HAWASSA UNIVERSITY

THE NEXUS BETWEEN URBANIZATION AND WATER BODIE: THE CASE OF LAKE HAWASSA WATERSHED, SIDAMA NATIONAL REGIONAL STATE, ETHIOPIA

MA THESIS

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HAWASSA UNIVERSITY, HAWASSA, ETHIOPIA

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This certifies that under our supervision, Yetnebersh Yitayew Zegeye ID No. GPDMW0015/14 carried out the thesis, The Nexus between Urbanisation and Water Bodies: The case of Lake Hawassa watershed, Sidama National Regional State, Ethiopia, in partial fulfillment of the requirements for the degree of Master's with specialization in Development Management, the Graduate Programme of the Department/School of College of Law and Governance, School of Graduate Studies. Therefore, we recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the department.

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DECLARATION

I hereby declare that this MA Thesis, The Nexus between Urbanization and Water Bodies; The Case of Lake Hawassa Watershed, Sidama National Regional State, Ethiopia, is my original work, has not been submitted for credit at any university, and includes properly cited sources.

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Members of the Board of Examiners for Yetnebersh Yitayew Zegeye's thesis defense, we, the undersigned, have read and evaluated her thesis, The Nexus between Urbanization and Water Bodies: The Case of Lake Hawassa Watershed, Sidama National Regional State, Ethiopia, and have submitted a partial fulfilment of the requirements for the Degree of Master of Arts in Development Management with the regulations of the university and meets the accepted standards.

Approved by Board of Examiners

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LETTER OF CERTIFICATION

This is to certify that the thesis, The Nexus between Urbanization and Water Bodies: The Case of Lake Hawassa Watershed, Sidama National Regional State, Ethiopia, was created by the student Yetnebersh Yitayew Zegeye, under my supervision, to partially fulfill the requirement for the degree of Master's with Specialization in Development Management.

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LIST OF ACRONYMS AND ABBREVIATION

BZP……....Buffer Zone Policy

CSA…….. Central Statically Agency

EIA ……. .Environmental Impact Assessment

EPA……...Environmental Protection Authority

ERVLs……..Ethiopian Rift Valley Lakes

FDRE……....Federal Democratic Republic of Ethiopia

FHH……..Femal Household Headed

ICDPs……...Integrated Conservation and Development Projects

ME……Ministry of Environment

MHH…….Male Household Headed

MoWE……...Ministry of Water and Energy'

MPRVLA……..Master Plan of Rift Valley Basin

NPSP…….Non-Point Source Pollution

NWKC……. Ethiopian National Water Resource Commission

PA……. Protected Area

RVBAO…….Rift Valley Basin Administrative Office

SNNPR……..South Nation Nationality people and Regional State

SPSS……..Statistical Package of Social Science

UIL…….University Industry Linkage

UNESCO ……..United Nations Educational, Scientific and Cultural Organization

WHO…….World Health Organization

WQI……Water Quality Index

ABSTRACT

The study examines the relationship between urbanisation and water bodies in the Lake Hawssa watershed, Sidama National Regional State, Ethiopia, where the lack of buffer zone policies hinders conservation efforts and challenges the implementation of such policies. The study employed a descriptive research design with mixed research methods; primary and secondary data sources were used. Data was collected from 390 households in 5 kebele and from Ministry of Water and Energy (MOWE) technical staff. A survey questionnaire, key informant interviews, and field observation were used as data collection methods. Descriptive statistical methods were used to analyze the data. The study found that due to a lack of buffer zone policy, Lake Hawassa and its tributaries, as well as its watersheds, had come under pressure from a variety of legal and illegal activities, such as floating, walking close to the lake, washing and swimming, dropping plastic caps, organic garbage, hotels, restaurant and industry waste, and the like. Moreover, due to uncontrollable urbanisation and its negative effects on the lake and its watershed, the study area typically exhibited characteristics of a high border adverse effect, low watershed cover, high sedimentation, high household waste, a high wastewater disposal area, and others. The survey results also showed that the absence of buffer zone policy had a significant negative relationship with urbanisation and water bodies' connectivity ($r = -.481^{**}$, $p < 0.05$), and the challenges in light of the absence of buffer zone policy were considered as vegetative cover was being depleted in an unsustainable manner, catchment's plant cover declines, and sediment loads rising were among the major factors that affected the survival and consistence of Lake Hawassa watershed. Thus, the important recommendations that are found to be of paramount importance from the findings of this study include: Contextualizing buffer zone policy and other environmental protection policies, laws, proclamations, and regulations for the Lake Hawassa watershed and implementing them by delegation of the responsible body, controlling the expansion of illegal settlement and urbanisation around Lake Hawssa, the nexus between urbanisation and water body connectivity, should be considered with buffer zone policy ratification and put into practice. The buffer zone of Lake Hawassa should be managed and protected from the disruption that comes from urban agriculture, intensive grazing, commercial development, and even unsustainable recreational development.

Keywords: Buffer zone policy, Lake, Urbanization, Water bodies Connectivity and Watersheds

CHAPTER ONE

1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Water invites humans across geographic and temporal ranges for both its tangible and intangible resources. This human interaction would likely have an effect on environmental concerns such as water quality and its management (Ayenew, 2011). From an environmental policy aspect, the challenge becomes how to design and shape environmental laws that result in as close to a 'win-win' scenario as feasible (Zinabu, 2013).

Humans contribute to lake water contamination in three ways: deforestation, agriculture, and development (Gregersen, 2012). These variables induce a number of processes that have a direct influence on water bodies. Overexploitation, the discharge of chemical fertilisers, soil degradation, and floods are a few examples (Concern for the Environment, 2009). Lake degradation has direct effects on human and environmental health, as well as subsequent or tertiary effects related to decreased productivity and resource levels (Reynolds et al., 2010). Caused by human activity, influences are identified through direct methods that threaten lake water quality. The consequences of decreased water quality are complex, interconnected, and difficult to measure, but they may (hopefully) be addressed through well-crafted policy changes.

A "basin" (also known as a "watershed") is an area that includes all of the tributaries, streams, rivers, lakes, and other bodies of water that link to drain to a single river, ocean, lake, or other larger body of water. Understanding this phrase is critical for comprehending the mechanisms at work here, Master Plan of the Rift Valley Basin (MPRVLB, 2011). Many different sorts and sizes of influencing components may exist depending on the geographical location of a watershed. The region's administration and institutions will also have an effect on how watersheds are managed. However, one fundamental mechanism of a river that is consistent across the world is that something that happens in one region of the watershed will have an influence downstream. Meanwhile, at the watershed's end, environmental consequences will merely accrue with no significant outlet, United Nations Environmental Programme (UNEP, 2018).

A significant portion of the Ethiopian Rift Valley Lakes (ERVLs) are endorheic, like Hawassa Lake, which means they are watershed subunits and do not drain farther (Gregersen, 2012). Since 97% of Ethiopia's surface water drains outside the nation, ERVLs that are endorheic (bodies of water that do not flow into the sea) or semi-endorheic highlight exceptions where the water generally stays within the confines of a lake's watershed (Kloos & Legesse, 2010). Herbicides, for example, that discharge into an endorheic ERVL will remain there; they will not go elsewhere. Herbicides placed in a lake that drains into an endorheic lake have varying impacts on both lakes (UNEP, 2018). These locations are crucial to investigate because the interactions that occur between people and lakes in these areas are more dynamic.

Water is one of humanity's most valuable resources, especially in the tropics, where lakes are often extremely productive biological systems. They provide habitat for biodiversity, leisure, fishing, irrigation, drinking water, and a variety of other ecological purposes. Because lakes are scarce and sensitive resources that are subject to the effects of climate change, they require specific care and management. Environmental changes may result in long-term changes as well as a loss of ecosystem services and biodiversity (Zinabu, 2013). As a result, environmentalists, legislators, and members of the general public are worried about lake vulnerability management.

Lake Hawassa, like the rest of the Ethiopian Rift Valley lakes, is exploited for both residential and industrial purposes and includes edible fish. However, as a result of a mix of human activity and climate-related natural circumstances, the lake has grown increasingly exposed to a variety of environmental problems (Zinabu, 2010). However, there is much doubt regarding Lake Hawassa's sensitivity to the effects of growing environmental threats such as pollution on the lake and its surrounding water bodies. Several studies have been undertaken at Lake Hawassa; however, the issue of buffer zones remains unsolved. The purpose of this thesis is to investigate the relationship between urbanisation and water body connections, along with the challenges associated with implementing the buffer zone policy in Lake Hawassa.

1.2. STATEMENTS OF THE PROBLEM

One of Ethiopia's most prolific and beautiful rift valley lakes, Lake Hawassa offers a wide range of natural benefits, goods, and services (Zerihun, 2013). The absence of a buffer zone management policy and its impacts on the water bodies in the lake's surroundings have not been sufficiently studied, despite several studies on the lake's hydrology, chemistry, and specific problems.

By researching the past and present state of Lake Hawassa and the water bodies that surround it, it may be feasible to detect any potential issues in protecting these important ecosystems. On this premise, attempts are being made to identify the issues that this lake faces. Several studies of analysis have been conducted in and around Lake Hawassa for this purpose, yet buffer zone policy and its effects on water bodies, as well as the nexus between urbanization and water bodies' connectivity in light of the absence of buffer zone policy, have not been explored so far. A lake study linked non-point source contamination in Lake Hawassa (Sissay, 2010). This study, however, revealed pollutants, notably fertilizers and pesticides, which had a significant impact on the composition and richness of aquatic life, as well as the quality of water and its surrounding bodies. However, his study did not focus on policy issues, including buffer zone policy. Therefore, more research is also needed on the lack of a buffer zone policy and its consequences for water bodies.

Another study was conducted on Hawassa Lake's catchment area by Tenalem (2009). In his study, he found that the lake's catchment area has undergone a large increase in population over the last two decades. As a result, natural resources, particularly vegetative cover, are being depleted in an unsustainable manner. When the catchment's plants cover declines, nutrient and sediment loads rise, affecting the chemical and physical features of the lake. As a result, the creatures that rely on these water bodies face changes in variety and abundance, distribution, quality, and activity. However, no and/or little efforts have been made so far to restore Lake Hawassa and its neighboring water sources that were used in an unsustainable manner. In his study, he recommends that additional efforts are urgently required to identify the relationship between urbanization and water bodies in light of the policy and to work to manage the challenges and pressures of environmental issues and minimize the lake's environmental deterioration.

Contrarily, as Hawassa's population rises, its economic activities diversify, the area's wetlands may be seriously impacted, and several functions of the lake, its tributaries, and its outlet have been challenged. The amount and composition of waste produced by many sources (including hotels, hospitals, homes, and businesses) are increasingly. Almost all of Hawassa's drainage systems empty into the lake (Ayenew, 2011). Presumably, many of the pertinent organizations do not yet have a policy or collection system in place for liquid waste. There is no information, however, on whether the aforementioned institution has a policy or collecting system in place for liquid waste. Waste management through discharge must soon come to an end due to the lake's constrained ability to absorb trash. Despite the lack of a buffer zone policy, the lake still contains dangerous inorganic and infectious pollutants. This calls for further research, a thorough investigation, implementation, and suitable action.

The aforementioned problems, which were brought on by a lack of a management structure, endangered the lake's recreational value and reliance on tourists. The lake has lost its public status, natural products, and service as a result of a lack of policy direction and damage brought on by unchecked activities and/or management systems. It would be crucial to collect and evaluate information on the physical characteristics of the lake as well as environmental elements in the watershed in order to raise awareness of the Lake Hawassa watershed and its surroundings. As a result, this study attempted to examine how the relationship between urbanization and water bodies' connectivity looked, as well as how the lack of a buffer zone policy affected the Lake Hawassa watershed. Furthermore, the study discovered the challenge and threats in light of the absence of a buffer zone management policy.

1.3. OBJECTIVE OF THE STUDY

1.3.1. General objective of the study

The main objective of the study was to investigating the relationship between urbanisation and water bodies in light of the buffer zone on Lake Hawassa, watershed.

1.3.2. Specific objective of the study

1. To establish the relationship between urbanization and the connectivity of water bodies, there is a lack of a buffer zone policy.

2. To assess the challenges of the Lake Hawassa watershed associated to rapid urbanization.
3. To identify the challenges faced by the lake's existences and consistency
4. To detect the problems that hindering the management of the water resources in the Lake Hawassa watershed.

1.4. BASIC RESEARCH QUESTIONS

The researcher was conducted this study with the aim to answer the following basic research questions.

1. Is there a relationship between urbanization and the connectivity of water bodies due to the lack of a buffer zone policy?
2. What challenges are faced the Lake Hawassa watershed as a result of the relationship between urbanization and water bodies?
3. What are the challenges faced by the lake's existences and consistency
4. What are the problems that hindering the management of the water resources in the Lake Hawassa watershed?

1.5. SIGNIFICANCE OF THE STUDY

There are several ways in which the study is significant. It first looked at the connection between urbanisation and the connectivity of water bodies as a consequence of the absence of a buffer zone policy and its impacts on water bodies in order to identify the factors that had a significant effect on the environment around water bodies. Therefore, it would be critical for policymakers, practitioners, and other interested parties to know about the aforementioned issue. Second, this study would inevitably add to the expanding body of knowledge about the reasons for and effects on water bodies of a lack of buffer zone policies. It may be helpful for individuals who desire to conduct more studies on pertinent problems related to buffer zone policy.

Additionally, this study would offer some advice on how to close some knowledge gaps about the conventional buffer zone policy and its effects that have been noted by earlier studies in and around the lake. Additionally, it is considered necessary for conducting comparable research on other bodies of water at locations with comparable topography, including rivers, streams, and even other lakes. According to the researcher, this study would add to the body of knowledge on buffer zone policies, particularly in Ethiopia.

1.6. SCOP OF THE STUDY

The watershed of Lake Hawassa was the site of this study because it is endorheic (bodies of water that do not flow into the sea), and the amount and composition of waste produced by many sources (including hotels, hospitals, homes, and businesses) are increasingly affected and endangered by the lake's recreational value compared to other rift valley basins like Lanagano, Abijata, Shala, Zeway, Abaya, and Chamo lakes. Thus, the study focused on the relationship between urbanisation and the connectivity of water bodies, along with the absence of a buffer zone policy. In order to make the study useful, specific, manageable, and result-full in a good manner, we took into consideration the financial and time constraints of the researcher's capacity. As a result, the focus of this research was only on the Lake Hawassa watershed, with a particular emphasis on the lake's lower and far catchments.

A mixed-methods approach was used in an effort to make the study successful, including statistical analysis of a survey and theme analysis of semi-structured interviews. Lake Hawassa watershed's lower and far catchment area households', MoWE, RVBAO, and Sidama regional environment protection bureau employees were identified as the study's target population. People who reside in lower and farther catchment areas were thus provided information on their home's proximity to the Lake Hawassa watershed. Based on the target demographic, the researcher used stratified sampling techniques to choose the right sample size for survey respondents. Interviewers also follow the principles of purposive sampling. As a result, 390 people were chosen for the survey, and 17 interviewees were chosen as participants in the study.

The two variables that constitute the independent variable and the dependent variable are also included in the study's scope. Therefore, urbanisation and connectivity of water bodies' challenges and effects were the dependent variables, while a buffer zone policy was the independent variable. Finally, in terms of timing, data collection was held for three months, and the researcher's time road map finalised the thesis in 2023/24 with the right schedule.

1.7. LIMITATIONS OF THE STUDY

While undertaking this study, there were limitations that faced associated with the study. The problems related to access the respondents according to the sample size was the challenge while the data collected. Moreover, resource and shortage of time was other challenges in

the study. Meantime, to obtained information pertained with the study was limited. Hence, the researcher dealt the issue like resource and shortage of time as well as access required respondents strategically how to manage such limitation that was faced and then, was selected and trained enumerators those were used as facilitators to help in the data collection effectively. In addition to mitigation that helps in data collection, the resource scarcity was managed via efficient utilization of finance and time.

1.8. DEFINITION OF KEY TERMS

- Buffer Zone: any area, often peripheral to a protected area, inside or outside, in which activities are implemented or the area managed with the aim of enhancing the positive and reducing the negative impacts of conservation (Kate,2017).
- Catchment: means the area of land from which all surface run-off flows through a sequence of streams and rivers into the lakes (Oldfield, 2013).
- Ecology: the relationships between living organisms, including humans, and their physical environment (AG Consult, 2007);
- Ecosystem: a unit made up of all the living and nonliving components of a particular area that interact and exchange materials with each other or a community or group of living organisms that live in and interact with each other in a specific environment (AG Consult, 2007) .
- Environmental management: Procedures and controls aimed at conserving the status of an environment. It may aim to balance the conservation of a particular natural resource with the needs of local human communities to promote sustainable development (Kate, 2017).
- Wetland: an area of land that is either covered by water or saturated with water (Goncalves, 2009).
- Watershed: it, also called the drainage basin, is all of the land and water areas that drain toward a particular river or lake (Brook, 2008).
- Water Resources Management: comprises the whole set of human interventions in water resources. It consists of all activities for the study, planning, development, protection, conservation and control of water resources. It can also be defined as the decision making, manipulation, and non-manipulative processes by which water is protected,

allocated or developed (Sherpa, 2000).

1.9. ORGANIZATION OF THE THESIS

The research was divided into five chapters. The first chapter introduced the background, the statement, research questions, research objectives, scope, and significance. The second chapter dealt some of the important literature review and theories relevant to the study, focusing on theoretical, empirical and conceptual review of related literature about buffer zone policy and its effects on water bodies as well as the study conducted in the area of Lake Hawassa watershed. The third chapter described the methodology that dealt on sampling, data collection and methods of data analysis. The fourth chapter presented the results of study based on data obtained via survey, interview and filed observation. The last chapters dealt with the conclusion and recommendations the study. This part would include research references as well as a collection of appendices.

CHAPTER TWO

2. REVIEW OF RELATED THE LITERATURE

2.1. CONCEPTUAL LITERATURE REVIEW

2.1.1. Buffer zone concept

Although the concept of a buffer zone has been around for a while, the word is more recent. It is challenging to provide a general description of buffer zone management since it may be tackled from a number of different perspectives. The buffer zone idea, its administration, purpose, and its different relevant ways described in a later section.

According to an influential book emerged from the 1982 World Parks Congress, MacKinnon and others (Wells, 1992) offered the following definition of buffer zone: "Areas adjacent to protected areas, on which land is partially restricted to give an added layer of protection area itself while providing valued benefits to neighboring rural communities" Sayer (Sherpa, 2000) defines a buffer zone as: "A zone peripheral to a national Park or equivalent reserve, where restrictions are placed upon resource use or special development measures are undertaken to enhance conservation value of the area"

The earlier concept of conservation was the "fences and fines" approach, which failed because of its top-down nature, ignorance to traditional use rights as well as social and economic interests of local people and lack of local involvement in decision-making activities (Paudel, 2002). So, the buffer zone concept was first developed by UNESCO to provide additional layer of protection around protected area as well as to bridge the gap between the immediate needs of local people and the long-term objective of protected area system (Aryal, 2008).

Buffer zone may be defined as a process of management of a buffer zone with the objective of optimizing the political, economic, social, cultural, ecological and intrinsic value of resources. It is usually adaptive management and participative, with fairness to all groups, allowing for changing values over time. Buffer zone in Nepal means the peripheral area of national park/wildlife reserve where people have usufruct right on the resources (New ERA, 2004). Buffer zone concept implies that the establishment of protected areas has measurable impact on adjoining areas and the

people living there and vice-versa.

Buffer zone concept in Nepal has been adopting an ecosystem approach to resource conservation and a sustainable human development approach to community development, based on self-reliance and community mobilization principles. It aims to provide an alternative natural resource base and livelihood opportunity to buffer zone communities so that their dependence on park resources could be minimized, resulting in park- people harmony for long term biodiversity conservation.

The concept of buffer zone was simply to safeguard the biodiversity of the park and reserve from the surrounding communities, by providing them with alternative economic opportunities and resources and to reduce conflicts between communities and parks/protected areas by compensating them for the depredation caused by wildlife on their crop fields, livestock and even their lives (Sherpa, 2000). These alternatives might include ecotourism, employment, agro forestry, vocational training and other activities which improve the socio-economic condition of the surrounding communities.

2.1.1.1. Evolution of the buffer zone concept

The conceptualization of the fundamental ideas of buffer zoning is not new. In the early 1970s, the basic parts of the buffer zone concept were already incorporated into multilateral development organizations' policy thinking and program planning. The introduction and spread of the term buffer zone management, as well as the introduction of the integrated buffer zone concept in Integrated Conservation and Development Projects (ICDP) on a larger scale and among a broader group of development organizations, primarily in the public and informal sectors, is a more recent development (Correll, 2011).

The idea was born out of a desire to lessen the negative impacts of human activity on environment in order to better maintain the core areas of nature reserves or the conservation area as a whole (Brook, 2008). The notion of the buffer zone concept was already being employed before it became well recognized, typically in connection with operational goals. Teak plantings bordering reserves in India are an example of a forest plantation that has shown to be an excellent buffer. In Kenya, Uganda, and India, tea plantations around conservation zones have shown to be efficient wildlife buffers (Iwata and Watanabe, 2009).

Three stages of conceptual development have been involved in buffer zone management (Oldfield, 2013). First, the primary purpose of buffers was to safeguard humans and their crops from animals escaping forests and reserve zones. The buffer zone principle was used to protect conservation areas from harmful human influences until 10–20 years ago, and in the present, buffer zones are more frequently used to simultaneously reduce human impact on conservation areas and address the socioeconomic needs and wants of the affected population (former resource users of the conservation area).

The buffer zone concept gained popularity in the 1970s as a result of increased global awareness of biological values as a result of increased demand on natural resources. As a result of increased interest in stakeholders and traditional user rights, buffer zone concept took on a more socioeconomic face and value. The Man and Biosphere Programme (MAB) of UNESCO were established to apply the concept of buffer zones UNESCO (1974) at a structural level.

An Indian task committee devised the 'Core-Buffer-Multiple Use Zone' plan in 1982 (Mukherjee, 2006). This technique intended to separate incompatible land uses, particularly those involving wildlife. The buffer zone would be managed by the park authority in this case. Controlled usage of forest products was occasionally permitted. The multiple-use zone was placed outside of the park's rural development borders.

2.2. THEORTICAL LITERATURE REVIEW

2.2.1. Theories of Urbanization

Urbanization is an irreversible process. The first known mention of urban areas and towns dates back to the Indus Valley Civilization, which lived in India throughout the middle of the third millennium BC (Bhattacharya, 1979). As a result, a variety of urban ideas exist, some of which go all the way back to the dawn of human civilization.

2.2.1.1. Dependency Theory

The dependency (theory) school argues that urban regions could establish expand and develop only if agriculture is well developed. The developing countries are sources of input for developed Countries (Tetty, 2005). Hence developing countries receive larger foreign investment in agriculture as well as non-agricultural sectors. Developed agriculture pushed

rural fanner and labourer while developing industries attract labourer due to large employment scope in urban areas.

