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Keredin Temam Siraj
(M.Sc, M.A) Research Scholar,
Andhra University, Collage of
Science and Technology,
Department of Environmental
Sciences. Lecturer, Adama
Science and Technology
University. Adama, Ethiopia
(Home) or Vishakhapatnam-
530003, India.

PVV Prasada Rao
Professor, Department of
Environmental Sciences,
College of Science and
Technology, Andhra
University, Visakhapatnam-
530003, India.

Correspondence

Keredin Temam Siraj
(M.Sc, M.A) Research Scholar,
Andhra University, Collage of
Science and Technology,
Department of Environmental
Sciences. Lecturer, Adama
Science and Technology
University. Adama, Ethiopia
(Home) or Vishakhapatnam-
530003, India.

Review on water resources and sources for safe drinking and improved sanitation in Ethiopia

Keredin Temam Siraj, PVV Prasada Rao

Abstract

Fresh water resources and sources are depleting. Today, Most of developing countries are enforced to use unprotected and unsafe water sources and large number of death due to unsafe water. Thus, high pressure on countries' development specially by increasing number of death and infected people then high socio-economic losses, instabilities, high population mobility's, environmental insecurities and many others. Disparities, entire the globe in safe drinking water supply and improved sanitation is huge and it is achieved only by less than 2/3 of the world population and also poorly distributed entire the world. Among 2.6 billion people who do not get improved sanitation, majorities are found in Sub-Saharan Africans and south Asian countries. In most of the developing countries like Africa drought and politics are main causes for water shortage in which Ethiopia is one of such in horn of Africa where drought and politics are for millions of death. Reviewed literature shows that in Ethiopia access to safe drinking water and improved sanitation is one of the lowest in the world. In rural only ¼ of the population will get safe drinking water from protected sources and in urban residents areas ¾ can access. Ethiopia is sources of many major rivers amongst sub-Saharan African countries with the possible availabilities of on average 1575 M³ of available water resources per capital per year but almost all drinking water is from ground water. Because, this large volume of water is not available either whenever or/and wherever needed. Only 3% of water resources can be accessible. Good progress in sub-Saharan African countries including Ethiopia in providing safe drinking water and sanitation but still great gap. The impact due to lack of access to water are highly affecting communities in Ethiopia specially women. The major determinants in Ethiopia to provide better water access, sewerage and depletion of its source are financial problem, absence of WWTP, communication gap among RWB and RHB, water quality disparity and unstructured urban expansion. In addition, Ethiopia's water supply systems are characterized by high system losses, fewer networks and low capacity and lack of timely maintenance, illegal connections are changing water quality after reservoirs and before uses. Therefore, more action is required and even too late. MoWE set a strong national policy and adapted Universal Access Plan. This paper tries to review literature about status of fresh water resources and sources, safe drinking water and improved sanitation in Ethiopia in addition to author's field observation for further researches

Keywords: Ethiopia, safe drinking water and improved sanitation

Introduction

The impact due to some of natural and anthropogenic sourced activities entire the world, water resource is exerting pressure in all direction to all nations' entire the globe and becoming world most competitive resource in many parts of the world. In many researches this impact is increasing drastically with increasing natural and anthropogenic climatic threats, introduction of newly emerging pollutant, population growth, prolonged drought, climate changes and many others. Supply of clean and affordable water with ever growing demands, with all climatic threats and current population growth is one of the grand challenges of this century to meet human need. Water demand is raising entire the globe, though fresh water resources are depleting due to some of natural and anthropogenic activities and coupled with strict water quality standards have been introduced (Lee & Schwab, 2005) [4]. Most of developing countries enforced to use unprotected and unsafe water sources as a result of fresh water supplies are getting depleted. This may create much more pressure on countries development specially by increasing number of death and infected number of population then resulted high pressure on health centers especially in developing and undeveloped country due to water related disease and potential vector as far as water qualities concern.

The impacts of water resources have integral of all aspects on human life. It is not affecting only on human health, availability of food resources, energy and economy of the nations but also it has extended impact on environmental security, socio-economic, sanitation, politics and many other related impacts will be (Mara, 2003) [3].

