incompatible with the water resources in the dam, are indicators of the lack of awareness creation of the responsible bodies to the communities in the area. The awareness creation activity on environmental rehabilitation that is expected to be done by NGOs in the catchment area is almost negligible.

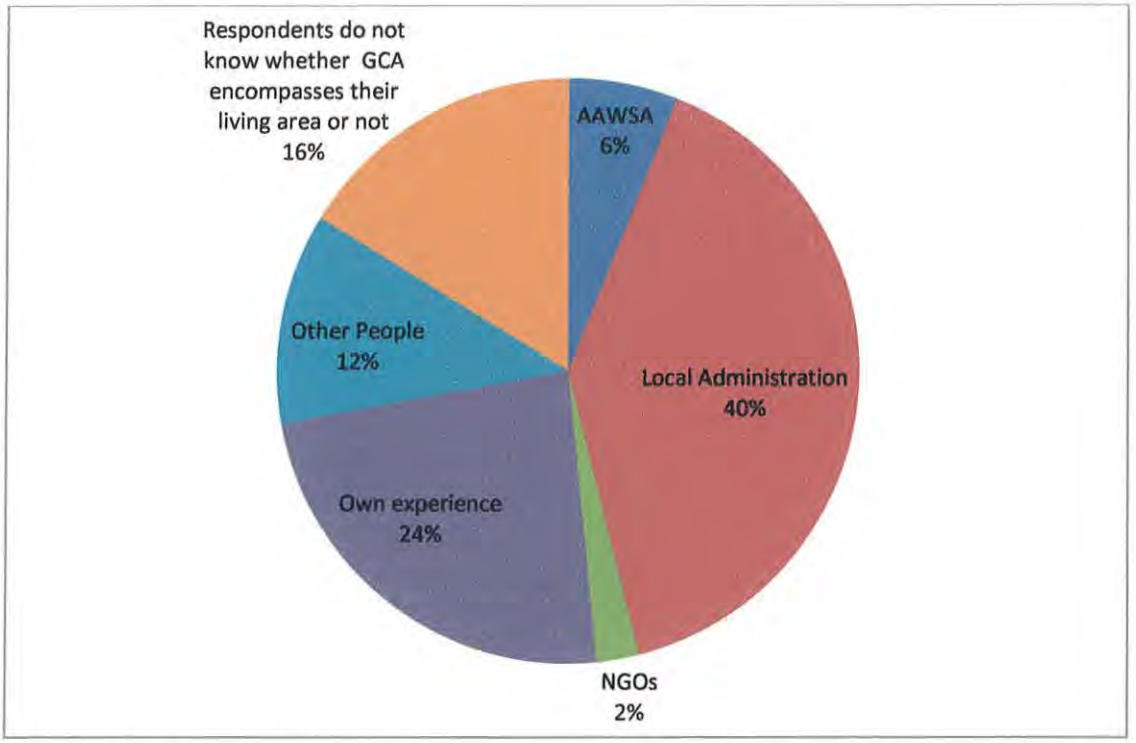

Figure 13 the sample HHs who have information about their living place as it is encompassed in the GCA

Source: Author's field survey (March, 2011)

The study result from table 20 indicated that 62.4 percent of the sample households are aware of about their activities in their living area that could affect the water resources used in the downstream in the catchment. However, 37.6 percent of the respondents are not aware of the impacts of their activities in water resources on downstream users in the catchment.

Table 20 the respondents' awareness about activities/action affecting the downstream users of water

Respondents with awareness		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	121	62.4	62.4	62.4
	No	73	37.6	37.6	100.0
	Total	194	100.0	100.0	

Source: Author's field survey (March, 2011)

Thus, to sustain the utilization of water in Gafarsaa dam the community mobilization activities should be done at large and there should be efforts especially from AAWSA.

The respondents having the understanding of the impacts of their activities on the downstream users of water resources in the catchment also have different perception on the ways they could affect water resources. Table 4.20 shows the ways human activities affect the water

resources and thus 41.8 percent replied water quality, 5.2 percent responded water quantity and 15.5 percent answered both (water quality and quantity).

Table 21the ways of human activities affect water resources

		Frequency	Percent
HHs know the ways of human activities affect water resources	affecting water quality	81	41.8
	affecting water quantity	10	5.2
	Both	30	15.5
	Total	121	62.4
HHs do not know the ways of human activities affect water resources		73	37.6
	Total	194	100.0

Source: Author's field survey (March, 2011)

The study also investigated whether the sample households have knowledge on the importance of water resources management or not. The survey found out that 88 percent of the respondents know the importance of water resource management while the remaining does not know (table 22). Nevertheless, practically the field observation realized that the rivers and streams found in the catchment do not have protection. The land use practices seen throughout the catchment have high potential of threatening water resources and therefore it needs the attention of all stockholders.

