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FACULTY OF SCIENCE, ENGINEERING AND AGRICULTURE

DEPARTMENT OF URBAN AND REGIONAL PLANNING

SPATIAL PLANNING STRATEGIES FOR SUSTAINABLE MUNICIPAL HOUSEHOLD WATER SERVICE PROVISION: A CASE STUDY OF THOHOYANDOU TOWN IN VHEMBE DISTRICT MUNICIPALITY OF LIMPOPO, SOUTH AFRICA.

BY

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THESIS SUBMITTED TO THE DEPARTMENT OF URBAN AND REGIONAL PLANNING, FACULTY OF SCIENCE, ENGINEERING AND AGRICULTURE AT THE UNIVERSITY OF VENDA IN FULFILMENT OF THE REQUIREMENTS OF MASTER IN URBAN AND REGIONAL PLANNING DEGREE

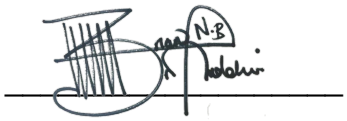
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DECLARATION

I, Nyadzani Brian Mudavhi, declare that this thesi is my original work and was submitted to the Department of Urban and Regional Planning, under the Faculty of Science, Engineering and Agriculture at the University of Venda. It has not been submitted before, in whole or in part, for any degree at this or any other institution. Where I have drawn on the work of others, I have given proper credit.



Signature of student

04 August 2025

Date

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DEDICATION

To my daughter, Eliana Mudavhi

To my sister, Faith Nembahe

To my brother, Dakalo Nemakhavhani

To my mother, Livhuwani Nethavhani, who believes in me more than anyone ever will.

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ABSTRACT

Many towns across South Africa, including Thohoyandou, continue to face significant challenges when it comes to reliable municipal water supply. The root causes often lie in aging or inadequate infrastructure, the pressures of rapid town expansion, and ongoing governance issues that hinder effective service delivery. This study focuses on how spatial planning can play a key role in supporting sustainability and access to household water services in Thohoyandou town. A mixed-methods case study approach was used to explore these issues in depth. Data collection included 382 household questionnaires, interviews with ten municipal officials, direct observation of local water infrastructure, and a thorough review of existing planning documents. Through both quantitative and qualitative analysis, the study assessed the current state of water service delivery and how it relates to the town's planning processes. The findings point to a range of interconnected problems. The study identified a disconnect between Vhembe District Municipality's Spatial Development Framework and its Water Services Development Plan. This misalignment has contributed to gaps in infrastructure provision, particularly in newly developed or rapidly growing areas. The study responds to these issues by proposing a more integrated planning approach that would better coordinate rural and town development with water infrastructure needs. This includes aligning spatial development plans with water service strategies, fostering collaboration between planners and engineers, targeting infrastructure upgrades in fast-growing parts of the town, and actively involving communities in decision-making around water services. If these strategies are put into action, Thohoyandou could see a meaningful improvement in both the consistency and fairness of its water supply. Moreover, the proposed framework supports national policy goals laid out in the Spatial Planning and Land Use Act (SPLUMA, 2013) and the National Development Plan 2030. It also aligns with key global goals, including Sustainable Development Goal 6 (clean water and sanitation) and Goal 11 (sustainable cities and communities).

***Keywords**: Spatial planning, Sustainable water provision, Thohoyandou, Municipal Household Water Services, Infrastructure, Water, Integrated Development*.

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LIST OF ACRONYMS AND ABBREVIATIONS

DWS-Department of water and sanitation

GIS-Geographic information system

IDP-Integrated development plan

IWRM-Integrated water resource management

LGDP-Limpopo growth and development plan

MIG – Municipal infrastructure grant

NDP-National development plan (2030)

NGO-non-governmental organization

NWA-National water act (1998)

PPP-Public private partnership

RBIG-Regional bulk infrastructure grant

SDF-Spatial development framework

SDGs-Sustainable development goals

SPLUMA-Spatial planning and land use management act (2013)

VDM-Vhembe district municipality

WSA-Water services authority

WSDP-Water services development plan

WSP-Water services provider

WSUD-Water sensitive urban design

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CHAPTER 1: SETTING THE SCENE

1.1 Introduction

Spatial planning strategies for sustainable municipal household water service provision are crucial for a sustainable water supply in South Africa. Water is important for life, and environmental sustainability (Water Environment Federation, 2015). However, the provision of sustainable and reliable municipal water services remains a serious challenge globally, particularly in developing countries. South Africa, a semi-arid country, also faces challenges in municipal household water service provision as attested by Walker (2013). Mavhungu et al., (2021), converge with that observation and mention that Thohoyandou town, located at the Vhembe District Municipality of Limpopo Province, serves as an example of these conundrums. It has experienced a rapid population growth that places enormous pressure on its municipal water infrastructure. Thohoyandou town's water supply system is known for frequent water shortages, poor water quality, and unreliable municipal water service delivery (Hofstetter, et al., 2021). These issues are influenced by the inadequacy of infrastructure. Spatial planning strategies are crucial in addressing such challenges and in ensuring the sustainable municipal household water service provision (Ndiritu et al., 2011). Spatial planning includes but not limited to, the coordination of land use policies, infrastructure development, and management of the environment to optimize the use of resources and promotion of sustainable development. This research aims to propose a framework on spatial planning strategies that can be leveraged for the sustainability of municipal household water service provision in Thohoyandou town. By analysing the current practices, identifying key gaps, and proposing of innovative solutions, the study seeks to contribute to the growing body of knowledge on sustainable municipal household water service provision in South Africa.

1.2 Research gap and rationale

The rationale and research gap for this research lies in the urgent need to address challenges that relate to the sustainability of municipal household water service provision in Thohoyandou town, that is situated in the Vhembe District Municipality of Limpopo, South Africa. Thohoyandou, just like many other growing towns in developing districts,

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faces many issues that are related to municipal household water services as purported by Makalela, (2021). According to a study conducted by Hutete, (2022), these challenges are perpetuated by different issues such as the climate conditions causing water stress and an increase in the frequency of extreme weather temperatures, which puts additional pressure on the already constrained water resources. Addressing these issues through sustainable spatial planning strategies is important for creating the long-term sustainability of municipal household water services (Nealer and Mtsweni, 2013).

This research is timely and mostly relevant as it seeks to develop a framework for sustainable municipal household water service provision. Drawing on successful case studies from both developed and developing countries to link other relevant studies, which assists with looking at other strategies that have been applied elsewhere, as emphasized by Zvobgo (2021). By focusing on Thohoyandou town, the study aims to develop a tailored framework that considers the town's unique infrastructural contexts. The results of this research carry the potential to improve governance frameworks. Ultimately, this study also seeks to contribute to the larger discourse on sustainable rural development and produce a model that can be adapted and applied to similar district municipalities that are facing comparable challenges (Coleman et al, 2010). Through this study, I aspire to institute a meaningful and lasting impact on the quality of life for residents of Thohoyandou town while ensuring reliable and equitable access to safe and sustainable municipal household water service provision.

1.3 Research problem statement

Access to reliable and sustainable household water services remains a major development challenge in South Africa, especially in rural areas such as those within the Vhembe District Municipality (VDM), where small towns like Thohoyandou frequently experience water shortages, erratic supply, and deteriorating infrastructure. These persistent service delivery issues have sparked public dissatisfaction, as demonstrated by recurring protests and mounting pressure on municipal authorities. Although the South African Constitution guarantees access to water, existing institutional and spatial planning frameworks have largely failed to address the complex interlinkages between land use, settlement growth, infrastructure provision, and water services. The situation is further

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worsened by fragmented water governance between district and local municipalities, often resulting in blurred responsibilities, poor coordination, and limited resource allocation. Rapid population growth in rural towns has intensified the strain on already weak infrastructure, underscoring the urgent need for integrated planning approaches that effectively align spatial development with water service delivery. In light of these challenges, this research is motivated by the ongoing failures in municipal water provisioning in VDM and seeks to develop a spatial planning framework aimed at enhancing sustainable household water service delivery in small rural towns, with Thohoyandou serving as the primary case study.