There are huge numbers of disparities entire the globe in case of safe drinking water supply and in provision of improved sanitation. In providing improved sanitation services, it is achieved only by less than 2/3 of the world population (WHO/UNESCO, 2010) [21]. Even this is poorly distributed entire the world. This disparity is not only intercontinental even entire a continent there is great disparity. For instance the access to safe drinking water supply in South Africa is 91% while in Ethiopia it is only 38 % as of 2010 (WHO/UNESCO, 2010) [21]. Almost all the population in developed country getting well services but ½ of the population in the developing countries will not get improved sanitation facilities. This disparity is not only in providing safe drinking water supply and improved sanitation facilities but also in progress wise since 1990. Particularly the progress in south-eastern Asia, eastern Asia and North Africa are noteworthy increased, whereas there are greatest numbers among world population of 2.6 billion people who do not get improved sanitation facilities are mainly found in sub-Saharan African and south Asian countries (WHO/UNESCO, 2010) [21].

One of the common feature entire the globe in developing countries like African and Asian countries is that of water shortages, poor sanitation and lack of access to clean and affordable water. In most of the developing countries like Africa drought and politics are two main leading causes for water shortage. Accordingly, Ethiopia is located in horn of Africa where Nile and other huge river are sourced and where drought and politics are leading cause of water shortages in which resulted millions of death (*Water Project: water in crisis-spotlight Ethiopia WP:WCSE*). According to water.org report in “*water in crisis spotlight Ethiopia*” in Ethiopia “42% of the population has access to clean water” in which only “11% has access to adequate sanitation services”. This figure is an average but it will be getting ever lower in rural area especially in drought prone and Ethiopian pastoralist areas which is resulting in health problems for both human life and their animals. Ethiopia is known by a nation of beauty and culture. However, due to natural and anthropogenic causes some parts of the country have severely affected by prolonged drought and water shortage which is leading fields for drying up and farmers are fighting over water to support their life. Due to prolonged and repeated drought in the past decades’ streams and lakes are drying up or extremely becoming shallow & most of the people in such areas are enforced to use unsafe water sources in which it is contaminated with human and animals waste, worms or disease. According to WHO and UNESCO joint report in 2010 and “Water Project” this is one of the main cases for spreading of water born diseases and death of children under five year in Rural Ethiopia. Recently, UN reported that due to El Nino a global weather pattern that is expected to last until early 2016, “food insecurity is forecast to worsen over the coming months, especially in Ethiopia”. In many parts of Ethiopia, hundreds of thousands of farmers have fallen victim to the hot winds originating in the Pacific, causing the worst drought to hit the country and the region in decades. Accordingly, Ethiopia hit by worst drought in

decades in which more than 8.2 million people need emergency food aid in Ethiopia in 2015/16 due to climatic factors of El Nino

One of the main problem in assessing safe drinking water supply and condition of improved sanitation services level is the availabilities of confidential data, time of data and disparities among different sources. Though available data on the topic is too old, there are great disparities among different sources (Ethiopian government and some international organization). For instance according to MoWR- WSDP (ministry of water resources-water sector development program main report volume-I) in 2002 reported; Ethiopia is gifted naturally huge water resources which can easily satisfies domestic requirements, irrigation and hydropower and sacred with major rivers with naturally poorly distributed entire the country. Accordingly, the main cause for water shortage is that of inadequate finance but not due to climatic treats and politics. There by Ethiopia’s geographical location and sympathetic climate provide relatively high rainfall among sub-Saharan Africa. But, according to WHO/UNESCO and water org report the main cause is climatic threats and politics. In other report the access to basic social services such as safe drinking water and improved sanitation in Ethiopia is one of the lowest in the world. In rural areas only ¼ of the population will get safe drinking water from protected sources and in urban residents areas ¾ can access (MoWR- WSDP, 2002) [5].

The impact of politics on water resources in Ethiopia and other sub-Saharan country have long enough historical background as well as today. For instance Nile River is one of the best example in which its surrounding nations were split up on Nile River and its tributaries. However now a day’s Ethiopian farmers getting themselves no access to water for daily requirements due to the way in which river were divided poorly years ago (*Water Project: water in crisis-spotlight Ethiopia WP:WCSE*). There is in alarming position of the survival of Ethiopian farmers as of prolonged draught and shortening of rainy season resulted from natural and anthropogenic activities which is drying and sandy land is becoming common today for farm lands in the country. In another way, the political instabilities in and around Ethiopian borders (Somalia and south Sudan) are one of the cause triggering water scarcity. In addition, in Ethiopia one of the main reason/obstacles for the successes of water sector which inhabiting to achieve MDG (millennium development goals) is the performance limitation of water bureaus in all the country’s 9 regions and 550 waredas water desks, insufficient finance recovery (operational and maintenances), disparity of policies and procedure by different donors are not withstanding the PDAE (Paris Declaration on Aid Effectiveness) (MoFED: GTP, 2010) [11].