2.2.1.2. Central place theory

The central location the theory is a well-known theory that has been extensively investigated in both the Global North and the Global South. Christaller (1933) claimed that the central place theory explained the number and size of urban centers by ranking them, assigning a market region to each, and accounting for the distance between various order centers and their geographic dispersion. This theory essentially vanished from the policy discourse after blossoming in the settlement system discussions of the 1970s and 1980s (Coffey et al., 1998). As a result research on India's settlement hierarchy also began to be conducted in the 1980s.

The discovery of functional (infrastructure) gaps in the regional settlement system to supply those services in the settlement is the practical significance of central place theory. By identifying and offering these services, communities can prevent functional duplication and close the functional gaps that exist between developed and underdeveloped settlements (Chaudhuri, 2009). Additionally, the policy value of central place theory in planning techniques has been acknowledged (Mulligan et al., 2012). The central location hypothesis is particularly applicable to the Global South in terms of describing the settlement system (Camagni and Salone, 1993; Batten, 1995; Meijers, 2007).

Due to the restricted capabilities of GIS technology, central place theory has not been able to describe growth dynamics at the regional and national levels up until now. Large-scale analysis is now achievable, though, thanks to advancements in GIS technology (Mulligan et al., 2012). Additional, central location theory has been criticized for lacking temporal dimension and being static (Beguin, 1992; van Meeteren and Poorthuis, 2017). In particular, neither the importance of time (accessibility) nor prospective alterations to the central place system's structure were taken into account when identifying central locations (van Meeteren and Poorthuis, 2017).

2.2.1.2. Multiple-Nuclei Theory

In an attempt to explain urbanization from a fundamental developmental perspective, geographers Chauncy D. Harris and Edward L. Ullman developed the multiple-nuclei theory

and model in 1945 (Lichtenberger, 2013). Given that both ideas are intended to examine how urban areas evolve, it may be assumed that is serves a comparable function and goal to the sector theory of urban growth.

According to the many-nuclei theory, multiple simultaneous growth processes around different nuclei within a single geographic area produce urbanization instead of emanating from or progressing from a single, traceable point or nucleus. Dispelling the notion of a single Central Business District (CBD), which is taken to be the center or urban expansion in other theories of urbanization (such as the sector theory), is one of the goals of the multiple-nuclei theory. Because of this, the many-nuclei model shows that and urban area has multiple nuclei, or CBDs.

Pros of the multiple-nuclei model include its versatility, adaptability and applicability for analysis of urban development at any given stage and in any geographic context. On the other hand, cons of the multiple-nuclei model include its relative complexity and tendency to fragment a given urban scenario into irreconcilable segments (Caldeira, 2016)

2.2.1.3. Peripheral Theory

According to the peripheral theory of urbanization, new urban space is constantly being created on the edges of existing urban areas, resulting in the decentralized and infinite nature of urban regions. The creation of urban regions that are not immediately impacted by nearby urban areas or nucleus is known as peripheral urbanism or urbanization, and it results in a heterogeneous distribution of self-constructed metropolises (Caldeira, 2016). The peripheral theory plays a significant role in explaining the many forms of sub-urbanism found in an extensive urban expansion, along with the differences in resource distribution, sociocultural trends, and quality of life.

2.2.1.4. Conflict Theory

The conflict theory of urbanization focuses on the occurrence and role of social and economic differences in the development, modification and control or urban areas. A conflict theorist's view on urbanization is based on conclusions that the middle and upper-class in urban societies, dictate the trend of development to suit their instantaneous needs, so that the dynamic of conflict of interest plays a huge role in shaping cities (Mcdonagh, 2007). Conflict a theory is more focused on the political aspect of urbanization than other theories and

evaluates economic aspect only on the basis of how they influence or are influence by political factors.

2.2.1. Management issues in buffer zones

Protected areas are elements of complexity that should be managed, allowing the persistence of viable populations and the use for some economic activities (Crooks & Sanjayan, 2006). There are various approaches in buffer zone management depending on the type and objectives of the conservation area for which it is created. For instance, activities in the buffer zones around some protected areas or World Heritage Sites are recommended to be regulated so as to protect the core zone. In the Biosphere Reserves and ICDPs, socio-economic developments of local communities play a crucial role.

As Kate (2017), additionally, a buffer zone can be administered as a location for research to create methods for resource conservation, ecosystem restoration, education and training, as well as carefully planned tourism and leisure activities. The buffer zone has varying levels of legal protection. The ability to create and oversee buffer zones is currently exclusively granted to a select few countries' protected area management authorities. In most situations where the buffer zones are outside of the protected area, authorities other than those in charge of managing the protected area have institutional control and jurisdiction over them.

For protected areas to maintain viable populations at the long-term, a minimum amount of habitat area is needed in a single area or a network with other habitat patches where potential connectivity is possible. Connectivity can be defined as the degree to which the landscape facilitates or impedes movement among resource patches. It can be divided into “structural connectivity”, which refers to the spatial arrangement of the elements of the landscape, and “functional connectivity”, which refers to the behaviour response of organisms to landscape structures (Crooks & Sanjayan, 2006).

Data must be the foundation of conservation initiatives, ideally data that permit the interplay of biological and socioeconomic viewpoints (Gonçalves et al, 2009). Impacts on the composition and operation of natural systems have been described using the "landscape species" concept. It develops as a tool for use in public policy and conservation programs. In this method, the species are chosen based on the variety of habitats they occupy, the land uses they are vulnerable to, their ecological functionality, and their socioeconomic

importance (Sanderson et al, 2002).

As noted by Gonçalves et al. (2009), a proposal to delineate buffer zones can be created by combining the landscape species method with the minimal area required for a species' long-term persistence. As a result, it is anticipated that the buffer zone should be smaller the greater the protected area is in order to meet the minimum habitat requirements for population persistence over the long term. The buffer zone may be increased or decreased in highly fragmented landscapes based on the quantity and arrangement of the natural remnants around protected areas, in addition to the level of vegetation cover within the protected area.

Studies recommend defining and delimiting the size of the buffer zone around protected areas based on the species' needs for space. If there are such endemic species, it is even better to target them based on the minimum amount of habitat they require to sustain a long-term viable population (Brito & Grelle 2004). Additionally, it can be determined by monitoring, evaluation, and measurement whether the expansion of the protected areas' ecosystems results in a reduction in the size of their buffer zones.

2.2.2. Buffer zone and lake management

A buffer zone, according to Mukherjee (2006), is typically a zone area that is located between two or more other areas (frequently, but not always, countries). Depending on the sort of buffer zone, its purpose may be to separate regions or to link them together. Buffer zones have various purposes and among them, they can be set up to protect the environment, protect residential and commercial zones from industrial accidents or natural disasters, and have uses in several other scenarios. Buffer zones often result in large uninhabited regions which are themselves noteworthy in many increasingly developed or crowded parts of the world (Correll, 2011).

Kate (2017) observed that buffer zones are areas created to enhance the protection of a conservation area, frequently on its borders, within or outside. This is relevant to water body conservation. Within buffer zones, certain legal and/or customary restrictions on resource use are put in place, and/or they are managed to lessen the negative consequences of restrictions on neighboring communities. A buffer zone may also be categorized as a protected area, depending on the conservation objective. According to the definition of a buffer zone, it is "a region surrounding the nominated property which has complementing legal and/or customary

limits put on its use and growth to give the property an additional layer of protection." This should include the property's immediate surroundings, noteworthy views, and any additional locations or qualities that serve as a support for the property and its protection (Correll, 2011).

2.2.3. Lake’s buffer zone situation assessment

In side Hawassa City, a number of recreational institutions have been built at the Lake’s edge. In addition, solid waste affecting the water quality and aquatic life is usually thrown either in the surrounding or into the lake water without any restriction since there is no legal framework to do so. Population density surrounding Lake Hawassa is high and this has been increasing the volume of waste production that finally ends up in the lake directly, since there is no buffer zone demarcation to the lake’s surrounding (RVLBA Buffer Zone Study Report, 2016).

Small scale irrigation is also expanding at the Lake’s south, southwest and southeast shorelines. Irrigation agriculture around the lake contributes to the entrance of eroded soil, crop residue, pesticide, inorganic fertilizers and other agricultural chemical contaminants into the Lake degrading the Lake’s water quality, sediment deposition leading to Lake depth reduction, and eutrophication (Lencha et al., 2021).

In general, major issues in the lake’s buffer zone are cultivating lands at the vicinity of the Lake, provision of land use license to the youth near the Lake for the objective of job creation, use of pesticides and herbicides that may pollute the Lake’s water, clearing lake shore plants which exacerbates lake ecosystem degradation, sand mining creating gullies that discharge sediments into the lake and uncontrolled cattle grazing. So, paying attention to set goal, objective and strategic plan for buffer zone protection in the Sub-basin plan development is vital (RVLBA Buffer Zone Study Report, 2016).

2.2.4. Roles of buffer zones

2.2.4.1. Buffer zones for conservation

Even a little riparian habitat, such as the bank of a river or stream, may have important biological importance. In an intensively cultivated environment, neglected or minimally managed areas along temporary or permanent ditches are essential habitats for biodiversity. Even along big floodplain rivers, a tiny riparian habitat with a suitably broad range of species

can have significant ecological advantages (Oldfield, 2013). The buffer zone is essential for a range of terrestrial vertebrate and invertebrate species in such situations.

Greater ecological values can be found in larger, more physiographically diverse buffer zones. Even 5-meter-wide buffer zones with trees and plants can contribute significant habitat and have significant appeal when connected to public sidewalks, for example. Woodland patches, marshes, backwaters, and ponds can all contribute to the creation of a larger-scale ecologically rich buffer zone, which commonly supports rare species. The buffer zone in these situations might be imagined as a string of beads in the landscape, but it truly might be a series of regions that need to be connected. Oldfield et al. (2013) found that even tiny riparian areas are crucial for habitat.

2.2.4.2. Buffer zones for water storage

Given the current knowledge of low-flow difficulties, buffer zones' role as water storage areas was taken into consideration in two cases, according to Oldfield et al. (2013). To start, sustaining modest flows may be helped by wed and river head positions. Second, under certain conditions of a higher order, floodplains may be used to store water during strong flows, having a considerable impact on wetland habitats as well as flood control.

2.2.5. Functions of buffer zones

According to Tamiru (2007), when used in a policy context, buffer zones are physical spaces that separate two biological systems, an ecological system from other land uses, or a physical area that borders a body of water. The functional component of watershed buffer zones consists of natural (as ecological) and human (as socioeconomic) functions.

2.2.5.1. Ecological functions

By holding silt and chemicals (fertilizers, pesticides, heavy metals) from runoff before they reach water courses, wetlands, lakes, and reservoirs, basin buffer zones, as described by Tamiru (2007), can improve water quality; bolster stream bank stability and stop soil erosion; Protect both land and aquatic environments from the damaging effects of direct sunrays to produce a cooling effect; Can provide waste and big woody debris, which some aquatic and terrestrial creatures use as food, shelter, and breeding grounds; serve as "connecting corridors" that allow species to securely transition between habitats; serve as oxygen producers and carbon sinks; influence the local climate and help recharge groundwater by

capturing and percolating floodwater through the soil into aquifers.

2.2.5.2. Socio-economic functions

In addition to the aforementioned ecological role, Tamiru (2007) noted that non-timber forest products (NTFPs), such as fodder, fruits, and wildlife, can be used as alternative revenue sources for local community members as well as providing them with valuable timber; supplying indigenous plants of various species that are typically gathered for use as building materials and medicines; For the community's benefit in terms of farming and ecotourism, preserve natural scenic landscapes with recreational value within and around watercourse zones; supports fish populations that are traditionally harvested as a key food item in many fishing communities, filters contaminants from water to make it more wholesome for local communities using it for household and agricultural purposes, and marginal riparian zones act as grazing and watering areas for livestock especially during the dry season.

The most important factors to be considered in relation to the establishment of an effective buffer for water quality improvement and habitat maintenance are the catchment conditions, e.g. slope and land cover; dimension and design of buffer, e.g. width and choice of vegetation and the education of nearby communities. Hence, through the interaction of their soils, hydrology, and biotic communities, buffers perform many important physical, biological and ecological functions as well as important socio-economic benefits (Yang & Liu, 2010).

2.2.5.3. Buffer zones and jurisdiction

The majority of nations have fairly comprehensive conservation area regulations, although their zoning laws are frequently lacking. Conflicts may consequently develop regarding the worth and importance of buffer zones in addition to their jurisdiction. Buffer zones are not even explicitly stated, let alone precisely defined, in several international accords (Kate, 2017).

Buffer zones lack a definite legal definition; hence there is a lot of variation in their creation, administration, and application (Tenalem, 2009). Because of this, situations where buffer zones are located inside the natural preserve are common. It's clear that this is done to give the core and buffer zones a single accountable authority and to make management of both easier. Wherever the buffer zone is found inside the bounds of the defined nature preserve, the authorities of the protected areas will really have control over it, unless clearly stated

differently by decree (Kate, 2017). This approach won't be successful in accomplishing the conservation goal if rural development and other social and economic activities are permitted in the buffer.

Nepal and Cameroon are two countries where the buffer zone concept has in fact been laid out in legal terms. In Nepal the Buffer Zone Management Regulations (1996) define the buffer zone as an area outside the protected area under the warden. In Cameroon the law defines the buffer zone as area of 1km outside the boundaries of the nature park (Mukherjee, 2006).

According to Tietenberg (2005), there are two straightforward but crucial requirements for a functional buffer zone in India: it must be under the jurisdiction of the park authorities to have the most control over its uses and it cannot have national park status (since this carries too many restrictions). However, it is evident that the management of conservation areas and economic buffer zones are very different from one another. Liaison between the various relevant authorities will be essential in certain situations.

2.2.6. Benefits of buffer zones

Buffer zones may provide a variety of benefits, depending on the type of buffer zone, natural conditions and other factors. These benefits can be categorized as biological, social, economic, institutional or policy-related benefits (Sayer & Poore, 2009).

2.2.6.1. Biological benefits

Biological benefits include, according to Sayer (2009), providing a filter or barrier against human access and undesirable use of the core zone or conservation area, safeguarding the core zone or conservation area from invasion by exotic plant and animal species, offering additional protection against storm damage, drought, erosion, and other forms of damage, and expanding the habitat and thereby increasing the population of large, wide-ranging species in the protected areas.

2.2.6.2. Social benefits

On the other hand, the buffer zone had advantages from a social perspective, including offering a flexible mechanism for resolving conflicts between the interests of preservation and those of the occupants of adjacent resources; enhancing the earning potential and quality of the environment of the locals; defending their traditional land rights and cultures; and

offering a reserve of animal and plant species for human use and for restoring species, populations, and ecological processes (Sayer, 2009).

2.2.6.3. Economic benefits

The increased benefits from protected areas for direct users, such as: incomes from tourism, research permit fees from scientists, and income of local people employed in the area, were noted by Sayer (2009) in addition to the benefits from a social perspective. These benefits were included as compensation to people for losing access to the strictly protected core zone or conservation area. In keeping with the compensating benefit, it had a benefit as enhanced value of protected land from indirect use: watershed impacts and protective role of buffer. Additionally, the value of protected areas was boosted for non-users by the value of protected wildlife and plants.

2.2.6.4. Institutional and policy-related benefits

Buffer zones had advantages in terms of institutional and policy-related benefits, including the introduction of participatory planning methodologies, direct and indirect users' awareness of the value of natural areas and resulting willingness to contribute to their establishment, establishment of local level monitoring mechanisms involving local population, involvement of local population in management of conservation and buffer zones, and increased responsibility with local government.

2.7. Assessment of Water Quality in the Hawassa Sub-Basin: Current and Trends

Since Lake Hawassa is situated adjacent to Hawassa City and surrounded by agricultural lands, it is prone to contamination with a variety of pollutants either through point and non-point discharges. The Sub-basin is a closed system with no known outflow, and retains all pollutants that enter in to it. As stated by Desta (2003), harmful human activities such as poor agricultural practices, deforestation, use of excessive fertilizers, herbicides and pesticides, rapid and unplanned urbanization, poor waste management and industrial emission from within the catchment have significantly affected the quality of water in Lake Hawassa and its wetland system. Pollutants from agricultural land surfaces, built-up areas, factories, residential and business establishments are getting access in to the lake through flooding, wind, and direct discharge of effluents through open ditches (Degife at al., 2021).

The quality of the water in Lake Hawassa has been deteriorated considerably in the past few decades. A study conducted by Elizabeth et al. (1994) showed that, despite the very few parameters considered, the value of these parameters fulfilled the WHO's standards for various purposes. According to Gilbertson and Carpenter (2004), Lake Hawassa has high concentrations of trace metals, pesticides and sediment as a result of exposure of the lake to effluents from factories and domestic sewages in addition to erosion and deposition from the catchment. These processes can lead to contamination of the biodiversity of the lake ecosystem including fish. Eutrophication is visible in the lake, and as a result of it, the growing and dying grasses are supplementing to the sediments which accumulates in the lake through floods and discharges (Kassaye et al., 2012). As stated by Worako (2015), the Lake's water was found to be categorized as "marginal", which means that the water is considerably affected by pollution. In addition, a study conducted by Zigde and Tsegaye (2019) indicated that the concentration of a number of water quality indicators exceeded WHO standard. The authors also stated that these could be caused by both point pollution sources from various locations in the Sub-basin and non-point source pollution as a result of urban storm water, runoff from agricultural areas, and over grazing, deforestation, soil erosion and urbanization that could modify water quality. According to Teshome (2020), the water quality index (WQI) of Lake Hawassa showed higher values of 870.3 and 1,313 for dry and rainy seasons, respectively, both values indicating that the water is unfit for human use, and the status of the water body is hyper-eutrophic.

Eutrophication process alters basic lake characteristics such as depth, biological productivity, oxygen levels, and water clarity (US-EPA, 1994). If proper protection of Lake Hawassa from pollutants is not in place, the concentration of pollutants may be increasing in the lake with the potential bio-magnification and bioaccumulation in different trophic levels of the water ecosystem. This, in turn, affects the health of the community which is dependent on the lake for livelihood. Therefore, the aim of this plan is to assess the overall activities in Lake Hawassa Sub-basin that can be detrimental to the lake ecosystem, and to determine the level of pollutants from point and non-point sources (Teshome, 2020).

Table 2.2 presents water quality index based quality of the Lake water for different uses. Based on the results presented in the table the quality of the water is poor for different use categories.

Table 2.2: Water quality status of Lake Hawassa for different uses

Name of the lake	Water quality index for Drinking water	Water quality index for irrigation water	Water quality index for recreation water	Water quality index for aquatic life
	Uses	Uses	Uses	
Lake Hawassa	25	35	18	44

Source: Rift Valley Basin Administration Office, 2022

2.2.8. Issues affecting water quantity in Hawassa sub-basin

2.2.8.1. Socioe-conomic issues

Socio-economic issues result from income inequity and limited opportunities for citizens to make both ends meet despite their willingness to work hard. The income gap manifests in unequal access to health care, barriers to post-secondary training and harsher treatment in the criminal justice system. Socioeconomic status profoundly impacts an individual or family's reputation and standing in the community. It includes the ethics, fairness and results of policies, theories and institutions that may result in a different standard of treatment and opportunities based on income and background. Poverty is a major socioeconomic issue because lack of money for basic necessities is the source of many other socioeconomic concerns. Socioeconomic factors are lifestyle components and measurements of both financial viability and social standing. They directly influence social privilege and levels of financial independence. Factors such as population growth, health status, income, environment, level of education and Justice System inequalities affect human behaviors and circumstances.

Population growth influences the economic performance (development) in a sense that development is accelerated or decelerated by population. This shows that population growth has a dual effect on the economy. The first effect is raising the productive labour force (APL) that added the value to the economy which in turn boosts the productivity in the economy (positive impacts). On the other hand, population growth has also its own demerit in such a way that as population increases, the demand for food, agricultural land, fire wood, settlement,

dependency ratio, etc increases. The later effect leads to decrease in output or productivity and it further aggravates environmental degradation, over-utilization of resources ...etc. In general, the former effects of population growth had constructive role while, the later one had destructive effects. Most river basins, including the RVLB, can, if properly managed, support their population. Development of a river basin requires an intensive study of the spatial distribution and dynamics of the population as a component of planning.

Population growth requires providing basic infrastructure like power, roads, communications, water supply, sanitation, schools, health centers and others. Development and provision of such basic infrastructures need additional amount of water. Moreover, fast economic growth which is being registered in the country as well as in the basin demands more water resources.

Due to the expansion of irrigated agriculture, population growth and industrial expansion, the water need in Lake Hawassa Sub-basin has been growing rapidly. This socoi-economic activity has its own significant pressure beside the benefit of improving the livelihood of individuals and regional as well as local economic activities. There are five types of water demand in the sub-basin. These are: domestic, irrigation, industrial, environmental and recreational demands. The unbalanced water abstraction and ineffective water use trend on the sub-basin lead to natural system pressure which could be considered an issue of water demand.

In general, associated with population growth in the sub-basin, water demand for domestic use, irrigation, hotels and resorts, commercial activities and other social purposes is increasing progressively. Since the sub-basin is suitable for economic development project implementation in terms of resources availability, road and other infrastructure accessibility, many national and international investments are being opened there.

Along with industrial expansion and urbanization, water scarcity is emerging affecting people, livestock, environment and other any creatures in the sub-basin. It is assumed that the water demand and its scarcity will continue and associated water use conflicts may occur in the sub-basin. Therefore, scientific water resources allocation plan should be developed based on existing legal framework of the country as well by assessing actual situation in depth.

2.2.8.2. Industrial demand issues

In Lake Hawassa Sub-basin, there are different industries that consume water for their process of production. These include Hawassa Industrial Park, BGI, MOHA Soft Drink, Seramic, Chipwood, Agrostone, Hawassa Pole Factory, Selam Water Botteling and Hawassa Flour Factory. All use groundwater by drilling the borehole. They have big effect and issue for water demand management. Next from irrigation schemes, 8 industries and one higher institution in the Sub-basin take the majority stake in groundwater abstraction in the Sub-Basin. Annually they take 2,368,704 m3 of water from the aquifer. The estimated amount of groundwater in the sub-basins and geo-political boundaries of the basin is recharged from surface water and precipitation. But currently the unplanned utilization of the river water and the deforestation of the basin cause serious land degradation and hence the amount of groundwater storage and recharge could get lower and lower.

2.2.8.3. Buffer zone cultivation

Major problems at Lake buffer zone in the Sub-basin are cultivating the lands at the vicinity of the Lake including water displaced area, illegal settlement, provision of land use license to cooperated youth near the Lake for the objective of job creation, use of pesticides and herbicides that may pollute Lake water, clearing lakeshore plants which exacerbates lake ecosystem degradation, sand mining creating gullies that trap sediments and uncontrolled cattle grazing. Such listed problems are familiar at the lake and the wetlands in the sub-basin. So, paying attention to set goal, objective and strategic plan for buffer zone protection in sub-basin plan development is vital.

