

# **Joint Report of the Task Force on Aquifer Management in Addis Ababa and its Vicinities**

*Draft for Discussion/Endorsement*



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on Aquifer Management in Addis Ababa and its Vicinities

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*Proposal for the Establishment of  
Addis Ababa - Oromia Special Zone  
Aquifer Management Office (AMO)  
February 2013*

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# 1. Introduction

## *1.1 The National and Addis Ababa Region Groundwater Management Frameworks*

In terms of its groundwater resources use, Ethiopia is entering a new era. Up to recent times, the use of groundwater has been limited for rural water supply and urban water supply, but this scenario is rapidly changing with the growing use of ground water for irrigation and multiple purposes. The ongoing Growth and Transformation Plan (GTP) of the Government has set ambitious targets for developing and utilizing water resources to fulfill the Government’s social and economic development priorities, sustainably and equitably, by increasing the national coverage of potable drinking water supply to the population and irrigation supply to ensure food security. It is expected that during the GTP period (2009/10-2014/15), the urban potable water supply coverage within 0.5 km radius would reach 100%; the rural potable water supply coverage within 1.5 km radius to be 98%; and additional 786,000 ha of land will be provided with secure supply of irrigation water. More specifically, the use of ground water resources for irrigation is expected to cover 2 million ha by 2020.

Along with the increasing groundwater development, there is growing awareness among the policy makers and the water resources specialists that management is needed to ensure the sustainability of investments in groundwater development. In this context, the Ministry of Water and Energy and the World Bank /GWMATE developed a Strategic Framework for Managed Groundwater Development in 2011 in which a number of follow up actions were recommended: (i) prepare and implement groundwater management plans for selected areas of high intensity use linking to local land use plans and introducing monitoring and quality protection measures; (ii) integrate groundwater development and management in larger programs – agriculture development, irrigation development, watershed management or road planning – making sure to maximize the benefits of ground water use within these programs; and (iii) accelerate development and capacity – human and material, public as well as private sector.

With respect to the introduction of groundwater management in the intensively developed areas, the case of Addis Ababa and its vicinity aquifers stood out and, related to the national Strategic Framework, a separate strategic framework was prepared for this important region. This singled out a number of top priority actions for managed development and suggested:

- operationalizing AMAR , which is renamed as AMO in this work( fig 1, below)
- strengthen and empower regulatory bodies
- enhance monitoring and information exchange
- reduce water losses/unaccounted for and launch conservation measures
- awareness for major stakeholders and decision makers

At this point, the importance of establishing a Task Force was crucial to particularly take the recommendation for Addis Ababa forward for the development of an institution (working title AMAR) that would manage the groundwater resources around Addis Ababa and the surrounding areas.

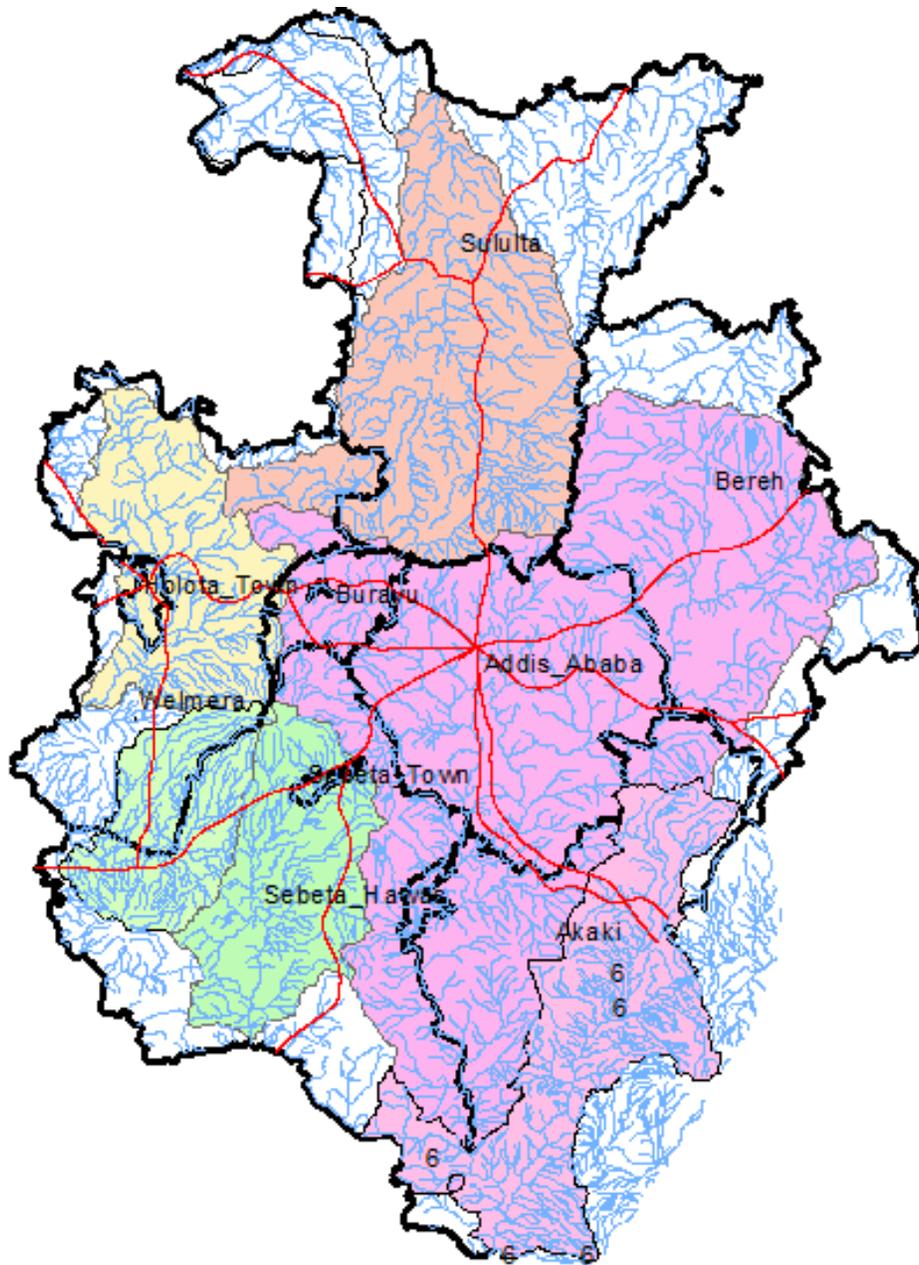


Figure 1: proposed area of operation of AMO and major catchments

### ***1.2 Establishment, Composition and Mandate of the Task Force***

The Task Force was established by the letter from the State Minister of Ministry of Water and Energy. Members of the Task Force, as shown in table 1 below, are drawn from key institutions that are directly or indirectly engaged in groundwater resources development and management. Their experiences and positions they held in their respective institutions were also considered for the selection.