Reviewed Results

Water Sources in Ethiopia

Even though many major river sources in Ethiopia including Nile in which more than 85 % is from Ethiopia, almost all drinking water is from ground water. There are about 12 river basins in Ethiopia with huge amount of annual runoff 122 billion metric cube and nearly 2.6-to-6.5 billion metric cubes of ground water availabilities. This refers on average 1575 M³ of available water resources per capital per year. These mean that nearly 4315 litter per capital per day. This is actually large volume of water in normal cases. Unfortunately, due to large temporal variation and spatial

variation in rainfall and lack of proper storage, this large volume of water is not available either whenever or/and wherever needed (Seleshi, Aster, Makonnen, Willibald, Mekonnen & Tena, 2007) [13]. This means that only 3% of water resources are physically used (Water Resource Institutes, 2010) [27]. The main sources of drinking water for Ethiopian capital city Addis Ababa is the Gafarsa dam which is built during Italian occupation and reformed in 2009. Wells and another dam are complementing the supply of water for the city (UN Habitat, 2010) [16]. In another way there are many indicators which can show that the impacts of natural and anthropogenic climatic threats have been exerting much more impacts for the shortage of water resources. For instance, drastical change happened in Harar city which is nearby city of Dire Dawa “Lake Haramaya” dried up due to local climate followed the change in land uses in the basin of the lake and due to incredible increases in irrigation for “chat” being grown both for the daily consumption and exports is one among many indicators. This lake found in highlands of Ethiopia is supporting surrounding population by providing water for intensive agriculture, domestic purposes, livestock’s and fishery purposes. As reported in many literatures’ is diminishing even before 1980s both in its areas and depths. Unfortunately this lake was changed to terrestrial ecosystems and this creates more difficulties on water sector to provide water. Thus, extending pipelines on long distance which is more than 75KM for urban areas is faced (UNEP 2008, Lemma. B 2003 and African Development Bank, 2002) [17, 10, 1]. Thus, majority of rural areas’ communities highly dependent on shallow wells, deep wells and springs groundwater in most of the area while those can’t access from this relatively improved sources are usually enforced to use water from unprotected sources such as rivers, springs and hand-dug wells and sometimes rainwater harvesting is used (Seleshi et.al 2007) [13].

Water Accessibilities in Ethiopia

As of WHO and UNESCO joint report in 2010, during 1990-2008 based on the available data for seven sub-Saharan African countries including Ethiopia in the case of safe drinking water and sanitation accessibility is in good progress but it needs more and more action. Followed this in 2010, plan has made for Ethiopia to increase water access from 68.5% to 91.5% (within the radius of 0.5km) for urban and to elevate this in rural to 65.8% (within the radius of 1.5km) by 2015. This means that even if this plan is successful there is gap to fully satisfy the demand and also there is increase in need as well as in per-capital consumption trends with the modern development. In another way this may considered as good achievement because there is a report which shows that in 1990 access to safe water was only 17% and standard sanitation was only 4% (MoFED: GTP, 2010 & WHO, 2008) [11]. Thus from 2008-to-2010 138,000 community water points were established and maintained (World Bank, 2011) [25]. However, southern part of Ethiopia (Foro-Konso woreda as example), where due to lack of access to water communities in the areas specially women spent 3-5 round trips per day to get unsafe water from Koiro River in which each round trips will take 2-3 hours (Tina.R, 2010) [15]. The communication gap among Regional Water Bureaus (RWB) and Regional Health Bureaus (RHB) and water quality disparity in Ethiopia is also one of the major determinants due to its natural and anthropogenic factors. For instance one of the

major problems in and around Rift Valley is fluoride content in addition to its microbial contamination (WHO/UNCEF, 2010) [22]. In Ethiopia 20% of rural water point/system were not working, it downs by 25% from 2007-to-2010 (World Bank, 2011) [25] while 35% of 30,000 hand pump water points in Ethiopia is serving for 2million population in the area (Rural Water Supply Network, 2009) [12]. There are frequent service interruptions and in piped water ration is also one of the features of water accessibility in Ethiopia (World Bank: SSP, 2010) [26].