Table 22 Respondents believe in the importance of water resources management

		Frequency	Percent
Respondents believe in the importance of water resources management	Yes	171	88.1
	No	23	11.9
	Total	194	100.0

Source: Author's field survey (March, 2011)

Furthermore, the finding from survey questionnaire demonstrated that about 80 percent of households are participating in water resources management in GCA while 20 percent do not participating in water resources management (table 23).

Table 23 sample HHs Participating in Water resource management

		Frequenc y	Percent
Sample HHs Participating in Water resource management	Yes	155	79.9
	No	39	20.1
	Total	194	100.0

Source: Author's field survey (March, 2011)

Table 24 tells us 73.7 percent of the respondents manage water resources with other natural resources like soil and plants while the rest 6.2 percent tried to manage water alone. This indicates that the respondents have the concept of interrelationship of the natural resources management.

Table 24 the ways sample households manage water resources

		Frequency	Percent
The ways sample households manage water resources	Managing with other natural resources	143	73.7
	water alone	12	6.2
	Total	155	79.9
HHs do not participate in water management		39	20.1
	Total	194	100.0

Source: Author's field survey (March, 2011)

However, the authenticity of the result set in table 23 and 24 is not reliable with the facts seen in the catchment area. Because, the environmental protection practice in the catchment is poor and the water resources found in the area is ruined.

Table 25 illustrates the knowledge of the respondents about the relation between the land, water, forest and soil. Seventy five percent of respondents know, as there is a close relation between the conservation of land, water, forest and soil and impossible to separate one from the other. On the other hand, 25 percent do not know the interrelationship between these natural resources. Lack of knowledge about the interrelationship of the natural endowment by the society may make them to utilize one type of resource without caring for the other.

Table 25 The knowledge of sample HHs about the relationship between land, water, forest and soil

		Frequency	Percent
HHs know about the relationship between land, water, forest and soil	Yes	146	75.3
	No	48	24.7
	Total	194	100.0

Source: Author's field survey (March, 2011)

4.2.3.2 Benefit Sharing of local community from the Gafarsaa Water supply dam

It is obvious that investing on the upstream in the catchment area of a dam can increases clean water supply and reduce sedimentation. Environmental rehabilitation programmes like water and soil conservation and reforestation should be carried out in the catchment area by the expense of revenue generated from the sales of water supply. According to the information earned from the participants of FGD of AAWSA the performance of the organization in terms of making the upstream community beneficiary from the dam is limited. The participants of FGD from AAWSA mentioned that:

> Mainly, AAWSA focus on water supply activities to the downstream users (Addis Ababa city). Even though the bathymetric study of the catchment area put clear direction to ensure the benefits of upstream dwellers from the revenue generated, AAWSA has not make it practical. The budget allocated for the catchment management per fiscal year is not enough to ensure the equitable benefit throughout the whole catchment of the dam and hence it is limited to the maintenance of the buffer area.
>
> They also illustrated that the local community do not have voice over the decision made at the catchment area. They are always in fear of being dislocated from their living area due to the dam and could not lead stable life. The owners of the land in the catchment area do not have the master plan of their own land and cannot use it for the purpose they want. Or else, the AAWSA should not compensate and resettle them to protect the catchment as a whole. More over the local community complain for they could not get clean water for domestic uses. Allowing them only for livestock use is not enough. Due to this, they are not happy. As much as community do not care for the natural resources they could not get benefit from it, AAWSA should supply the people in the catchment area with clean water and other incentives.

Bayyanaa Hordofaa, one of the respondents (from elders) of in-depth interview said that:

Many people found near the Gafarsaa dam are always in fear of losing their land without enough compensation due to the area became under BTA. Because of this, they are transferring their land to other people illegally.

For the effective management of GCA through community participation, they should get the necessary benefit from the dam. The field survey also revealed that the local community living in the catchment area are using water from unprotected streams for domestic uses (fig. 15). This shows that no one gives attention to these people.

AAWSA does not set the environmental protection program as its goal and thus does not give attention to this activity of the catchment.

A  B 

C  D 

Figure 14 The surrounding community fetching unprotected streams. A) A girl fetching from *Dibaba* stream B) Children fetching from *Corrisaa* stream C) Children fetching From *Subbii* stream.

Photo: Author's field survey (March, 2011)

4.2.4 Participation of NGOs in Gafarsaa Water supply Dam Catchment Management

From fig.4.7 and fig.4.9, the result of the survey questionnaire of households indicated that the role of NGOs in the catchment management is negligible. This finding is also matching with the discussion carried out with the representatives from AAWSA. The result of discussion is explained as follows:

AAWSA tried to find NGOs and international fund donors working on environmental rehabilitation and catchment management programmes like UN-habitat, World Food programme Merit project, JICA and World Bank. One individual among the participant of the FGD said that UN-habitat works with AAWSA on three programmes-namely water quality, catchment management and water demand

management. Particularly, the programme called UN-habitat Water for African Cities mainly works on water demand management and catchment management.