Table 1: AMO Task Force Members

Institution	Responsibility	Remark
Ministry of Water and Energy	Groundwater Directorate	Chairperson
	Basin Administration Directorate	Member
	Water Utilization Permit and Administration Directorate	Member
Oromia Water, Mines and Energy Bureau	Process Owner	Member
Addis Ababa Water Supply and Sewerage Authority	Process owner	Member
Addis Ababa Environmental Protection Authority	Process Owner	Member
Ethiopian Association of Hydrogeologists and Drillers	CEO	Member
Ethiopian Geological Surveys	Process Owner	Member
Ethiopian Horticulture Production and Export Association	Expert	Member

As per the ToR, the main tasks of the Task Force were focused on:

- the preparation of action plan under the guidance of the Ministry of Water and Energy
- reach broad agreement on the priority actions and the main targets in the coming three years
- prepare a position paper on the establishment of AMO ( main regulatory tasks, legal mandate, organization, 3 year work plan, financial plan etc.)
- communication with the core team and management of the main stakeholders organizations to get their feedback and seek formal clearance
- finalization of the AMO organizational and operational plan
- workshop with all stakeholders to present the final plan and launch AMO and finally
- support to the implementation of the action plan

Following its establishment, drawn from different and relevant government and private sectors, the task force convened for a two day working session (Dec. 14 and 15, 2012) in Addis Ababa. The background framework document (updated) and related materials on the existing groundwater management and development situations in Addis Ababa and its surrounding aquifers, including international experiences, were compiled and distributed by the consultant to all task force members well ahead of the planned workshop.

### **1.3 Objectives**

The overall objective of the project was to formulate joint practical recommendations on the need and possibilities of establishing an institution responsible for managed groundwater development in Addis Ababa and the surrounding region of Oromia Special Zone. This followed from a main recommendation in the Ethiopian Framework for Managed Groundwater Development issued by the Ministry of Water and Energy in 2011 and developed with support from the World Bank. The specific objectives are to:

- define the main tasks that the institution will handle
- propose the institutional setup and organizational requirements
- outline the short term and medium term activities and goals
- indicate a first estimate of the budget required for establishment and for the first year operation costs
- identify possible sources of funding

### ***1.4 Methodology***

Based on the report and recommendations of the study team on the national and Addis Ababa groundwater management framework, the following methods were followed:

- Review of the framework documents and study reports and international experiences on groundwater management
- Review of existing policy, strategy and regulatory documents
- The review was made both individually and collectively in a series of workshops
- Compiling the findings in to a document and disseminating to all stakeholders
- Present the results on a national workshop to further enrich the document
- Finalize and submit the final result to the national core team.

It has been proposed that the national core team to consist of House of Federations, Oromia Regional State, Addis Ababa City Administration, Ministry of Water and Energy, Ministry of Construction and Urban Development, Ministry of Agriculture and Addis Ababa University. Following this initial step, the recommendation will be finalized and submitted for endorsement to a Core Group.

### ***1.5 Role of the Study Team***

The study team is a group of national and international consultants hired by the world bank to undertake the following major tasks:

- Assess experiences in Ethiopia in the use of deep aquifers and the issues that are at stake
- Make an inventory of international experiences in the management of regional aquifers
- Update the rationale, need, mandate, tasks and structure of the proposed AMAR structure
- Consult with MWE on the legal and institutional requirements
- Propose and facilitate the establishment of AMAR Task Force, composition, consult with the individual stakeholders to assess their views
- Support the Task Force and facilitate the preparation of a draft working document on AMAR mandate, responsibilities, tasks and structure
- Hold first meeting with the Task Force members to discuss the draft document
- Support and facilitate the preparation of the final document
- Consult with the WSSP/MWE on further steps/inclusion in national strategy

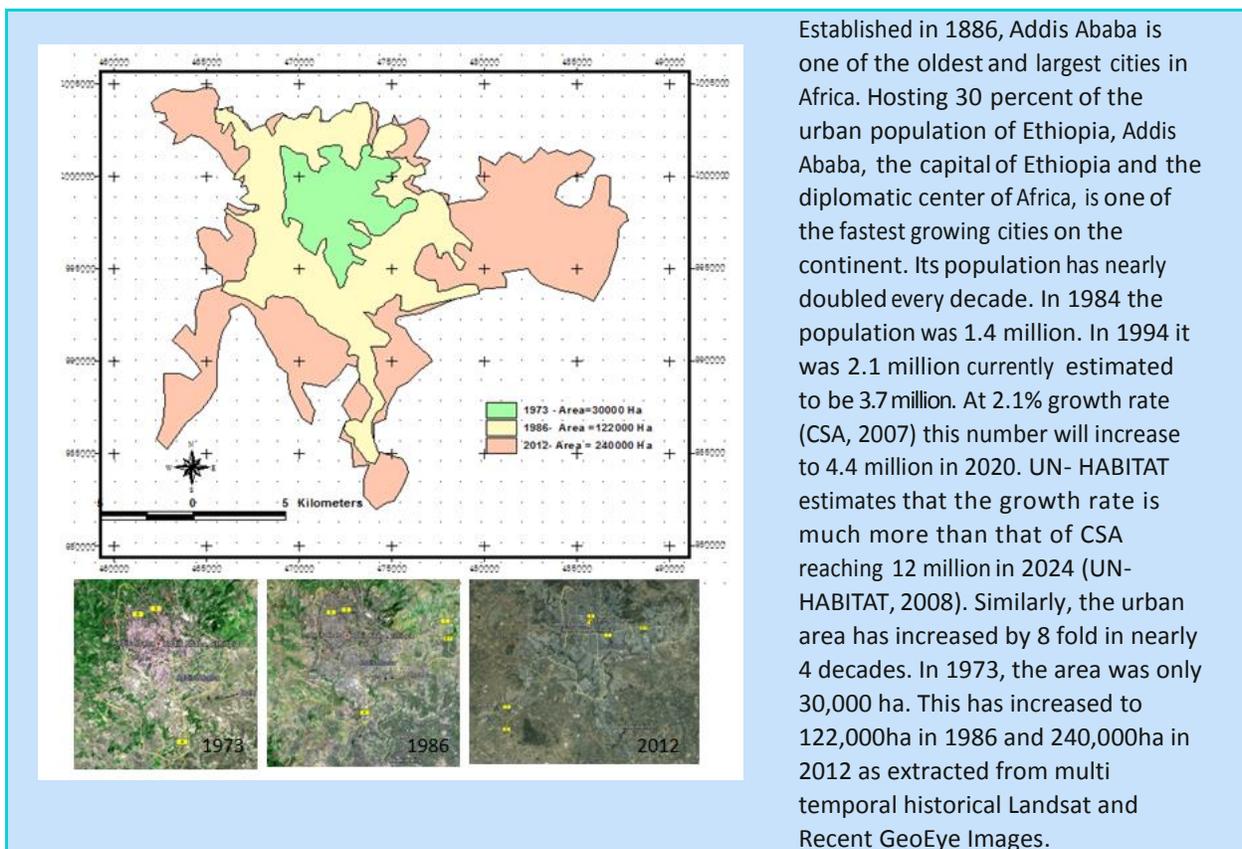
## 2. Major Groundwater Management Issues in Addis Ababa and its Vicinities and Selected International Experiences