Water Qualities in Ethiopia

Even though groundwater is relatively considered as less polluted water sources as far as pathogens are concern, but the supply of drinking water from groundwater for some of Ethiopian city is reported that it is highly polluted. For instance drinking water for Dire Dawa city which is found in south-eastern part of the country completely supplied from ground water which is highly polluted (UN Habitat, 2010) [16]. By its nature water is highly vulnerable for pathogens because water will travel long distance in the water cycle and it can be contaminated easily in any one of the many points in the way from sources to users. In addition to this it is highly expected that the concentration of pathogens are high in urban environment and can easily enters to water systems at one of the point before consumption. According to water aid Ethiopia’s report (2005) almost all community in urban area including the capital city of Ethiopia highly dependent on public water point and used in house storage with commonly used storage material “jerry-can”. In another way Ethiopian’s city including the largest city (Addis Ababa) drastically growing since foundation and more rapidly now a day and also it is very recently having urban plan. The cities in the country are simply persistently on growing in a natural organic ways, with no much pressure and unstructured. This unmanageable and unstructured expansion is now a day exerting high pressure in services quality and coverage like water supply and sewerage. Ethiopian urban water supply especially in large city like Addis Ababa, Adama, Bahir-Dar and Dire-Dawa are characterized high system losses, less/derisory networks and low capacity and this is also coupled with increasing more people are arriving then the less city can cope ever. Even though the provided water for the communities by the city municipal distribution channels is so safe and free from pathogens, due to lack of timely maintenance, illegal connection to the pipe line are changing water quality by contaminating it with pathogens after reservoirs and before uses. This problem is very common in a capital city Addis Ababa (J. Crampton, 2005) [9]. One of the factors for deformation of water qualities in Ethiopia is the absence of wastewater treatment plant (WWTP). Even though there is good start very recently for establishment of wastewater treatment plant, till now there is no wastewater treatment plant at all in the country. So all wastewater collected in different sewerage system is directly discharged without any treatment to the natural environment. Accordingly, there are high expectations for continually depleting water quantities and quality more and more in future. Therefore, more action is required and too late even.

Water policy and regulation in Ethiopia

There are number of action have been taken by Ethiopian government especially in recent time than ever. However with the current population growth of the country, city and

industrial expansion and climatic threats need more and much more action is highly required. There are governmental structures in all 9 regional states and 2 chartered cities from top to lower level administrative units. However there are great disparity of developmental status and institutional performance capacity between regions and also entire a region. Nearly 70% of Ethiopian populations are living in 3 regional states (Amhara, Oromia and Tigray) in which developmental and institutional capacity is relatively at good status and with relatively less disparity when compared to others but not uniform, while Southern Nations, nationalities and people's Regional state which expected that have 20% of population is heterogeneous in both development and institutional capacities. However Ethiopian pastoralist remote areas and "emerging region" such as Afar, Benishangul-Gumuz, Gambela, Somali are expected that by having 10% of population, have the lowest capacity even in the country (World Bank: WSSP, 2004 & 2010) [26]. Ethiopian Ministry of water and energy (MoWE) former ministry of water resources (MoWR) has set a strong national policy in collaboration with Ministry of Health (MoWR for access to water supply and MoH for access to improved sanitation) and key agencies with the clear roles and strategies (USAID, 2007 & 2010) [20]. The Ethiopian government adapted universal access plan (UAP) and have planned to achieve 100% of access in water supply and sanitation for urban areas and 98% access to water supply in rural areas of the country as of 2012 E.C. with the cost of 2.5 billion US\$ (Ministry of Water and Energy, 2011) [8]. In this regard the memorandum of understanding signed in 2006 between Ministry of Water Resources, Ministry of the Environment, Ministry of Health are clear bench marks in the implementation of UAP Act by setting out clearly the roles and responsibilities of each ministry (UNDP, 2006) [2]. Regional Water Bureaus and Woreda water desks have been stated here clearly for the discharge of their activities such as investment planning, technical assistance and monitoring, but their capacity is in doubt.

Conclusion and Recommendation

The raising entire the globe for Water demand is real, also our fresh water resources are depleting due to some natural and anthropogenic factors. Accordingly, developing countries populations are enforced to use unprotected and unsafe water sources then large number of death is recorded. The impacts of water resource is happening entire the globe but the pressure is more and more high on developing countries' development and growth. More number of death and infected people are found in developing countries as a result of this their socio-economic losses, instabilities, high population mobility's, environmental insecurities and introduction of new water related disease and potential vector are seen. It is an alarming for the world for the strength of solidarities entire the world as far as water resources concern.