1.4 Research aim

This study aims to propose spatial planning strategies for sustainable municipal household water service provision in Thohoyandou town under the Vhembe District Municipality of Limpopo Province in South Africa.

1.5 Research objectives

To achieve the aim of this study, the following objectives were defined:

(1) To assess the current state of municipal household water service provision in Thohoyandou town.

(2) To analyse the challenges and opportunities underlying municipal household water service provision in Thohoyandou town.

(3) To propose a framework on sustainable spatial planning strategies for sustainable municipal household water service provision in Thohoyandou town.

These grounding specific research objectives will be discussed in detail in chapters 6,7, and 8.

1.6 Research questions

To ensure a thorough and organized approach to data collection and analysis, the following subsidiary questions are intended to support the sub-problems by delving deeper into specific aspects.

1.6.1 Research sub-problem questions and subsidiary questions

Table 1.1 Research Sub-problem questions and subsidiary questions

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Research Sub-problem questions	Subsidiary questions
1. What is the current state of municipal household water service provision in Thohoyandou town?	1. Who are the actors in municipal household water service provision in Vhembe District Municipality? 2. What are the governance issues regarding municipal household water service provision in Vhembe District Municipality? 3. How is household water service accessed in Thohoyandou town? 4. What are the main sources of water in the Vhembe District Municipality? 5. What infrastructural issues contribute to water service problems in Thohoyandou town?
2. What challenges and opportunities are underlying municipal household water service provision in Thohoyandou town?	1. What are the challenges regarding municipal household water service provision in Thohoyandou town? 2. What are the opportunities flowing from the modalities of municipal household water service provision? 3. What are the drivers of the opportunities and challenges of municipal household water service provision in Thohoyandou town? 4. What are the potential benefits of upgrading existing water infrastructure?
3. Can a framework on sustainable spatial planning strategies for sustainable municipal household water service provision be developed for Thohoyandou town?	1. What are the existing strategies for municipal household water service provision in Thohoyandou town? 2. How can the existing strategies for municipal household water service provision be improved? 3. What can be the components of the proposed framework on sustainable spatial planning strategies for municipal household water service provision? 4. What infrastructural limitations exist within the current spatial framework?

Source: Mudavhi NB (2025)

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1.7 Research hypothesis

The following hypothesis is put forth in this study;

Proposing Spatial planning strategies can improve the sustainability of municipal household water service provision in Thohoyandou town under the Vhembe District Municipality of Limpopo Province in South Africa.

1.8 Significance of the study

The significance of this study is in its potential to produce a comprehensive understanding of how spatial planning can be used to expedite municipal household water service provision in Thohoyandou town. The research findings will be useful to policymakers, urban planners, and water service providers in South Africa and other developing areas that are facing similar challenges. By the proposal of integrated spatial planning strategies, the study aims to contribute to the broader goal of sustainable municipal household water service provision. The study will also contribute to aiding the Sustainable Development Goal 6 and 11 (SDGs) which aims at making rural and urban spaces inclusive, and sustainable and also ensure the availability of clean and sustainable management of water, hence even the key findings of this research study will also assist in informing the development of evidence-based policies that prioritize the sustainable municipal household water service provision while also in support of Spatial Planning Land Use Management Act (SPLUMA) of 2013 objectives on purposeful spatial strategies which enhance service delivery in rural towns. The study's findings could support policymakers, especially those who draft amendments for the National Development Plan and policy frameworks for development, in making sound and effective policies and frameworks in the international, national, and local spheres of government. This study could also assist district municipalities in allocating resources more effectively and making infrastructure maintenance a priority so that they can be able to meet the demand for household water provision and ensure that these water services are meeting the needs of Thohoyandou town. This might also contribute to knowledge improvement towards the provision of municipal household water service provision by the district municipalities and will assist in

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developing evidence-based frameworks for both rural and urban sustainability hence it is crucial.

1.9 Temporal scope

This research focuses on strategies for sustainable municipal household water service provision from 2010 to 2025 to cover both the dry and wet seasons.

1.10 Conceptual scope

The research work focuses on various concepts such as municipal household water service provision, water access, grey water, green drop point, and municipal water service infrastructure.

1.11 Theoretical scope

This study focuses on three theories, namely the systems theory by Ludwig von Bertalanffy (1937); the new urbanism theory by Andres Duany and Elizabeth Plater-Zyberk (1980); and the smart growth theory (1990).

1.12 Spatial scope

The investigation is limited only to Thohoyandou town, which is in the Limpopo Province of South Africa.

1.13 Definition of keywords

Grey water can be referred to as domestic wastewater generated in households (Tiyasha *et al.*, 2021).

Municipal household water is water that is supplied to households by means of municipal pipelines.(Malakoana, 2020)

Spatial Planning can be referred to as the coordination of practices and policies affecting spatial arrangements (Zvobgo, 2021).

Sustainable water service provision means ensuring that there is adequate water supply to meet the needs of people (Mashabela et al., 2022).

1.14 Description of the study area

Thohoyandou is a town located in the south of the Vhembe District, northwest on the R524 main road between Louis Trichardt and the Kruger National Park. This town is the

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lush agricultural centre of Vhembe with subtropical fruits and maize lands. The Vhembe District Municipality is a category C municipality found in the northern part of the Limpopo Province. It shares borders with Zimbabwe and Botswana in the north-west and Mozambique. Figure 1.1 shows the map of the study area.