2.2.8.4. Wetland degradation

According to the U.S. Environmental Protection Agency (USEPA), wetlands refer to those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (George et al., 1994). The term refers to a diverse range of shallow water and intertidal habitats, which occur in various locations around the world. This single sentence of definition has a complex structure: there is a cause (inundation by water), a proximate effect (reduction of oxygen levels in the soil), and a secondary effect (the biota must tolerate both the direct effects of flooding and the

secondary effects of anaerobic conditions) (George et al., 1994).

Due to their inherent diversity, wetlands are highly productive systems that play a fundamental and disproportionate role in providing a multitude of ecosystem services that sustain all life on the planet, regardless of the particular landscape in which they are found.

Natural wetlands perform a number of functions. Many functions are based on subtle relationships, which may have occurred from as few as three years to thousands of years to develop. Some of the functions performed by wetlands are listed below:

- Plant and Animal Habitat. Wetlands represent a very small fraction of our total and area, but they harbor an unusually large percentage of our wildlife.
- Food Chain Support. Wetlands have the capacity to accumulate nutrients.
- Flood Storage. Many wetlands are natural flood detention areas.
- Sediment and Pollutant Trapping. Because of the slow water velocities in wetlands, most sediment flowing into the wetlands will be trapped.
- Shoreline Protection. Wetland vegetation along shorelines of lakes and rivers provides soil stabilization by absorbing and dissipating the energy of waves and currents and by binding the soil.
- Groundwater Recharge. Most wetlands have limited value as groundwater recharge areas.
- Groundwater Discharge. Wetlands that intersect the water table can serve as groundwater discharge points if the piezo metric surface (head) is sufficient.
- Biogeochemical Cycling. Two examples of this process are the accumulation of various forms of carbon in peat bogs and the reaction of sulfur with other elements in wetlands and its release as gaseous and liquid compounds.

2.2.9. Ethiopian environmental policy, regulation and standards

Although individual and communal efforts are very important to prevent pollution of lakes, rivers and ponds, a common policy, regulation in the form of legislation is more effective for implementing the activities. Because there will be a legal power for controlling the implementations and regulating the failure for protecting the water resources. The Federal Democratic Republic of Ethiopia, ministry of water resources and the former Environmental Protection Agency detail on how to utilize and protect water resources. The ministry in its

water policy document entails the responsibility of industrial, water supply, livestock, agriculture sectors and individual users (FDRE Minstry of Water Resources, 2011).

The FDRE Constitution guarantees the fundamental right to live in a clean and healthy environment, the right to livelihood, and the right to sustainable development. For example, article 44 (1) declares that "all persons have the right to a clean and healthy environment". The right to livelihood is also guaranteed to every person with article 44 (2). Ethiopia, by virtue of article 43 (3) and/or concluded, established or conducted international agreements relations, should protect or ensure the right to sustainable development.

Article 92 states government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment. It also imposes a corresponding constitutional "duty" on the Federal and the Regional Governments, along with citizens, "to protect the environment".

The Constitutional framework for the protection of the environment is put in various legal institutes like the Environmental Protection Organs Establishment Proclamation No. 295/2002, the Public Health Proclamation No. 200/2000, the Environmental Pollution Control Proclamation No. 300/2002, the Environmental Impact Assessment (EIA) Proclamation No. 299/2002, the Development Conservation and Utilization of Wildlife Proclamation No. 541/2007, and the Forest Development, Conservation and Utilization Proclamation No. 542/2007.

According to the EIA Proclamation definition environmental impact's any change to the environment or its components that may affect human health or safety, flora, fauna, soil, air, water or climate. So, such impact shall be assessed on the basis of the size, location, nature or cumulative effect in comparison with other concurrent impacts. EIA is a legal requirement devised to implement the rights granted by the constitution and protects against the violation of these by any person or development project. EIA puts a provision that it is not possible to render any development activity without getting an authorization to do so from Environmental protection Agency or other authorized bodies like the regional environmental authority. It also defines a set of environmental crimes. Therefore, the Ethiopian floriculture industries as one of the devilment activities are in charge of implementing the Ethiopian EIA ahead, during and after implementation of their projects.

The Ethiopian Environmental Protection Authority Establishment Proclamation No, 9/1995 established the Environmental Protection Authority to prepare environmental protection policies and laws. Its objectives were enhancing good environmental governance through removing the constraints faced by public agents, individuals, civil society and the private sector to know, explore and utilize fully their own potentials to enlarge their choices for understanding their respective functions in an environmentally sound manner. It does this by mandating power to federal regional levels. The Environmental Organs Establishment Proclamation No. 295/2002 was later reestablished as a federal EPA as an autonomous organization vested with expanded mandates. The 295/2002 environmental proclamation allows to establish regional environmental agencies or designate an existing agency instead for the same environmental management and protection function. The decentralization also goes to every sector or ministerial office by letting them to establish their own environmental units for the function of environmental management. The Authority has specified preconditions for importation, formulations, usage and management of fertilizers, pesticides and other chemicals. Issues related to registrations and post registrations are also of essential issues. The FDRE constitution proclaims the registration and control of pesticides in accordance with Article 55 sub article (1) under proclamation number 674.2010.

FDRE government, under the ministry of water resources has established policies including aquatic resources policies as part of water resources management policy.

2.2.10. International environmental policies, regulations and sstandards

According to world health organization (WHO), water whether used for the purposes of drinking, food production, irrigation, domestic utility has an important impact on health. Therefore, standards to maintain the quality of surface water are very important. For this, world health organization and other national and international organizations have put standards of water quality to be used as reference.

2.2.10.1. Pollution intervention and remediation

Wetlands can be protected, restored, and built to catch pollutants before they enter lakes, which is a smart strategy to protect water bodies (Yang & Liu, 2010). Built-in wetlands are designed systems that exploit the natural vegetation, soil, and microbial life of wetlands to remove contaminants in surface water, ground water, and waste streams (Helmer, Hespanhol,

1997). Wetland building plants need to be highly capable of removing nutrients by absorbing them into their bodily processes. The wetlands are also crucial for protecting the environment while acting as a buffer zone for the improvement of water bodies.

2.2.10.2. Buffers to protect lakes from pollution

If there are pollution sources near water resources, buffer zones should be used as protectors. These act as a barrier between the water resource and polluting sources. In other words, they serve as a link between the polluting source and marine ecosystems. Riparian forest and vegetation buffers are one of the most effective buffers for water body conservation (Kate MacFarland, 2017). The optimum effective buffer zone location, size, and composition are determined by site characteristics and water resource objectives (Correll, 2011).

Plant buffer zones around rivers, lakes or ponds apart from their water quality conservation goals, can be designed for various single or multiple goals. However, the multi-purpose buffers are a little bit complicated for designing and management though they have many advantages.

Both large trees and little vegetation can be used, but the choice of plant relies on how soon the results would be visible. For instance, riparian forest buffers, which rely primarily on massive trees, take years to grow. However, those looking for quick results are advised to sow and grow grass. Therefore, it is essential to implement effective planning, design, and management strategies in order to provide buffers with long-term services in the future. Plant- or vegetation-based buffers are not the only ones used. Long striped holes can be built between water supplies and pollution sources to act as buffers. The perforations will help keep toxic water away from water sources. Because there are less leaks the longer the stripped holes will reach the water body (Kate MacFarland, 2017).

2.2.10.3. Surface water, its pollutants and their sources

Surface water according to S. Manahan in Fundamentals of Environmental Chemistry is the water found in Lakes, streams, and reservoirs whereas groundwater is found in aquifers underground (Manahan, 2001). The water that humans use is primarily fresh surface water and groundwater. The use of surface water is various ranging from agricultural activities to ecosystem balance and drinking. Surface water is interlinked with the ground water, its

affection also affects the ground water and vice versa. Moreover, the ecosystem balance is greatly supported by surface water.

Surface water ecosystems (Lakes, Rivers ...) are sensitive to the chemicals developed for the ease of life that changes water quality and quantity. The pollutants may arise from many human activities or natural phenomena within their watershed. The main pollutants include pesticides, sediments/ silts, nutrients and many more. These all affects the aquatic life in the surface water directly or secondarily. For example, less than 0.1% of an applied pesticide actually reaches the targeted pests, while the rest (99.9%) has the potential to move into other environmental compartments, including ground and surface waters (Anderson et al, 2012). Surface waters can also get polluted from excessive use of fertilizers, growth regulators, and etc.

2.2.11. Types of surface water pollution

Surface water pollution, defined by Dessie (2007) as "an alteration in composition and condition of its waste, either directly or indirectly as a result of the activities of man, which initiates modification of ecological systems, hazards to human health, and renders less acceptable to downstream users," is the degradation of the quality of water for downstream users. If this concept is correct, there are nine possible categories of surface water pollution: Namely, thermal pollution, the addition of pathogenic organisms, creating a public health hazard, oil pollution, the addition of inert, insoluble mineral material, the addition of readily biodegradable organic material that will result in the depletion or complete removal of dissolved oxygen, toxicity due to the presence of (a) synthetic organic compounds and (b) salts of heavy metals, enhanced eutrophication, acid depositions or discharges and radioactivity.

Various researchers may classify contaminants differently based on their own presumptions in their research. According to William (2006), there are five main categories of harmful contaminants that are likely to be present in surface waters: These are, the heavy metals (cadmium, zinc, lead, mercury, copper, etc.), synthetic organic compounds (principally pesticides but also including polychlorinated biphenyls, solvents, detergents, organometallic compounds and phenols), toxic gases, e.g. chlorine, ammonia, toxic anions (cyanides, Sulphides, fluorides, etc.) and acids and alkalis.

2.2.12. Sources of pollution for Lake Hawassa

Residents of semi-urban and urban areas use Lake Hawassa, one of the largest freshwater lakes in Ethiopia's Rift Valley, for a number of purposes. It is considered to be the main source of revenue for all enterprises constructed along the beach and is crucial for luring customers, luring investors, and protecting wildlife. However, anthropogenic and natural activities such as urbanization, intensive agriculture, rapid industrialization, population growth, urban runoff and municipal waste, overfishing, cutting of grass along the shores, car washing on the lakeshore, and horticultural farming on the lakeshore pose a high risk of contaminating the lake (Gebremedhin, and Berhanu, 2015).

2.3. EMPIRICAL LITERATURE REVIEW

2.3.1 Previous Relevant Studies on Buffer Zone policy in the Globe

A study conducted at Sulejów Reservoir (Poland) concluded that enhancing a buffer zone comprising a plant riparian land/water ecotone and a limestone-based barrier effectively reduces diffuse pollution and ecosystem restoration. It also has the potential for removal from contaminated shallow groundwater (Fratczak et al., 2019). Buffer strips significantly have greater saturation; even after 57 years, it doesn't get saturated with pollution exports from adjacent land (Habibiandehkordi et al., 2019). Using wetlands and forests as a buffer zone is recommended to minimize pollution leaching and equilibrium pollution concentration (Cao et al., 2019). In addition, Pennsylvania has proposed buffer strips as an effective tool to reduce N (25%) and P (80%) goals and utilize the benefits of forest and grass buffers (Jiang et al., 2020). However, the benefits of the buffer zone are not limited to non-point source pollution (NPSP) as it also improves biodiversity, conserves water and soil, controls erosion, and adds aesthetic value (Yi et al., 2021).

The riparian buffer zone effectively protects the aquatic ecosystem from non-point source pollution (NPS) pollutants. The pollutants are transformed following various purification processes such as precipitation, adsorption, volatilization, filtration, microbial processes, and plant uptake. It is inexpensive and requires little maintenance; therefore, enhancing its purification performance is a serious and attractive concern (He et al., 2020). Previous literature demonstrated that various factors significantly impact the efficiency of the riparian buffer zone, including the composition and configuration of land cover and land use

regarding water environment quality. The width of a riparian buffer zone is positively related to its efficiency in improving water quality and protecting the aquatic environment (Wang et al., 2020).

2.3.2. Previous Relevant studies on Lake Hawassa

Since the early 1970s, several studies have been conducted in the study region regarding the development of water resource projects, hydrology and hydrogeology, natural resource management, environmental impact assessment, and pollution.

The British Land Resources Division (LRD) Ministry of Overseas Development, working closely with the Executive Organ of the Ethiopian National Water Resources Commission (NWRC), produced the first formal research on the region's water resources in 1973. The study was limited to the socioeconomic factors affecting the exploitation of land and surface water resources. According to AG Consults' evaluation of this study, variations in Lake Hawassa's level, its relationship to climatic changes, and the effects of changes in the watershed brought on by human activity have all been noted. According to AG Consults, some of the key proposals included creating the Hawassa Catchment Development Board to regulate the use of land and water, opening a soil and water conservation office, and designating a protected forest above 2000 m a.m.s.l (AG Consult, 2007).

The Rift Valley Lakes Basin Integrated Natural Resources Development Master Plan Study was commissioned in 1992 by the former Ethiopian Valleys Development Studies Authority and carried out by Sir William Halcrow & Partners of the UK. In 1990, the national Water Resources Development Master Plan Study was carried out by India's Water and Power Consultancy Services (WAPCOS). In 2000, Lake Hawassa Level Rise was also studied by Water Works Design and Supervision Enterprise (WWDSE). The Hydrogeology and Engineering Geology of Hawassa Lake Catchment Study was carried out by the Geological Survey of Ethiopia in 2003. In 2004, Yemane Gebreegziabher conducted a watershed-level investigation for his master's thesis.

The most current investigation into Lake Hawassa pollution was carried out by AG Consult Consulting Hydrogeologists & Engineers Plc under contract with the South Nations Nationalities and Peoples Region (SNNPR) Water Resources Development Bureau (WRDB). Out of all the prior studies, no one are that directly relates to this research.

2.4. CONCEPTUAL FRAMEWORK OF THE STUDY

The buffer zone policy is a crucial management tool for maintaining stability, consistency, and importance to minimize environmental contamination and maintain clean lake water. Pollutants, which are further broken down into inorganic contaminants (heavy metals, sediments), organic contaminants, pesticides, human pathogens, drug residues, and environmental hormones, are mostly produced by home and industrial sewage. When these contaminants move with surface runoff, they not only threaten and impair biodiversity but also have negative effects on lakes, rivers, and aquatic ecosystems (RVLBM, 2009).

However, urbanization and industrialization have had a negative impact on the quality of the water in lakes, streams, and other bodies of water (Wang et al., 2020). A threat to the aquatic ecosystem, the safety of drinking water, and human health has resulted from the expansion of intensive livestock and poor land-use practices (RVLB, 2009). Additionally, pollution that degrades water quality and urbanization are two primary sources of pollution added to water bodies. Urbanization and industrialization are the primary causes of surface water pollution and contamination in the majority of the lake sub-basin, including excessive nutrients from fertilizer runoff, herbicide and pesticide runoff, and soil erosion that increases turbidity (Nigatu, 2011). Thus, the puffer zone policy and the nexus between urbanization and water bodies had relationships one another.

The Nexus between Urbanization and Water Body on DPSIR

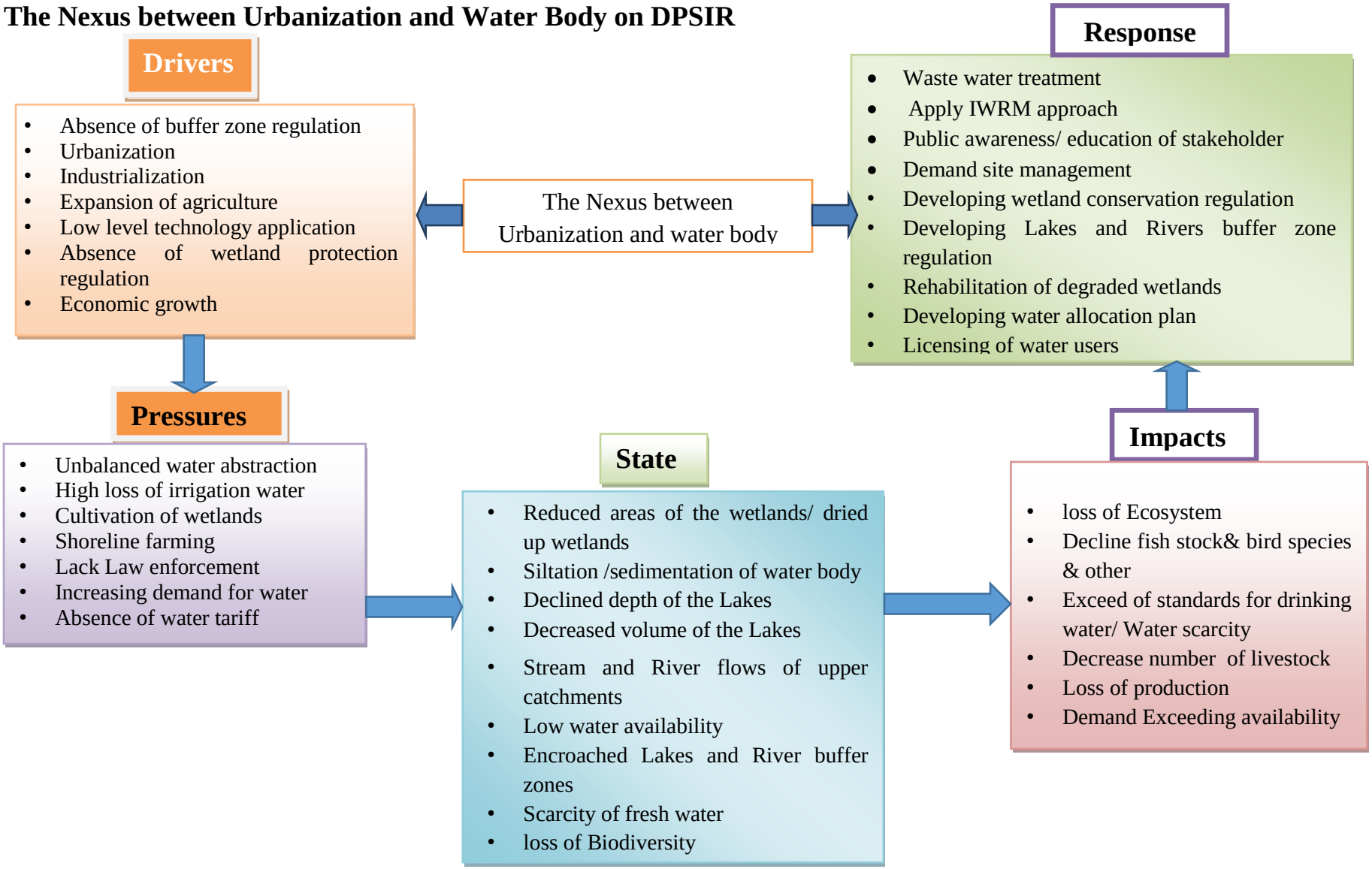

Figure 2.1: Conceptual Framework of the study

Source: Developed based on the literature reviewed by the author, 2023

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 DESCRIPTION OF STUDY AREA

The regional state of Sidama is centered on Hawassa. The city is located along the trans-African highway, a global route that connected Cairo with Cape Town. Lake in the west, Oromiya region in the north, Wondogenet woreda in the east, and Shebedino woreda in the south define the city's boundaries.

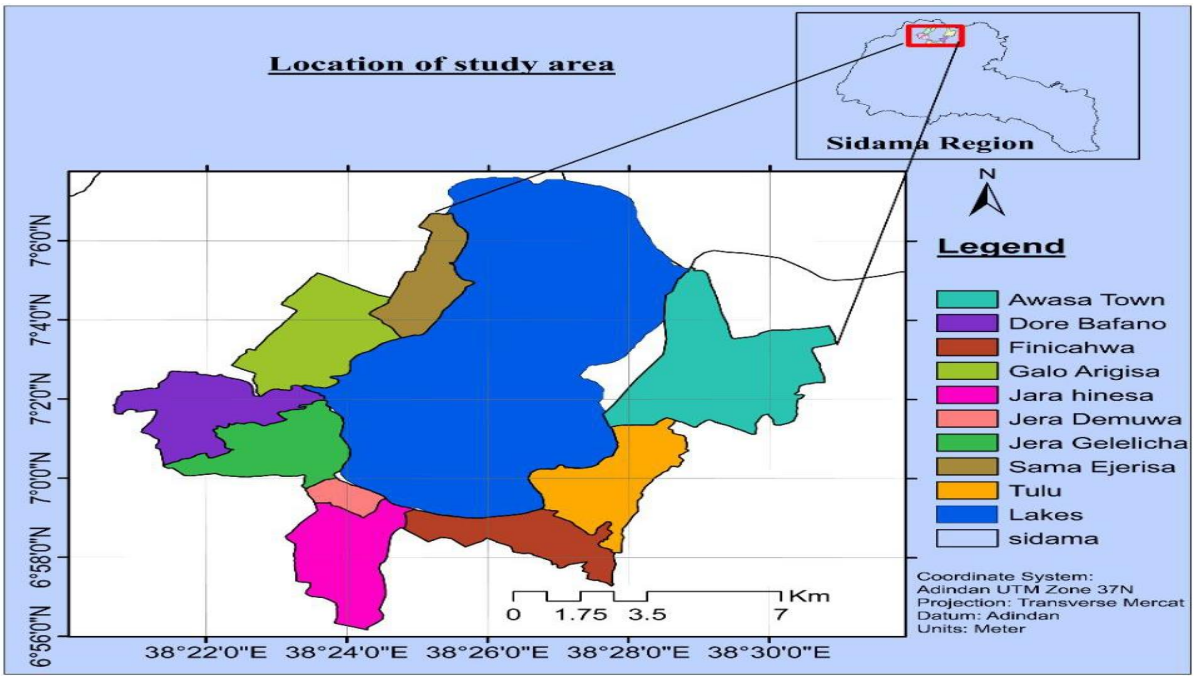

Figure 3.1: Map of the Study Area

Source: Rift Valley Basin Administrative Office, 2022

With a total size of 157.2 square kilometers, the city government is organized into 32 kebeles and 8 sub-cities. These eight sub-cities are Hayek Dare, Meneharia, Tabore, Misrak, Bahil Adarash, Addis ketema, Hawela-tulla, and Mehal ketema.

According to the results of the 2007 census, Hawassa's urban population would be 201,027 in 2012, with 103,646 men and 97,381 women. With a total population of 115,576 people, there are 59,393 men and 56,422 females living in rural areas. Therefore, Hawassa has 316,842 people living in both the urban and rural areas (CSA, 2007).

Lake Hawassa is the smallest of all major lakes of Hawassa sub-basin. The catchment has no

surface outlet; it is about 15 km long and 5.5 km wide with a maximum depth of 22m (NUPI, 1994). Lake Hawassa is one of the few fresh water lakes that may be used for irrigation. The maximum depth is 18-22m. The shoreline length of the lake is 50-65 km (RVBAO, 2020). It is a small closed system but fresh and has high productivity.

Lake Hawassa is a major source of fish for the local community. The fishing shore at Hawassa town, especially when the commercial fish catch is being landed and sold, is dramatic and beautiful place to see. In the western shore areas the lake is being used for drinking by the local community. The littoral zone is extensive and has abundant aquatic vegetation. It is feeding ground for many species of water birds that are extraordinarily abundant (WWSDE, 2001).