Disparities entire the globe in safe drinking water supply and improved sanitation is huge and it is achieved only by less than 2/3 of the world population and also poorly distributed entire the world. Among 2.6 billion people who do not get improved sanitation, majorities are found in Sub-Saharan African and south Asian countries. In most of the developing countries like Africa drought and politics are two main leading causes for water shortage in which, Ethiopia is one of such in horn of Africa where drought and politics are leading

cause of water shortages resulting millions of death. Therefore there are grand challenges for sub-Saharan African and south Asian countries to save their nations.

Ethiopian economical development was very slow in earlier time, but not now it is so boosted. Earlier in Ethiopia as far as water resources concern it was about quantities not quality because the impact of anthropogenic activity is much more less as compared to today. It mean that less pollution load on water resources, less population, less industrial and agricultural application but this is changed today. It also known that environmental problem is slow on growth by its nature and more difficult to revert in its climax. So prevention/protection/conservation is better than restoration. In another way Ethiopia is one of the country which is highly prone to drought and great disparity of weather entire the country. Therefore strong measurement has to be taken as far as environment concern especially water resources which support all the life.

Even though Ethiopian is one of the fastest growing in the world, according to reviewed literature in Ethiopia access to safe drinking water and improved sanitation is one of the lowest in the world. In rural areas only ¼ of the population will get safe drinking water from protected sources and in urban residents areas ¾ can access. Therefore, there is challenging and emergency work is waiting the concerned body in Ethiopia than ever seen.

The impact of politics on water resources in Ethiopia and other sub-Saharan country have long enough historical background as well as today. Ethiopia is sources of many major river amongst sub-Saharan African countries but almost all drinking water is from ground water. Though plenty of water in its volume in the country, this large volume of water is not available either whenever or/and wherever needed. Shortly, only 3% of water resources can be accessible. Very recently Ethiopian have been start utilizing large river such as Great Nile, Tekeze, Baro, Gibe and other without affecting other countries especially for power generation. In the same way measurement has to be taken for sanitation and drinking water because it is clear that as the shortage of electrical power is coming in parallel with countries development this is also an indicator for drinking water shortage will come soon. It is seen that Ethiopian government has working hard locally and internationally for the women empowerment but, lack of access to water highly affecting Ethiopian communities specially women. The major determinants in Ethiopia to provide better water access are financial problem, communication gap among Regional Water Bureaus and Regional Health Bureaus, water quality disparity due to natural and anthropogenic factors. In another way though groundwater is relatively considered as less polluted water sources, the supply of drinking water from groundwater for some of Ethiopian city is reported that it is highly polluted. Therefore, Ethiopian government and any concerned body in Ethiopia have to take strong action for the enhancement of water quality as well as quantities.

In addition to boosting water quantities and qualities in Ethiopia the trends of communities in which highly dependent on public water point and used in house storage has to be changed. Unmanageable and unstructured urban expansion in Ethiopia which is exerting high pressure in water supply and sewerage is coupled with need of urgent work need in reducing high water systems' losses, increasing networks in water distribution system and capacity development in water sector also need more action than ever.

The water for the communities by the city municipal distribution channels are so safe and free from pathogens in general, but lacks of timely maintenance, illegal connection to the pipe line are changing water quality after reservoirs and before uses. Therefore, public awareness is one of the missed tools in the country and has to be effective. One of the factors for unsafe of water supply qualities and depletion in the sources is the absence of wastewater treatment plant (WWTP) especially for downstream cities. Till now there is no effective wastewater treatment plant and treatment trends for wastewater at all in the country both in public and private sector. Therefore, more action is required and even too late. Ethiopian Ministry of water and energy (MoWE) set a strong national policy and adapted Universal Access Plan (UAP), but there is lack of awareness even among different administrative unit under MoWE and also entire whole communities. This is also another challenging task which needs urgent and high effort.