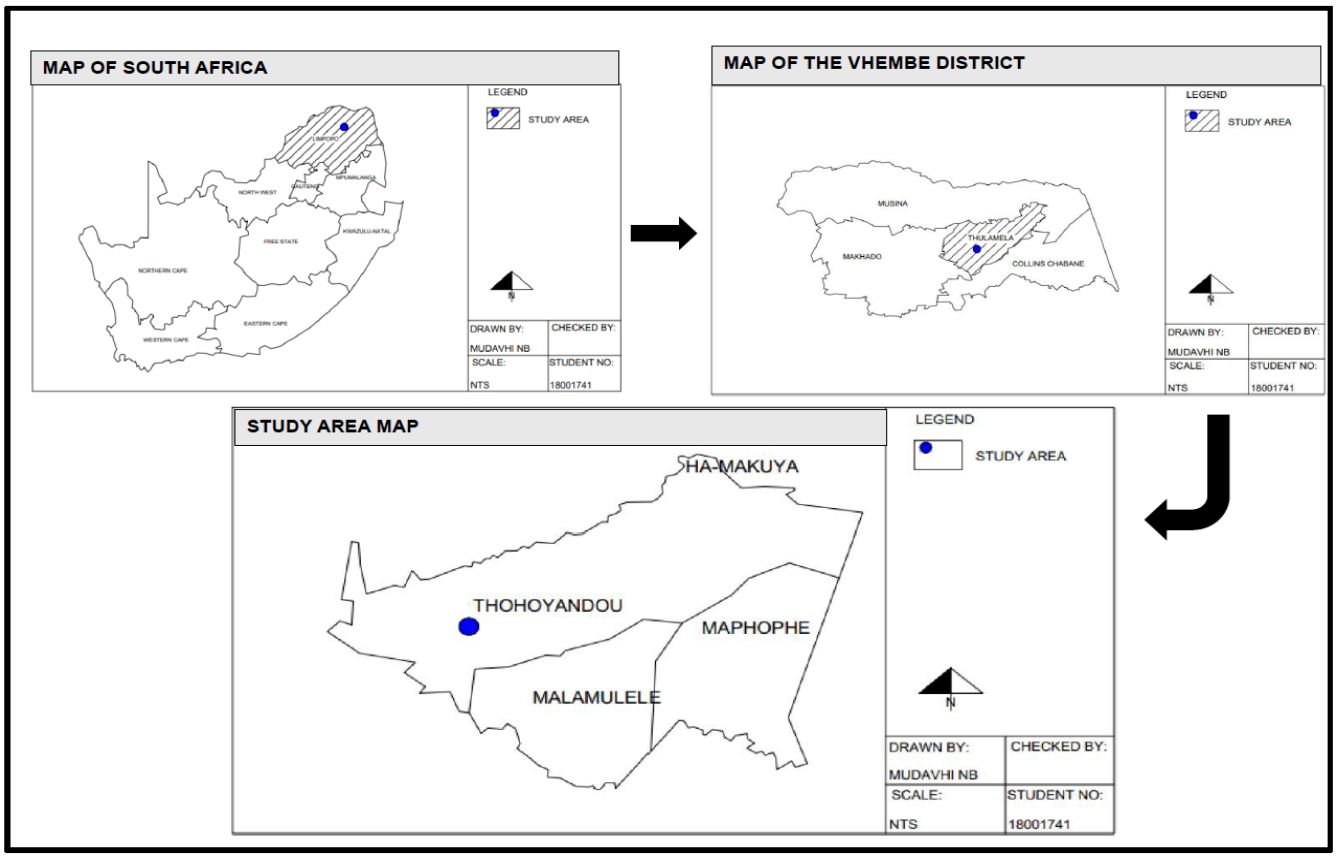


Figure 1.1 Study area maps

Source: Mudavhi NB (2022)

1.15 Thesis chapter layout

This thesis consists of nine chapters. Chapter one is a scene setting chapter (introduction) and explains while contextualising the research problem. Chapter two is the first literature review that reviews the key concepts of the study. Chapter three is a second literature review chapter which analyses the policy and legislative landscape of municipal household water service provision. Chapter four gives in detail the research methodology utilized in the study. The study adopts a mixed methods approach both in data collection and its analysis. Chapter five details the analysis of the first research objective. Chapter six analyses the second research objective. Chapter seven discusses the proposed

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framework of spatial planning strategies for sustainable municipal household water service provision. This framework can be adopted by both districts and local municipalities in South Africa or in the developing countries facing the same challenges. Chapter eight is a concluding chapter that summarises the key findings on spatial planning strategies for sustainable municipal household water service provision. This chapter also presents the recommendations that can be leveraged by other scholars and those who are policymakers with a zeal to provide sustainable municipal household water services.

1.16 Chapter summary

This chapter covered the introduction and background of the proposed research study. The statement of the problem, research aim, objectives, and hypothesis and research questions of the study are clearly articulated. This was also followed by significance of the study, scope of the study and definition of concepts. The location of the study was also explained and presented using sketches drawn by the researcher. The next chapter unpacks the literature on the study's key concepts.

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CHAPTER 2: UNPACKING THE KEY CONCEPTS AND THEORIES

2.1 Introduction

In South Africa and many other developing countries across the globe, there is a concern over the reticulation of water especially towards municipalities that hold the prerogative to supply water (Malima, et al, 2022). There is also a growing concern over how the concept of sustainable municipal household water service provision can be understood within the context of spatial planning (Goldblatt, 2023). Bondarde *et al.*, (2025) refers to literature review as an important tool in any research as it provides a solid foundation on which the study then relies. This chapter reviews the study's main concepts some which were highlighted in section 1:10 in the previous chapter, and these are important in understanding the different challenges and opportunities which are related to the municipal household water service provision when looking at it within the context of Thohoyandou town. The review also delves deep into the examination of different theoretical frameworks, such as the systems theory, new urbanism, and smart growth, as it also provides insights as to how these concepts can be applied to improve water service delivery in Thohoyandou town.

2.2 The concept of water

The concept of water is broken down in this section by looking at its definition and the different kinds that are available. A thorough understanding of water and its various classifications is essential for gaining a deeper understanding of its importance, roles, and wider environmental effects. Water can be divided into categories based on its source, function, and impact on ecosystems. This provides crucial information for efficient management and sustainable use of this important resource.

2.2.1 Kinds of water.

A study done by Al-Mafarji (2023) identified different types of water, such as blue, green, black, virtual and grey water, within which each of these represented different aspects of water resources and their use in natural and built environments. Understanding these water types is crucial for sustainable water service provision, especially in rural towns dealing with water scarcity such as Thohoyandou.

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2.2.2 Blue water

Blue water is freshwater found in surface water bodies such as rivers, lakes, and reservoirs, as well as in groundwater stored in aquifers (Mekonnen, 2020). This water is commonly used for agricultural irrigation, domestic supply, and industrial purposes. Blue water is typically managed through infrastructure such as dams, canals, and water treatment plants.

Wu *et al.*, (2023) suggest that the global demand for blue water is increasing, particularly for irrigation in agriculture, which is one of the largest consumers. As populations grow and industrialization expands, the stress on blue water resources has led to significant depletion of water tables and rivers in many towns.

2.2.3 Green water

Green water refers to the moisture retained in soil after rainfall, which is available for plants to absorb through their roots (Nylen, 2021). This type of water is crucial for rain-fed agriculture and natural vegetation. Unlike blue water, green water is stored in the soil and is not visible on the earth's surface, making it more challenging to quantify and manage.

Green water is essential for the productivity of ecosystems, as it supports forest growth, grasslands, and crop production without the need for irrigation. Efficient use of green water through practices like rainwater harvesting and soil conservation can contribute to enhancing agricultural productivity and resilience to climate variability (Green *et al.*, 2020).

2.2.4 Grey water

Grey water is the wastewater generated from household and industrial processes, such as from baths, sinks, washing machines, and industrial processes that do not involve human waste (Wöhler *et al.*, 2020). Grey water can be treated and reused for certain non-potable applications like landscape irrigation, flushing toilets, and some industrial processes.

Ansorge, et al, (2020) opined that reusing the grey water as a method that reduces the

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demand for blue water, helps conserve water resources, and can mitigate the environmental impact of wastewater discharge. However, its safe reuse requires proper treatment to avoid contamination and health risks, as grey water can contain detergents, oils, and other pollutants.

2.2.4 Black water

Black water contains human waste, typically from toilets, and is considered unsafe without proper treatment (Al-Mafarji, 2023). Black water is more contaminated than grey water and requires more intensive treatment processes before it can be safely returned to the environment. Inadequate treatment of black water can lead to pollution of water bodies, health risks, and degradation of ecosystems (Mashabela *et al.*, 2022).

2.2.5 Virtual water

Virtual water is the hidden water used in the production of goods and services. For example, large quantities of water are required to produce food, clothes, and manufactured goods (Tian *et al.*, 2022). Virtual water flows internationally through trade when products are imported and exported. The concept of virtual water highlights the indirect water usage and its role in the global water service provision.

2.3 Exploring the concept of municipal household water service provision

In this section, I examine the concept of municipal water service provision and its definition, together with its importance, the challenges in this provision, and who tends to be more affected by the lack of this water service in times of disservice. This will assist in getting a more vivid and clear meaning of this concept.

2.3.1 The concept of municipal household water service provision.

The concept of municipal household water service provision is not a difficult one to understand as many of the people in South Africa rely on municipal services for the maintenance of their daily livelihoods (Zvobgo, 2020). Municipal household water service provision can thus be defined as the delivery of water to households by municipal officials through proper reticulations systems. This service provision is very much key in the process of ensuring the health of the public, anchoring the economic activities, and ensuring that there is proper maintenance of a decent quality of life (Vuuren, 2012).