### 2.1 Major Groundwater Management Issues in Addis Ababa and its Vicinities

This section gives background information as to why an independent institution is required for the managed groundwater development of Addis Ababa and its surrounding area. There are both technical and institutional issues that warrant well established institutional and regulatory arrangements to manage the development and management of ground water in this aquifer system.

In general, there is uncontrolled population growth and urban expansion (box 1) that will put an increasing pressure on water resources in general and groundwater resources in particular. Currently there is a growing interest and need by government and private sectors to invest on groundwater development for agricultural water management for poverty alleviation and economic growth. Due to the fact that the source areas for surface water harvesting are limited in Addis and its surroundings, the burden in the future for any demand, consumptive use or productive use, remains on groundwater sources.

Box 1: Four decades trend in urban expansion and population growth in Addis Ababa



At present 35% or 105,000m<sup>3</sup>/day of the water supply provision for the ever growing population of Addis Ababa City Administration is provided from groundwater sources. The total demand, based on CSA's population growth rate, will increase to 180Mm<sup>3</sup>/a in 2020 and the proportion of groundwater contribution is expected to increase from the current 35% to at least 50%. In terms of groundwater abstraction, it increases from the present 38Mm<sup>3</sup>/a to 90Mm<sup>3</sup>/a by 2020, which is more than double in eight years time.

In addition, several groundwater-based irrigation interventions have also been planned. Some irrigation projects are being developed by the Government on a pilot scale at several locations, especially on Ad'a-Becho plains part of an effort to develop groundwater based irrigation of about 55,000 ha as planned in the first Growth and Transformation Plan Period. Additionally, several new industrial and horticultural developments are planned requiring for more water well drillings and developments in the same area. If a minimum of 2000ha of land is assumed to be developed by 2020, including horticultural projects, the groundwater abstraction for the same purpose will be estimated to 50Mm<sup>3</sup>/a. Generally, without considering abstractions by the surrounding urban and rural areas for water supply as well as many private wells for various purposes, the total groundwater abstraction from the aquifers of Addis Ababa and its vicinities will increase at least by three fold in 2020.

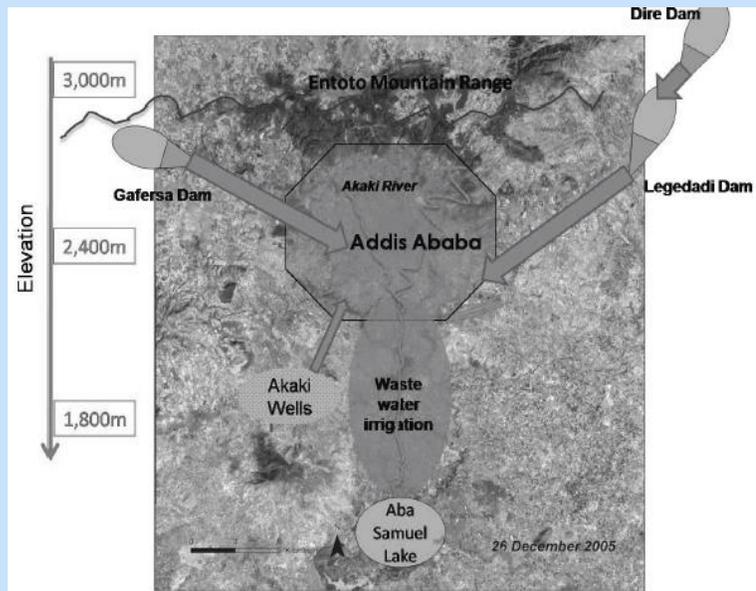
The consequence is that there will be more drilling and development of groundwater leading to concerns on over extraction and depletion of the resource. These concerns are already a reality, for example in Akaki well field: here some wells have been already abandoned because they became unproductive, while most of the wells are operating, in terms of yield, at 64% less discharge than what was initially expected after only few years in operation.

Apart from depletion of the resource, deterioration in surface and groundwater quality is also becoming apparently a matter of concern. While municipal and industrial effluents from Addis Ababa and its surrounding urban centers, such as Sebeta, already causing degradation of the shallow aquifer systems, with the expansion of groundwater-based irrigation and horticultural developments surface and groundwater pollution may become an even larger threat in the future. Surface water resources and unconfined shallow aquifers are highly vulnerable. The high nitrate and chloride concentrations in groundwater observed in Addis Ababa (box 2); frequent complains such as the death of cattle, human skin diseases and stomach complaints, coming from different segments of the society on the waters of Upper Awash Sub basin, in particular Aba Samuel Lake, Mojo River and Koka Lake are few that send strong warning signals.