According to the idea of another participant, the AAWSA attempted to work with World Food Program- Merit Project that involves the community in environmental rehabilitation activity for food. The AAWSA wants to implement this programme within the catchment areas of surface water dams. However, World Food Programme did not donate the fund due to the area is relatively considered to be food secured. According to this respondent AAWSA is yet persisting in asking this donor organization to provide budgetary for environmental rehabilitation because Addis Ababa city get water from these areas.

Another donor organization asked to give financial and material support for AAWSA was JICA. One of the participants of FGD suggested that once JICA promised to donate us with the materials important for water resources management and soil conservation. Even though they take the lists of materials important for environmental rehabilitation, until now they do not make it practical.

According to the idea given of the participants of FGD from AAWSA World Bank is the current donor organization aiding the organization financially. When the bathymetric study of the catchments of surface water dams prepared the fund was donated from the World Bank. The World Bank also promised to donate fund for the implementation of the bathymetric study. However, it could not make it practical.

The participants also suggested that, even though there are other international fund donors that support AAWSA for the catchment management, the fund is being used for the expansion programmes of deep well to increase the water supply of the city.

In general, the FGD confirmed that the effort of AAWSA to work in collaboration with voluntary NGOs and International fund donors on the catchment management and environmental rehabilitation is not adequate.

4.2.5 Participation of Women in Catchment Management

According to the responses of the participants from AAWSA, no special attention is given to the women's participation in catchment management. The participation of the community in catchment management as a whole is almost nil and the same is true for women's participation.

4.2.6 The stumbling blocks of IWRM in GCA

The focus group discussion carried out with AAWSA revealed that the obstacles to practice IWRM have political, economical, cultural, social and legal aspects. According to the idea raised from one participant of FGD;

> The political aspect is related to the two administrative bodies (the AAWSA and Oromiyaa Regional state). As much as these administrative bodies are autonomous, they act independently to use the resources in the GCA i.e. AAWSA focus on water resources utilization while Oromiyaa Regional State wants to use its land for different developmental programme. AAWSA cannot interfere with the plan of Oromiyaa Regional State while trying to supply Addis Ababa city with water. Such kind of problem is political in nature.
>
> The respondents also mentioned that those activities, which are important for the Oromiyaa regional state and the surrounding community but are not allowed to be invested in the catchment area, have economic impact on the upstream community. The investments carried out in the catchment area have economic importance for Oromiyaa regional state while it could affect the water in the dam. Therefore, the existence of the Gafarsaa dam is economic loss in terms of land utilization right for the Oromiyaa regional state and the inhabitants of the catchment.
>
> The participants of the focus group discussion from AAWSA go on with giving their idea about the obstacles of practicing IWRM as follow:
>
> The farmers in the catchments show high resistance to shift from crop production to vegetation production and to participate in natural resources conservation. They are not voluntary to change traditional activities that have high potential of affecting the natural environment.
>
> In addition, the participants pointed out that the movement of people from other parts of the country to the areas near Gafarsaa dam is the problems related to the social aspect that can bring other problems. The participants said that around 15 to 20 households migrate to this area every day.

For the question raised to assess the legal rule existing in AAWSA, which ensures the benefits of the upstream and downstream community in the catchment area, the participants of FGD replied that,

> There is no binding rule that ensures the benefit of the upstream and downstream community of the Gafarsaa water supply dam. Providing the city with clean and adequate water by taking from anywhere around the city is a mandate given to AAWSA during central government administer the country. To the extent that the

central governance is not effective in federalism, there should be legal rules that govern the land and water users in the catchment.

4.3 The hydrology of Gafarsaa Water Supply Dam Catchment Area

The hydrology of a given area is determined by the climate, existences of the natural vegetation and exotic plants, topography of the land, the type of soil and the land use activities of that area. In this study, to get information about the existence of the forest during the prior years of the dam construction, in-depth interview was carried out with five elders who have long experience with the dam. According to the response of one elder whose name is Raggasaa Dabalii the land inundated by water due to the construction of the dam belongs to him and his relatives during emperor Haileselasie I regime. Hence, Raggasaa explained the condition of existing forest prior to the construction of the dam as follows:

> The area around the dam was covered with forest in which Juniperus procera (Gattiraa), Rosa abyssinica (goraa), Carissa edulis (Agamsa), Acacia spp. (Laaftoo), Olea europaea var africana (ejersa), etc are the dominant trees. These natural plants were highly removed during Italy evade the county. Especially, Juniperus procera is highly removed during this period. The complete removal of this natural forest happened during the Dergi regime. As this area is near to Addis Ababa the wood from the forest was sold for fire wood, construction and furniture production.

Another respondent named Beyene Hordofaa also described how the natural vegetation was replaced by eucalyptus tree as follow :

> The landlords, who were the owners of land in the catchment during the emperor Haileselasie I, removed the natural forest and replaced with eucalyptus tree. Later on when the land was transferred to peasants at failure of Monarchical rule, the eucalyptus plantation became common properties of farmers of the society in the catchment area.

Even though it needs further study, Raggasaa Dabalii suggested that:

> The streams and shallow wells near eucalyptus trees most of the time seen dried while those sources of water near other indigenous plants do not. For instance, the stream locally called burqaa maracoo used for irrigation has already dried.