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However, Pamla, et al, (2021) revealed in her study that the effective water service provision is one that fully takes into account reliability in terms of the supply of potable drinking water, maintaining infrastructure, and also the insurance of efficient management of water resources. Other studies, such as the study done by Van Houtven *et al.*, (2017) suggests that municipal household water service provision faces a magnitude of problems that can only be solved if the political leadership have/maintain good relations with the officials of those municipalities which serve or have the responsibility as water service authorities.

2.3.2 The importance of water service provision in Thohoyandou town.

The importance of water lies in the mere fact that it is a basic human need. Wen and Xu (2017) disclose that access to safe, reliable, and adequate water supply is an important determinant of public health and an area's economic development. The World Health Organization (2019) emphasizes that inadequate water service provision leads to illnesses such as waterborne diseases, reduced agricultural productivity, and economic inefficiencies, which are the core areas of concern in any town or area.

In Thohoyandou town, the challenges of water provision are further perpetuated by the rapid population growth, which continues to put a lot of pressure on the current systems in place (Anyumba, 2019). The increased demand for water that places additional strain on an already inadequate infrastructure makes it very difficult for people to all have potable drinking water and thus leads to many resorting to strikes to make sure that they push officials to make plans for water reticulation. Li *et al.*, (2021) argued that in such contexts, improving water service provision is important not only for meeting current needs but also for ensuring long-term sustainability. However, Makalela, (2021) recommends that potable water and sanitation services are very essential for health, economic development, and environmental protection in rural towns as these are often areas of concerns for them. Makalela, (2021) also asserted that the recognition of the importance of access to a safe and adequate water supply, must become the main business of many water service authority municipalities and other government institutions. There has been a deep public outcry in South Africa regarding the poor performance of municipalities in line with their plans for service delivery (Sethunya, 2022).

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2.3.3 Challenges in municipal water service provision in Thohoyandou town.

The provision of municipal water services faces numerous challenges, particularly in developing regions like Thohoyandou. These challenges include aging infrastructure, inadequate maintenance, water scarcity, and governance issues. Ledger, (2021) highlighted that mismanagement of funds, lack of technical capacity, and political interference as in changing of political leadership, will not alleviate the challenges because the significant governance challenges hindering effective water service delivery need an integrated set of united leaders. Water scarcity is critical, especially in semi-arid regions like Limpopo province. The variability in water availability due to climate change, combined with more frequent extreme weather events, makes it imperative to take action to ensure reliable water services (Makalela, 2021).

Municipal water service provision encounters numerous challenges, especially in rapidly growing towns and resource-constrained regions (Hutete and Sibanda, 2022). One key challenge is the aging infrastructure, which needs upgrades to meet the demands of growing populations (Zvobgo, 2021). Insufficient investment in maintenance and upgrades exacerbates this issue, resulting in frequent breakdowns, water losses through leakages, and inefficient service delivery (Makgopela, 2023).

Additionally, financial constraints hinder municipalities' ability to implement necessary improvements, leading to temporary fixes rather than sustainable solutions. Hungwe, (2023) found in their study that in developing regions, the lack of technical expertise and capacity within municipal management often results in poorly planned and executed water projects which further compromise the service delivery.

Another significant challenge in municipal water provision is the increasing variability in water supply due to climate change (Malakoana, et al, 2020). Changes in precipitation patterns, prolonged droughts, and extreme weather events disrupt the availability and reliability of water sources, making it challenging for municipalities to ensure consistent supply to households (Mensah, 2022). Ahmed *et al.*, (2022) highlights that strategies such as the effective governance and regulatory frameworks are crucial in managing these challenges and ensuring equitable access to water, particularly in underserved communities.

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2.4 The concept of spatial planning.

Spatial planning is a vital process that involves coordinating land use, infrastructure development, and environmental management to achieve sustainable development (Sun, 2023). It addresses the challenges associated with urbanization and resource management. Zvobgo (2021) believes that spatial planning optimizes resource use, improves infrastructure resilience, and ensures equitable distribution of services. The process involves organizing and managing land use to balance social, economic, and environmental needs. It aims to create sustainable communities by strategically guiding urban and rural development (Wong, 2022). This planning considers factors such as infrastructure, transportation, housing, and environmental protection to ensure efficient and equitable use of land resources. It also seeks to integrate different sectors and scales of development, promoting cohesive growth while addressing challenges like so-called rural sprawl, resource depletion, and climate change. Spatial planning helps shape communities to improve quality of life and support sustainable development goals (Chalastani *et al.*, 2021).

2.4.1 The role of spatial planning in water service provision.

Spatial planning has a significant impact on the efficiency and sustainability of water service provision (Magagula *et al.*, 2022). By integrating land use policies with water resource management, spatial planning can help address spatial disparities in water access and ensure that water infrastructure supports sustainable growth (Magagula *et al.*, 2022). In the context of Thohoyandou town, spatial planning is crucial for managing the town's rapid population growth and its impact on water demand. (Davids, 2021) assert that spatial planning can facilitate the development of infrastructure resilient to the challenges posed by climate change. Spatial planning plays a critical role in ensuring efficient and sustainable water service provision by strategically guiding the development and management of land and water resources (Govender, 2020). By integrating water provision considerations into land use planning, spatial planning helps prevent conflicts over resource allocation and ensure that water infrastructure is appropriately placed and scaled to meet current and future demands (Maimaiti *et al.*, 2021).

This proactive approach allows municipalities to anticipate and address potential

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challenges such as population growth and climate change, thereby reducing the risks of water shortages or over-extraction of water resources. Spatial planning serves as a vital tool for balancing the competing needs of different sectors, such as agriculture, industry, and residential areas, while protecting critical water resources and ecosystems (Maimaiti *et al.*, 2021). Magagula *et al.*, (2022) argued that spatial planning facilitates the equitable distribution of water services, and it does this by identifying and prioritizing different areas that need infrastructure investment. In many developing regions, informal settlements and marginalized communities often lack access to reliable water services due to their exclusion from formal planning processes. Spatial planning can address these disparities by incorporating these areas into the broader rural framework and ensuring that water infrastructure is extended to underserved communities (Hofisi, 2022).

Hofisi, (2022) also established that spatial planning plays an important role in promoting the integration of green infrastructure and nature-based solutions, such as wetlands and permeable surfaces, which can enhance water provision by improving groundwater recharge, reducing runoff, and mitigating flood risks, contributing to the resilience and sustainability of water service provision, particularly in the face of climate variability. A study done by Intason., et al, (2021) in Thailand confirms that spatial planning supports the coordination and collaboration among various stakeholders involved in water service provision. The study suggested that through aligning land use decisions with water provision strategies, spatial planning fosters cooperation between municipalities, water utilities, environmental agencies, and community groups. Joshua, et al, (2022) also wrote a paper that partially converges with the findings by Intason as they suggested that a collaborative approach ensures that water services are delivered in a manner that is not only technically and economically viable but also socially inclusive and environmentally sustainable. Effective spatial planning also involves monitoring and adapting to changing conditions, allowing for continuous improvement in water service provision (Maimaiti *et al.*, 2021).

Stithou et al., (2023) disclose that spatial planning in water service provision creates a coherent framework enabling the sustainable use and management of water resources, ensuring that all communities have access to safe, reliable, and equitable water services.

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Spatial planning has a significant impact on the efficiency and sustainability of water service provision. By integrating land use policies with water resource management, spatial planning can help address spatial disparities in water access and ensure that water infrastructure supports sustainable growth (Magagula *et al.*, 2022). In the context of Thohoyandou town, spatial planning is crucial for managing the rapid rural population growth and its impact on ongoing water demand. Ndiritu et al. (2011) in one of their studies suggested that spatial planning can facilitate the development of infrastructure resilient to the challenges posed by climate change and rural expansion, especially in those rural towns.