3.1.1. Description of lake Hawassa sub-basin

Lake Hawassa Sub-basin is one of the major sub-basins in the Rift Valley Lakes Basin and the geographical location of the sub-basin is 420,000 E and 760,000 N; 470,000 E and 800,000N (Figure 3.2). According to Riftvalley Lake Basin Master Plan (Volume 1), the Lake Hawassa Sub- basin is located in the central north east of the Rift Valley Lakes Basin and covers an area of 1,436 km^2 (143,651ha). Lake Hawasa Sub-basin is shared between two Regions, two Zones and 12 Woredas. Overall, 71% of the Sub-basin lies in Sidama National Regional State (SNRS) and 22% lies within the Oromiya Regional State administrative boundary. 7% of the area of the Sub- basin is Lake Hawasa. The Sub-basin consists of only one major tributary river, Tikur Wuha. This lake system is hydrologically closed, meaning there is no surface water flowing out from the lake except for seepage, evaporation and abstraction. Hawassa City, the Capital of the Sidama Region, is located right on the eastern shore of Lake Hawassa

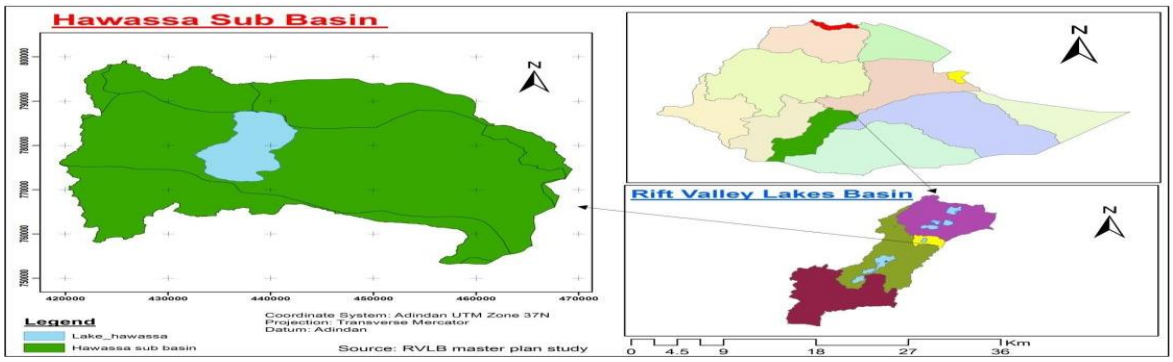

Figure 3.2: Location of Lake Hawassa sub-basin

Source: Rift Valley Basin Administrative Office, 2023

3.1.2. Geo-political and other physical characteristics of Lake Hawassa sub-basin

Interims of administrative boundary that the sub-basin is comprised of six woredas from Sidama Regional State and four woredas from Oromia Regional State. The area coverage and the map of the woredas in the sub-basin are presented below (Table 3.1 and Figure 2.7):

Table 3. 1: Administrative structure of Lake Hawassa Sub-basin

Region	Zone	Woreda	Area (Km^2)
		Hawassa Zuria	254.8
		Boricha	94.6
		Shebedino	39.8
Sidama		Wondo Genet	227.4
		Melga	150.4
		Goriche	56.7
		Hawassa City	155.5
Sub Total			**979.2**
		Shashemene	188.3
		Shala	74.8
Oromia	West Arsi	Siraro	51.9
		Kofele	23.6
		Sub-total	**338.6**
		Lake Hawassa	**93.8**
		Total	**1,411.2**

Source: Rift Valley Basin Administrative Office, 2023

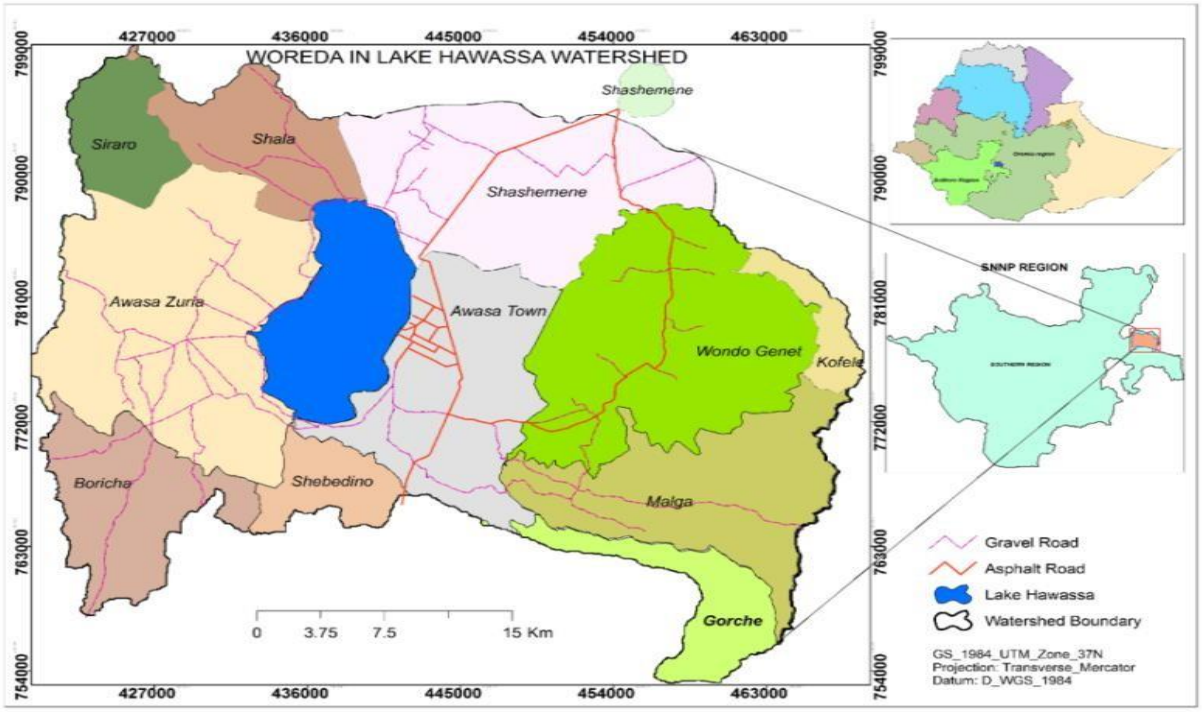

Figure 3.3: Administrative Map of Lake Hawassa Sub-basin

Source: Rift Valley Basin Administrative Office, 2023

3.1.3. Socio-economies and Infrastructure

3.1.3.1 Population

In Lake Hawassa Sub-basin, the 2017 projected population of the sub-basin is estimated at 3,374,341 from which the urban population is 573,638 (17%) and the rural population is 2, 800, and 70 (83%). According to the Rift valley Lakes Basin Master Plan (2009), population density (urban and rural) for the whole sub-basin is very high at 624 people per km2 (total RVLB average = 167 people/km2). The rural population density is 3.65 per ha in the west and 5.17 ha in the east.

3.1.3.2. Road Infrastructure

According to the RVLB Master Plan (2009), the main asphalt road in the sub-basin is the Addis Ababa-Moyale road that runs north-south through the sub-basin. In the east there an upgraded asphalt extending from Shashemene to south of Hawassa City via Wondo Genet and Meribo. In the west an all-weather road links Hawassa City with Dore Bafano, the capital of Hawassa Zuria Woreda where the road splits and provides a link to Konsore Chefa and further south and Siraro Woreda to the west.

3.1.3.3. Education

The education and literacy levels in the sub-basin are very low. There is a general lack of awareness on the importance of educating children, especially in rural areas. This is an area of great importance as parents need to be made aware of the value of education, for their children and themselves, and the impact it will have on future earning power. Education in the sub-basin suffers from difficulties in retaining teachers. There is high teacher turn over, mainly due poor incentives. Most schools are poorly equipped with educational materials and school services/facilities (books, chairs, desks, classrooms, water supply, toilets), the quality of education is poor. Food insecure areas experience high dropout rates, teachers are poorly trained and scarce, and family participation in the management and operation of education is weak. There is imbalance between boys and girls enrolment and high illiteracy rates, especially in rural areas and amongst women (RVLBMP, 2009).

3.1.3.4. Tourism

The tourism infrastructure of the Lake Hawassa Sub-basin is moderately well developed, but there are some untapped opportunities. Areas with tourism attractions include cultural and historical attractions of Haile Selassie's Loke Palace 6km from Hawassa and the Sidama Cultural Hall (Gudumale) in Hawassa and Sidama Tukuls. Natural attractions include Lake Hawassa, Tikur Wuha River, the Cheleleka wetlands, Hot Springs, Amora Gedel, The Tabor Mountain, Mount Alamura, Hare Forest, the ever-green nature of Sidama Zone and Senikele Park. Hawassa, the capital of SNRS, is one of the most prominent tourist centers in the RVLB, given its proximity to Wondo Genet hot springs, natural forest, and Yirga-alem Town are particularly important for domestic tourists. The tourists attractions in the sub-basin include bird watching, boating, hot springs, lakeside views, Abaro Mountain forest and a reserved grassland area in the far northwest corner in Siraro Woreda (RVLB Master Plan, 2009).

3.1.4. Scenario for water resources utilization and management in the RVLB

According to RVBAO (2020), a scenario is a concept for an imagined or predicted series of events. It must take into account both how the system operates and how the environment reacts to it. It serves as a framework for illustrating how a system of water resources would both impact and be influenced by the outside world and the players in the game of

management and utilization. It demonstrates how the entire system would operate within its social and political contexts. One of the underlying presumptions is that issues with water use and management require a holistic approach in order to be completely understood.

3.1.5. Four interdependent hydrological sub-basins

The four interdependent hydrological sub-basins that have been researched by numerous specialists are the Ziway-Shala sub-basin (14,000km2), the Hawassa sub-basin (1,400km2), the Abaya-Chamo sub-basin (18,118km2), and the Chew Bahir sub-basin (19,029km2) (RVBAO, 2020).

3.1.6. Watersheds in Hawassa Sub-Basin

The smallest of all the four major Sub-Basins in the RVLB, Hawassa Sub-Basin is made from one gauged and four ungagged watersheds. Tikure wuha Watershed is made from six catchments having annually 0.2 billion cubic meter of surface runoff (RVBAO, 2020).

In the Central Main Ethiopian Rift valley (MER), the Lake Hawassa watershed is situated between latitudes 6°48'45" and 7°14'49"N and longitudes 38°16'34" and 38°43'26"E. The lake watershed covers a total area of 1407.23 km2, of which 112.78 km2 (or around 8.1% of the total area) is the lake's surface. The watershed is divided between the two administrative areas of Oromia and Sidama. The elevation of the region is typically between 1680 and 2940 meters above sea level, and it is made up of escarpments, ridges, plateaus, undulating to rolling and dissected plains, depressions, and wetlands.

With no surface water outflow, Lake Hawassa is a closed-watershed lake. It is situated in the Sidama regional state, bordering the region's capital Hawassa on the west, some 275 kilometers from Addis Abeba. With a maximum depth of 21 meters in its NE part and a decrease in depth to the shores, it has a length of 16 km NE-SW (the longest axis) and 6 km NW-SE (the shortest axis) (Yemane, 2004). The Tikur Wuha River, the sole permanent river, enters Lake Hawassa on the northeast side, draining the Cheleleka wetland. The lake is also supplied by a few flow of water on the north-west and western sides of the catchment. Surface runoff from the eastern rift escarpment's headwaters and from other sources enters Cheleleka Wetland.

The lake watershed is mostly distinguished by a flat landscape with scattered minor hills. The rift escarpments and ridges in the east and west of the watershed are between 2000 and a

maximum elevation of 2940 meters above sea level. The uplands on each side of the level lowlands are known to be deforested and denuded. Shortly after individual storms, the steeply sloped and deforested uplands are prone to create heavy runoff to the lowlands. Cheleleka Lake has become a wetland due to the ongoing erosion process on the eastern highlands, which has filled the lake with sediment (Yemane, 2004).

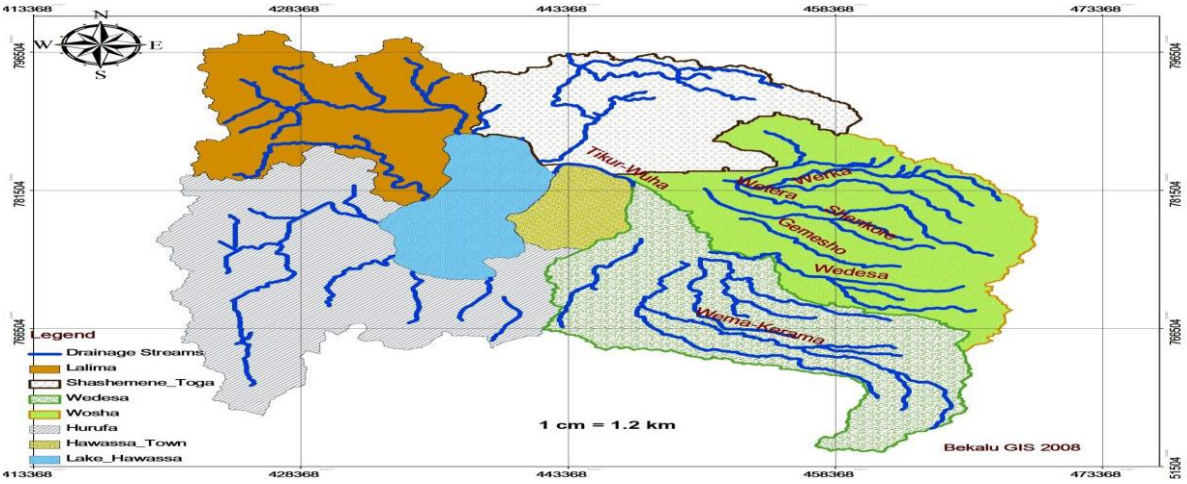

Figure 3.2: Map on watersheds

Source: Rift Valley Basin Administrative Office, 2020

3.1.7. Climate

Lake Hawassa watershed has extended period of wet season (March-October with mean monthly rainfall varying from 85 to 133mm). June to September rainfall contributes 44% of the mean annual precipitation in the watershed. The climate in the area is dry to sub-humid according to the Thorn Thwaite's system of defining climate or moisture regions (Dessie, 2007). The mean annual rainfall on bases of 12 to 30 years of record of five rainfall stations that contribute to the watershed is estimated to be 1028 mm. Though there is no other station in the watershed that records temperature to compare with, it can be concluded from Hawassa station that, the lowland part of the catchment annual temperature ranges from 9^0C to 29^0C, while mean monthly temperature is 19.7^0C (Yemane, 2004).

3.2. RESEARCH DESIGN AND APPROACH

Due to the lack of a buffer zone policy, the aim of this study was to investigate the relationship between urbanization and connectivity of water bodies with its effects. The researcher used a descriptive research design with a mixed-method to accomplish her study's

objectives. The study used a mixed research design that used qualitative and quantitative techniques.

The descriptive research approach is useful for achieving a number of research objectives, including the description of phenomena or features related to the subject population, estimation of the percentage of the population that shares the same characteristics, and identification of associations between various variables. While the mixed method is considered to be very efficient in answering research questions compared to the quantitative and qualitative approaches when used in isolation (Creswell, 2009). Furthermore, by using a mixed method approach at different stages of research, any bias that exists in any single method can neutralize or remove biases.

3.3. TARGET POPULATION AND SAMPLE TECHNIQUE

3.3.1. Target population

The purpose of this study was to examine the relationship between urbanization and the connectivity of water bodies in light of absence of a buffer zone policy in the Lake Hawassa watershed. The closest and lower catchment make up of 11 kebeles of the study area's population with total of 35,871 people, of which 29,696 are men and 6,175 are women (RVBAO report, and kebeles office, 2021/22). But, the study's population consists of five kebeles in accord too closest and lower catchment: Jara Damwa, Galo Argisa, Tulo, and Gudumale kebele is the nearest lower catchment and Sama Agirsa kebele is the far lower catchment. These kebeles contained a combine total of 16,305 (M = 13,130, F = 3,175) household members. Additionally, from Ministry of Water and Energy (MOWE) technique staff including RVBAO employees and Sidama regional state Environmental Protection Bureau expertise’s with total 237 (M=196 and F=41).

3.3.2 Sampling design and techniques

In the study, to capture a representative sample, a multi-stage sampling technique was used. In Lake Hawassa watershed, the nearest lower and far lower catchment area was purposively selected by the researcher because of her familiarity with the area, personal experience of the work, severity of the problem, and low adoption of water resource management practices and there was no research conducted in the area to alleviate the problem. Following this reason, three stage sampling procedure was employed to select sample kebeles in catchment area as

respondent household.

First, based on the nearest lower and far lower catchment area of the Lake Hawassa watershed, 11(eleven) kebeles were stratified into two catchment strata (nearest lower and far lower catchment area). In the second stage, 5 (five) kebeles were selected purposively to represent the whole Lake Hawassa watershed based on the evidence of its severity of the problem. In the third stage, to give equal chance and be free from selection biased, a total of 16,305 respondents were selected via systematic sampling techniques from the respective list of household which was complete list of households obtained from each kebeles offices. Moreover, 237 respondents were selected from Ministry of Water and Energy (MOWE) employees and managers, including RVBAO, and Sidama National Regional Environmental Protection Bureau technical staff. In general, a total of 16,542 respondents were selected from both the aforementioned study area population.

In order to gathered information for the research question, the researcher used purposive sampling to select key informants, total of seven (17) members from the ministry of water and energy (MOWE) (including RVBAO technique staff), from the Sidama regional environmental protection bureau, households in the lower catchment area, and from Hawassa, Wolita Sodo, Dila, and Arba Munich university sub-basin industry linkage forum members.

3.3.2. Sample size determination

Sample size was designed to consider the representativeness of population, desired level of confidence to achieve reliability and parameters interest in the study and cost constraints.

For survey, the researcher determined the sample size by employed Yamane sample size determination formula (Yamane, 2004). Thus, from the total of 16,542 populations was determined accordingly. To calculate sample sizes was considered 95% confidence level which is P = 0.5. The formula of Yamane is written as:

$$\boldsymbol{n = N/1+N(e)^2}$$

Where,

N = Number of total population

n = Sample size

e = Level of precision (0.05).

Then, based on this formula,

$$n = \frac{16{,}542}{1 + 16{,}542\ (0.05)^2}$$

$$n = \frac{16{,}542}{1 + 16{,}542\ (0.0025)}$$

$$n = 390$$

Therefore, for this study, the total sample size of the study population was 390. The size of the sample depended on the purpose of the study, the nature of the population under scrutiny, the precision the researcher desires in estimating the population parameter, and available budget. This was done by using probability proportional sampling to the size of the population in each kebeles and technique staff. The sampling frame for this study were kebeles diary, MOWE, RVBAO and Sidama regional environment protection bureau hiring, which consists lists of groups in the selected kebeles and bureau was used as guidance.

The method is shown below:-

$$NK_1 = \frac{NK_1 * n}{N}$$

$$Nk_2 = \frac{NK_2 * n}{N}$$

$$NT_3 = \frac{NT_3 * n}{N}$$

Where:,

N= Total population

n = Sample size

Table 3.2: Sample Size distribution

Definite of population	N	n
Nearest lower catchment area household (Nk1)		
Jara Damwa,	3,293	78
Galo Argisa tulo	4,234	100
Gudumale kebele	5,125	120
Far lower catchment area household (NK_2)		
Sama Agiras	3,653	86
Technical staff (NT3)		
Ministry of Water and Energy (MOWE) (including RVBAO	202	5
Sidama Environmental Protection Authority	34	1
Total	**16,542**	**390**

Source, RVBAO, 2023

3.4. DATA COLLECTION INSTRUMENTS

3.4.1. Survey questionnaire

As discussed early, the researcher used descriptive research design with a combination of both quantitative and qualitative approaches. Data gathered using survey tools in order to accomplish the study's stated goals and responded to the research questions. A closed-ended questionnaire employed as the data collection tool for this study's purposes. Since this tool is less expensive and takes less time to use than other measuring instruments, it could be administered to groups of people at once (Meyer, 1990). Based on the research question, the questionnaire was designed by the researcher. According to a scale of 1 to 5, respondents were asked to rate their level of agreement with the item in the survey. In the absence of a buffer zone policy, concerns including pressure and effect, obstacles, impeding water resource management (WRM), and threat were emphasized on as they relate to the connectedness between urbanization and water bodies while developed the questionnaire.

To make the question straightforward, intelligible, and accessible to responders, the questionnaire was translated into Amharic, the country's official language. The demographic and socio-economic circumstances of the target households (sex, age, marital status, educational status, and watershed management experience), the usability of the water

resources, threats to those resources, institutions and policies that affect households, the level of technical staff participation, and the main obstacles that prevent the use of watershed management practices in light of the legal and policy framework were all heavily weighted during the preparation and collection of the questionnaire.

In the data collection process five enumerators who speak local language were employed. Before started the data gathering, brief orientations was held and offered to enumerators by the researcher regarding how to approach, handle the interview and discuss on each question. Thus, enumerators during the data collection was used both local and national language ("Sidamgna and Amahric'') for those who speak "Sidamgna'' in order to make clear understanding of the given questions. In addition, the enumerators were provided with the necessary stationery materials to take additional notes. At the beginning stage of the survey, an informal meeting was held with representative household in order to know the general practices and watershed management situations of the study area. Finally, the whole process was administered under the close supervision of researcher to minimize errors.

3.4.2. Key informant interview

The researcher used semi structured interview guideline for key informants interview (KII) because of its flexibility and to make its clear any time when there is ambiguity. In the absence of a buffer zone policy, concerns including pressure and effect, obstacles, impeding water resource management (WRM), and threat were emphasized on as they relate to the connectedness between urbanization and water bodies while developed the interview. The interview was held with key informant who was purposively selected from the Ministry of Water and Energy (MOWE) (including RVBAO technical staff, Sidama Regional Environmental Protection Authority relevant expertise, University Sub-Basin Industry Linkage Forum members (Hawassa, Wolita Sodo, Dila, and Arba Munich University) and households of lower catchment that they had relevant information. In line of this, interview was held with seventh (17) members, four (4) from MOWE (including RVBAO) technique staff, four (4) from the Sidama National Regional Environmental Protection Authority and four (4) from University Sub-Basin Industry Linkage forum members and five (5) kebele administrators who were selected from each sample kebele. The interviews was took place

face to face conversations in conducive setting. A short note was taken during the interview and full account of the story was writing immediately after the interview.

Table 3.3: Key Informant interview sample

Key Information categories'		Remark
MOWE including RVBAO	4	Two from MOWE and two from RVBAO
Sidama National Regional Environmental Protection Authority	4	
University Sub-Basin Industry Linkage Forum members	4	One from each university
Kebele administrators	5	One from each sample kebele
Total	17	

Source: Field survey, 2023

3.4.3. Field observation

Field observation was conducted throughout the whole process of the research in order to make sure the validity of information obtained. It was done with the purpose of getting guidance for development, for the formal question, and to be acquainted with the perception of local people especially the "effect" "pressure" and "the nexus" between urbanization and water body in light of lack of a buffer zone policy. During direct observation, field notes and visual photographs of some important catchment area and what actions visit in the lack of a buffer zone policy and its effects on water bodies were taken. Thus, the researcher opinion summed up in the analysis based on before and after household and technical staff survey data collection, her visit of the study area.

