

## Towards an Alternative Wastewater Treatment and Use for the Microclimate in Kolfe Keraniyo Sub-City Condominium Houses, Addis Ababa

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### Abstract

The urban level climatic circumstances are considered to be of particular relevance to the domain of environmental sciences. Microclimatic variations within urban domains are found to affect metropolitan areas at local and global scales, with immediate effects on the health of people living in cities. The extent of these impacts may vary considerably due to global urbanization, different structural morphologies, land cover, materials of the built environment, and the presence and density of industrial or commercial buildings. Errell, et al. discussed the positive consequences of anthropogenic heat flux on external extensive use of air conditioning systems.

The quality of life of millions of people living in cities can be improved if the factors that affect the urban microclimate are understood and the form of the city responds to them in a manner that is appropriate to its location. Underlying this approach is the idea that climatically responsive urban design is vital to any notion of sustainability: it enables individual buildings to make better use of natural energy, it enhances the potential for pedestrian comfort and activity in outdoor spaces, and it encourages city dwellers to moderate their dependence on air conditioned buildings and private vehicles.

**Keywords:** Global urbanization; Natural energy; Heat flux; Global scales

### Introduction

Residential areas are the basic unit, and a fundamental component, of urban space. As the concentration of residents living increases, so too does the need for a high quality microclimatic environment. Researchers have suggested that natural ventilation and a comfortable thermal environment in outdoor spaces can greatly improve the livability and vitality of residential areas.

Furthermore, improving outdoor microclimates can effectively reduce building energy consumption in residential areas. Consequently, improving the quality of microclimates in residential areas is a focus for researcher and residential planning.

For example, waste managers in Africa need to tackle some issues including, lack of data, insignificant financial resources, vast different of amount and waste types between urban and rural area, lack of technical and human resources, low level of awareness and cultural aversion towards waste. On the other hand, problems faced among Asian countries differ with two distinct groups; developed and developing countries. While some of the countries are having specific national policy on waste management, some others experience problems such as increasing urban population, scarcity of land, services coverage area, inadequate resources and technology, and so on.

The management of waste become complex and the facilities provided cannot face and deal with responsibilities with the increasing demand and needs. Therefore, best approach need to be implemented immediately while considering environmental, social and economic aspects. The drivers of sustainable waste management were clarified by Agamuthu, which include human, economic, institutional and environment aspect.

Information on waste generation is important to determine the most suitable waste disposal options. Improper waste disposal may cause pollution. The main purpose in implementing best practice for liquid and solid waste management is to prevent pollution.

Pollution is a threat to human and other living organism. It may also damage the ecosystem and disrupt the natural cycle and climate on earth. There are many disposal options available to suit the nature of waste and a country's preference and interest. Economics and environmental aspects of waste disposal option are always the main issue in choosing the right technology.

There are efforts exerted by various governmental and non-governmental organizations including the private sector towards improving the sanitation sub-sector. These include: Ministries of Health, MoWIE, urban development and construction, education, and agriculture, as well as the federal and regional EPA authorities/bureaus, municipalities, NGOs, academic institutions, private sector sanitary suppliers and donors. Efforts are made in the areas such as policy and strategy formulation, planning, coordination, infrastructure provision, monitoring and evaluation. Urban wastewater management activity in the country in a planned manner is limited to Addis Ababa and few other cities. Akaki rivers used as receivers of all kinds of wastes; industrial wastewater is the primary causes of water pollution, followed by domestic wastewater and human excreta. Most of the

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Due to the combination of poor sanitation and undulating topography almost all wastewater generated in the city finds its way through a dense network of streams into the Akaki river, which originates in the north and flows *via* two branches to the south of the city. Several factories also dump their untreated effluents into the Akaki river. Wastewater collection and treatment are limited and treated wastewater is discharged into the same river. Therefore because of such usage of unplanned wastewater removal system, the waste water is collected and released to the surrounding little Akaki river which creates, the little and great Akaki rivers to become difficult to use it for any agricultural or drinking purposed of the downstream areas and the site microclimatic condition to be unhealthy and difficult for livability of the surrounding area because of the bad smell and sewerage system.

### Research questions

- What are the measuring factors to determine sewerage system quality?
- How can a wastewater can be treated, reused and released without affecting the environment?
- How do we achieve a healthier liveable microclimatic conditions for condominium houses area in terms of appropriate sewerage system in Kolfe Keraniyo?

### Objective of the research

**General objective:** Study the impact of wastewater on the micro climatic area of Kolfe Keraniyo condominium houses and finding an alternative wastewater treatment and use system for the microclimatic conditions of Kolfe Keraniyo sub city.

**Specific objectives:** Finding the design failure of Kolfe Keraniyo condominium houses sewerage system. Studying local and international wastewater treatment and reuse systems for condominium houses. Proposing a wastewater treatment and use guideline that enables Kolfe Keraniyo condominium houses microclimatic conditions to be healthier for the liveability of residents.

### Significance of the research

This research seeks to explore the problem of wastewater through the lens of systems and design and will study systems as a tool for wastewater remediation and regeneration. It will explore and examine both building systems such as sewerage and energy efficiency as well as space making systems, scenario based, environmental, sociological, and economical systems, all which have an important and integral impact on design, our environment, and the human population.

This result will help the mission of Addis Ababa city administration to create pollution free and green Addis Ababa and syndicate development with environmental works that are researched, evaluated and monitored with the collaborative efforts of the community to ensure the right of the society to live in a clean and healthy environment with sustainable development and wise use of natural resources.