Such dwindling resource against the uncontrolled population increase will trigger fierce competition in the future and will be the source of potential conflict between various users of the resource such as urban, rural, industrial and agricultural uses. Since the aquifer system is shared between regions (trans-region aquifers), conflicts are also expected between regions, more importantly Addis Ababa and Oromia).

## Box 2: Water quality and water links of Addis Ababa with surrounding rural areas

Samples from 9 sites in Addis Ababa (Coca Cola well, Ras Mekonen spring, Tsebay Maremiya well, Anwar Mosque well, Africa Hotel well, Lideta spring, Mekanisa Abo spring, Abunearegawi spring and Ras Hotel well) are found contaminated and had more than the maximum acceptable concentration (MAC) of nitrate. The distribution and extent of  $\text{NO}_3^-$  is mapped based on the result and showed the central part of the city had higher concentration from 58 to 102mg/L beyond the WHO maximum acceptable limit. Pollution of  $\text{NO}_3^-$  and  $\text{Cl}^-$  might be due to sources like seepage of pit latrines and infiltration of polluted effluents (Girma Hailu, 2011)



Source: D. Van Rooijen & G. Tadesse, Ghana, 2009

Why such threats of groundwater “depletion,” “pollution” and consequential potential “conflicts” are seemingly occurring and becoming major concerns? A number of reasons could be mentioned but majorly it is related to regulatory, policy and institutional issues as described below.

### Regulatory:

- no proper management and monitoring of groundwater resources are taking place
- drilling and development of wells are not fully licensed; the number of existing wells and future development plans are unknown
- well design and construction is not standardized; insufficient well head protection
- abstraction is uncontrolled and in general, regulatory framework is not effective

### Institutional:

- Addis Ababa and its surroundings’ aquifer is shared between two regions, namely Addis Ababa City Administration and Oromia Regional State-Finfinne Special Zone
- different stakeholders involved, directly or indirectly, in the development and management of the groundwater resources in the area without proper coordination and regulation
  - Oromia Regional State
    - Oromia Water, Mines and Energy Bureau
    - Oromia Land Administration and Environmental Protection Bureau
    - Oromia Investment Commission

- Oromia Bureau of Agriculture
  - Addis Ababa City Administration
    - Addis Ababa Water Supply and Sewerage Authority (AAWSSA)
    - Addis Ababa Environmental Protection Authority
    - Urban planning and development office
    - Bureau of land management
    - Urban agriculture (trade and industry bureau)
  - Federal Institutions
    - Ministry of Water and Energy
    - Environmental Protection Authority
    - Ethiopian Geological Survey
    - Ministry of Urban development and construction
    - River Basin Organizations (Awash and Abay basins)
  - Private Sectors
    - Industries
    - Horticulture producers
    - Drilling Companies and Civic associations, such as hydrogeology and hydrology
- Though there are isolated efforts going on, the basic issues among these stakeholder institutions are that:
  - there is no efficient communication and information exchange mechanisms,
  - there is weak or no cooperation and coordination efforts
  - there is no clear and well defined mandates, duties and responsibilities as to who should do what in terms of regulatory, monitoring, management and development of groundwater resource
- There is weak organizational arrangements and low capacities within the institutions to undertake proper management and monitoring of the aquifers.

### **Policy:**

There is a policy issued by the Federal ministry of water and energy some 10 years ago that deals with the management and development of water resources in general. However for the reasons related to institutional and regulatory aspects, the implementation of the existing policy, particularly for groundwater management and development, is weak. Though some countries have separate policies for groundwater management and development, globally the resource is widely misunderstood and given less attention - out of (public) sight, out of (political) mind. Moreover, it is considered as *infinite* resource compared to abstraction.

In Ethiopian context, it is only very recently that much attention is being given to develop groundwater at a larger scale, particularly for irrigation purpose. Therefore, the strict implementation of the existing policy, revisiting and updating it as necessary in line with the current and future growing demand, will be essential. It will be crucial to focus on:

- linking ground water resources/aquifers management with development or land use/cover plans. As a result, future source areas both surface and groundwater would

be protected; urban and industrial expansions would take place with minimum/no potential impacts on the resource.

- defining the mode of cooperation for management and development when the aquifer is shared between two or more regions.
- addressing the role of private sectors in groundwater development and management, such as opportunities to develop private sector role and capacity in drilling, well operation, monitoring compliance and communication, etc.

## ***2.2 Selected International Experiences in the Management of Regional Aquifers***

Besides assessing the gaps at local level, international experiences like that of China, Spain, Jordan and Latin America in managing shared aquifers and urban aquifers were used by the Task Force in designing AMO.

Table 2: Some international experiences in regional aquifer management

<b>Country/Town</b>	<b>Main Challenges</b>	<b>Main Features in Groundwater Management</b>
<b>Shanghai (China)</b>	Threatened to have been submerged in the sea- reaching up to 2.63 locally	Groundwater withdrawal reduced from the 60's onwards- to 40% of the 1964 levels
<b>Bangkok (Thailand)</b>	Water quality deterioration and land subsidence due to overpumping	Control on industrial well drilling and fees on abstraction. Fees are put in water fund used for monitoring, action research and capacity building
<b>Qinxu (China)</b>	Rapidly falling groundwater tables	Quota determined for all industrial and agricultural users. All pumps regulated and operated by swipe card – with pricing related to quota. Consumption reduced with 60%.
<b>Barcelona/Spain</b>	Threatened aquifers & lack of appropriate GWM & Admin. institution	Participatory Aquifer mgt., water policy, AM norms, setting hydrogeological planning boundaries, GWUA, etc.
<b>Jordan</b>	Lowering GW Table and use conflict	Water public property & under gov. Control, all wells have files, strong well monitoring, users notified of the rules violation may result in confiscation of rigs and crew will be arrested
<b>South Africa</b>	Lack of GWM regulatory and Admin. Tools, poorly managed and administered GW system	<ul style="list-style-type: none"> <li>• Developed national water , have GWM strategy, guideline,</li> <li>• Catchment Mgt. Agency including GWM,</li> <li>• Groundwater Advisory Group (GWAG)</li> </ul>