3.5. DATE SOURCE AND TYPES

To achieve the objectives stated in chapter one in this study, data was collected through primary and secondary sources. The primary sources of data have been generated through questionnaires, interviews (KIIs) and direct observation. Secondary sources of data was collected from both published (books, journals, articles, reports and papers, magazines) and unpublished official documents from concerned offices to make the study complete. Secondary data serves researchers with the opportunity to better understand and explain the

research problem (Biggam, 2008). Thus, it is very important to start a review of the existing data with clear mind set of what it is that one wants to accomplish with the study.

3.6. METHOD OF DATA ANALYSIS AND PRESENTATION

As indicated earlier, the research was employed qualitative and quantitative research approach. The data that was collected via questionnaires and key informant were organized accordingly. The data obtained via questionnaires was fed and analyzed used statistical Package for Social Science (SPSS-21version). Data gathered through the quantitative method was presented with descriptive statistics; frequency, mean, standard deviation, and correlation statistical. The qualitative aspect of the data was presented to strengthen and to supplement the results of the quantitative data.

3.7. VARIABLES SELECTION OF THE STUDY

The researcher was employed both independent and dependent variables in the study. Independent variable was the variables that the researchers utilized to measure the buffer zone policy. On the other hand, the variables that the researchers utilized to measure urbanization and the interconnection of water bodies, along with the pressures, threats, and challenges they present, could be regarded as dependent variables.

3.8. RELIABILITY AND VALIDITY

Reliability and validity are two key components to be considered when evaluating the instrument used within this study. According to many literatures indicating reliability is concerned with the consistence of the instrument and an instrument used in this study is said to have high reliability if it can be trusted to give an accurate and consistent measurement of an unchanging value. The validity of an instrument refers to how an instrument measures the particular concept it is supposed to measure. Thus, in this study, the researcher used questionnaire that the validity and reliability was checked according to the specific topic. The researcher was tested the reliability employed Cronbach's Alpha (α) which measure an internal consistency test that measures the degree to which the items or measurements consistently measures the underlying construct, the result of the Cronbach's coefficient of reliability test was indicated it's consistency throughout the study (Creswell, 2010). Therefore, the reliability and validity of the instruments ensured in this study through pilots test within target sample population.

3.8.1. Reliability of the measurement instrument (developed questionnaire)

The intention of this part is to analyze the reliability of the instruments utilized in this thesis, namely the developed questionnaire by the researcher based on the objective of the study. The results obtained are compared to the reliability results of other studies conducted with the same instruments. The reliability level of the instrument is represented by Alpha Cronbach (Creswell, 2010). Pallant (2001) states Alpha Cronbach's value above 0.6 is considered high reliability and acceptable index (Nunnally and Bernstein, 1994). Whereas, the value of Alpha Cronbach is less than 0.6 considered low. Alpha Cronbach values in the range of 0.60-0.80 are considered moderate, but acceptable. While Alpha Cronbach in the ranges of 0.8 and up to 1.00 is consider very good. Therefore, through this study the determination of Alpha Cronbach values on instruments developed is used to determine the degree of reliability of the instruments.

Cronbach's alpha coefficient was utilized to determine the reliability of the nexus between urbanization and waters bodies in light of absence of buffer zone policy related pressure and effect, challenges, hindering water resource management (WRM) and threat questionnaire by stated value Pallant (2001). Table 3.3 illustrates below the Cronbach's alpha coefficients value.

Table 3.4: Cronbach's alpha reliability of the Nexus between urbanization and waters bodies in light of absence of buffer zone policy

The nexus between urbanization and water bodies and policy related items	No of items	Cronbach's Alpha	Remark
Pressure and effect	7	0.851	> 700 Good and Acceptable
Challenges	8	0.834	> 700 Good and Acceptable
Hindering WRM	6	0.789	> 700 Good and Acceptable
Threat	7	0.754	> 700 Good and Acceptable

Source: Survey Data, 2023

Table 3.4 above indicated that the nexus between urbanization and waters bodies in light of absence of buffer zone policy related pressure and effect, challenges, hindering water

resource management (WRM) and threat scale has a good reliability of 0.851, 0.834, 0.789 and 0.754, respectively which was compared favorably better than the value of 0.87 determined by Pallant (2001). Thus, the nexus between urbanization and water bodies and buffer zone policy related items had good and acceptable Cronbach's alpha values that they indicated their scales yield consistent results. This implied that the reliability of the nexus between urbanization and water bodies and buffer zone policy related items were better than that of good and acceptable set standards. Therefore, in terms scales they all yielded acceptable Cronbach's alpha scores.

3.8.2. Validity

Quantitative Data: This study used Content Validity Index (CVI) so as to establish the degree to which a sample of items, taken together, constitutes an adequate operational definition of a construct. According to Beck and Gable (2001), to examine the content validity, professional subjective judgment is required to determine the extent to which the scale was designed to measure a trait of interest. This is because content validity is a subjective judgment of experts about the degree of relevant construct in an assessment instrument. However, inclusion of at least five experts (mostly senior lecturers, associate professors, and professors) in that field or five to ten experts would be useful to judge the content domains of a scale through use of rating scales (Mugenda & Mugenda, 2003). The researcher achieved this by involving area specialization and experts in the field of Environmentalist, Water Supply and Environmental engineering, Water Resources Engineering , specifically two (2) Environmentalist and (1) Water Supply and Environmental Engineer from Rift valley basin authority administrative office, and two researchers in the area of Lake Hawassa watershed from University Sub-Basin Industry Linkage Forum members. Their suggestions, expert opinions and recommendations were adjusted accordingly and the following formula was used to substantiate it.

Where CVI=Content Validity Index

According to Amin (2005), if the CVI is ≥0.70, the items are considered valid; therefore, the results of 0.91 index shows that the instrument was valid.

Qualitative Data: Validity under the qualitative model is exhaustively theorized into five dimensions, that is, descriptive, interpretive, theoretical, generalizability and evaluative validity although other dimensions are identified (Maxwell, 1992). However this study employed interpretive validity. In order to ensure interpretive validity which resultantly enhances trustfulness of the data, measure was taken to ensure that the interpretations reflect the participants' perspectives, not the researcher's. The intention was to ensure that the participants' words and actions were interpreted rightly and without bias. To realize this, the data analysis was exposed to an expert reviewer who was adequately knowledgeable about the subject matter and context. This, in view of Saunders, et al. (2012) safeguards against a situation of "holistic fallacy" where data or results have a habit of looking more patterned, consistent or similar than they were and the tendency of the researcher to selectively note and record certain data at the expense of other data.

3.9. ETHICAL CONSIDERATIONS

This study observed the following ethical considerations:

The researcher ensured quality and integrity by reporting only what she found in the field and following a scientific and generalized report writing for academic research.

The researcher respected the confidentiality and anonymity of the research respondents by involving them in the study in their own terms and place of convenience and coding their names in the final report of the study.

The researcher ensured that participating in the study was voluntary. No one was coerced, forced or bribed in order to be part of the study. The researcher also ensured voluntary withdrawal from the study in case of change of mind by the respondent.

Last but not least, the researcher ensured that the final reporting was impartial and independent of her personal opinion rather it was the opinion of the respondents that were used in the final analysis of the research.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

This chapter discussed the results from the household, technical employees' survey, also interviews and field observation with district catchment area inhabitants. Along with the researcher's observations and judgment from the field, information about challenges and interventions in the field of water resource management that was learned through prior training and experience has also been included. The threat, effect, and insufficiency that the Lake Hawassa watershed is experiencing are examined in this chapter. The overall results showed that pressures arise from both legal and illegal activities; they might have direct and indirect effects as well as urbanization and water bodies' connectivity in the absence of a buffer zone policy on Lake Hawassa watershed areas.

4.1.DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF STUDY AREA

It is essential to comprehend the socioeconomic and demographic background of the sample group in order to comprehend their characteristics and carry out research in the study area. Technical employees and households for a formal survey totaled 16,542 individuals, of whom 13,915 were men and 2,627 were women. A formal survey was conducted among this entire population, with the participation of 390 technical staff sample sizes, households from the nearby lower catchment areas (Jara Damwa and Galo Argisa, Tuloo and Gudumale kebeles), the distant catchment area Sama Agirsa kebeles, and the Sidama environmental protection bureau, MoWE and RVLBAO.

4.1.1. Sex Composition of the Respondents

The results from the sample indicated that households with men and technical employees make up the majority of participants. 76.2 % of the 390 sample households and technical employees that responded were MHHs, and the remaining 23.8 % were FHHs. The study area's technical staff and male and female sample households were both proportionally chosen. Males in the catchment area of the Lake Hawassa watershed had better socio-economic possibilities, more access to resource information, and heavier daily workloads related to water resource management than females do. Additionally, it is asserted that

having a female head of household might have an impact on the Lake Hawassa watershed's catchment area because women might have less access to information, land, and other resources management. Sisay (2016) found that because of their socio-cultural standing, male-headed families participate more in catchment area practices than their female counterparts and have greater access to resources and information about newer technology. Male extension agents typically work with houses headed by men. Male-headed households aggressively occupied crop land within the watersheds, leaving degraded bare properties and irrigated vegetation, which negatively impacts Lake Hawassa's life through sedimentation and siltation in addition to heavy use for irrigation after the Lake's drying catchment.

Table 4.1: Sex of the respondents

Variable	Category	F	%
Sex of the HHs and technical employees	Male	297	76.2
	Female	93	23.8
Total		390	100

Source: Survey data, 2023

NB: F=Frequency; %= percentage

4.1.2. Age groups of the respondents

It is another demographic variable assumed in affecting household participation in watershed management practices. Concerning the age characteristics of the households and technical employees classified into five age groups. The majority 43.6% of respondents are between the ages of 30-39 years old. About 25.4% of them accounted for household heads and technical employees aging between 20-29 years while 20.3 percent were 40-49 years old. 8.2 % and 2.6 % accounted for 50 and above years and less than 20 years old, respectively. The smallest portion of household heads and technical employees whose age groups were < 20 years old constituted 2.6 %. Most respondents 43.6 % were in the age range of 30-39 years old. As age increases, household heads and technical employees probably acquired more water resource management experiences and they perceive the effect and challenges of absence of buffer zone policy in Lake Hawassa watershed. The result was consistent with some studies, like Letsinger (2011) and Sissay (2016) reported as a negative nexus between urbanization and water bodies' connectivity and age distribution. It was possible to conclude

that the largest portions of a respondent were in the working age group and they had obtained enough experience in their lifetime in the study area. As explored through structured interviews, the household heads and technical employees of these age groups to have good understanding on the issues of absence of buffer management policy in Lake Hawassa watershed problem and are usually more interested in implementing buffer zone policy in Lake Hawassa watershed than the other age groups.

Table 4.2: Ages groups of the respondents

Variable	F	%
Less than 20 years	10	2.6
20-29	99	25.4
30-39	170	43.6
40-49	79	20.3
50 and above	32	8.2
Total	390	100

Source: Survey data, 2023

4.1.3. Marital statuses sample household heads and technical staff

Based on the findings of the study area, the marital status of sample households and technical employees' results showed that 72.8 % of the respondents were married. The rest of the respondents 25.9 % were single and 1.3 % was divorced. The least one was divorced respondents. This result was in-line with the findings of Senait (2005) that water resources management and efficient utilization were very much unpracticed by married people.

Table 4.3: Marital statuses of the respondents'

Marital Status	F	%
Single	101	25.9
Married	284	72.8
Divorced	5	1.3
Total	390	100

Source: Survey data, 2023

4.1.4. Family size of the respondents

In Ethiopia, the main labor sources were the family members including wife and children (Alemayehu, 2007). Water resource management practice is influenced by the size of family members who need to fulfill their home consumption. From the sample households in the area indicated that 54.9 % of respondents had household sizes ranged between 1 and 4. The next larger household sizes between 5 and 8 members who accounted for 26.9 % of households. 16.2 % no family members and 2.1 % had more than 9 family members. The least household sizes had more than 9 family members constituting 2.1 %. The households with the nearest catchment of Lake Hawssa watershed area expected to utilize resource in surrounding area. Earlier studies conducted by EPA (2003) the farmers with large family size were more likely engaged in long term utilized the environment inappropriate ways. Another previous study indicated that family sizes had negative and significant influence on environmental management (Aklilu, 2006).

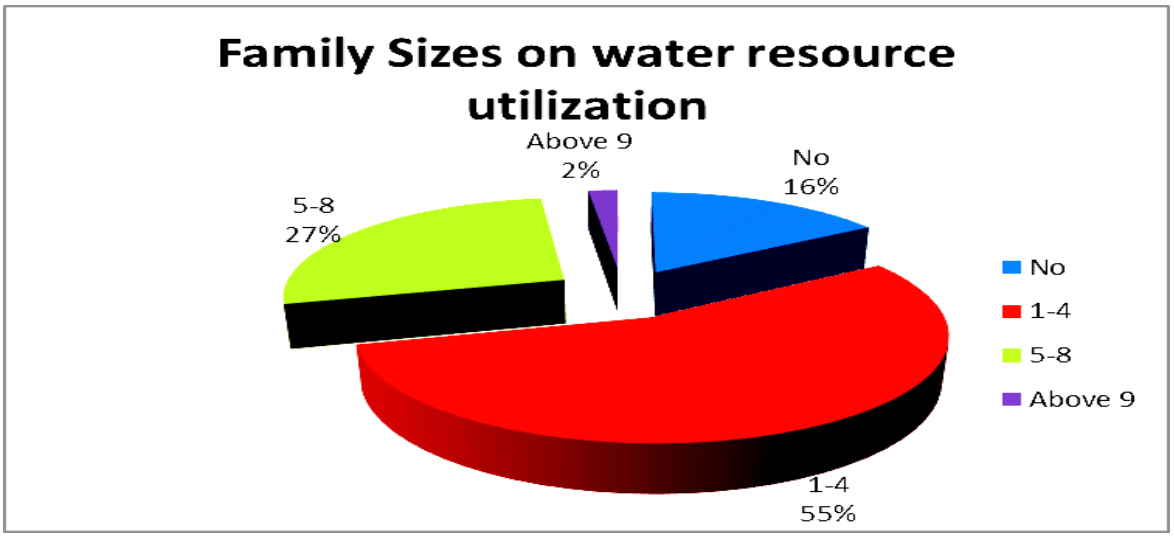

Figure 4.1: Family sizes of the respondents'

Source: Survey data, 2023

4.1.5. Education status of the respondents

Education is one of the basic human needs that all human beings deserve for the proper understanding of socio-economic, institutional and biophysical environment. With regard to level of education, 19.7 % of the respondents' attended primary school first cycle (1-4), 28.2

% completed primary school second cycle (Grade 5-8) education and 6.9 % of respondents completed secondary school education (Grade 9-12) and 10.3 % had diploma certificate. Moreover, 19.5 % of respondents completed tertiary education (First degree) and 15.4 % second degree, respectively. The result showed that the majority of respondents' attended primary and secondary school cycle. The study resulted were in line with Lakew.et.al (2013) concluded that literacy status has a significant role in the implementation of water conservation practices and could be integrated with local practices. The practical performance of respondents who attended primary education (1-8) was better than that of respondents who did not attend formal education. Similarly, respondents who attended secondary school (Grade 9-12) and diploma and above were found to be superior compared to primary education in general (Haile and Assefa, 2012). Therefore, the above survey result indicated that the majority of respondents had low level of educational qualification which could be a challenged towards water resource management for effective utilization. The conclusion was the opposite of the premise hence, effective water resource conservation practices and literacy has direct relation with water resource management.

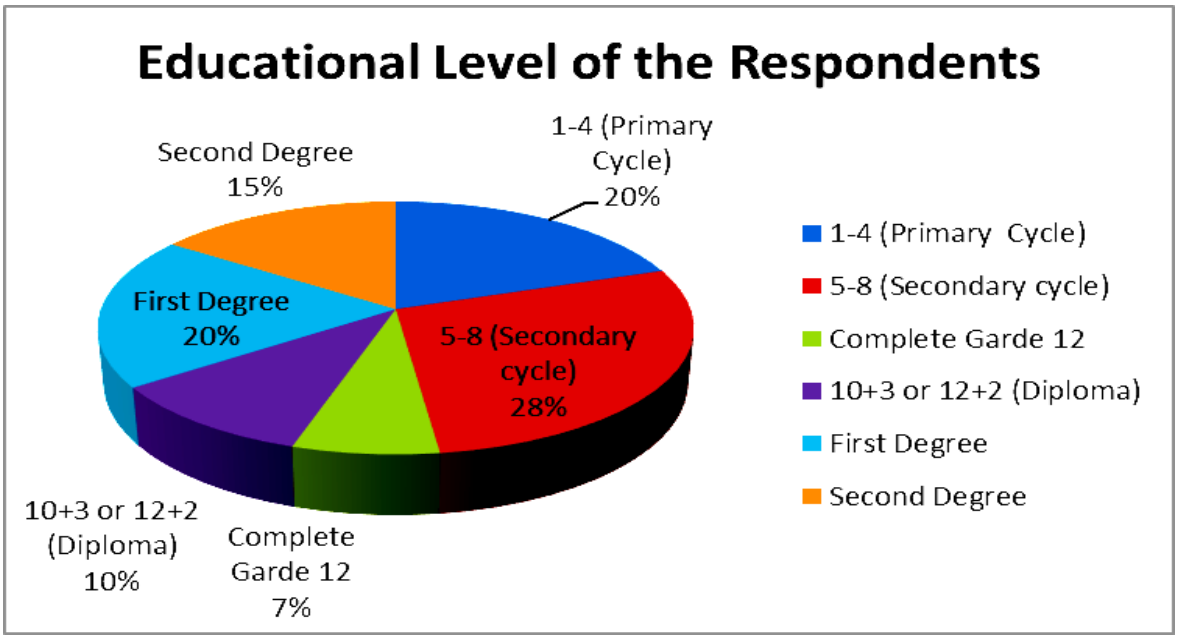

Figure 4.2: Distribution of respondents based on education level

Source: Survey data, 2023

4.1.6. Accesses of training/workshop on water resources management practice

This study results in Table 4.4 indicated that 57 (14.6%) of the respondents' were trained with about 1-2 times which was given by Ministry of Water and Energy and Environmental Protection Office to household heads and technical employees, while 42 (10.8%) of the respondents also trained in average 3-4 times were given by district office and 33.2% was given by NGO. The rest 35 (9%) of the respondents were trained more than five. This showed that the respondents have understood about water resource management and also aware the effect that could harm the surrounding area of wetlands.

Table 4.4: Access of awareness creation/workshop on WRM

Category	F	%
1-2 times	57	14.6
3-4 times	42	10.8
5 and above	35	9
Has no access	256	65.64
Total	390	100

Source: Survey data, 2023

4.2. SURVAY ANALYSIS AND DISCUSSION

This section comprises the analysis of data acquired from households head, technical employees/ expertise and University Sub-basin Industry Linkage Forum Members from catchment area kebele households, MOWE, Sidama Regional Environment Protection authority and UIL.

The relationship between urbanization and connectivity of water bodies in light of the absence of a buffer zone policy and its pressure, challenge and threaten on water bodies and watershed in generals questions have presented in the questionnaire to be responded by households head, technical employees/ expertise and UIL, as well as the interview was conducted with all the aforementioned participants was arranged and analyzed in the following tables. For the purpose of analysis, the responds were rated as;

Rattray & Jones (2007) identified the range categories for the purpose of data analysis and decision; thus the research was used likert scale categories based on the following perspective.

≤ 1.49 = Strongly Disagree (1), 1.50-2.49 = Disagree (2), 2.50-3.49 = Uncertain (3), 3.50-4.49 = Agree (4) and ≥4.50 = strongly Agree (5)

The responses of key information were obtained and converted in to; Mean (M), Standard deviation (SD), and Percentage (%) for meaningful interpretation.

Table 4.5: Mean values for nexus between urbanization and connectivity of water bodies in light of the absence of a buffer zone policy

Scale	Mean range	Level of agreement	Interpretation
5	4.5-5.00	Strongly agree	Very Satisfactory
4	3.5-4.49	Agree	Satisfactory
3	2.5-3.49	Not sure	Fairly satisfactory
2	1.5-2.49	Disagree	Unsatisfactory
1	1.00-1.49	Strongly disagree	Very unsatisfactory

Source: Rattray & Jones, 2007

4.2.1. Pressure Due to the Nexus between Urbanization and Water bodies' Connectivity in Light of Lake of Buffer Zone Policy

Based on the data obtained from Table 4:6 the researcher was dig out that to understand towards the relationship between urbanization and connectivity of water bodies in light of the absence of a buffer zone policy and in turn the pressures.

Table 4.6: The Pressures in light of the nexus between urbanization and water bodies' connectivity

Opinion of the respondents on Nexus between Urbanization and Water bodies' and its Pressures	**Likert's rating score**											
	SD		**DA**		**Un**		**AG**		**SA**			
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**M**	**SD**
The probability of the threat and pressure	8	2.1	30	7.7	14	3.6	149	38.2	189	48.5	4.39	0.74
The threat will not be a threat	103	26.4	200	51.3	59	15.1	14	3.6	14	3.6	1.85	.62
The pressures (legal and illegal) activities	3	0.8	26	6.7	37	9.5	204	52.3	120	30.8	4.06	.85
The main pressures and threats to consider	4	1.0	17	4.4	37	9.5	202	51.8	130	33.3	4.12	.81
Urbanization effect	8	2.1	28	7.2	70	17.9	209	53.6	75	19.2	4.15	.89
Illegal activities	7	1.8	10	2.6	29	7.4	216	55.4	128	32.8	4.15	.80
The high level intensity between urbanization and water bodies'	4	1	10	2.6	60	15.4	203	52.1	113	29	4.05	0.79

Source: Survey data, 2023

NB: SD= Strongly Disagree (1), DA=Disagree (2), UN= Unsure (3), AG= Agree (4), and SA=strongly Agree (5)

As shown in Table 4.6 item one, 48.5% of the respondents strongly agreed that considerable pressure were likely to emerge in and around the Lake Hawassa watershed if the relationship between urbanization and the connectivity of water bodies was not managed. While 38.2% of the respondents indicated that they agree with the observation of considerable pressure. However, some respondents 2.1% and 7.7% revealed that they disagree and strongly agree, respectively, about the likelihood of major pressure in and near Lake Hawassa watershed. About 3.6% of the respondents indicated they were unsure about serious pressure. However, there was a disparity in how pressures are likely to be experienced because of Lake Hawassa lacks a buffer zone policy. However, the statement's mean rating score with standard deviation was 4.39 and 0.74, falling in the agree level and implying what encounter Lake Hawassa and its tributaries based on the opinions of the general respondents. This showed that, on average, most respondents believed that high level pressure were presented around Lake Hawassa's tributaries, which had an impact on the lake's water bodies. Previous study of Amanuel Aklilu (2011) also confirmed that if no legal enforcement and buffer zone policy had seriousness of pressure and threat which was led finally to over-grazing and livestock watering, washing clothes and irrigating crops were some of the additional activities which can threaten the lake ecosystem.