Cronk, et al, (2024) found that spatial planning plays a critical role in ensuring efficient and sustainable water service provision by strategically guiding the development and management of land and water resources, they also found that by integrating water service management considerations into land use planning, spatial planning helps prevent conflicts over resource allocation and ensures that water infrastructure is appropriately placed and scaled to meet current and future demands. This proactive approach allows municipalities to anticipate and address potential challenges such as population growth and climate change, thereby reducing the risks of water shortages or over-extraction of water resources. Spatial planning serves as a vital tool for balancing the competing needs of different sectors, such as agriculture, industry, and residential areas, while protecting critical water resources and ecosystems (Cronk, et al., 2024).

Sun, (2023) wrote in his paper that spatial planning is crucial as it facilitates the equitable distribution of water services by identifying and prioritizing areas in need of infrastructure investment. In many developing regions, informal settlements and marginalized communities often lack access to reliable water services due to their exclusion from formal planning processes (Holness *et al.*, 2022). Spatial planning can address these disparities by incorporating these areas into the broader rural framework and ensuring that water infrastructure is extended to underserved populations (Wong, 2022). Other scholars such as Agustina, et al, (2021) described spatial planning as one critical tool that promotes the integration of green infrastructure and nature-based solutions, such as wetlands and permeable surfaces, which can enhance water provision by improving

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groundwater recharge, reducing runoff, and mitigating flood risks, contributing to the resilience and sustainability of water service provision, particularly in the face of climate variability.

Planning in general supports the coordination and collaboration among various stakeholders involved in water service provision (Magagula *et al.*, 2022b). By aligning land use decisions with water provision strategies, spatial planning fosters cooperation between municipalities, water utilities, environmental agencies, and community groups (Christmann *et al.*, 2020). This collaborative approach ensures that water services are delivered in a manner that is not only technically and economically viable but also socially inclusive and environmentally sustainable (Wu *et al.*, 2023). Effective spatial planning also involves monitoring and adapting to changing conditions, allowing for continuous improvement in water service provision (Grenni, et al, 2020). Christmann *et al.*, (2020) suggested that the role of spatial planning in water service provision is to create a coherent framework that assists in enabling the sustainable use and management of water resources, ensuring that all communities have access to safe, reliable, and equitable water services.

2.4.2 Spatial planning strategies for sustainable water provision.

Spatial planning strategies for water provision are critical in ensuring sustainable water resource utilization and minimizing the impacts of water scarcity (Wong, 2022). One key strategy that other rural areas use is the integration of Water-Sensitive Urban Design (WSUD) into rural planning (Mwale *et al.*, 2021). WSUD emphasizes the preservation of natural water cycles through green infrastructure, such as porous surfaces, rain gardens, and constructed wetlands (Tiyasha *et al.*, 2021). These elements assist in managing storm water, reducing runoff, and enhancing groundwater recharge, which is essential for maintaining water quality and availability. By leveraging the WSUD principles into rural planning, rural municipalities can reduce the pressure on traditional water provision systems and contribute to long-term water sustainability (Kim *et al.*, 2020).

Popovici *et al.* (2022) found that there is need for an essential strategy, which they referred to as the implementation of Integrated Water Resources Management (IWRM), this is because it advocates for a holistic approach towards managing water resources at

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a basin level. IWRM involves coordinating the development and management of water, land, and related resources to maximize social and economic welfare without compromising the sustainability of vital ecosystems (Popovici *et al.*, 2022). He further enunciated that this approach assists in the promotion of equitable distribution of water resources while encouraging the involvement of all stakeholders, including communities, industries, and governments, in the planning and decision-making processes. IWRM also emphasizes the importance of data collection and monitoring, enabling adaptive management strategies to respond to changing conditions and emerging challenges.

Spatial planning for water provision also includes the zoning of land uses to protect water resources from contamination and over-exploitation. Establishing buffer zones around water bodies, enforcing land-use regulations to prevent pollution, and planning for land uses that are compatible with water resource protection are essential components (Wong, 2022). These zoning practices help safeguard critical water sources, such as rivers, lakes, and aquifers, from the impacts of industrial activities, and agriculture. Spatial planning can sometimes guide the location of new developments in areas with sufficient water supply, reducing the need for costly infrastructure investments and mitigating the risks associated with water shortages (Hutete, 2022). Magagula *et al.*, (2022) recommended that through the integration of these spatial planning strategies, municipalities can ensure the sustainable management of water resources and support long-term environmental and economic resilience.

2.5 Sustainable water service provision.

Water service provision can be defined as the provision of safe, potable water and managing wastewater systems for residential, commercial, and other purposes (Magagula *et al.*, 2022). This includes acquiring, treating, and distributing water, as well as collecting and treating wastewater for proper disposal or potential reuse. Luwe *et al.*, (2022) define sustainability as a crucial concept in water service provision, especially considering the increasing environmental pressures and resource limitations. Sustainable water service provision means ensuring that water services fulfil current needs without compromising the ability of future generations to meet their own needs (Bahrain, 2022). Sustainability in water service provision is a complex concept that requires balancing

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environmental, social, and economic considerations to ensure that water services are dependable and fair in the long run (Nave et al, 2021). Holness et al., (2022) found that the essential aspect of sustainability is the efficient use and conservation of water resources. This involves implementing strategies such as demand management, which encourages water conservation through pricing mechanisms, public awareness campaigns, and the use of water-saving technologies (Jacobs-Mata, et al, 2021). Through the reduction of water consumption and minimizing wastage, service providers can alleviate pressure on existing water supplies, extend the lifespan of infrastructure, and reduce the environmental impacts associated with water extraction and distribution (Bahrain, 2022).

Kotoku, (2022) suggest that an important element of sustainable water service provision is the adoption of resilient infrastructure that can withstand the challenges posed by various negative factors. Nave, et al, (2021) argued that sustainable infrastructure planning includes the development of decentralized water systems, such as rainwater harvesting and wastewater recycling, which reduce dependence on centralized systems and enhance the flexibility and adaptability of water services. Pande, (2022) describes the use of green infrastructure, like constructed wetlands and permeable pavements, as solutions that can help manage storm water, reduce flooding, and improve water quality, contributing to the overall resilience of water service systems. Investing in innovative technologies and practices that promote energy efficiency and reduce the carbon footprint of water services is also essential for achieving sustainability (Christmann *et al.*, 2020). Some literature speak of ensuring the social sustainability of water service provision involves promoting equitable access to water for all communities, regardless of socio-economic status (Mensah, 2022). This includes addressing disparities in water access in both urban and rural areas, ensuring that marginalized and vulnerable populations have reliable and affordable access to clean water (Kotoku, 2022). A significant part of this process is community participation and stakeholder engagement, which are not just important but integral (Malima, et al, 2022). They help ensure that water services meet the needs and preferences of all users, and that local knowledge and priorities are integrated into planning and decision-making processes. Furthermore some literature by other academics have deemed sustainable water service provision requires strong

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governance frameworks, including transparent policies, effective regulation, and adequate funding mechanisms, to support the long-term operation and maintenance of water infrastructure and services (Duane *et al.*, 2022). By prioritizing these aspects of sustainability, water service providers can contribute to the overall well-being of communities and the environment, making the audience feel empowered and being involved in the process.

2.5.1 The principles of sustainable water service provision.

The effective provision of sustainable water services is guided by a crucial set of principles (Kinseng *et al.*, 2023). In Thohoyandou town, these principles are vital as the persistent water scarcity and infrastructure challenges threaten the long-term sustainability of water services. The following table outlines each principle and emphasizes its significance in addressing these challenges.

Table 2.1 Principles of sustainable water service provision

Principle	Importance
1. Resource efficiency	Ensures the efficient use of water resources, assisting in the minimisation of waste and optimisation of water supply.
2. Equity	Allows for the provision of equitable access to water services for all the residents, regardless of their socio-economic status and or their location.
3. Resilience	Encourages the development of infrastructure and strengthens their management practices to solidify the infrastructure to be able to withstand rapid environmental changes and unprecedented extreme weather events.
4. Environmental protection	Safeguards the existing water sources and the ecosystems from pollutants and its degradation to maintain the natural water cycle without fault.