<b>Guarani Aquifer Systems (GAS) – Latin America</b>	Transboundary/shared aquifer shared by four LA countries with Growing use conflict:	<ul style="list-style-type: none"> <li>• Enhance and enlarge technical knowledge of the aquifer system</li> <li>• Coordinated management framework, harmonizing policies and management tools</li> <li>• Technical and socio-economic assessment</li> <li>• Reduce quantitative and qualitative threats</li> </ul>
<b>Texas- USA</b>	Threatened aquifers & lack of appropriate GWM & Admin. institution	<ul style="list-style-type: none"> <li>• Delineation of primary groundwater management areas</li> <li>• Groundwater conservation districts- permits for well drilling, spacing and size of pumps</li> <li>• Regional water planning group (RWPG)- to prepare development plans</li> </ul>
<b>Mendoza, Argentina</b>	Water use conflict and lack of water use allocation system	<ul style="list-style-type: none"> <li>• Development of user quota</li> <li>• automatic recorders on all wells</li> <li>• exchange of excess quota</li> </ul>
<b>Santa Fe, Argentina</b>	Deteriorated water quality and loss of recharge	<ul style="list-style-type: none"> <li>• Monitoring;</li> <li>• Pollution risk management;</li> <li>• Delineation of protection zones;</li> <li>• Recharge quantification</li> </ul>
<b>Jakarta, Indonesia</b>	Sea water intrusion	<ul style="list-style-type: none"> <li>• Phasing out individual pumping;</li> <li>• Increasing groundwater price four fold;</li> <li>• 10% of water prices shared with surrounding communities</li> </ul>
<b>Shenzen, China</b>	Water scarcity	<ul style="list-style-type: none"> <li>• Systematic use of rain water:</li> <li>• capture, infiltration and treatment of roof runoff;</li> <li>• additional management of parking area runoff and design of the stormwater wetland</li> </ul>

### ***2.3 The Need for New Institution to Manage Regional Aquifer***

Based on the assessments made on groundwater management issues in Ethiopia and some international experiences, it is timely that a well-focused independent institution with clearly defined duties will be established to take on the responsibilities so that all stakeholders and their efforts are coordinated; regulatory frameworks, guidelines and standards are set and become effective; practical aquifer management and groundwater development approach is emplaced; and finally sustainability of this economic heartland is ensured.

It is believed that the pressure on groundwater resource will increase in the coming years elsewhere in the country so that the experience and practical approach in Addis Ababa and its surroundings' Aquifers will be a working model.

### **3. Proposed Tasks and Institutional Arrangements**

#### **3.1 Main Tasks**

Based on the assessment of the above described technical, regulatory, policy and institutional aspects and identified gaps, the main tasks of the new institution will be:

- Awareness creation on water use and protection
- Monitoring of groundwater resources
- Coordinated planning
- Initiating regulation and ensuring its effectiveness
- Undertaking joint protection programmes

These tasks are detailed below:

##### **3.1.1 Awareness**

Awareness creation is important to:

- Support public education on water saving, protection and watershed management
- Support cooperation and education of main users and (potential) polluters
- Aware on compliance and enforcement of regulation, permits and licensing conditions for drillers and consultants
- Make sure groundwater is incorporated in urban and other planning processes, including catchment protection
- Ensure linkages and cooperation with existing initiatives and platforms
- Trigger cooperation with universities and research organizations on groundwater management.

##### **3.1.2 Monitoring**

Monitoring will be an important and unique task of the Aquifer Management Office. At present there is no systematic and comprehensive monitoring on groundwater resources. The following detailed tasks will be undertaken by the AMO:

- Carry out a full inventory and registration of all groundwater users
- Maintain an open access repository for data on groundwater studies, monitoring and well logs
- Plan and establish monitoring network for abstractions and groundwater levels
- Undertake regular water quality and resource monitoring
- Introduce water metering for main abstraction and encourage use of water book

- Initiate missing studies, such as determining of safe yields, assessment of groundwater potential and abstractions
- Carry out regular audits of work done by drillers and consultants, and link extension of permits to performance

### **3.1.3 Coordinated Planning**

The AMO will also initiate the coordinated planning process as these relate to the management of groundwater in the Addis Ababa - Oromia Special Zone region:

- Initiate the systematic planning of groundwater abstractions between Addis Ababa and Oromia Special Zone
- Delineate hydrological and hydrogeological planning boundaries or groundwater management areas or active groundwater management areas
- In cooperation with the Ministry of Water and Energy, prepare norms, standards and guidelines for borehole siting, design and development
- Prepare guidelines for disaster/risk management- acute shortages, droughts or floods
- Contribute to conflict management and resolution
- Sign an MoU with the Awash River Basin Organization and the Abay River Basin Organization where it relates to the interaction between aquifer management and river basin management in the two respective basins

### **3.1.4 Initiate Regulation and Ensure its Effectiveness**

Though the AMO will not in its early stage provide regulatory services, it will provide support to the concerned regulatory organizations and ensure the effective implementation of the regulatory provisions. The main tasks here are:

- Facilitating the development of strategic guidelines for the management and protection of aquifers
- Ensure proper issuing of licensing, including checking of licenses and referral of cases to respective bodies
  - Drilling and renewal
  - Regulate unlicensed abstraction
- Support the adequate preparation of ESIA (Environmental Social Impact Assessments) of projects under approval, that are relevant to water resource management in the AMO area – among other by determining safe yield/withdrawal rate of existing schemes
- Support and strengthen the existing regulatory bodies
- Mapping effluent disposal of potential polluters and addressing potential threats
  - Point sources- industrial, solid waste dump, leachate from stack piles of raw materials
  - Line sources- sewerage lines, spills during transport
  - Distributed sources- pesticide, fertilizer, oil effluents, deposits from smoke stacks
- Clarify basis for water use and allocation in the AMO area:

- Define and clarify water rights
- Reconcile public ownership and individual use rights
- Set rules/guideline for GW transfer or water transaction among users

### 3.1.5 Joint Protection and Management Programs

The AMO will actively initiate and where appropriate take part in the implementation of programs that serve to protect and manage the groundwater resources in the area – including the protection of the catchment and the related management of water use. The envisaged activities are:

- Establish platform for dialogue between government stakeholders and users
- Establish partnership between users and government at aquifer level
  - Ensuring incentives are provided for efficient water use
  - Provide or arrange mediation services
- Support activities in demand management of groundwater (combined with awareness and ensuring incentives for proper water usage)
  - Reduce unaccounted water
  - Promote water use efficiency
  - Introduce water safety plans in selected areas
- Support activities for adequate catchment management
- Set up training programs and courses (also in collaboration with the private sector)

### 3.2 Institutional Arrangements

Based on the challenges in groundwater management and the identified and listed tasks of the new institution, the following institutional arrangements were considered as options:

Option	Emphasis	Pros and cons
Project Coordination Office	Special projects	Project-based, effective, temporary life-span, no status
Sub Basin Office	Monitoring and co-ordinated planning	Can be marginalized, using (modified) existing arrangement
<b>Aquifer Management Office or Centre</b>	Technical studies, cooperation/partnership	Can be side-lined, can work as catalytic watchdog
Aquifer Management Authority	Regulatory and development	Heavy, long lead time

The tasks of the new institution are more technical in nature - being in charge of systematic monitoring - and further will consist working in cooperation with existing institutions and where required improve their effectiveness. The AMO is set up to reinforce the operation of other organizations and avoid conflict if there is any competing institution exists. The organizational set up is to work in partnership

with the main direct responsibility institutions, which is close to the option proposed as “*Aquifer Management Office - AMO*” in the above table. Since the aquifer is shared between two regions, namely Addis Ababa and Oromia, the name needs to address such concept. Therefore the following full name has been proposed to be called as “*Addis Ababa –Oromia Special Zone Aquifer Management Office,*” and abbreviated as AOSZAMO or AMO. The Task Force fully emphasizes that the proposed name and aquifer management boundary as such are different from political/administrative boundary and is only based on hydrogeological boundary for managed ground water development.

The AMO will ensure sustainable shared aquifer management linking with land and surface water management. It will catalyze and support the work of different organizations by signing MoUs with those that are involved in different aspects of aquifer management and will check that the work is done adequately. The AMO may next evolve into a Sub Basin Office under Awash River Basin Organization or later into an Aquifer Management Authority with more direct powers.

Regarding the internal governance options, the Task Force looked into different options:

- Governed by board of directors elected or drawn from key stakeholders and appointed (non-voting) members.
- Functioning as an autonomous institution, i.e. a budgetary regulatory institution established by proclamation
- Led by an advisory committee
- Making use of arbitrators, technical units and water point administrators

Double accountability, administrative and technical, has been proposed. The AMO will be accountable administratively to the board of directors (BODs) and technically to the Ministry of Water and Energy (MoWE). The Board of Directors will represent the main stakeholders at regional and federal level.

This proposed setting is intended to develop a strong linkage with all main stakeholders and also to enjoy the benefit of administrative freedom and ability to take timely decisions, and at the same time to get technical support and cooperation on policy, regulatory, planning and joint programming.

### ***3.3 Indicative Organizational Structure and Manpower Requirements***

The following indicative organizational structure is proposed following the envisaged main tasks of AMO and recommended institutional setting and internal governance arrangements. Under the leadership of the Executive Director six sections are proposed taking care of the core tasks of the AMO as well as providing the support services.