In addition to the discussion of the foregoing quantitative data, the researcher dealt with qualitative data gathered via in-depth interview conversations with representative interviewees. Some of KII participants' were believed that lake has also been exposed to pressure from neighboring agricultural activities. Due to nexus between urbanization and connectivity of water bodies' waste water is being directly discharged into the lake. According to the participants' indiscriminate disposal of waste water in to the lake can have an adverse impact on its sustainability and created pressure on ecosystem. This is mainly because untreated of the high intensity nexus between urbanization and connectivity of water bodies.

According to the survey results in Table 4.6, item 2, around 51.3% respondents strongly disagreed that if the buffer zone policy will not be ratified and put into practice, the threat will exist in the watershed (catchment area) in the next three years. While 26.4% respondents indicated that they disagreed that these threats will likely pose a threat. However, some

respondents 3.6% and 3.6% said they strongly agree and agree, respectively, that the threat will not likely to come true in the future and that the risk of it happening in and around the Lake Hawassa watershed might be extremely high. About 15.1% of the respondents said they were unclear of the threats. The degree and extent of the threat in the past, outside causes including ecosystem pressures, and current management restraints in the study area are all things to take into account when determining the possibility of the threat. The statement's mean rating score with standard deviation, however, was 1.85 and 1.3, falling in the disagree range and suggesting that there is a possibility that Lake Hawassa and its tributaries will face a threat in the coming if the buffer zone policy is not ratified and put into practice. This demonstrated that, on average, most respondents think that if the buffer zone management strategy is not approved and implemented in and around Lake Hawassa's watershed, its parts and tributaries, a high degree threat will occur and challenges. The researcher also dealt with qualitative data obtained through in-depth interviews with representative interviewees, in addition to discussing the aforementioned quantitative data. According to the majority of interviewees, if the buffer zone policy is not ratified and put into effect, there would likely be a threat in the watershed area surrounding it within the next three years. Additionally, they thought that the lake was more at risk from the watershed's negative human impacts and needed mitigation measures to stop future degradation.

The results of items 3 in Table 4.6 revealed that the majority of the respondents 52.3% agreed that the pressures include both legal and illegal activities, and might result from direct and indirect impacts on unprotected area of Lake Hawassa watershed. Also, 30.8% of respondents indicated that they strongly agreed that such legal and illegal activities had effect on watershed area. However, about 0.8% and 6.7% of respondents disagreed and strongly disagreed, respectively, concerning the legal and illegal activities. On the other hand, 9.5% of the respondents were unsure. The mean rating score with standard deviation for the respondents' overall assessment of the legal and illegal activities was 4.06 and 0.85, respectively, falling within the agree range. This demonstrated that, on average, the majority of respondents think that the legal and illegal activities have greatly affect the Lake Hawassa and its water bodies. In addition to analyzing the aforementioned quantitative data, the researcher also dealt with qualitative data collected through in-depth interviews with

representative participants. The majority of the interviewees who were located in the Gudumale kebele and Haik Dar sub-city stated that the illegal expansion had had a significant impact on the watershed. The majority of participants firmly believed that, notwithstanding the Kebele administrations' limited control over the area, the watershed was accessible for farming and housing purposes. According to information from the Gudumale kebele government, 400 people were recently accused of engaging in erroneous house construction and farming operations near/in the lake watershed.

Similarly, the results of item 4 in Table 4.6 depicted that around 51.8% of the respondents were agreed, whereas 33.3% strongly agreed with the assertion that "one of the main pressures to consider in Lake Hawassa, watershed as include legal and illegal logging, fishing, drinking water, agriculture, inappropriate waste disposal from legal activities as urbanization take place alarmingly". The fact that about 1.0% and 4.4% of respondents disagreed and strongly disagreed, respectively, concerning the legal and illegal pressures on the watershed (catchment area), indicated that there were a significant amount of pressure for all activities within Lake Hawassa and its catchment area. In contrary with level of agreement, 9.5% of respondents were unsure for those legal and illegal pressures. The respondents' average rating score with standard deviation for the legal and illegal pressures was 4.12 and 0.81, respectively, falling within the agree range. This showed that, on average, most respondents believed that increasing urbanization was one of the problems that Lake Hawassa and its water bodies must deal with.

In relation to the claim “urbanization effect in Lake Hawassa watershed in light social, cultural, or economic importance," in Table 4.6 Item 5 around 53.6% of respondents agreed with it and 19.2% of them strongly agreed, while 2.1% and 7.2 of the respondents are strongly disagreed and disagreed. On the other hand, 17.9% of the respondents were unsure, with the statement. The respondents' mean rating score with a standard deviation of 4.15 and 0.89, respectively, the respondents' mean rating scores for the tasks were within the agreed range. This showed that the majority of respondents thought that rapid urbanization had a negative impact on Lake Hawassa and its surrounding water bodies by transferring social, cultural, and economic value.

The above result was in line with some research. For instance, the findings of several researches, such as those by Kassaye et al, (2012), indicated that Lake Hawassa has a high concentration of sediments and fish species as a result of exposure to urbanization's effluents. Similar findings about the pattern of urbanization's expansion and its impact were also found in the study by Degif et al. (2019). The findings of his study indicated that compared to other natural resources, urban lakes are more vulnerable to urban and human activity. A detailed study on the relationship between urbanization and lake management is required, something that is lacking in the context of Africa in general and Ethiopia in particular. Furthermore, his analysis proved that urbanization had considerable detrimental consequences on lakes. The researcher additionally dealt with qualitative information gathered through in-depth interviews with representative participants in addition to the analysis of the aforementioned quantitative data. The majority of participants agreed that the increased industry and urbanization in the Lake Hawassa watershed had an effect on the quantity and quality of water. Participants listed a number of issues related to urbanization, such as inadequate sewage and waste management, which results in runoff and pollution of water supplies.

Likewise, the results of Item 6 in Table 4.6 demonstrated that almost 32.8% of the respondents agreed with the assertion that illegal activities within the catchment area were difficult to manage while urbanization alarmingly increasing around the Lake Hawassa. Similarly, 55.4% of respondents strongly agreed with the difficulty of illegal activities to manage. However, 1.8% of the respondents disagreed and 2.6% of them strongly disagreed when asked about the illegal activities within the catchment which was difficult to manage around the Lake Hawassa. Around 7.4% of respondents were unsure of the statements. The respondents' mean rating score with standard deviation for the illegal activities within the catchment was 4.15 and 0.80, respectively, falling within the agree range. The majority of respondents, it might be inferred from these remarks, the illegal activities within the catchment were beyond the capacity to manage in and around the lake and its environs.

The last item result in Table 4.6 revealed that, the majority of the respondents 52.1% were strongly agreed with the strong correlation between urbanization and the connection of water bodies in light of the absence of law enforcement in the Lake Hawassa. Furthermore, 29% of respondents indicated that they agreed with the high degree of intensity between them. In

contrast, around 1% and 2.6% of them rated disagreed and strongly disagreed, respectively, about the degree of severe dependency between urbanization and connectivity of water bodies. The rest 15.4% of respondents were unsure of the assertions in light of the respondent. According to the respondents' overall perceptions, the statement's mean rating score with standard deviation was 4.05 and 0.79, falling inside the agree range. It also indicated that, on average, respondents thought there would be high-intensity interactions between urbanization and water bodies in the absence of law enforcement, and that these interactions would have an adverse effect on Lake Hawassa and its water bodies.

In addition to the above results obtained via survey and interview, the filed observation data depicted that due to Lacking a buffer zone policy, Lake Hawassa and its tributaries, as well as its wetlands, had come under pressure from a variety of activities, such as floating, walking close to the Lake, washing and swimming, dropping plastic caps, organic garbage, restaurant waste, and the like. As displayed in the accompanying figure 4.3 and 4.4, the catchment surrounding of Lake Hawassa was a source of various pollutants and dirt due to the interaction between urbanization and water bodies. The liquid and solid wastes are dumped straight into this study area because there was no buffer zone policy. As a result, the study area filled with organic garbage and non-biodegradable pollutants (plastic wastes, sediments). Due to uncontrollable urbanization and its negative effects on the Lake and its watershed, this study area typically exhibits characteristics of high border adversely effect, low wetlands cover, high sedimentation, high household wastes, and high wastewater disposal area, and others. This demonstrated that the need for buffer zone policies and other environmental protection laws to be enforced around Lake Hawassa and its wetland as depicted below figure.

Figure 4.3: The nexus between urbanization and water bodies' in practice in study area

Source: Field survey, 2023

Figure 4.4: Lak of buffer zone policy, the Nexus between urbanization and Water -bodies' at Lake Hawassa watershed at Haik Dar sub-city Gudumale kebele

Source: Field survey, 2023

Table 4.7: The challenges that the Lake Hawassa watershed faced

Challenges in-light of absence of buffer zone management policy	Likert's rating score											
	SD		**DA**		**Un**		**AG**		**SA**			
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**M**	**SD**
No boundary demarcation	11	2.8	6	1.5	40	10.3	151	38.7	182	46.7	4.2	0.9
Inconsistency of legally binding and, management strategies'	15	3.8	10	2.6	28	7.2	197	50.5	140	35.9	4.1	0.88
Un-proactive involvement of staffing and / or stakeholders'	4	1	18	4.6	39	10	214	54.9	115	29.5	4.07	0.81
Incremental of urbanization impact	7	1.8	11	2.8	17	4.4	206	52.8	149	38.2	4.23	0.80
Sustainable water resource management policy and strategies'	12	3.1	24	6.2	62	15.9	222	56.9	70	17.9	3.81	0.9
No buffer zone policy	4	1	10	2.6	60	15.4	203	52.1	113	29	4.05	0.79
Ratify policy and related law by legislature	17	4.4	28	7.2	99	25.4	125	32.1	121	31	3.78	1.1
Low level of awareness	11	2.8	20	5.1	43	11	145	37.2	171	43.8	4.14	0.99
Urbanization and its effect on watershed	8	2.1	17	4.4	20	5.1	165	42.3	180	46.2	4.26	0.89

Source: Survey data, 2023

According to Item 1 in table 4.7, the majority of respondents 46.7% said that they were strongly agreed that the absence of a buffer zone policy made it difficult to demarcate watershed (catchment area) boundaries. However, 38.7% of respondents indicated their agreement with these difficulties in their responses. Contrarily, about 2.8% and 1.5% respondents acknowledged that strongly disagreed and disagreed, respectively, with the issues of there being no boundary delineation on the Lake Hawassa watershed (catchment area). According to respondents' perceptions, the statement's mean rating score with standard deviation was 4.2 and 0.90, falling in the agree level. This demonstrated that the majority of

respondents consider the obstacles to be the lack of border demarcation in the Lake Hawassa watershed (catchment area) as lack of a buffer zone policy. Past studies also support the results of this study. For examples Wani et al., (2003) study results reveals that buffer zone management including demarcation border is increasingly being recognized as the ideal approach for integrated natural resources management in Lake Watershed areas. In order to achieve watershed objectives and maintain water quality and quantity, boundary delineation is viewed as a watershed management strategy (Combe and Najjar, 2009). Lake Watershed boundaries have not been the subject of many studies to date; instead, they have been discussed in the context of urban growth and how it affects the Lake Watershed (Liu et al., 2017; Ning et al., 2018; Tayyebi et al., 2011). Similar to Ethiopia, the importance of poorly managed Lake Watershed boundaries and associated social-ecological difficulties was overlooked by policy and other legal grounds for Lake Watershed areas (Benti et al., 2021).

On the other side, the researcher used qualitative information gathered through in-depth interviews with individuals who acted as sample interviewees. In actuality, more obstacles were mentioned in the bulk of the interviews as a whole. But they argued that the issue with the absence of a buffer zone policy was that it guaranteed socio-ecological difficulties. Uncertain property ownership rights caused by lakes of demarcation and mismatched and incompatible water uses are two issues that have been identified as challenges that have been growing over time and characterizing as a conflict of interest on water resource management between the community and concerned bodies due to demarcation.

The finding of item 2 in Table 4.7 showed that the majority of the respondents 50.5% indicated that they were agreed with the inconsistency of the legally required protection, management strategies, and cooperation between partners, local communities, and concerned organization’s for effective intervention on Lake Hawassa and its waters bodies. Additionally, 35.9% of respondents said that they were strongly agreed with the discrepancy. However, about 3.8% and 2.6% were strongly disagreed and disagreed regarding the discrepancy, respectively. The statement's mean rating score with standard deviation was 4.1 and 0.88 in terms of the respondents' overall perceptions, falling in the agree range. This demonstrated that, on average, respondents think that the inconsistent application of the legally required protection, management strategies, and collaborate among partners, local

communities, and concerned organizations is one of the challenges facing Lake Hawassa and its water bodies.

Previous study of Grima Tilahun, et al., (2014) also confirms and they believe that there is no single method of mitigating vulnerability in watershed. They assured that collaboration to fight against the invasion of lake and its tributaries. As mentioned in the aforementioned, establishing collaborative activities could serve the effort to halt the spread of invasive and help to implement mitigation strategies. In theirs finding pinpointed that organizing the different stakeholders in terms of research, awareness creation, sharing information and creating linkage between stakeholders it is possible to prevent the spread of water challenges in lakes.

The researcher, on the other hand, used qualitative data from in-depth interviews with persons who served as sample interviewees. In fact, majority of the total interviews noted and acknowledges the concept of integrated water resources management as a means to improve the efficient use and conservation of water resources.

In Table 4.7, Item 3 result showed that the majority of the respondents 54.9% were strongly agreed that proactive management of the catchment area of Lake Hawassa and associated water bodies was not being done by employees and/or stakeholders. Whereas, 29.5% of respondents indicated that they agreed that such passive involvement was inappropriate. However, about 1% and 4.6% of respondents disagreed and strongly disagreed, respectively, concerning the lack of proactive involvement. The mean rating score with standard deviation for the respondents' overall assessment of the challenges was 4.07 and 0.81, respectively, falling within the agree range. This demonstrated that, on average, the majority of respondents think that one of the challenges facing Lake Hawassa and its water bodies was the failure to proactively involve personnel and/or stakeholders in order to make an effective intervention. The study's findings agreed with those made by Zerihun (2003). He identifies proactive institutional arrangements as prioritizing actions to reduce challenges in the Lake Hawassa basin. But during the past several years, proactive management practices have had a growing impact on the ecosystem of the lake. His research produced recommendations for several government line agencies to carry out development projects and to make proactive management techniques viable.

Similar to above results, around 4.4% of the respondents were undecided, whereas 38.2% of them strongly agreed and 52.8% agreed with the assertion that "one of the challenges' the negative effects on watershed (catchment area) was as a results of an incremental of urbanization". However, 2.8% and 1.8 of respondents' determined disagreed and strongly disagree, respectively, about the detrimental impacts of urbanization on the watershed (catchment area). The respondents' average rating score with standard deviation for the challenges was 4.23 and 0.80, respectively, falling within the agree range. This showed that, on average, most respondents believed that increasing urbanization is one of the problems that Lake Hawassa and its water bodies must deal with. This finding was consistence with the finding was found by Legesse, (2010). As him, in Lake Hawassa, the expansions of urbanization and industrialization have exerted significant impacts on water quality and quantity. The challenges that are attributed to urbanization include lack of sewerage and proper waste management systems which causes waste-water runoff and pollution to water resources. Similarly, Adimasu (2015) , assured in his study showed that Lake Hawassa, one of the lakes located adjacent to Hawassa city, has been subject to several pollutants generated from alarmingly urbanization and impacted the life of the lake.

In addition to analyzing the aforementioned quantitative data, the researcher also dealt with qualitative data collected through in-depth interviews with representative participants. The majority of the interviewees assured that lakes faced challenge from driving factors of a higher rate of urbanization in a Lake Hawassa context. Moreover, other factors such as administrative and commercial and transport connectivity may also contribute to it as results of urbanization around Lakes.

Regarding the statement "sustainable water resource management policy and others including strategies were not incorporated in all aspects of policy development." Item 4 of Table 4.7, 56.9% of respondents were rated it as strongly agreed with it, and 17.9% agreed. On the other hand, 15.9% of the respondents were unsure. 3.1% and about 6.2 of the respondents are disagreed and strongly disagreed with the statement. The respondents' average rating score with standard deviation for the challenges was 3.81 and 0.90, respectively, falling within the agreed range. This showed that the majority of respondents considered that policy, strategies

and sustainable water resource management were not integrated in all parts of policy as necessary to effective Management Lake in and around its water bodies. The absence of integration and evidence-based support for several cross-sectoral policy issues makes it difficult to manage water resources sustainably (Ingold et al., 2016). This research looked into policy combinations that would lead to the development of more resource-effective and resilient water management systems, and the results were consistent with those obtained by Pakizer et al. in 2020. The authors discover that many countries did not have a policy mix that was consistent in determining the effects of its policy instruments, but they also find that linking substantive and procedural instruments has proven to be essential for successful policy.

In addition to analyzing the above data obtained from survey, the researcher also dealt with qualitative data collected through in-depth interviews. According to majority of participants in interviews assured that even if necessarily sustainable water resource management policy that lead to sustainability or to solving wicked environmental problems, there were imbalances policy guideline that had not contributed to sustainable water resource management on Lakes Hawassa. Moreover, they forwarded that did not seen and had not experience about successful integrating policy that include all concerned sectors.

The results of items in Table 4.7 showed that 29% of the respondents were strongly agreed with the assertion that rules and ordinances pertaining to traditional buffer zone are not effective to enforce at all levels. Similarly, 52.1% of respondents agreed with the statements. However, 1% strongly disagreed and 2.6% agreed when asked about the lack of laws and ordinances at all levels to enforce the buffer zone management in and around lakes and its water bodies. Around 15.4% of respondents were unsure of the statement. The respondents' average rating score with standard deviation for the challenges was 4.05 and 0.79, respectively, falling within the agree range. The majority of respondents, it might be inferred from these remarks, did not believe that there was a legitimate reason to establish a buffer zone around the lake and its environs.

Regarding the claim that the Lake Hawassa watershed was faced difficulty due to legislature's lack of focus, dedication to ratify policy and related law on buffer zone management. The majority of the participants 31% agreed, and 32.1% strongly agreed with

the statement. On the other side, 4.4% and 7.2% of total respondents rating the statement as disagreed and strongly disagreed, respectively. The mean rating score for the challenges among the respondents was 3.78, with a standard deviation of 1.14, which were within the acceptable range. From this results one can conclusion that the legislature's lack of attention and commitment to the ratify policy and accompanying law on buffer zone management was unquestionably impeding.

The finding results in last item of Table 4.7 demonstrated that the majority of the respondents 46.2% said that they strongly agreed with urbanization's impact on the watershed (catchment area). In addition, 42.3% of respondents were agreed with the impact of such urbanization on watersheds. However, 2.1% and 4.4% of total respondents were disagreed and strongly disagreed with urbanization and its impact on the watershed, respectively. The mean rating score with standard deviation for the respondents' overall assessment of urbanization and its impact on the watershed was 4.26 and 0.89, respectively, falling within the agree range. This demonstrated that, on average, the majority of respondents think that urbanization and its effects on the watershed in and around Lake Hawassa were one of the challenges that face Lake Hawassa and its water bodies.

In addition to the above results obtained via survey and interview, the filed observation data depicted that the Lake Hawassa catchment was impacted by a number of pollution sources, including organic pollution from residential, livestock and agricultural cultivation, heavy metal and other chemical pollution from industries and hotel, restaurant’s and resort discharge and agricultural chemical and pesticide pollution from agricultural areas. Conflict between the life of the lake and its watershed has steadily been brought on by the ever-growing human population, lax implementation of environmental laws, and irresponsible use of natural resources. As seen in the figure 4.5 below, the Lake Hawassa catchment was impacted by a number of pollution sources. Moreover, conflict between the natural resources of the Lake Hawassa catchment and the human population has been observed and confirmed during filed survey of the Lake Hawassa catchment study area. Gudumale kebele administrators assured that mainly illegal urbanization was considered as critical actor for such conflict. This conflict has been caused by the breakdown and loss of forestlands, clearing of riverbanks; poor land use planning and urbanization development adversely

influence the survival and the existence of Lake Life. The past studies also support the results of this study. For examples Getachew (2014), study results reveals that the frequent illegal activities, illegal stream, river diversion and damming, dumping of industrial waste in unapproved areas, cultivation along river bank buffers, and illegal conversion of public utility land for private use were adversely affected Lake Hawassa catchment as depicted in figure below.

Lack buffer zone riparian zone

Failed storm water in Gudumale kebele

Figure 4.5: The Challenges of Lake Hawassa Watershed in the absence of BZP

Source: Field Observation photo, 2023

The third objective of this study was to the problems hindering watershed's water resource management in Lake Hawassa. Thus, Table 4.8 gives the summary of the findings related with water resource management challenges.

Table 4.8: Shortcomings in the Lake Hawassa Watershed's Water Resource Management

Shortcomings	Likert's rating score											
	SD		DA		Un		AG		SA			
	F	%	F	%	F	%	F	%	F		M	SD
Urbanization and Its infrastructure development	11	2.8	20	5.1	23	6.4	186	47.7	150	38.5	4.19	0.84
Less local communities awareness	22	5.6	13	3.3	33	8.5	195	50	127	32.6	4.01	1.0
Incompatible strategies'	15	4	13	3.3	46	11.8	215	55.2	101	25.9	4.27	2.1
Incapacity to realization of water resource management policy	17	4.4	35	9	59	15.1	167	42.8	112	28.7	3.83	1.0
Incremental economical advantage around lake	30	7.7	41	10.5	73	18.7	135	34.6	111	28.5	3.66	1.2

Source: Survey data, 2023

The results of Item 1 in Table 4.8 showed that the majority of respondents 38.5% were agreed that effective water resource management in and around Lake Hawassa was troubled by urbanization and the resulting infrastructural development. Additionally, 38.7% of the total respondents said they strongly agreed with this contest in their answers. On the other hand, 2.8% and 5.1% of the total respondents admitted that they disagreed and strongly agreed, respectively, with the problems that urbanization and the expansion of infrastructure posed for efficient management of water resources. The statement's mean rating score with standard deviation, as seen by the respondents, was 4.19 and 0.84, falling in the agree range. This showed that the majority of respondents believed urbanization and the growth of accompanying infrastructure to be the problem preventing efficient management of water resources.

In Table 4.8 the survey results under Item 2 depicted that the majority of the respondents 50% agreed that the local residents had lack of awareness that needed to them to manage water resources effectively. While, 32.6% of the total respondents indicated that they agreed with the notion that the local residents had a low level of understanding regarding the management of water resources. However, around 5.6% and 3.3% respondents strongly

disagree and disagree, respectively, on the level of local communities' awareness. On the other hand, 8.5% of the total respondents were unsure if the local residents were becoming less aware or not. Regarding the respondents' overall perceptions, the statement's mean rating score with standard deviation was 4.01 and 1.0, falling within the agree range. This showed that, generally speaking, respondents believed that the local residents were less informed of how to manage water resources to allocate the resource effectively and maintain the Lake.