The following figures show the picture of natural vegetation taken during the field observation.

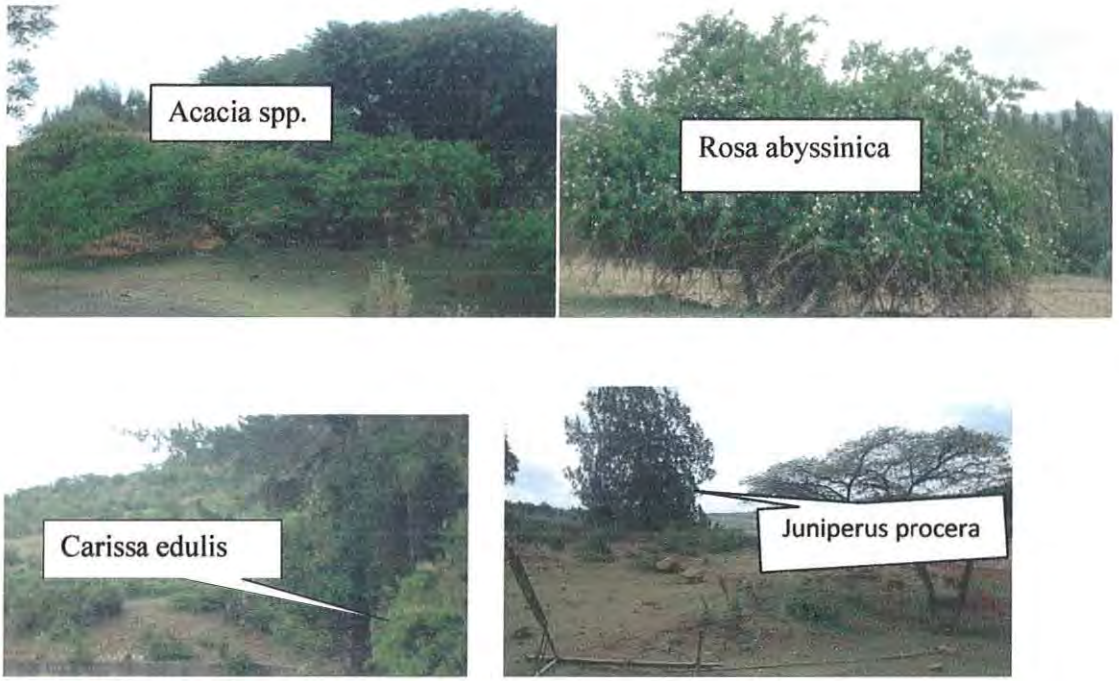

Figure 15 some natural plants remaining in the catchment area.
Photo: Author's field survey (March, 2011)

For the sustainability of harvested water and continuous flow of streams to the reservoir, the conservation of the natural vegetation is crucial issue and hence the plantation of indigenous trees should get attention in the environmental rehabilitation programme of this catchment area.

Built up areas, cultivated and impervious lands are formed because of land use activities of human beings in a given area. The current condition of Gafarsaa water supply dam catchment area shows that the expansion of urbanization, construction of factories, hotels, recreation centres, public and private offices, schools, health centres, oil station, concrete and asphalt roads. The activities related to construction alter surface runoff and decreases the infiltration of rain and result in decline of discharge of streams. The survey questionnaire with sample households revealed that around 44 streams decrease in their discharging or completely dried (table 26). Out of 194 sample households, 124 respondents listed the name of streams completely dried and/or decreased in their discharging found in the catchment area or riparian areas. Again, among the respondents only 71 or 36.6 percents are becoming aware of the problem of increasing water scarcity in their living area. It is the activity of administrative

related resources. It is also important to train the communities in the catchment area to raise awareness on water scarcity issue that encounters the today's world. The responses of the respondents show that because of the drying of streams and rivers in riparian areas of GCA, the livestock travel long distances to drink water from the dam. For instance, one of the dried rivers mentioned by eight respondents during the survey of sample HHs named *Laga Sareen* is located toward the south direction of the GCA in the industry zone of the Burayu town. Since it is located in the industrial area, the chemical wastes realised from point sources pollute the water and it has become out of uses. The area is well developed and encroached with many factories and buildings and this situation may result in prohibiting the infiltration of rainwater that brings in drying of springs and streams. The in-depth interview with Badhadha Qumbii witnessed rivers like *Laga Sareen* has been dried and it is difficult for community to get water for household uses and for their animals.