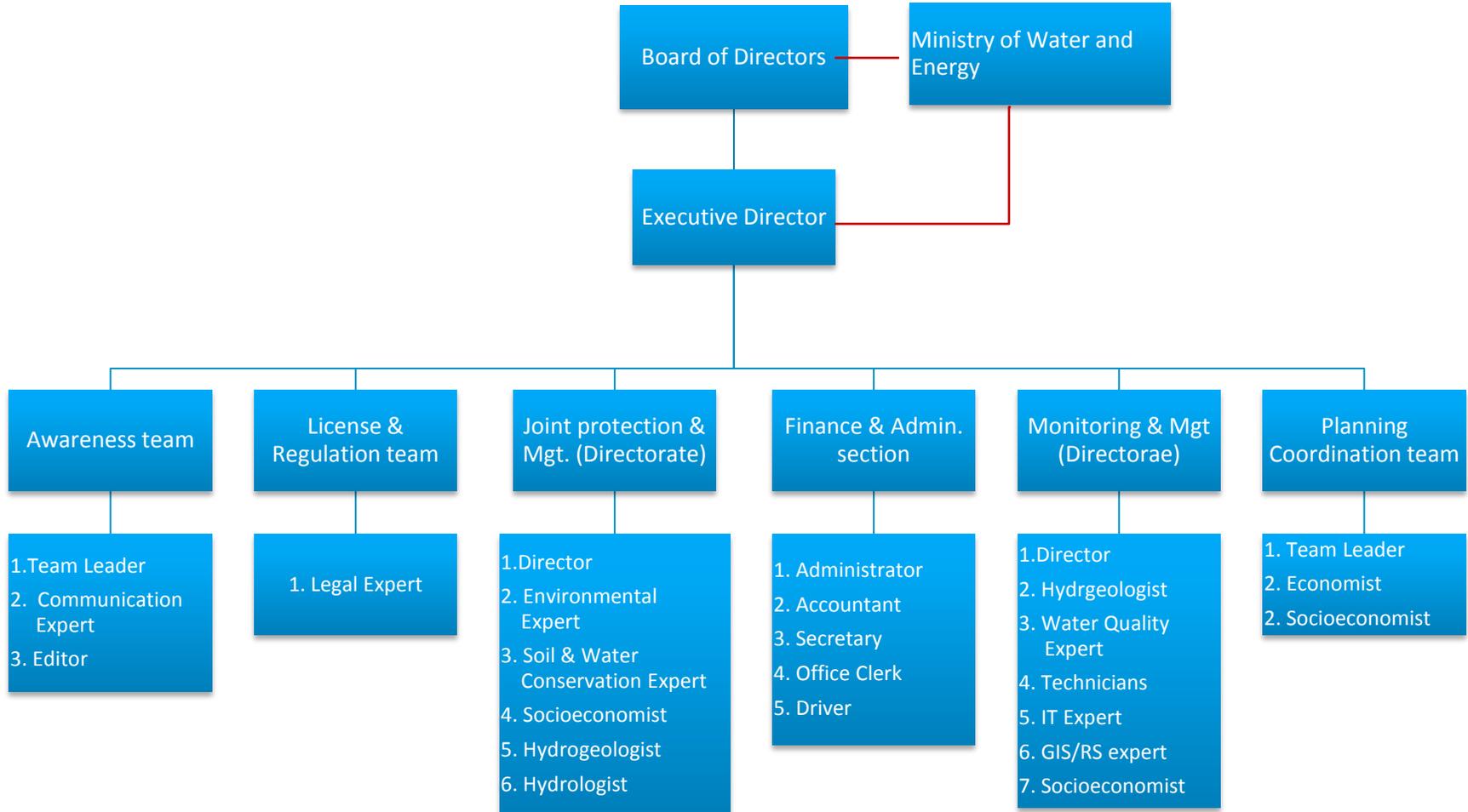


Figure 2: Indicative Organizational Structure and Manpower Requirements

## 4. Proposed Work Plan, Budget Requirement and Possible Sources of Budget

### 4.1 Indicative Work Plan

It includes major activities identified by the Task Force to be handled by AMO and establishment organization process. Here the nature and contents of major aspects of the activities are discussed while indicative action plans are presented in annex 5.1.

#### 4.1.1 Establishment and Organization:

This is the stage at which the AMO would get organized with the necessary manpower, logistics and finance in order to start discharging its duties and responsibilities as intended. Most of the human resources recruitment and materials for office organization will be done during the first year whereas capacity building and strengthening of the organization will continue over the consecutive years. The core team, Ministry of Water and Energy, the board of directors (to be appointed) and the Aquifer Management Office – AMO (to be established) will take the role of establishment and organization tasks.

#### 4.1.2 Awareness Creation:

Awareness creation on aquifer management is one of the major tasks identified and to be addressed by AMO. There has been a general consensus that the potential threats on groundwater resource are the lack of awareness among key stakeholders who, one way or the other, are involved in managing, abstracting or polluting the aquifer. Therefore, it is imperative to identify such key players and boost their knowledge on groundwater management and development so that each actor will come on to the same platform.

Policy and regulatory frameworks; resource depletion, pollution and potential consequences; local and international experiences; and the importance of collaboration and coordination for sustainable development are key areas to be addressed by the awareness creation program. Knowledge dissemination is through short term trainings, discussions on stakeholders' workshops or using different media outlets. Manuals are prepared to guide trainings and workshops.

#### 4.1.3 Regulate Licensing:

One of the setbacks on the sustainability of managed groundwater development arises from a weak regulatory enforcement. Many existing wells are unlicensed. Therefore, AMO will carry out an inventory on such wells and make sure all wells are operating under license and set regulations. In this respect, AMO will work with directly mandated institutions such as Ministry of Water Resources and Energy, Regional Water, Mines and Energy Bureaus or Environmental Protection Authorities.

#### **4.1.4 Joint Protection and Management:**

Aquifer management involves various institutions that they need to work in partnership for practical and successful implementation. Catchment management, for example, involves at least two players (Bureau of Agriculture and Bureau of Land Administration and Environmental Protection) within a region or between two regions. AMO will support and facilitate such activities so that the efforts are coordinated towards a common goal.

#### **4.1.5 Aquifer Management and Monitoring:**

In order to help the strict implementation of regulatory framework, monitoring of well spacing, drilling and abstraction are crucial. Monitoring will be done against a set standard so that guidelines and standards for drilling, well spacing and maximum daily abstraction will be prepared. AMO will make sure metering instruments are installed on deep and shallow wells and monitoring network is established for abstraction control. Data on wells and aquifer system will be made available for various stakeholders and AMO will play a leading facilitation role.

#### **4.1.6 Coordinated Water Management and Development Planning:**

An integrated development planning that incorporates groundwater is extremely important for the sustainability of aquifers. All developments, if not planned well, potentially affect groundwater resources. The expansion of urban development (uncontrolled) may occupy the prime source areas for water or the municipal effluents may pollute the resource. Unplanned infrastructural developments may hinder recharges to the groundwater. Therefore, this activity is intended to integrate all the development plans and efforts making groundwater resource at the center. Focus will be made on the key areas believed to cause potential impacts such as urban development, rural (agricultural) development, investments (industrial and horticultural developments) and infrastructural developments.

### ***4.2 Indicative Budget Requirements***

The Task Force made a first assessment of the establishment and running costs of the AMO - summarized in the tables in Annex 3 and indicated in figure 3, below. The overall concern was to keep cost manageable and develop an effective catalyst organization. Fixed costs, salary and benefits, and other operational costs are considered for the period of 5 years.

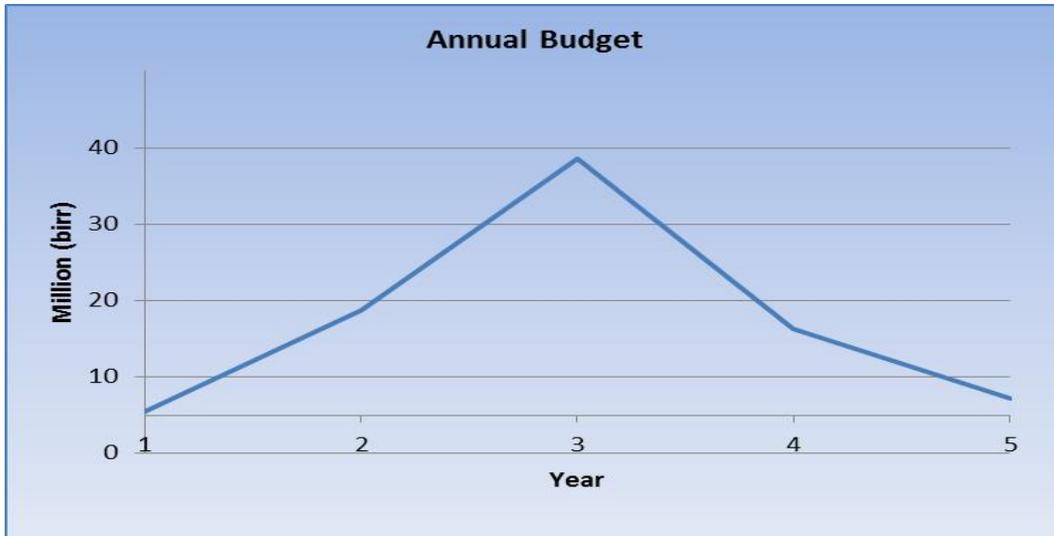


Figure 3: trend of budget requirement over 5 years

The largest cost estimated to 58 million Birr is an establishment cost for purchasing fixed assets (establishment costs) and installation of equipment for monitoring network. It is assumed that the procurement and installation of essential equipment will be attained during the third year where the highest expense is expected estimated to a little bit less than 40 million Birr. Nevertheless, the annual operating cost for salaries, various benefits and running costs is estimated to an average of 5.6 million Birr per annum, which can be considered not so significant.