Incompatible strategies and actions among the relevant organizations (environmental office, lakes basin authority, etc.) were viewed by the majority of respondents 55.2% Item 3 of Table 4.8 and they agreed that as problems that hindered the management of water resources in and around Lake Hawassa. Also, 25.9% of the total respondents stated they strongly agreed with this flaw. It was known that, with regard to this flaw, 3.3% and 4.6% of the total respondents disagreed and strongly disagreed, respectively. The respondents' average rating score with standard deviation for the challenges was 4.27 and 2.1, respectively, both falling within the agree range. This showed that, on average, most respondents believed that incompatible plans and activities across interested organizations (environmental office, lakes basin) were one of the flaws that limit water resource management.

Similarly, the study result in Table 4.8, under Item 4 depicted that 15.1% of the total respondents were unsure whether there was a capacity gap to the realization of water resource management policy or not, while 28.7% agreed and 42.8% strongly agreed with the statement that "there is a capacity gap to the realization of water resource management policy". However, regarding the capability gap to realize such management on the watershed (catchment area) of Lake Hawassa, 9% and 4.4% of the total respondents disagreed and strongly disagreed, respectively. The average rating score among respondents for the skill-to-realization gap was 3.83, with a standard deviation of 1.0, both of which were within the agreeable range. This revealed that, on average, the majority of responders think there was a capacity gap to realize water resource management policy in Lake Hawassa and its water bodies.

The survey result in Item 5 of Table 4.8 revealed that around 34.6% of the total respondents agreed with the statement that "incremental economical advantage around Lake Hawassa watershed (catchment area) was shortcomings that impeding water resource management,"

and 28.5% of them strongly agreed with it. While 7.7% and 10.5% of the total respondents were strongly disagreed and disagreed, respectively, 18.7% of the respondents were undecided. The mean rating score with standard deviation given by respondents for the issues preventing effective management of water resources was 3.66 and 1.2, respectively, it was falling within the agree range. This suggested that the majority of respondents believed that the incremental economic advantage created by the lake Hawassa watershed was detrimental to the management of the lake's water resources.

The researcher also addressed qualitative data obtained through in-depth interviews with representative participants, in addition to the discussion of the previously mentioned quantitative data. The absence of a buffer zone policy allowed for the identification of the relationship between urbanization and water body connectivity, as well as the implications for the Lake Hawassa Watershed. According to their claims, activities between participating organizations (such as the environmental office and lakes basin authority), conflicting organizational plans, urbanization and the expansion of its infrastructure, and a lack of knowledge in the local community are the main causes of the problems with water resource management. As stated indicated, it is a concern in the study area. A significant obstacle in the management of water resources is these kinds of problems, in addition to what figure 4.6 below illustrates.

A number of the KII participants who took part in the interviews confirmed that the amount and quality of Lake Hawassa's water were negatively impacted by water resource management. The Lake was impacted by improper ecological landscape planning for the buffer zone and the development of recreational shore areas, financial challenges in performing conservation work, illicit activities close to Lake Hawassa, a lack of knowledge among the locals and settlers, and a lack of collaboration among stakeholders. Other problems that had exacerbated the situation were the push for urbanization, the strong desire for economic gain that arose from this quest, urban agriculture along the shore, and pollution. However, some of the rest confirmed that the city's wastes were not managed but rather dumped into wetlands, and there were no consistent controls in place to prevent point source pollution from shore area development.

The researcher also addressed the observational data files and firsthand reports of issues impeding the management of water resources in and around the Lake Hawassa watershed, in addition to the previously described discussion. The observation data that was filed showed that the lake is significantly impacted by low awareness, inadequate solid waste management, and lack of buffer zone policy. Furthermore, the primary point sources of pollution were municipal drainage systems and drainage systems from other infrastructures, such as hotels, restaurants, and hospitals. Urban population growth leads to a rise in the amount of trash dumped into lakes, which distorts the lake's ability to assimilate waste and eventually pollutes it irreversibly, as seen in figure 4.6 below. The findings of this investigation are corroborated by the previous survey. For instance, a survey conducted by the RVBAO (2022), indicated that traditional trash management techniques are employed, which have a detrimental effect on the lake, particularly in the communities surrounding the shoreline because they lack access to water services. Solid waste issues arise in the coastal region and at various locations in the buffer zone policy of the waterfront. Sites designated for specific purposes but left unoccupied are used as disposal points for solid waste.

Figure 4.6: Mismanagement of solid waste in and around Lake

Source: Field survey, 2023

Moreover, the filed observation data depicted that the lake Hawassa is used as a direct source of water for different functions in the city. Water are pumped directly from the lake using different pumps which were installed by government and private owners used for urban gardening, construction works, fire extinguishing, for recreational activities like swimming pools, ponds and other several purposes. Throughout filed observation confirmed that around twenty water tanks which are about 60,000 liters are used per day for various purposes. Thus, water use from the lake without considers the water balance could be leading a threat with its quality and amount. Such unsustainable consumption of water resources is caused by low awareness among stakeholders and absence of law enforcement.

Figure 4.7: Water resource consumption problems

Source: field survey, 2023

Table 4.9: Threaten of Lake Hawassa watershed's Existence and Consistency

Threaten	Likert's rating score											
	SD		DA		Un		AG		SA			
	F	%	F	%	F	%	F	%	F		M	SD
Declining mount of water and its quality	21	5.4	27	6.9	27	6.9	175	44.9	140	35.9	3.99	1.0
Diminished economic advantages	22	5.6	34	8.7	44	11.3	185	47.4	105	26.9	3.81	1.0
Severity of the threat over watershed	4	1.0	30	7.7	78	20	197	50.5	81	20.8	3.82	0.88
Pressures are forces, activities, or events that have already had a detrimental impact on the integrity of the catchment area	1	0.3	35	9.0	47	12.1	182	46.7	125	32.1	4.01	0.9
Diminished biological diversity, inhibited regenerative capacity, and/or impoverished the area's natural resources.	8	2.1	47	12.0	35	9.0	181	46.4	119	30.5	3.91	1.0
cross-boundary influences likely to be high	1	0.3	7	1.8	56	14.4	176	45.1	150	38.5	4.2	0.76
Increasing urbanization with pressure around Lake	7	1.8	10	2.6	10	2.56	186	47.7	177	45.4	4.35	0.73

Source: Survey data, 2023

As seen in Item 1 of Table 4.9 above, the majority of respondents 44.9% strongly agreed that Lake Hawassa's diminishing water quality and quantity were threats due to a lack of buffer zone policy. Moreover, 35.9% of respondents noted in their responses that they agreed with this threat. On the other side, the threat that the quantity and quality of the water in Lake Hawassa and its tributaries are deteriorating was noted by 5.4% and 6.9% of the total respondents strongly disagreed and disagreed, respectively. However, 6.9% of the respondents said they were unsure about the threat. According to the respondents' response, the statement's mean rating score with standard deviation was 3.99 and 1.0, falling inside the agreed range. This demonstrated that the majority of respondents think that the lack of a buffer zone management policy had resulted in a decrease in the quantity and quality of water in Lake Hawassa.

Moreover, to clarify the connection between urbanizations' and water bodies, its challenges as well as the threat of Lake Hawassa, the researcher used qualitative data from in-depth interviews with Ministry of Water and Energy (MOWE) staff (including RVBAO technique staff), Sidama National Regional Environmental Protection Bureau, households in lower catchment area, and Hawassa, Wolita Sodo, Dila, and Arba Munich university sub-basin industry linkage forum members. The sample interviewed was viewed the issue in different perspective. They demonstrated the threat in three distinct thematic ideas: Some of the interview participant identified and came to the conclusion that the Lake Hawassa watershed was polluted by illegal residents and involved in some farming, industrial wastage, illegal urbanization, and laundry activities. Ineffective management of the water resources led to the locals also consuming lake water. According to theirs scientific phrase, the aquatic plants growing in or close to the lake are known as emergent macrophytes, and they have not stabilized the shoreline area due to heavy erosion and sediment loads. Its catchment area has not been protected from damage by human and animal disturbance. As a result, they believed that this burden threatened and immediately challenged the Lake, resulting in a decline in the quantity and quality of the water, a decrease in economic and socio-economic benefits, a decrease in biological diversity, a reduction in the area's capacity to regenerate, and/or an impoverishment of its natural resources, as discussed with survey participants.

The results of other investigations corroborated the findings of this study. Among these, Zerihun's (2003) study was one that illustrated Lake Hawassa's history of pollution in relation to the lake's legal and regulatory framework. A research on its tributary, the Tikur Wuha River, revealed that without an effective management mechanism and legal protection, a significant volume of waste water are released into the river and into the lake, particularly from various the industries and urbanization (Zerihun, 2003). Livestock deaths and a decline in the quality of irrigated vegetables were two effects of this occurrence that were noted (Zerihun, 2003; Birnesh, 2007).

The majority of respondents 47.4% in Item 2 of Table 4.9 were strongly agreed that Lake Hawassa's decreasing economic benefits and socio-economic significance were at risk due to a lack of buffer zone guidelines. Whereas, 26.9% of the respondents were indicated that agreed with this threat. In contrast, 8.7% and 5.6% of the respondents reported that they strongly disagreed and agreed, respectively, with the threat that Lake Hawassa's socio-economic benefits would be diminished. However, 11.3% of the respondents replied that they were unsure about the threat. The respondents gave the statement a mean rating score with a standard deviation of 3.81 and 1.0, which was within the agree range. This depicted that the majority of respondents attribute Lake Hawassa's lower economic benefits and socio-economic significance to the lack of a buffer zone policy. The conclusions of this study were supported by the findings of previous investigations. According to Yeman (2004) research, lake levels have changed over the previous 15 years as a result of rising socioeconomic advantages that caused discharge. According to Daniel and Yonas (2010) and Amanuel (2011), human activities including agricultural and urban expansion that likely enhance impervious surfaces and lead to excessive runoff have been rising on occasion in the lake catchment. This suggests indirectly that many pollutants are likely introduced into the lake through runoff from the lake drainage. In addition, the garbage from the nearby hotels and resorts and traditional fishing practices may further affect how the lake's environment is altered. The cumulative effect of these activities may have a detrimental effect on the biodiversity and fishing activity, which are vital to the local population, local fishermen, and the leisure industry. Most of these human alterations have an impact on the lake's general ecosystem functions, human health (Anyanwu et al., 2018), aesthetic value, and

socioeconomic functions (WHO, 2003), as well as the fish stock and health (Zeitoun & Mehana, 2014).

Among total respondents, about 50.5% of them were strongly agreed that the lack of buffer zone policy likely result in a high threat level across all watersheds (catchment areas) over the next three years as indicted in Item 3 of Table 4.9. Similarly, 20.6% of the total respondents said in their responses that they agreed with this danger. However, if there no buffer zone policy, 1% and 7.7 of the total respondents acknowledged that they were strongly disagree and agreed, respectively, with the statement that the threat's seriousness likely be high during the next three years. However, 20% of the total respondents said they were unsure about the threat. According to the respondents' average judgments, the statement's mean rating score with standard deviation was 3.82 and 0.88, falling inside the agree range. This demonstrated that the majority of respondents think that if there is no buffer zone management policy, the threat's severity likely be severe during the next three years in every watershed (catchment). On the other hand, some of KII participant identified and came to the conclusion that the Lake Hawassa watershed served as the primary location for the landing and processing of fish and demonstrated active fishing. Different contaminants and sediment were also coming from the area's degraded catchment. The liquid and solid wastes were thrown straight into the Lake Hawassa watershed as a result of the storm water treatment plant's failure. Due to this, there was a significant amount of organic material and non-biodegradable garbage (plastic waste, sediments) on this side of the lake. Due to the lack of required law enforcement and a buffer zone regulation, Lake Hawassa is typically endangered by low riparian vegetation cover, high sedimentation, high levels of household garbage, and storm water disposal areas, among other things. As a result, they assumed that there would be a significant amount of cross-border affects, such as an increase in local and regional pollution and acidification as well as an increase in waste production from the point of origin to the catchment area (its final disposal), as reported by survey participants.

In addition to the information provided above, 46.7% of the total respondents were replied that strongly agreed that the pressures were forces, actions, or occurrences that had already a negative effect on the catchment's integrity as a result of the lack of a buffer zone policy. While, 32.1% of the total respondents were indicated that agreed with this danger. However,

0.3% and 9% of the total respondents acknowledged that they strongly disagreed and agreed, respectively, with pressures, actions, or events that had already negatively impacted Lake Hawassa as a result of the absence of a buffer zone policy for management. However, 20% of the total respondents said they were unsure about the threat. According to the respondents' average judgments, the statement's mean rating score with standard deviation was 4.01 and 0.90, falling inside the agree range. This demonstrated that the majority of respondents think that the lack of a buffer zone policy led to threats being perceived as pressures, actions, or events that had already had a negative impact. The Lake Hawassa watershed is distinguished by significantly more riparian vegetation, majority of the KII participant who made this activities were forward their idea. On the lake's edge, there is a community and a drainage canal that empties runoff into the body of water. Even though watering livestock, irrigating crops, and overgrazing were some additional activities that might endanger the lake ecosystem, the level of awareness of the locals, as well as that of the Ministry of Water and Energy (MOWE) employees (including RVBAO technique staff), the Sidama National Regional Environmental Protection Bureau, the households in the lower catchment area, and the members of the Hawassa, Wolita Sodo, Dila, and Arba Munich University Sub-Basin linkage forum have been worked together for survival and rehabilitation. The KII believed that the government, stakeholders, and other concerned bodies must endeavor to intervene more and eliminate threat. Moreover, they advise that a buffer zone had been developed along with other necessary legal framework to control the relationship between urbanization and water body connectivity and how it affects the Lake Hawassa watershed.

The results of earlier research studies corroborated with the above study result. Due to the lake's legal and policy framework, there is a high risk of pollution from anthropogenic activities like urbanization, intensive agriculture, rapid industrialization, urban runoff, and natural activities like erosion and heavy rainfall (Zerihun, et al., 2003). Particularly, it has been reported that some of the businesses located in Hawassa Industrial Park (HIP) and others discharge effluents into the rivers and streams that flow into the wetlands region of the former Lake Shallow, which is where River Tikurwhua originates (Zinabu and Zerihun, 2002) and fed the lake. The community's usage of the rivers and streams for diverse reasons, the survival of aquatic species, and the lake's long-term sustainability are all immediately

threatened by this. In addition, the lake is at a high danger of pollution due to a lack of legislation.

In Item 5 of Table 4.9 the majority of responders' perceived that diminished biological diversity, hampered ability for regeneration, and/or depleted natural resources in the area. In this regard, about 46.4% of the total respondents indicated their agreement that this posed a threat to the lake's continuity and existence. In addition, 30.5% of the respondents indicated that they were strongly agreed with these threats. It was known that 12.1% and 2.1% of the total respondents said that disagreed and strongly disagreed with the threats, respectively. The average rating score among respondents regarding the dangers to Lake Hawassa's existence and consistency was 3.91 and 1.0, respectively, it was falling within the agree range. This demonstrated that, on average, most respondents think that the area's natural resources likely dangerous to exist and to continuity as a result of decreased biological variety, restricted regeneration potential, and/or depleted natural resources as the absence of a buffer zone policy. On the other hand, some interview participants forward that their idea towards the threat of Lake Hawasssa watershed. According to them, huge amount of effluents discharge especially from Hawassa Industry Park into the River which went to the lake without efficient treatment and causes social, ecological and economic impacts are considered as threat. Moreover, Runoff from the lake catchment also probably took different contaminants, sediments and biodegradable and non-biodegradable wastes into the lake. Besides, the wastes from the surrounding hotels and resorts and traditional fisheries activities might also had an effect and they considered as the alteration of the lake ecosystem. Furthermore, socioeconomic functions of the lake would be threated and affected the next few years if buffer zone policy ratified and implemented.

The results of past research studies also supported the above study findings under the Item 5. For instance, Anyanwu et al. (2018) study identified human involvement with unfavorable watershed land use, rapid urbanization development, and industrial expansion as the main threats to Lake Hawassa. They found evidence of this in the Lake Hawassa sub-catchment, where soil erosion has considerably increased over the previous ten years, mostly as a result of deforestation and unsustainable farming methods. Faced with a growing population, which was puts more strain on natural resources. The resulting soil erosion has increased Lake

Hawassa's siltation, reducing the lake's capacity for storage and its water quality as well as restricted regeneration potential. Moreover, according to Mehana (2014), the cumulative effect of these activities may have a negative impact on the biodiversity and fishing activity that local people/fisher people and the leisure sector rely on.

In Table 4.9, the survey result under Item 6 depicted that 45.1% of the total respondents that they were said strongly agreed about the cross-boundary pollution and acidification influences, whereas 38.5% of the total respondents agreed with the statement. On the other hand, 0.3% and 1.8% of the total respondents were strongly disagreed and disagreed, respectively, while 14.4% of the total respondents also were undecided. The average rating score among respondents for cross-boundary pollution was 4.2, with a standard deviation of 0.76, which was within the agreeable range. This revealed that, on average, the majority of responders think that the a mount of cross-boundary influences likely to be high which includes increasing the amount of local and regional pollution and acidification, and increasing the amount of waste from its inception to catchment area (its final disposal) as threat and it was adversely affect the existence and the consistence of Lake in the near future if not manage as much as possible. Along with the data analysis from the survey, the findings of the study were also confirmed by the outcomes of earlier research investigations. According to research conducted in Ethiopia (Desta and Lemma, 2017; Haregeweyn et al., 2017; Hurni, 1993; Bantider, 2007; Erkossa et al., 2015; Gelagay, 2016), problems with waste quantity from the point of origin to the catchment region (its final disposal) are a common occurrence. In Ethiopia's south-central rift-valley region, in a watershed of Lake Hawassa that is environmentally sensitive, the study was carried out. Numerous people's livelihoods depend significantly on the lake and the resources in its watershed. However, unchecked anthropogenic activities are currently exposing the watershed to a number of stressors.

The statement that "increasing urbanization around Lake likely impacted Lake Hawassa watershed (catchment area)," this statement was agreed with by 47.7% of the respondents, it was strongly agreed with 45.4%. Around 2.56% of the respondents were undecided, 1.8% and 2.56% of the respondents were strongly disagreed and disagreed, respectively. Respondents gave a mean rating score and standard deviation of 4.35 and 0.73 for the

problems that most likely affected Lake Hawassa, respectively. These values fell within the agree range. This showed that the majority of respondents thought that the pressure on the catchments of the lake and the ecology more generally would increase as urbanization around the Lake will increase.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY OF MAJOR FINDINGS OF THE STUDY

Many ecological and biological water conservation measures, including traditional buffer zone management practices like environmental protection through community involvement, such as reforestation tree seedling plantation, and plantation, as well as area closure in the study area, were implemented by the government of Ethiopia, regional governments, NGOs, and communities in order to help the communities adapt to the effects of wetland and watershed. The many systems that were put into place allowed households to improve, to minimize pressure and threat, enhance water availability, increase irrigation use, to manage urbanization and water bodies' connectivity's and to reduces land degradation that adversely affect the life of Lake watershed.

Additionally, the life of the Lake Hawasaa watershed is significantly impacted by urbanization and the interconnectedness of water bodies due to the absence of a buffer zone. Therefore, it was determined in the study that the buffer zone policy and other environmental protection laws, proclamations, and regulations for the Lake Hawassa watershed must be implemented by the delegated authority in the near future. Controlling the growth of unauthorized settlement and urbanization around Lake Hawassa, maintaining the link between urbanization and water bodies, and approving and implementing buffer zone policies were also taken into consideration.

According to the results of the current study, the primary challenges in the study area are the destruction of systems, incompatibility of integration among concerned organisations like the Ministry of Water and Irrigation and the Regional Environmental Office, absence of low enforcement, low level awareness, and lack of strategic integration among sectors. The effects of threat hazards in the study area were substantially more serious and severe prior to the watershed management intervention. Sectoral integration of the actions is urgently required. Therefore, coordinated ecological and biological water conservation measures play a significant role in the consistency and existence of the Lake Hawassa watershed in the studied area.

5.2 RECOMMENDATIONS

For the Lake Hawassa watershed, a sustainable development plan is required in order to safeguard the environment, society, the economy, and cultural preservation. The current management issue and insufficient buffer zone legislation negatively impact natural water and environment. The necessity to protect Lake Hawassa will lead to the crucial suggestions listed below.

- The Ethiopia government should develop and implement environmental protection policies, laws, proclamations and regulations for Lake Hawassa watershed, and involving regional government delegation.
- Sidama National Regional Government is urged to regulate illegal settlement and urbanization around Lake Hawssa and focusing on the nexus between urbanization and waterbodies connectivity.
- It is the responsibility of Rift Valley Basin office and Sidama National Regional Environmental protection Bureau to managed and safeguard against disturbance cause by urban agriculture, intensive grazing, and commercial development and even from unsustainable recreational development.
- Before releasing liquid waste into the city drainage system, industrial companies, hotels, and other service provider institutions should treat the liquid waste from manufacturing, industrial, and service land uses on-site.
- Rift Valley Basin authority office shall be study the water resource consumption of the urban residents and the surrounding community and balanced with the water budget of the lake. To do so there must be sustainable water resource management plan in the Lake.
- Rift Valley Basin office and any authorized bodies should be involvement the community and other important stakeholders in protecting and revitalizing the watershed.

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Appendixes I

Survey questionnaires for respondents

The Nexus Between Urbanization and Water Bodies Connectivity and Their Challenge as to the Deficiency of the Buffer Zone Management Policy Questionnaire (English Version)

Hawassa University

School of Governance and Development Studies

Dear Sir/Madam

This questionnaire attempts to assess the nexus between urbanization and water bodies' connectivity and their challenge as to the deficiency of the buffer zone management policy with the more under consideration of the challenge and the probability of the threat Lake Hawassa watershed (catchments area) encountered.

All answers provided will be treated with the strictest of confidence for thesis only. You are under no obligation to complete this questionnaire but tries to best as much as possible with your time span.

Remark: - Please complete each section and answers all the questions.

- Please don't write your name.

Thank you in advance for your participation in this thesis!

With regards!

Yetnebersh Yitayew

Biographical information

Instructions I: - This section consist (s) questions. For each question in this section, draw a cross(x) in the box next to answer you choose. Please answer all questions.