Table 26 Name of dried/decreased streams in GCA

Name of dried/ decreased streams in GCA	Frequency	Percent
Doosoo	2	1.61
Manjaroo	8	6.45
Shaarrii	3	2.42
Antuuta	3	2.42
Calalaqaa	5	4.03
Sanqqallee	1	0.81
Taaddee	1	0.81
Dhitaa	1	0.81
Xirxirrii	2	1.61
Hurufa qallaa	3	2.42
Haroo	3	2.42
Billisa	1	0.81
Kuree	1	0.81
Katamaa	1	0.81
Guttiyyaa	1	0.81
Corree	1	0.81
Bocoroo	4	3.23
Caffee Tumtuu	2	1.61
Hodaa	1	0.81

Dabalaa	2	1.62
Ayyalaa Dalagoo	1	0.81
Ona sharuu	1	0.81
Warabaa	2	1.61
Gaddafaa Tiksee	1	0.81
Gafarsaa	5	4.03
Masqala	9	7.26
Adaadoo	1	0.81
Oka'aa	1	0.81
Kattaakuree	1	0.81
Doobbee	3	2.42
Corrisaa	3	2.42
Mogoroo	2	1.61
Bofataa	2	1.61
Yeeyyii	1	0.81
Sareen	8	6.45
Gurmuu	3	2.42
Bakakkaa	12	9.68
Maammitee	1	0.81
Malkaa Roobii	1	0.81
Burqaa Baqqalaa Tufaa	1	0.81
Subbii	7	5.6
Hinnee	2	1.61
Total Respondents	124	

Source: Author's field survey, (March, 2008)

Undoubtedly, the lack of integration of the land use activities of Oromiyaa regional state with water requirement of Addis Ababa city upsets the scarce water resource harvested from the catchment area. The reconciliation of the interests of these two bodies through the implementation of IWRM could overcome the problems observed in the catchment area.

CHAPTER FIVE

5 CONCLUSION AND POLICY RECOMMENDATION

This study was conducted to understand the practice of IWRM and its stumbling blocks in the catchment area of Gafarsaa water supplying dam. Based on the findings of this research, the following conclusion could be drawn and policy recommendations were forwarded.

5.1 Conclusion

Catchment area of Gafarsaa water supply dam is one of the surface water sources of Metropolitan area of Addis Ababa. The households of GCA are characterized in their rural and urban livelihood life style. They are engaged in different activities like crop production livestock rearing, daily labourer, private and government employment and others.

The research finding revealed that the catchment management is not extended beyond the buffer area of the dam so that most activities beyond this area, though prominent, were not taken in to consideration about their effect on the water resource. This is due to the lack of integration of all stockholders for the catchment management and budget constraints from AAWSA side. The main land related activities observed in the catchment area are cultivation, livestock rearing, growing eucalyptus trees, urbanization and the investments activities. In addition, expansion of infrastructures like construction of new roads, schools, health centres and public service institutes are practiced in the study area.

Within catchment area of GWSD factors like illegal settlement, illiteracy and high fertility rate of population can exacerbate environmental degradation that, in consequence, brings the vulnerability of water resources in the dam.

Farmers in the GCA use chemical inputs, like industrial fertilizers and herbicides, to increase agriculture productivities that pose significant threats to the quality of water harvested in the dam. Sedimentation of the dam is another agricultural related problem, which shortens the storage capacity there by its design life.

Even though the study revealed that most households use latrine and animal waste disposal hole in their homesteads, the waste disposal treatment mechanism that is being adopted in their living area is not that much reliable in blocking the flow of the liquid wastes towards the reservoir and hence its possibility to cause pollution of water in reservoir is very high.

The conservation practice of grazing land is low in the study area that can enhance soil erosion during the rainy period and in turn brings sediment loading in to the dam. The problem related to the livestock rearing is not only over-grazing but also direct pollution of

the raw water with animals' urine and dung, while they are drinking from the dam and grazing in the buffer area.

The study found out that after three or four years the urbanization around the dam, unplanned human settlement in the catchment area, the expansion of investments, private and public institutes that are detrimental to the water utilization of the dam have become common. The urbanized area does not have sewerage system; on account of these, the liquid wastes generated from the area and roads directly sewer in to the dam through the open channel and in the end it pollutes the water. Moreover, the land degradation related to the urbanization and infrastructure construction contributes to the siltation of the dam.

The study also revealed that many streams found in the GCA and its riparian area have either dried or decreased which is pertaining to the alteration of the land use activities of the area. Thus, if these anthropogenic activities in the catchment area will be proceeded as in the current condition, the water in the dam will stop its services to Addis Ababa city in the near future.

The miss uses of lands by the inhabitants of the catchment area emanate from lack of integration among the stockholders of the GCA. This shows that there is limited understanding of the concepts of IWRM. Hence, the study confirmed that the IWRM has not practiced in the catchment area of GWSD. The lack of IWRM is reflected through different direction as divulged in the study. These include:

- AAWSA, as a stockholder sector of GCA, does not take part in decision making for the land related developments in the area.
- There is no regular meeting time for all stockholder sectors to deal on the issues of land developments and catchment management.
- A community mobilization activity on the natural resources conservation is not sufficient; especially awareness increment on the catchment and water resource management for the households through AAWSA is insignificant.
- The effort of AAWSA to work in collaboration with voluntary NGOs and International fund donors focused on water supply programme rejecting the catchment management and environmental rehabilitation activities.