### Scope of the research

The research covers investigation of the microclimatic condition component of the selected area condominium houses *i.e.*,

- Topography
- Water

- Soil
- Vegetation and
- Artificial structures

Then provides architectural measurement to overcome a way of wastewater removal system and treatment system by assessing international and local wastewater management systems to be applied according to the site environment condition. Concerning the limitations of this research, the major constrain is the COVID-19 pandemic. As it is known that it is dangerous disease, and the country is under state of emergency, it is challenging to investigate and to search for other more number of condominium sample sites in wider range. Because of this pandemic, the time frame constrains comes at the second place due to the unknowing period of time for how long the pandemic exists and the state of emergency ended [4].

### Introduction to urban life and wastewater

Cities are large organisms which consume and transform huge amounts of energy, water, food and materials into goods and waste products. Water is a particularly vital resource needed for the survival of humans and cities. In places where, in response to rapid urbanization, water supply has outpaced sanitation coverage and wastewater management, pollution of natural water bodies and the use of wastewater in irrigated agriculture have become common realities. The quality of life of millions of people living in cities can be improved if the factors that affect the urban microclimate are understood and the form of the city responds to them in a manner that is appropriate to its location. Underlying this approach is the idea that climatically responsive urban design is vital to any notion of sustainability: It enables individual buildings to make better use of natural energy, it enhances the potential for pedestrian comfort and activity in outdoor spaces, and it encourages city dwellers to moderate their dependengJ to t rbEcol iMtJpste reseaMtton. accordinth tJh poto use

the Awash river. The upper Awash river had low water quality status which is likely to be due to poor farming, untreated effluents from factories and poor provision of sanitation facilities to the riparian communities.



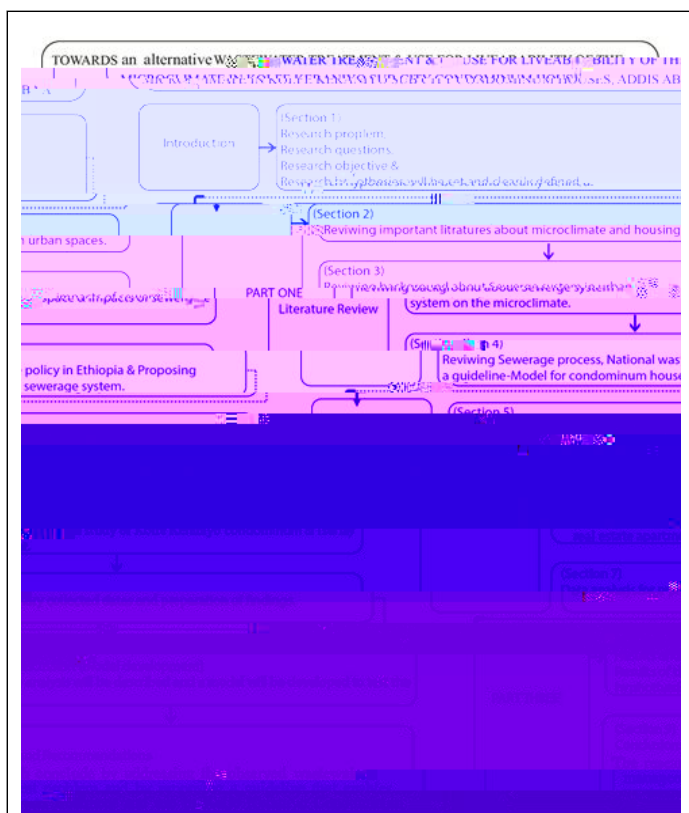


Figure 2: Diagram of the research methodology.

Task name	Duration	Start	Finish
Develop research proposal	21 days	Fri 8/21/20	Fri 9/18/20
Approval of research proposal	43 days	Tue 10/20/20	Thu 12/17/20
Literature review and data collection	10 days	Fri 12/18/20	Thu 12/31/20
Literature survey data analysis	20 days	Fri 1/1/21	Thu 1/28/21
Primary data collection from case studies	10 days	Fri 1/29/21	Thu 2/11/21
Data analysis for primary data	20 days	Fri 2/12/21	Thu 3/11/21
Result and discussion	10 days	Fri 3/12/21	Thu 3/25/21
Conclusion and recommendation	14 days	Fri 3/26/21	Wed 4/14/21
Thesis draft submission	10 days	Thu 4/15/21	Wed 4/28/21
Final thesis submission	10 days	Thu 4/29/21	Wed 5/12/21
Thesis defence	10 days	Thu 5/13/21	Wed 5/26/21

Expense elements	Cost (in Birr)
<b>Stationary materials and equipment</b>	
A4 paper	3000 Birr
Pen and markers	
Envelopes	
Handbooks	
Printing and photocopy	3,000 Birr
Internet usage and telephone balance cost	5,000 Birr
Conducting case study expense	4,000 Birr
<b>Rental materials</b>	
Photo camera	5,000 Birr
CDMA or internet device	
<b>Miscellaneous</b>	
Transportation	8,000 Birr
Day pocket	
Total	28,000 Birr
Contingency (15% of total cost)	4,200 Birr
Total	32,200 Birr

Table 2: Research budget.

4. Givoni B, Noguchi M, Saaroni H, Pochter O, Yaacov Y, et al. (2003)  
Outdoor comfort research issues. *Energy Buildings* 35: 77-86.

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