Source: Water and sanitation services policy on privately owned land (2022).

2.5.2 Case studies in sustainable water service provision.

The following examples of sustainable water service provision offer valuable insights into practical approaches for achieving long-term water security and resilience in different areas.

2.5.6 Case study of Copenhagen, Denmark.

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One notable case is the city of Copenhagen, Denmark, which has implemented an innovative approach to managing rural water services through its "Cloudburst Management Plan" (Jørgensen *et al.*, 2023). This plan was developed in response to severe flooding incidents caused by heavy rainfall overwhelming the city's drainage system. Copenhagen's strategy involves the integration of blue-green infrastructure, such as green roofs, permeable pavements, and retention basins, to manage storm water naturally. These measures not only mitigate flooding risks but also enhance water quality and contribute to rural greening, thereby creating multiple environmental and social benefits. The success of Copenhagen's approach lies in its emphasis on climate adaptation and the holistic integration of water provision with rural planning.

2.5.7 Case study of Singapore.

Another case study highlighting sustainable water service provision can be found in Singapore, a city-state known for its comprehensive water provision strategies (Ba-Alawi, et al,, 2024). Faced with limited natural water resources, Singapore has developed a diversified and resilient water supply system known as the "Four National Taps," which includes local catchment water, imported water, recycled water, and desalinated water (Sun *et al.*, 2022). The cornerstone of Singapore's approach is its investment in water reuse technology, particularly the production of NEWater, which meets up to almost 40% of the country's water demand. By combining technological innovation with robust public education campaigns on water conservation, Singapore has achieved a high level of water security while minimizing its environmental impact. This case study underscores the importance of diversifying water sources and investing in advanced technologies to enhance the sustainability of water services.

2.5.8 Case study of eThekwini Municipality (Durban)

In Africa, the eThekwini Municipality (Durban) in South Africa presents a compelling case of sustainable water service provision in a developing country context. The municipality has implemented a range of initiatives to improve water and sanitation services, particularly in informal settlements and rural areas (Zungu *et al.*, 2020). One key aspect of eThekwini's approach is the use of decentralized sanitation systems, such as urine diversion toilets, which reduce the demand on centralized wastewater treatment facilities

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and promote the safe reuse of nutrients in agriculture. The municipality has engaged in extensive community outreach and education programs to raise awareness about water conservation and hygiene practices. eThekwini's success is attributed to its innovative use of appropriate technologies, strong community involvement, and the integration of water and sanitation services into broader social and economic development goals. The case study illustrates how sustainable water service provision can be achieved even in challenging contexts by adopting context-specific solutions and fostering community partnerships.

2.5.9 Key takeaways for Thohoyandou town.

These literature examples provide valuable insights for Thohoyandou town, where similar strategies could be adapted for the current local conditions. This is because through leveraging and learning from these case studies, the proposed spatial planning framework for Thohoyandou town can incorporate best practices in sustainable municipal water service provision and ensure the overall provision of efficient service delivery.

2.6 The concept of municipality as a water service authority under study.

Local government, also known as a municipality, is the level of government closest to the people. Its members are elected by citizens to represent them and are responsible for ensuring that services such as water, sanitation, waste management, and local infrastructure are delivered to the community (DWAF, 2005). In most countries, including South Africa, the local government is responsible for water service delivery and provision, such as the Vhembe District Municipality currently under this study. In South Africa, local government is made up of different categories of municipalities as defined in the Constitution of 1996, section 155(1), and the Municipal Structures Act 117 of 1998. The categories are as follows:

a) *Category A*: Metropolitan municipality, which has exclusive executive and legislative authority in its area, as described in section 155(1) of the Constitution.

b) *Category B*: Local municipality, which shares municipal executive and legislative authority (the power to make and enforce laws and the power to manage and direct the administration of the municipality) with a district municipality in its area, as described in

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section 155(1) of the Constitution.

c) *Category C*: District municipality (Vhembe District), which has municipal executive and legislative authority in an area that includes more than one municipality, as described in section 155(1) of the Constitution.

According to Department of Water Affairs DWAF (2003), a water service authority is any municipality with the executive authority to provide water services within its jurisdiction, as per the Municipal Structures Act 118 of 1998 or ministerial authorizations made under this Act. There can only be one water services authority in a specific area, and water services authority areas cannot overlap. Water services authorities can be metropolitan municipalities, district municipalities, or authorized local municipalities.

2.7 Theoretical framework

The study's theoretical framework is rooted in three key theories: (i) Systems Theory, (ii) New urbanism, and (iii) Smart Growth. These theories offer a perspective through which the connections between various elements of water service provision and spatial planning can be comprehended.

2.7.1 Systems theory (1937)

Ludwig von Bertalanffy's systems theory, developed in 1937, considers complex entities as interconnected systems working towards a common goal. In the context of municipal water service provision, this theory helps us understand how various components of the water supply system, such as infrastructure, governance, and environmental factors, interact and influence each other. By conceptualizing water service provision as a system, it becomes easier to pinpoint areas for intervention that can enhance overall performance and sustainability (Bhowmick and Lanzon, 2021). When applied to municipal water service provision in areas such as Thohoyandou town, Bertalanffy's systems theory allows for understanding the interconnected subsystems, such as infrastructure, policy, and environmental resources, and how these components influence one another. For example, governance policies affect the allocation of resources for infrastructure development, environmental factors like rainfall impact the available water supply, and infrastructure quality influences the reliability of water services. By viewing water provision

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as a system, we can identify areas where interventions, such as improving governance and upgrading infrastructure, will enhance overall sustainability and performance.

2.7.2 New urbanism theory (1980)

New urbanism is an urban design movement that emerged in the 1980s, advocating for walkable neighbourhoods, mixed-use development, and sustainable rural planning practices. This theory is particularly relevant to the spatial planning of Thohoyandou town, as it emphasizes the need for integrated planning that considers the social, economic, and environmental aspects of rural development. By applying New Urbanism principles, Thohoyandou town can be developed in a way that promotes sustainable water use and enhances the quality of life for residents (Vallance, 2021).

2.7.3 Smart growth theory (1990)

Smart growth theory, which originated in the 1990s, aims to promote sustainable rural development through efficient land use, infrastructure investment, and environmental protection. Its principles involve compact building design, creating walkable communities, and preserving open spaces. In Thohoyandou town, smart growth can help guide the development of water infrastructure that is both efficient and sustainable, reducing the environmental impact of rural expansion and ensuring the wise use of water resources (Wang *et al.*, 2023).

2.8 Conceptual framework

For me to establish a framework for this study, I am integrating several key variables to understand the factors that have a great deal of influence on municipal household water service provision in Thohoyandou town. One primary independent variable is spatial planning, which is based on sustainability principles and aims to manage land use and infrastructure development to ensure efficient and equitable water distribution. This variable interacts with governance, which refers to the policies, regulations, and institutional frameworks that guide water service provision. Infrastructure is another critical variable, encompassing the physical systems (pipelines, reservoirs, treatment plants) required for water extraction, treatment, and distribution. The capacity and quality of this infrastructure directly impacts the reliability of water service delivery. However,

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environmental management is another variable, focusing on the sustainable use of natural water sources, such as rivers and aquifers, while addressing challenges like climate change, droughts, and pollution. Lastly, water service outcomes (the dependent variable) represent the overall quality, accessibility, and sustainability of water services provided to households in Thohoyandou. By examining how spatial planning, governance, infrastructure, and environmental management influence water service outcomes, the framework offers a comprehensive approach to addressing Thohoyandou town's water service challenges.