The main obstacles to practice IWRM have political, economical, cultural, social and legal aspects and these problems should get relevant solution to proceed into the implementation of IWRM for the sustainable utilization of Gafarsaa Water supplying dam.

5.2. Policy Recommendation

At this point, it is important to suggest how to bring IWRM within GCA in to practice right from the beginning.

- The catchment area of GWSD should have independent management unit in which all the stockholders should involve. For the management of the catchment the committee including all stockholders should be established. The committee members should include head administrators of the related sectors of BTA and WAA, Gafarsaa water treatment site manager and his co-workers and local communities. The stockholder sectors of BTA and WAA are Land Use and Environmental Protection Office, Water Supply and Sewerage Services Office (*only BTA*), Health Office, Women Affair Office, Agricultural Office (*only WAA*) , Investment Office (*only BTA*), Water, Mineral and Energy Office (*only WAA*), Urban Infrastructure and Design Assurance Office (*only BTA*) .
- Supplying Addis Ababa city with clean and adequate water by its nature is multi-sectoral. Source of surface water for the city is exclusively found in Oromiyaa Regional State (Walmara Aanaa, Burayu Town, Sandaafaa Bakkee Town and Barraak Aanaa). Supplying water with millions of people living within a single city where thousands of economic and social sectors found is not affordable so that voluntary NGOs and International fund donors should take part to aid financially and technically. In short, it needs the involvement of all stockholders in the catchment management. Therefore, participatory forums that enable all stockholders (authorities, NGOs, local communities and other interest groups) to involve in catchment management should be established for facilitating the implementation of IWRM i.e. Water partnerships at Addis Ababa city and catchment level committee should be established.
- There should be guideline for planning permit applications that will oversee the use and development of land within the catchment areas of water supply dam.
- For the upstream community to develop the sense of ownership for the dam, they should be beneficiary from it. They should get clean and adequate water for domestic uses and their livestock. Care is needed to ensure that politically powerful, Metropolitan Area of Addis Ababa should not get benefit from the water resource at the expense of rural communities living in the catchment area. In order to ensure equity utilization of the resource, approaches that include negotiation, joint decision-

making, compensation, and payments for environmental services, should be practiced in the GCA.

- To create enabling environment for the implementation of the IWRM the legal framework that ensures the benefit of the upstream and downstream communities should be formulated.

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ANNEX1

A. Survey Questionnaire

Survey questionnaire to be filled by household living in the catchment area of Geffersa water supply dam

Dear sir/Madam

Tamiru Fufa, a postgraduate student of AAU, is carrying out a study on practices of IWRM and its stumbling blocks in the catchment area of Geffersa water supply dam. Thus, the researcher is kindly requesting you to provide him with right information. The opinion you give will help the researcher to draw the conclusion concerning the practices of IWRM and its stumbling blocks in the catchment area of Geffersa water supply dam. Your response will be confidential and be used only for the purpose of this study. The enumerator is expected to explain the purpose of the questionnaire and should put his/her signature at every page of the paper for its completeness.

Thank you.

I. Personal and household's data related to questions.

1.1. Name (optional) :_____

1.2. Sex: 1= male 2= Female

1.3. Age :1=18-29 2=30-60 3=61and above

1.4. Family size (in number):1= male___ 2= Female____ Total_____

1.5. Marital status : 1=married 2= not married 3= Divorced 4= other

1.6. Educational status: 1= Non-literate 2=grade1-4 3=grade 5-8 4=grade9-12 5=certificate and above

1.7. Duration of residence in this area: 1)since birth 2)other, specify

1.8. Major occupation: 1=crop production 2=animal husbandry 3=other, specify

II. The integration of Water and land use

2.1. Do you have your own land? 1=Yes 2= No

2.2. If your answer is yes, please fill the following table

Land use	Area in ha
1=Cultivation	
2=Fallow	
3=Woodlot	
4=Homestead	
5=Grazing land	
6=Hay land	
5=other, specify	
Total	

2.3. Are you aware of any impacts of these land uses on water resources?

1=yes 2=no

2.4. If your answer is yes for question No.2. 3 in what way they affect?

Impacts of land uses	yes=1	no=2
1= sediment load to the water sources	1	2
2=using large quantity of water	1	2
3=releasing waste material to the water body	1	2
4=other, specify	1	2

2.5. If your answer is yes for question No.2. 3 from where did you get this awareness?

Media type	yes=1	2=no
1= mass media	1	2
2=news letter	1	2
3=development agents	1	2
4=NGOs	1	2
5=other, specify	1	2

2.6. Is it important to understand or become aware of the impacts of land uses on water resources?

1=yes 2=no

2.7. If your answer is yes what measures are you taking based on the awareness you have already get?

Measure in which you are engaging	1=yes	2=no
1=planting tree	1	2
2=participating in soil conservation	1	2
3=changing the way of cultivation	1	2
4=other, specify	1	2