1. Please indicate your gender.

A. Male ☐ B. Female ☐

2. Please indicate your age.

A. Less than 20 ☐ B. 20-29 ☐ C. 30-39 ☐

D. 40-49 ☐ E. 50 and above ☐

3. Please indicate your Martial status

A. Single ☐ B. Married ☐ C. Divorced ☐

4. If you are married please indicate your dependent family?

A. No ☐ B. 1 – 4 ☐ C. 5 – 8 ☐ D. 9 and above ☐

5. Please indicate your educational status of formal education.

A. Grade 1-4 ☐ B. Grade 5-8 ☐ C. Grade 5-8 ☐

D .Completed 12th grade ☐ E. Graduate certificate or diploma (10+3) or (12+2) ☐

G. BA (BSC) degree ☐ H. Post graduate ☐

6. What is your profession/ area of working?

A. Farmer ☐ B. Merchant ☐ C Governmental organization employer ☐

D. NGO employer ☐ E. Others ☐ Please Specify _____

7. Do you have ever participate any awareness creation training/ workshop/ other concerning to water resource management?

A. Yes ☐ B. No ☐

8. If your answer is "Yes" how many?

A. 1-2 ☐ B. 3-4 ☐ C. More ☐

Instructions II: - Please indicate the extent to which you agree with the following statements about your idea on the nexus between urbanization and water bodies' connectivity and their challenge as to the deficiency of the buffer zone management policy: the case of Lake Hawassa watershed. For each of the statements circle only one (1) number to indicate your level of agreement.

Remark: - For one Question circle only one (1) number.

Note: - (5) SA= strongly agree, (4) A= Agree, (3) UD= Undecided, (2) D= Disagree, (1) SD=strongly disagree

1. The effect and the challenges of the nexus between urbanization and water bodies' connectivity as absence of the buffer zone management policy related questions

No.	**The nexus between urbanization and water bodies' connectivity related statements'**	**SD 1**	**D 2**	**UD 3**	**A 4**	**SA 5**
1	The probability of the threat occurring is high in watershed (catchment area) surrounding due to nexus between urbanization and water bodies' connectivity					
2	The threat will not be a threat in the next three years in watershed (catchment area) surrounding due to nexus between urbanization and water bodies' connectivity if the buffer zone management policy will not be ratify and implement					
3	The pressures include both legal and illegal activities, and may result from direct and indirect impacts on unprotected area of Lake Hawassa watershed.					
4	The main pressures and threats to consider in Lake Hawassa, watershed as include legal and illegal logging, fishing, drinking water, agriculture, inappropriate waste disposal from legal activities as urbanization take place alarmingly					
5	Urbanization effect is high in Lake Hawassa watershed as high social, cultural, or economic importance.					
6	In Lake Hawassa watershed, an illegal activities within the catchment area are difficult to manage as urbanization increasing alarmingly around the water bodies'.					
7	The high level intensity between urbanization and water bodies' connectivity is infer no law enforcement in the Lake Hawassa watershed					

2. The Challenges that encountered Lake Hawassa Watershed as the absence buffer zone management policy related questions

No.	The Challenges that encountered Lake Hawassa Watershed statements'	SD 1	D 2	UD 3	A 4	SA 5
1	No boundary demarcation on watershed (catchment area) as absence of buffer zone management policy					
2	Inconsistency legally binding protection, management strategies' and collaborate among partners, local communities, and concerned organizations					
3	Unproactive involvement of staffing and/or stakeholders' for effective management of catchment area					
5	Incremental of urbanization effects on watershed (catchment area)					
6	Sustainable water resource management and effective policy strategies' are not incorporated into all aspects of policy development.					
7	No effective enforcement of buffer zone management policy related laws and ordinances at all levels.					
8	Less attention and commitment to ratified policy and related law on buffer zone management by legislature/parliament					
9	Low level of awareness of the local community towards sustainable use of water resources					
10	Urbanization and its effect on watershed (catchment area) as lack of buffer zone management policy					

3. Shortcomings that Impeding Water Resource Management in Lake Hawassa Watershed (Catchment area) Related Questions

No.	Shortcomings that impeding the water resource management Related Statements'	SD 1	D 2	UD 3	A 4	SA 5
1	Urbanization and Its infrastructure development					

2	Less local communities awareness					
3	Incompatible strategies' and activities among concerned organization (environmental office, lakes basin authority, etc.)					
4	Incapacity to realization of water resource management policy					
5	Incremental economical advantage around lake Hawassa watershed (catchment area)					
6	High level unmanageable threat					

4. **Threaten of Lake Hawassa watershed's Existence and Consistency Related Questions**

No.	**Threaten of Lake Hawassa watershed's Related statements'**	**SD 1**	**D 2**	**UD 3**	**A 4**	**SA 5**
1	Declining the a mount of water and its quality					
2	Diminished economic advantages/ socio-economic importance					
3	The overall severity of the threat over the next three years is likely to be high in all watershed (catchment area)					
4	Pressures are forces, activities, or events that have already had a detrimental impact on the integrity of the catchment area					
5	Diminished biological diversity, inhibited regenerative capacity, and/or impoverished the area's natural resources.					
6	The a mount of cross-boundary influences likely to be high which includes increasing the amount of local and regional pollution and acidification, and increasing the amount of waste from its inception to catchment area (its final disposal)					
7	Increasing urbanization around Lake Hawassa watershed and it is likely to has high pressure the catchment area of Lake Hawassa					

Thank you

Appendix II

የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖሩ በከተማ መስፋፋት እና በውሃ አካላት መካከል የሚኖር ግንኙነት እና ተግዳሮት መጠይቅ (የአማርኛ ቅጂ)

ሀዋሳ ዩኒቨርሲቲ

የአስተዳደርና ልማት ጥናት ትምህርት ቤት

ውድ መላሾች

ይህ መጠይቅ የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖሩ በከተማ መስፋፋት እና በውሃ አካላት መካከል የሚኖር ግንኙነት እና ተግዳሮት አሁናዊ ደረጃ ለመፈተሽ የተዘጋጀ መጠይቅ ነው፡፡

ለቀረቡት ጥያቄዎች የሚሰጡትን ምላሾች ሚስጥራዊነታቸውን በመጠበቅ ለዚህ ጥናት ዓላማ ብቻ እንደሚውሉ አረጋግጣለሁ፡፡ ይሁን እንጂ በተቻለ መጠን ለቀረቡት ሁሉም ጥያቄዎች እርሶ ምላሽ እንዲሰጡ ይጠበቃል፡፡

ማስታወሻ፡- እባኮ ለእያንዳንዱ የጥያቄ ክፍል ምላሽ ይስጡበት እና ያጠናቁ፡፡

ስም መጻፍ አያስፈልግም

በዚህ ጥናት ውስጥ ለሚያደረጉት ተሳትፎ በቅድሚያ አመሰግናለሁ!

ከሠላምታ ጋር!

የትነበርሽ ይታየው ዘገየ

መጋቢት/2015 ዓ.ም

የመላሾች ዳራ መረጃ

ትዕዛዝ አንድ፡- ይህ የጥያቄ ክፍል የመላሾችን ዳራ የያዙ ጥያቄዎች ተካተዋል፡፡ ለእያንዳንዱ ጥያቄዎች የኤክስ ምልክት (x) ከመልሱ ፊት ለፊት በማስቀመጥ ምላሾትን ይስጡ፡፡ እባኮትን ለሁሉም ጥያቄዎች ምላሾትን ይስጡ፡፡

1. ጸታ
   ሀ. ወንድ ☐ ለ. ሴት ☐
2. እድሜ.
   ሀ. ከ20 አመት በታች ☐ ለ. ከ20-29 ☐ ሐ. 30-39 ☐
   መ. ከ40-49 ☐ ሠ. ከ50 እና በላይ ☐

3. የጋብቻ ሁኔታ

   ሀ. ያላገባ ☐ ለ. ያገባ ☐ ሐ. የፈታ ☐ መ. ሌላ.....

4. ያገባ/ሽ ከሆኑ የቤተሰብ ብዛት?

   ሀ. የለም ☐ ለ. ከ1-4 ☐ ሐ. ከ5-8 ☐

   መ. 9 እና በላይ ☐

5. የመደበኛ ትምህርት ደረጃ

   ሀ. 1-4 ክፍል ☐ ለ. ከ5-8 ክፍል ☐ ሐ 12ኛ ክፍል ያጠናቀቀ ☐

   መ. ሰርተፊኬት ወይም ዲፕሎማ (10+3) or (12+2) ☐

   ሠ. የመጀመሪያ ድግሪ ☐

   ረ. ሁለተኛ ዲግሪና በላይ ☐

6. የስራ ሁኔታ

   ሀ. ግብርና ☐ ለ. ነጋዴ ☐ ሐ. የመንግስት ሠራተኛ ☐

   መ. መንግስታዊ ያልሆነ ድርጅት ተቀጣሪ ☐

   ሠ. ሌላ ካለ .....

7. ከዚህ በፊት በውሃ ሀብት አስተዳደር የተዘጋጀ የግንዘቤ ማስጨበጫ ስልጠና፣ ወርክሾፕ እና ሌላ ከውሃ ሀብት አያያዝ ጋር ተያያዥነት ያለው ስልጠና ወስደዋል?

   ሀ. አዎ ወስጃለሁ ☐ ለ. አልወሰድኩም ☐

8. አዎ ወስጃለሁ የሚሉ ከሆነ ምን ያህል ስልጠና፣ ወረክሾፕ ወይም ሌላ ካለ መጠኑን ይገልጹ?

   ሀ. 1-2 ☐ ለ. 3-4 ☐ ሐ. ከ5 ጊዜ በላይ ☐
   ሠ. ሌላ ካለ

   .....

ትዕዛዝ ሁለት: - እባኮትን የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖር በከተማ መስፋፋት እና በውሃ አካላት መካከል የሚኖረውን ግንኙነት እና ተግዳሮት ለመረዳት ከዚህ በታች የቀረቡትን ጥያቄዎች በጥሞና በማንበብ ከቀረቡት አምስት አማረጮች መካከል የእርሶን የስምምነት ደረጃ ይገለጹ፡፡ ከእያንዳንዱ የጥያቄ ምላሽ አማራጮች መካከል አንዱን ብቻ በመምረጥ ይግለጹ ወይም ያክብቡ፡፡

ማስታወሻ፡- ለአንድ ጥያቄ አንድን ቲክ (ራይት) አንድ ጊዜ ብቻ ያድርጉ

(5)= በጣም እስማማለሁ (4) = እስማማለሁ (3) =ለመወሰን እቸገራለሁ

(2) =አልስማመም (1) = በጣም አልስማማም

1. የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖሩ በከተማ መስፋፋትና በውሃ አካላት መካከል በሚኖር ግንኙነት የሚስተዋሉ አሉታዊ ውጤቶችና ተግዳሮቶችን የሚመለከቱ ጥያቄዎች

ተ.ቁ	የከተማ መስፋፋትና የውሃ አካላት ግንኙነት ጥያቄ	በአ 1	አ 2	መእ 3	እ 4	በእ 5
1	በከተማ መስፋፋትና በውሃ አካላት መካከል የሚፈጠሩ አሉታዊ ግንኙነቶች በሀዋሳ ሀይቅ ላይ የሚፈጠሩትን ስጋቶች የመጨመር እድላቸው ከፍተኛ ነው፡፡					
2	በሀዋሳ ሀይቅ ዳርቻ ላይ ለሚፈጠሩ ችግሮች የጥበቅ እና የጥበቅ (የሚጠበቅ) የውሃ ዳርቻ ክለላ የፖሊሲ ማዕቀፍ አለመኖር ነው፡፡					
3	በከተማ መስፋፋትና በውሃ አካላት መካከል እየተፈጠሩ ያሉ አሉታዊ ግንኙነቶች በቀጣይ ሦስት አመታት በሀዋሳ ሀይቅ ዳርቻ አስተዳደር ፖሊሲ አለመተግበሩ ነው፡፡					
4	በከተማ መስፋፋትና በውሃ አካላት መካከል በተፈጠሩ አሉታዊ ግንኙነቶች ውጤት የሀዋሳ ሀይቅ ዳርቻ ወሰን ላይ ለሚያርፈው ተጽዕኖ በምክንያትነት የሚጠቀስ ነው፡፡					
5	በሀዋሳ ሀይቅ የውሃ ዳርቻ ወሰን ላይ የሚፈጠሩ ተጽዕኖች ህጋዊ ወይም ህጋዊ ያልሆኑ ሲሆኑ የተጽዕኖ ውጤታቸው በቀጥታም ይሁን በተዘዋዋሪ የሚያርፈው የዳርቻ ወሰን ባልተደረገባቸው የውሃ አከላት ላይ ነው፡፡					
6	በከፍተኛ ደረጃ የከተማ መስፋፋት በውሃ አካላት ላይ ለሚፈጠሩና ለተፈጠሩ ተጽኖዎችና ስጋቶች ዋንኛው መንስኤ ህጋዊና ህጋዊ ባልሆነ መንገድ ወደ ሀዋሳ ሀይቅ ዳርቻ ወሰን መግባት፣ አሳ ማስገር፣ የመጠጥ ውሃ መጠቀም፣ ግብርናና በተገቢው መንገድ ተረፈ ምርትን አለማስወገድ ተጠቃሾች ናቸው፡፡					
7	በሀዋሳ ሀይቅ ላይ እና በሀይቁ ዳርቻ ላይ ባለው ማህበራዊ፣ ባህላዊና ኢኮኖሚያዊ ጠቀሜታ በአከባቢው የከተማ መሰፋፋት በከፍተኛ ደረጃ					

	እየጨመረ ነው፡፡					
8	በሀዋሳ ሀይቅ እና በውሃ አካላት ዳርቻ የከተማ መስፋፋት ዋነኛው ምክንያት ህጋዊ ያልሆኑ ተግባራትን ለመቆጣጠር እና ለማስተዳደር አስቸጋሪ በመሆኑ ነው፡፡					
9	በሀዋሳ ሀይቅ ዳርቻ ወሰን በከፍተኛ የከተማ መስፋፋት መጨመረና አስገዳጅ የህግ ማዕቀፍ ባለመኖሩ ክልከላ ባልተደረገባቸው በሀይቁ ዳርቻ የሚገኙ የተፈጥሮ ሀብቶችን ተገቢ ባልሆነ መንገድ የመጠቀም ፋላጎት በመጨመሩ ነው፡፡					
10	በውሃ አካላትና በከተማ መስፋፋት መካከል የሚስተዋሉ አሉታዊ ግንኙነቶችን ለመቆጣጠር እና ለመቀነስ የውሃ ዳርቻ አስተዳደር ፖሊሲ ማውጣትና መተግበር የግዴታ አስፈላጊ ነው፡፡					

2. የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖሩ የሀዋሳ ሀይቅ እና የውሃ አካላት እየገጠማቸው ያለ ተግዳሮት በተመለከተ የተዘጋጁ ጥያቄዎች

ተ.ቁ	የሀዋሳ ሀይቅ እና የውሃ አካላት የሚያጋጥማቸው ተግዳሮት	በአ 1	አ 2	መእ 3	እ 4	በ እ 5
1	የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖሩ ምክንያት የሀዋሳ ሀይቅ የዳርቻ ወሰን ክለላ እንዳይኖር አድርጎታል፡፡					
2	በአጋር ድርጅቶች፣ በአካባቢ ማህበረሰብ እና በሚመለከታቸው ተቋማት መካከል በትብብር አለመስራት፣ ወጥነት ያለው ስትራቴጂካዊ ስራ አመራር እና የአካባቢ ጥበቃ አስገዳጅ የህግ ማዕቀፍ በዘላቂነት ያለመኖር በምክንያትነት የሚጠቀሱ ናቸው፡፡					
3	በውጤታማ የስራ አመራር አስተዳደር የዘርፉን ሙያተኞችና ባለድርሻ አካላትን ባሳተፍ መልኩ ለውሃ አካለት ችግር ተገቢውን ምልሽ አለመስጠት፡፡					
5	በከፍተኛ ደረጃ በሀዋሳ ሀይቅ ዳርቻ የከተማ መስፋፋት በሀይቁ ዳርቻ ላይ አሉታዊ ተጽዕኖዎች መጨመር፡፡					
6	ከውሃ ጋር ተያያዥነት ያላቸው ፖሊሲዎች ውስጥ ዘላቂ የውሃ ሀብት አስተዳደር እና ውጤታማ የፖሊሲ ስትራቴጂ አለመካተታቸው፡፡					
7	በሁሉም ደረጃዎች ውጤታማ የውሃ ዳርቻ አስተዳደር ፖሊሲ እንዲተገበር አስገዳጅ ህግና ሌሎች ተያያዥ ህጋጋት					

	አለመኖራቸው፡፡					
8	ትኩረቱን ሀይቆች እና የውሃ አካለት ላይ ያደረገ መሪ የህግ ማዕቀፍ በሀገሪቱ ውስጥ አለመኖሩ፡፡					
9	የህግ አወጪው አካል የውሃ ዳርቻ አስተዳደር ፖሊሲና ሌሎች አስገዳጅ ህጎች ለማወጣት ቁርጠኛ አለመሆኑ፡፡					
10	የውሃ ሀብት በዘላቂነት እና በፍትሀዊነት መጠቀም እንዲቻል በአካባቢው ማህበረሰብ ዘንድ ያለው የግንዛቤ ደረጃ ዝቅተኛ መሆኑ፡፡					
11	የውሃ ዳርቻ አስተዳደር ፖሊሲ ባለመኖሩ በሀዋሳ ሀይቅ እና በውሃ አካለት ዳርቻ የከተማ መስፋፋት እና ከመስፋፋቱ ጋር ተያይዞ የሚመጣ አሉታዊ ተጽዕኖ መጨመሩ፡፡					

3. በሀዋሳ ሀይቅ እና በውሃ አካለት ዳርቻ ቁጥጥር ወቅት በውሃ ሀብት አስተዳደር ስርዓት ላይ የሚያጋጥሙ ውስንነቶችን/ስጋቶችን የተመለከቱ ጥያቄዎች

ተ.ቁ	በውሃ ሀብት ዘላቂ አስተዳደር ስርዓት ላይ የሚያጋጥሙ ውስንነቶች/ስጋቶች	በአ 1	አ 2	መእ 3	እ 4	በእ 5
1	በሀዋሳ ሀይቅ ዳርቻ የከተማ መስፋፋትና መስፋፋቱን ተከትሎ የሚከናወኑ የመሰረተ ልማት ግንባታዎች (መንገድ፣ የውሃ መስመር ዝርጋት፣ የፍሳሽ ዉሃ ማስወገጃ ዲች፣ ወዘተ.) ከፍተኛ ስጋት መሆናቸው፡፡					
2	የውሃ ዳርቻ አስተዳደር ፖሊሲ እና ሌሎች ተያያዥ ህጎች አለመኖራቸው፡፡					
3	የአካባቢ ማህበረሰብ የግንዘቤ ደረጃ ዝቅተኛ መሆን፡፡					
4	የሃዋሳ ሀይቅ ዉሃ አስተዳደር ጉዳዩ በሚመለከታቸው ተቋማት መካከል በስትራቴጂ ጉዳይና በተግባር ክንውን ወቅት ተናቦና ተጣጥሞ አለመስራት ወይም አለመተግበር፡፡					
5	የውሃ ሀብት አስተዳደር ፖሊሲና ህጎችን እውን ለማድረግ የማስፈጸም አቅም ውስንነት መኖር፡፡					
6	በሀዋሳ ሀይቅ ዳርቻ ሊፈጠሩ የሚችሉ ስጋቶችንና ተጽዕኖዎችን ቀድሞ ለመተንበይ የሚያስችል የመሳሪያዎች እና የስርዓት ህግ (ሲስተም) እጥረት መኖር፡፡					

7	በሀዋሳ ሀይቅ ዳርቻ ከፍተኛ የኢኮኖሚ ጠቀሜታ እየጨመር መሆኑ/መመጣቱ፡፡					
8	ከስራ አመራር ስርዓት አቅመና ቁጥጥር ውጪ የሆኑ ችግሮች መኖራቸው፡፡					
9	ውጤታማ የሆነ የፍሳሽ ማሰወገድ ሂደት ከመነሻው እስከ መዳረሻው በተገቢው የተግባር ቅንጅት የማስፈጸምና የማስወገድ የአቅም ውስንነት መኖር፡፡					

4. የሀዋሳ ሀይቅ ቀጣይነትና ህልውና ላይ የተደቀኑ ስጋቶችን በተመለከተ የተዘጋጁ ጥያቄዎች

ተ.ቁ	የሀዋሳ ሀይቅ ቀጣይነትና ህልውና ላይ የተደቀኑ ስጋቶች	በአ 1	አ 2	መእ 3	እ 4	በእ 5
1	የሀዋሳ ሐይቅ ውሃ የጥራት ደረጃ እና መጠን መቀነስ፤					
2	የሀዋሳ ሀይቅ ማህበራዊ-ኢኮኖሚያዊ ጠቀሜታ ደረጃን ማጣት፤					
3	የሀዋሳ ሐይቅ በሚፈጠሩ አለታዊ ተጽኖዎች በቀጣይ ሦስት ዓመታት በከፍተኛ ደረጃ መጨመሩ፤					
4	በሀዋሳ ሐይቅ ዳርቻ ተጽዕኖ ፈጣሪ ተግባራትና ሁነቶች መጨመር					
5	የሀዋሳ ሐይቅ የብዝሀ- ህይወት መገኛ ስፋራነት እና የተፈጥሮ ሀብት ምቹነት ደረጃ መጥፋት ወይም መውደም፤					
6	ከባቢያዊና ክልላዊ የብክለት፣ የአሲዲነት እና ወደ ሀይቁ የሚመጡ የፍሳሽ መጠን በከፍተኛ ደረጃ በመጨመሩ ምክንያት ከከባቢያዊ አለታዊ ተጽዕኖ ፈጣሪነት ወደ ድንበር ተሻጋሪነት አለታዊ ተጽዕኖ አድራጊነት የሚያድግ መሆኑ፤					
7	በሀዋሳ ሐይቅ ዳርቻ የከተማ መስፋፋት መጠን በመጨመሩ በሐይቁ ላይ የሚፈጠሩ አለታዊ ተጸዕኖ በከፍተኛ ደረጃ የሚጨመሩ መሆናቸው፡፡					

Appendix III

INTERVIEW QUESTIONS

INSTRUCTION III: STRUCTURE INTERVIEW QUESTIONS

The following structure interview will guide the dialogue between the interviewers. The interviewed idea design based on the question which considering the objectives and the basic questions.

1. Do you believe that the nexus between urbanization and water bodies' connectivity has relation with the absences of buffer zone management policy?
2. Do you think that the nexus between urbanization and water bodies' connectivity has pressure in Lake Hawassa watershed (catchment area)?
3. What is the challenge that encountered Lake Hawassa watershed (catchment area) as absences of buffer zone management policy?
4. What are the shortcomings that impeding the effective management of Lake Hawassa watershed?
5. Could you tell the threat that faced the Lake Hawassa watershed (catchment area) next few years without buffer zone management policy?

Appendix IV

Check list of the questions for direct observation

	Check list Items	
1.	What the source of water pollution around Lake Hawassa, watershed	
2	Is there urbanization and water bodies' connectivity has been increased from time to time	
3	What are the challenge that encountered Lake Hawassa watershed	
4	What the main the threat that faced the Lake Hawassa watershed	
5	Do you think declining the amount of water and its quality due to poor water resource management	