2.9 Chapter summary

In this chapter, I have examined the crucial concepts that are relevant to this study such as sustainable municipal household water service provision, spatial planning, and sustainability on its own and the concept of Municipality and water service authority. I have also delved into the theoretical frameworks that form the basis of this study, such as systems theory, new urbanism, and smart growth. The literature review establishes a strong foundation for upcoming chapters, which will apply these concepts and theories to the specific context of Thohoyandou town. The next chapter will focus on reviewing the policy and legislative landscape that regulates municipal water service provision in South Africa, offering additional insight into the deeper literature discussed in this chapter but at a policy scale.

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CHAPTER 3: UNPACKING THE POLICY AND LEGISLATIVE LANDSCAPE

3.1 Introduction

The provision of municipal household water services in South Africa is governed by a complex framework of policies, laws, and regulations at national, provincial, and local levels. This chapter provides an overview of the key policies and legislative instruments that influence water service provision in Thohoyandou town, focusing on their relevance to spatial planning strategies and sustainable municipal household water service provision. It also evaluates the current policy and legislative framework, identifying challenges and areas for improvement to enhance the sustainability of water services in the town. In this chapter, I will also discuss the multi-level governance system, covering international, national, and local policies. I will start by unpacking global policies such as the Sustainable Development Goals (SDGs), then move on to key national and regional legislative frameworks like the National Water Act, Water Services Act, and the Limpopo Growth and Development Plan. Finally, I will explore local planning frameworks in relation to Thohoyandou town as the study area, focusing on the challenges of implementing these policies on the ground. Throughout this chapter, I will emphasize the link between water service provision and spatial planning to highlight the critical need for alignment between these two sectors.

3.2 International policy context

International frameworks, agreements, and commitments influence national and regional policy responses, and these will be described as they offer a starting point for promoting international cooperation and bringing local actions.

3.2.1 Sustainable development goals

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, are a universal call to action aimed at ending poverty, protecting the planet, and ensuring prosperity for all by 2030. SDG 6, known as "Clean Water and Sanitation," is particularly relevant to the provision of municipal water services. Several studies have been done on the aims of these goals directly impact water service provision. Chen *et al.*, (2022) showed that these SDDs aim to ensure the availability and sustainability of water and sanitation

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for all, emphasizing efficient water use, protection of water-related ecosystems, and addressing inequalities in water access. In Thohoyandou, where rapid urbanization is straining the available water infrastructure, SDG 6 provides a global benchmark for improving access to safe and affordable drinking water. Masekesa, (2022) established that to achieve SDG 6 in areas such as Thohoyandou town often requires addressing both infrastructural and governance challenges because these are the impeding challenges. This is backed up by a study done by Nephawe *et al.*, (2021) whom also made suggestions on how the town's water scarcity, coupled with its growing population, makes it a priority area for interventions aligned with the SDGs. Spatial planning strategies must incorporate these goals by ensuring that water infrastructure is developed in sync with urban growth (Nephawe *et al.*, 2021). Dasgupta, et al, (2021) made remarks regarding aligning SDG 6 while calling for coordinated efforts between national and local governments to enhance water service provision, improve water quality, and sustainably manage water resources. This global agenda is crucial in shaping local policies to ensure that areas such as Thohoyandou town meet their water service delivery targets while contributing to global water security efforts.

3.3 National policy context

South Africa's water policy framework is structured in a way that ensures equitable access to water resources, promotes sustainable development, and protects the environment (Drew, 2023). The following are key national policies that influence municipal water service provision:

3.3.1 The constitution of the republic of South Africa (1996)

The Constitution of South Africa (1996) establishes the framework for the country’s water service provision by acknowledging the right to access sufficient water as a fundamental human right in Section 27. This means that the government is obligated to gradually ensure access to water through reasonable legislative and other measures. The Constitution also emphasizes the importance of sustainable water resource management, balancing the need for human consumption with environmental protection. In towns like Thohoyandou town, ensuring water access is especially important for marginalized communities (Rakgogo, 2022).

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Schindler and Kanai, (2021) suggest that the constitutional mandate directly influences how municipal water services are planned and provided, and makes revelations on how rural areas such as Thohoyandou town continue to expand, which makes it then crucial to align spatial planning decisions with the constitutional right to water for sustainable development. Mengistu *et al.*, (2021) revealed that bringing the constitutional right to water for sustainable development may involve integrating water services into broader land-use plans and infrastructure projects to ensure that all residents, including those in unplanned settlements, have fair access to water. The Vhembe District Municipality faces the challenge of implementing this constitutional right within existing financial and technical constraints, while ensuring that water services remain accessible and sustainable amidst rapid rural growth (Mukonavanhu, 2024).

3.3.2 National water act (1998)

The National Water Act (NWA) of 1998 is a key component of South Africa's water policy, this is because it establishes a comprehensive framework for the management, conservation, and protection of the country's water resources (Maphela, 2020). Artz, et al, (2020) described this act as one that emphasizes that water is a public resource, and its use must be regulated in a manner that benefits all South Africans. Kotzé, (2023) suggested that the NWA is especially pertinent to municipal water service provision as it requires that water usage be sustainable and fair. This act also mandates that municipalities develop catchment management strategies that integrate water resource management with spatial planning (Artz, et al, 2020). This integration is essential for addressing the challenges of water scarcity and infrastructure development in towns such as Thohoyandou town.

Alobaidy et al., (2022) revealed this act as one that is a crucial part of South Africa's laws for managing water services while also suggesting that its goal is to ensure that the country's water resources are used sustainably, conserved, and distributed fairly. The act declares water as a national asset, placing it under the control of the government, which is responsible for allocating water in a way that benefits all citizens. Albert, (2021) showed that the NWA gives priority to protecting the environment by safeguarding aquatic ecosystems and requires the development of strategies to manage water use in balance

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with the needs of the environment. They also mentioned that the act also highlights the importance of integrating water resource management with other sectors, such as spatial planning, making it particularly relevant for municipalities as they provide household water services, especially in areas dealing with water scarcity and infrastructure challenges. A considerable body of literature has been done on how important the NWA is with regards to Thohoyandou town, but Hofstetter, et al, (2021) characterised the National Water Act (NWA) as an especially important tool in areas such as Thohoyandou town, due to the town's water scarcity and the necessity for a sustainable water management plan. Spatial planning efforts need to be in line with catchment management strategies to ensure efficient use of water resources and infrastructure development that supports sustainable rural growth. By connecting spatial planning with water resource management, the NWA establishes a framework for integrating water conservation efforts with land-use decisions. However, implementing these strategies in Thohoyandou is challenging due to insufficient funding and technical expertise, which hinders the municipality's ability to fully achieve the objectives of the Act.

3.3.3 Water services act (1997)

The Water Services Act of 1997 provides the legal framework for the provision of water services in South Africa. It separates the roles and responsibilities of municipalities as Water Services Authorities (WSAs) and Water Services Providers (WSPs). The Act also lays out the requirements for providing basic water services, including minimum standards for water quality, quantity, and accessibility. In Thohoyandou town for example, the Vhembe District Municipality serves as the WSA, which means that it is then responsible for ensuring that all residents within its jurisdiction have clear access to safe and reliable water services (Botai *et al.*, 2024). The Water Services Act requires WSAs, like the Vhembe District Municipality, to develop Water Services Development Plans (WSDPs) that are in line with Integrated Development Plans (IDPs). This is important to ensure that water services are not considered separately but are incorporated into the municipality's broader spatial planning and development objectives.

Botai et al., (2024) wrote a paper that began with a short review of the literature regarding how the WSA municipalities must develop water infrastructure to meet the increasing

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demand for household water services as stipulated by the Water Services Act. On the paper he was also cognisant of how the Act also emphasizes the importance of providing fair and equal services, addressing the differences in water access between urban and peri-urban areas. By integrating WSDPs with IDPs, the municipality can ensure that water service provision contributes to sustainable urban development and enables the municipality to tackle long-term water security challenges. However, some studies realised that challenges such as insufficient infrastructure, limited technical expertise, and financial constraints have hindered the Vhembe District's ability to fully execute these plans, particularly in rapidly urbanizing areas like Thohoyandou town.