2.8. Do you know catchment area of Geffersa Water supply dam encompasses your living area?1=yes 2=no

2.9. If your answer above is yes who did you tell you?

Sources of awareness	1=yes	2=no
1=AAWSA	1=yes	2=no
2=Burayu Town Administration/ Wolmera Aanaa Administration	1=ye	2=no
3= NGOs	1=yes	2=no
4=other, specify		

2.10. Are you aware that your actions/activities in and around this catchment will affect water of downstream users?

1=yes 2=no

2.11. If your answer is yes, in what way do you think?

1=affecting water quality

2=affecting water quantity

3=both

2.12. Are there any natural water resources like springs/ponds/streams etc. which were present in the pas but dried or decreasing in its amount of flow currently? 1=yes 2=no

2.13. If your answer is yes for question 2.12, how many are there in number?

List their type and number

2.14. Do you understand water is scarce natural resources that are going to be eliminated from the earth?

1=yes 2=no

2.15. Do you know the importance of water resources management?

1=yes 2=no

2.16. Do you contribute to water resources management?

1=yes 2=no

2.17. If your answer in above question, in what way?

1=joint management with other natural resources like soil and forest 2=trying to manage water alone

3=other, specify

2.18. According to question 2.2. if you have own farm land, what type of fertilizer do you use?

0=None 1=Traditional 2=Industrial 3=Both

2.19. What type and how many bags (50kg) do you use per cropping year?

Type	Amount
1=DAP	_____
2=Urea	_____
3=others	_____

2.20. Do you use chemicals for you crop protection against disease and/or weeds? 1=yes 2=no

2.21. If your answer is yes for question No.16, what types and how many litres do you use within one production year?

Types	Amount
Herbicide	_____
Insecticide	_____
Fungicide	_____

2.22. Under question No. 2.2 one of your land use type is for woodlot, for what purpose do you use the wood?

I uses wood for	1=yes	2=no
1=fire wood	1	2
2=construction	1	2
3=selling	1	2
4=other, specify	1	2

2.23. Do you think the trees need to be preserved?

1=yes 2=no

2.24. If your answer is yes for question No. 2.20 how do you preserve these plants?

plant preservation practices	1=yes	2=no
1=planting new trees	1	2
2=conserving existing vegetation	1	2
3=other, specify	1	2

2.25. If you have grazing land according to question 2.2, how many domestic animals do you have?

Type	Number
Cattle	_____
Horse/Donkey/Mule	_____
Goat	_____
Sheep	_____

2.26. Do you use the following conservation practices for your grazing land?

Conservation method	1=yes	2=no
Growing hedge	1	2
Limiting grazing to carrying capacity	1	2
Other, specify	1	2

2.27. Do you have waste treatment facility in homestead land?

1=yes 2=no

2.28. If your answer for question number 2.27 is yes which type of the following are using?

Type of waste treatment	1=yes	2=no
Pit latrine	1	2
animal waste deposit hole	1	2
other, specify	1	2

2.29. What are some of the impacts currently affecting the water resources in your area?

Environmental impacts	1=yes	2=no
1=agricultural activities	1	2
2= tree cutting	1	2
3=sedimentation	1	2
4= runoff	1	2
5=waste released from different institutes	1	2

2.30. Do you know the conservation of land, forests and water are inter related and cannot be separated?

1=yes 2=no

2.31. Is there integration of different sectors working for the sustainability of water resources in your locality?

1=yes 2=no

2.32. If your answer is yes, list their name.

2.33. In the future are you voluntary to participate in water conservation activities?

1=yes 2=no

2.34. If your answer is yes in question No. 2.33, why?

1=for own benefit

2=for the benefit of next generation

3=both

4=other, specify

2.35. If your answer for question No. 2.33 is no, why not?

1=I want to use my time for other activity

2=no trust in conservation measures

3=water will never be finished, so that no need of conserving it.

4=other, specify

2.36. If the way you are using your land has been found not compatible with the water in the Geffersa dam, do you agree with the proposal to take action to promote catchment compatible development?

1=yes 2=no

ANNEX 2

B. Check list for interview of elder found around the dam

Hydrology of the study area

1. For how long you have known the Gafarsaa dam and its surrounding?
2. What did the existence of forest looks like around the Geffersa Dam? What were the main types of trees found in the catchment area of GCA? What were the main factors for the removal of natural forest found in this area?
3. What change is seen on the amount and appearance of water enters the dam since its construction up to the current time?
4. Can the surrounding community use the water from the dam for drinking, irrigation, animals, etc?
5. Doe AAWSA usually aware the communities found in GCA how to use their own land and aware the activities affecting the water in the dam? How the society reacts to this awareness?
6. Is there any preserved land not allowed for cultivation, grazing, or other purposes around the dam? What legal measure is taken on individuals used the banned area?