References

1. African Development Bank. Harar Water Supply & Sanitation Project, approved on retrieved on, 2002, 2010.
2. AMCW/AFDB/EUWI/WSP/UNDP: Getting Africa on Track to meet the MDGs on Water and Sanitation - A Status Overview of Sixteen African Countries, 2006, 21.
3. Mara DD. Water, sanitation and hygiene for the health of developing nations. *Public Health*. 2003; 117(6):452-456.
4. Lee EJ, Schwab KJ. Deficiencies in drinking water distribution systems in developing countries, *Journal of Water and Health*. 2005; 3(2):109-127.
5. Federal Democratic Republic Of Ethiopia Ministry Of Water Resources Water Sector Development Program Main Report 2002, I.
6. Gebissa E. Leaf of Allah, Agricultural Transformation in Harerge Ethiopia Ohio University Press, Athens, Ohio, 2004, 1875-1991.
7. Jigjiga TV News. Gafarsa Water Dam Project Completed, 2009.
8. Ministry J. of Water and Energy. Universal Access Plan. Retrieved, 2011.
9. Johanna Crampton. Briefing Note Water Aid Ethiopia (WA Ethiopia), 2005.
10. Lemma B. Ecological changes in two Ethiopian lakes caused by contrasting human intervention. *Limnologia*. 2003; 33:44-53.
11. Ministry of Finance and Economic Development: Growth and Transformation Plan, Draft, 2010, 18.
12. Rural Water Supply Network Handpump Data, Selected Countries in Sub-Saharan Africa. Retrieved 19 July 2012. Data are from the Demographic and Health Survey 2000 and the number of handpumps has been estimated by B. Muluneh, 2009.
13. Seleshi Bekele Awulachew, Aster Deneke Yilma, Makonnen Loulseged, Willibald Loiskandl, Mekonnen Ayana, Tena Alamirew. International Water Management Institute: Water Resources and Irrigation Development in Ethiopia, Working Paper, 2007, 123.
14. The Water Project (Water in Crisis - Spotlight Ethiopia) (n.d.). Retrieved, 2015. from <http://thewaterproject.org/water-in-crisis-ethiopia>
15. Tina Rosenberg, April 2010, National Geographic: The Burden of Thirst retrieved on, 2010.
16. UN Habitat. Water for African Cities. Addis Ababa City Programme, retrieved on, 2010.
17. UNEP Atlas of our changing environment. Lake Alemaya, Ethiopia, retrieved on, 2008, 2010.
18. UNEP ND, Lake Alemaya. Environmental Change Hotspots. Division of Early Warning and Assessment (DEWA). United Nations Environment Programme (UNEP).
<<http://na.unep.net/atlas/webatlas.php?id=2173>>
(Accessed on 11.12.15).
19. UNICEF, 2004.
http://www.unicef.org/ethiopia/ET_real_harar.pdf
(Accessed on September 6, 2007)
20. USAID: Ethiopia Water and Sanitation Profile, ca. accessed on, 2007, 2010.
21. WHO/UNESCO Progress on Sanitation and Drinking-water: 2010 Update. Geneva: WHO press JMP, Update, 2010.
22. WHO/UNICEF. Rapid assessment of drinking-water quality in the Federal Democratic Republic of Ethiopia (PDF). Retrieved, 2011, 2010.
23. Wikipedia (Wikimedia Foundation) (n.d.). Retrieved, 2015. from https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Ethiopia
24. World Bank Ethiopia; Managing Water Resources to Maximize Sustainable Growth - Country Water Resources Assistance Strategy, 2006. http://siteresources.worldbank.org/INTWRD/Resources/Ethiopia_final_text_and_cover.pdf (Accessed on September 6, 2007)
25. World Bank: Ethiopia, retrieved on, 2011.
26. World Bank: Water supply and sanitation project, Project Appraisal Document, 2004, 24-25. accessed on, 2010
27. World Resources Institute: Water Resources and Freshwater Ecosystems COUNTRY PROFILE - Ethiopia, accessed on September 10, 2010, withdrawal data are for, 1987.

References web

- <http://changeeverything.wvpartner.us/watercrisis.html>
<http://pulitzercenter.org/projects/africa/water-wars-ethiopia-and-kenya>
<http://thewaterproject.org/water-in-crisis-ethiopia>
<http://water.org/country/ethiopia/>
<http://water.org/projects/ethiopia/>
<http://water.org/water-crisis/water-sanitation-facts/>
<http://www.irinnews.org/report.aspx?reportid=47575>
<http://www.pbs.org/frontlineworld/stories/africa705/history/africa.html>
http://www.rotaryclubny1.com/pdfs/water_ethiopia_brochure.pdf
https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Ethiopia#cite_note-WB_results-3