#### ***4.3 Possible Sources of Funding***

The following governmental or non-governmental institutions were identified and proposed as possible source of financing since they have stake one way or the other.

- Ministry of Finance and Economic Development (Government of Ethiopia)
- A special AAOSZAMO Water Fund to be developed
- User fee from large water abstractors
- Contributions from main stakeholders:
  - Addis Ababa city Administration
  - Oromia Regional Government
- International donors and financiers

## **5. Annexes**

*5.1 Short Term Indicative Activity Plan*

*5.2 Indicative Manpower Requirement, salary and benefits*

## Annex 5.1 Indicative Short term Activity plans

No.	Activities		Time					Remarks
	Major	Detail	Year 1	Year 2	Year 3	Year 4	Year 5	
1	Establishment and Organization	1.1 Endorsement by Core Team	X					Core team, MoWE, AMO
		1.2 Appointing BODs, recruiting human resources, office organization	X					
		1.3 Procuring logistics and material resources	X	X	X	X		
2	Awareness	2.1 Identify stakeholders	X					All stakeholders- identified in section 2.1 (institutional issues) of this report
		2.2 Prepare manuals	X	X				
		2.3 Workshops		X	X	X	X	
		2.4 Trainings		X	X	X	X	
		2.5 Media		X	X	X	X	
3	Regulate Licensing	3.1 Inventory		X	X	X		With MoWE, OWMEB, AAEPa, EPA
		3.2 Guidelines & standards		X	X			
		3.3 ensure Licensing		X	X	X	X	
		3.4 Regulation		X	X	X	X	
4	Joint protection and management	4.1 Support establishing platform for dialogue		X				All stakeholders identified
		4.2 Establish partnership		X	X			
		4.3 Support demand management of GW		X	X	X	X	
		4.4 Support catchment mgt.		X	X	X	X	
		4.5 Support training programmes		X	X	X	X	
5	Aquifer Management and Monitoring	5.1 Monitoring network establishment				X	X	MoWE, OWMEB, AAEPa, EGS, Drilling companies, consultants, users
		5.2 Metering all wells			X	X	X	
		5.3 Data Exchange		X	X	X	X	
		5.4 Drilling standard			X	X		
		5.5 Well spacing standard			X	X		
		5.6 Abstraction standard			X	X		
		5.7 Well dimension (pump size)						
6	Coordinated water mgt and development planning	6.1 initiate GW development master plan study		X	X			stakeholders
		6.2 guide Urban dev't plan		X	X			
		6.3 Rural dev't plan		X	X			
		6.4 Investment plan		X	X			
		6.5 Infrastructure plan		X	X			

## 5.2 Indicative manpower requirement, salary and benefits

Title	Qty.	Monthly Rate, birr	Yearly Rate, birr
General Director	1	12000	144000
director/ leader	4	44000	528000
Communication expert	1	10000	120000
Editor	1	8000	96000
Legal expert	1	10000	120000
Environmental expert	1	10000	120000
Soil and water conservation expert	1	10000	120000
Socioeconomist	2	20000	240000
Economist	1	10000	120000
Hydrogeologist	2	20000	240000
Hydrologist	1	10000	120000
Water quality expert	2	20000	240000
IT expert	1	10000	120000
GIS expert	1	10000	120000
Technicians	5	5000	60000
Admin & finance	1	8000	96000
Accountant	1	6000	72000
Secretary	2	6000	72000
Office clerks	3	6000	72000
Drivers	5	10000	120000
<b>Total</b>	<b>37</b>	<b>245000</b>	<b>2.940.000</b>

### 5.2.2: Fixed/ establishment costs

Description	Qty.	Unit cost, birr	Total Cost, birr
Office equipment	LS	500000	500000
Office furniture	LS	200000	200000
Vehicle purchase	4	1500000	6000000
Field equipment for monitoring	LS	5000000	5000000
Audio-visual equipment	LS	1000000	1000000
Others	LS	200000	200000
<b>Total</b>			<b>57.900.000</b>

### 5.2.3: Annual Running Costs

Description	Qty.	Annual cost, birr
Stationary	LS	250000
Office rent	"	500000
Fuel and oil	"	500000
Maintenance	"	100000
Utilities	"	100000
Other costs	"	50000
<b>Total</b>		<b>1.500.000</b>

### 5.2.4: Summary

Description	Qty.	Total cost, birr
Fixed/Establishment/installation costs	LS	57.900.000
Year 1, salary and benefits	"	2.940.000
Year 1, running costs	"	1.500.000
<b>Total</b>		<b>62.340.000</b>

plan

### 5.2.5 Annual Budget Requirement for Five Years

Description	Year				Total
	1	2	3	5	
Salary & benefits	2.940.000	3.234.000	3.719.100	4.918.510	<b>19.088.575</b>
Running Cost	1.500.000	1.650.000	1.815.000	2.196.150	<b>9.157.650</b>
Fixed Costs	1.000.000	13.800.000	33.000.000	100.000	<b>57.900.000</b>
<b>Total</b>	<b>5.440.001</b>	<b>18.684.002</b>	<b>38.534.103</b>	<b>7.214.665</b>	<b>86.146.225</b>

**This report is prepared by the Task Force constituted by the Minister of Water and Education concerning the joint management of groundwater resources in the area of Addis Abeba and the surrounding Oromia Special Zone. It constitutes a proposal for closer institutional cooperation that has been circulated and is now submitted for endorsement. The main recommendation is to set up an Aquifer Management Organization for the regional aquifer system.**

**It follows from the joint project of the Ministry of Water and Education and World Bank on Sustainable Groundwater Development and Management in Ethiopia.**