ANNEX 3

C. Check list for focus group discussion of AAWSA Representative

Practises of IWRM and its obstacles

1. How many catchments/watersheds areas does AAWSA use for the sources of surface water?
2. Is independent catchment management is practiced?
3. What type of water management strategy does AAWSA follows to manage the water harvested from these catchment areas?
4. Is AAWSA involving in decision making for the development-taking place in the catchment area of surface water sources? Is there any investment allowed in the Gafarsaa catchment area by Burayu or Walmara Aanaa but stopped by the interference of AAWSA? Is there permanent meeting time with these two administration bodies on the issue of catchment management? If yes, how many times per month/or year?
5. Is there guideline for planning permit applications for use and development of land within the catchment areas of water supply dam? Does AAWSA apply this planning permit application guideline within the GCA? Is there payment (compensation) from AAWSA For the investments prohibited from being implemented in this catchment area?
6. Does AAWSA practice IWRM within these catchment areas to ensure the sustainability of the water resources? If yes, how do you promote this programme to make it prominent? If your answer is no, why does not?
7. In the context of your organization, what meaning does IWRM have?
8. Are all the stakeholders in catchment, participating in the catchment management? If yes, how do they participate?
9. Do local stakeholders feel that they have voice over the decisions made at catchment level?
10. Are there clear lines of coordination and responsibility among the stakeholders of the catchment?
11. What is the role of women in the catchment management?
12. Does your organization seek out donor funding to assist in the rehabilitation and management of the catchment area? Is how much it is successful?

ANNEX 4

D. Check list for focus group discussion for Burayu Town Administration sector representative

Compatibility of Land use with the water use in the dam

1. How much does Burayu town work in collaboration with AAWSA to use the land resources found in GCA?
2. Which sector is decision maker to allow or forbid the investments in the Geffersa catchment area? (BTA, AAWSA)
3. What types of developmental activities are going on the catchment area of Geffersa dam? Are these activities friendly with the water in the reservoir? Does Burayu town investment office allow investment based on the EIA?
4. Do the urban and rural communities living within GCA have proper dry and solid waste treatment facilities? Do public and private institutes have appropriate waste systems?
5. Did AAWSA give awareness on the master plan of GCA for stockholder sectors? Are these sectors working according to the master plan of the catchment?
6. Do you think the integration of all stakeholders of GCA is important for the sustainability of water in the reservoir?
7. What roles does your sector play in sustaining the water resources in the dam? For the implementation of IWRM in the GCA, what do you think the role of stockholder sector?
8. As the stockholder of GCA, what type of developmental activities do you allow in the area? Are there any types of investment requested by investor you have rejected due to its harmfulness to the water in the dam? Instead of forbidden investments, does AAWSA pay compensation for BTA?
9. In general, are BTA and Communities living in the catchment benefitted from the catchment area? Can they use from the dam? Can they utilize the land for any developmental activities?

ANNEX 5

E. Check list for focus group discussion of Wolmara Aanaa sector representatives

1. Do you know that two Gendas (Wetabecha Minjaro and Ade Sibirit Qotu) are found in Geffersa dam catchment area? Are the communities these Genda aware of about it? Who made this awareness?
2. Do you understand any activities in the two Gendas have direct and indirect effects on the water in the reservoir? If yes, what important measure is taken for the sustainability of downstream water user?
3. Are there joint activities with AAWSA toward the catchment? If yes, in what way? Do they include all stakeholders?
4. What type environmental conservation activities are taking place in this catchment area?
5. Is there any interference from AAWSA in decision making for developmental activities in the catchment area? Does AAWSA is involving in the management this catchment?
6. Is IWRM known in your Aanaa and being practiced? If yes in which watershed/catchment areas?
7. Are the local community following the proper waste disposal? Which sector/s is/are responsible for awareness creation and to what extent it/they work with AAWSA?

ANNEX 6

F. Check list for interview of the private and public organization representatives

1. The name of the organization:_____
2. Year of establishment of the organization:_____
3. The land hold by the organization (in ha.)
4. From where did you get permit for land
    - ✓ Federal
    - ✓ Oromiyaa region investment Bureau
    - ✓ Burayu Town Administration
    - ✓ Rent from Private land owners
5. The Goal/purpose of the organization:
6. Did AAWSA know before you invested on the land?
7. Waste treatment of the organization
    - ✓ Latrine for workers and users of the institute
    - ✓ Waste disposal channels
8. Is there any complain from surrounding community due to the waste released from your organization?
9. Did your institute prepared EIA before investing in the catchment?
10. Does the institute have its own car wash service?
11. Do you know that your organization is found in the catchment area of Gafarsaa waters supply dam?
12. Do you think your organization has impacts on the water in the reservoir?
13. If this organization has found that harmful to the water in the reservoir, are you voluntary to accept any correction measure that will be taken by government? If yes, what do expect from government? If not, why not?

Declaration

This thesis is my original Work and has not been presented for a degree in any other university and all sources of material used for this thesis have been duly acknowledged.

Name: Tamiru Fufa

Signature: _____

Date: 21/06/2011

I, as University advisor, confirmed that this thesis has been submitted for examination with my approval.

Name: _____

Signature: _____

Date: _____

Place and date of submission: Addis Ababa, June 2011