3.3.4 Spatial planning and land use management act (2013) (SPLUMA)

Previous studies have emphasized that the Spatial Planning and Land Use Management Act (SPLUMA) of 2013 established a framework for spatial planning and land use management in South Africa. Over time, an extensive literature has developed on how SPLUMA underscores the importance of coordinated and integrated planning across all government levels, with an emphasis on promoting sustainable development and ensuring equitable access to resources (Pienaar, et al, 2020).

Xing, (2020) successfully established that SPLUMA requires municipalities to integrate water service provision planning with spatial planning efforts/strategies, ensuring that water infrastructure is developed in a way that supports sustainable urban growth. This integration is particularly important in rapidly growing towns like Thohoyandou town, where the demand for water services is increasing alongside the town’s rapid expansion.

SPLUMA also mandates that there be development of Spatial Development Frameworks (SDFs) which outline the long-term vision for spatial development in a municipality. These frameworks must consider the availability of water resources and the capacity of water infrastructure, making SPLUMA a critical tool for ensuring that water service provision is sustainable in the long term (Xing, 2020).

Madikizela-Madiya, (2021) characterises the significance of SPLUMA in guiding sustainable development, its implementation as one that has already encountered numerous challenges, particularly at the local level. These challenges include a lack of

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technical capacity, insufficient funding, and political interference. In Thohoyandou town, Vhembe District Municipality in particular, these obstacles have impeded the effective integration of water services planning with spatial development, consequently contributing to the town's water service delivery problems (Moolman, 2021).

3.3.5 National water resource strategy (NWRS)

Several studies have revealed that the National Water Resource Strategy (NWRS) outlines how South Africa's water resources will be managed. It focuses on sustainable water use, fair access, and protecting water resources (van Koppen *et al.*, 2024). Sieben *et al.*, (2022) conclusively showed that the National Water Resources Strategy (NWRS) contains significant implications for municipal water service provision, particularly in ensuring the sustainability and resilience of water supplies. The strategy clearly emphasizes the need for municipalities to adopt integrated water resource management (IWRM) approaches, which involve the coordinated development and management of water, land, and related resources (Sieben *et al.*, 2022). In Thohoyandou town, the NWRS provides a critical framework for addressing the town's water service challenges, particularly in terms of managing water scarcity and ensuring that water services are sustainable in the long run. Hutete and Sibanda, (2022) characterised the NWRS as one strategy that also underscores the importance of municipalities engaging in water conservation and demand management practices, which are crucial for addressing the town's growing demand for water.

3.4 Regional policy context

3.4.1 National development plan (NDP) 2030

Tebogo, (2023) defines the National Development Plan (NDP) 2030 as South Africa's long-term vision for achieving sustainable development and reducing poverty and inequality while outlining several goals related to water service provision, including ensuring that all South Africans have access to clean water and improving the efficiency and sustainability of water use. Mothelesi, et al, (2022) found that the NDP emphasizes the importance of integrated water resource management and sustainable water service provision, efficient use of water resources, and the protection of water quality. These

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objectives are directly relevant to the provision of municipal water services in Thohoyandou town and as such addressing the challenges of water scarcity, infrastructure deficits, and governance issues in line with the NDP's vision is of paramount importance. A study undertaken by Muloiwa, *et al*, (2022) also underscores the significance of spatial planning in achieving sustainable development, and infrastructure development, especially in the context of rapidly growing towns. By aligning Thohoyandou's municipal water services with the NDP's objectives, Muloiwa, *et al*, (2022) also suggested that towns can ensure that their water provision is sustainable and contributes to the broader development goals of the district municipalities that are water service authorities and the country.

One of the key constructs that Muloiwa, *et al*, (2022) pointed out was that the NDP's focus on spatial planning and infrastructure development provides a crucial framework for integrating water services into broader municipal planning strategies. In Thohoyandou town, this requires prioritizing water infrastructure projects to support the town's future growth and development. The NDP also emphasizes the need for coordination between national, provincial, and local governments to ensure efficient delivery of water services. For Vhembe District Municipality, this means aligning their spatial development framework (SDF) with national priorities to address Thohoyandou's water service challenges in a way that supports the town's long-term development (Tebogo, 2023).

3.4.2 Limpopo growth and development plan (LGDP)

The Limpopo Growth and Development Plan (LGDP) is a provincial development plan that outlines the strategic priorities for economic growth, infrastructure development, and service delivery in Limpopo Province. The LGDP emphasizes the need for sustainable water provision as a key component of economic development and poverty reduction. The Limpopo Growth and Development Plan (LGDP) recognizes water as a crucial resource for economic development in Limpopo Province and calls for the efficient use and management of water resources. In Thohoyandou, the LGDP's focus on water management is particularly relevant due to the town's challenges with water scarcity and infrastructure development (Magagula *et al.*, 2022). Magagula *et al.*, (2022) also found that the LGDP stresses the importance of integrated planning and coordination among

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different sectors, such as water, agriculture, and industry while Marosa, et al, (2022) highlighted that such an integration is important when it comes to ensuring that water service provision in Thohoyandou town supports the town's economic growth and development. A plethora of papers have been written about the importance of sustainable water service provision but Marosa, et al, (2022) indicated on their study that in Thohoyandou town, the LGDP plays an important role in ensuring that the management of water resources to address the town's infrastructure deficiencies and support its economic development is taken seriously. The plan proposes increased investment in water infrastructure to ensure that water services can meet the needs of a growing population. Sirayi, (2022) highlighted that for those who are spatial planners in Thohoyandou town, aligning with the LGDP means integrating water infrastructure projects with broader land-use and economic development initiatives. This integrated approach is then crucial for ensuring that water service provision supports both sustainable rural development and the town's economic growth objectives.

3.5 Local policy and planning context

3.5.1 Integrated development plans (IDPs) and water services development plans (WSDPs)

Integrated Development Plans (IDPs) are five-year strategic plans that gives guidance towards development and service delivery priorities of various municipalities in the Republic of South Africa. The Water Services Development Plan (WSDP) is a sectoral plan that forms part of the IDP but specifically focuses on water service delivery (Motsoeneng, 2022). IDPs and WSDPs are essential for ensuring that water service provision is aligned with broader municipal development goals (Makalela, 2021). In Thohoyandou town, the Vhembe District Municipality's IDP outlines the town's strategic priorities, including the development of water infrastructure, improving water quality, and ensuring equitable access to water services. The WSDP, as part of the IDP, provides detailed plans for the provision of water services. This includes identifying infrastructure needs, strategies for water conservation, and measures to address water scarcity. Aligning the WSDP with the IDP is crucial for integrating water services into Thohoyandou's overall development strategy (Albalate et al., 2022). While Integrated

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Development Plans (IDPs) and water and sanitation development plans (WSDPs) are essential for planning water service provision, their development and implementation face several challenges. Ngossaha et al., (2022) alleges that the different challenges that exist for the development of these guiding policies include limited financial resources, technical expertise, and coordination among different levels of government. Munzhedzi, (2022) found that in developing towns like Thohoyandou, these challenges have unfortunately led to gaps in the planning and delivery of water services, worsening the town's water service issues.

3.6 Local Water Service Certification Programs

3.6.1 Blue drop and green drop certification programs

The Blue Drop and Green Drop certification programs are initiatives by the South African government to assess and improve the quality of water and wastewater services provided by municipalities. The Blue Drop program focuses on drinking water quality, while the Green Drop program evaluates the performance of wastewater treatment systems (Kelly, 2021).

3.6.3 Blue drop and green drop programs' relevance to Thohoyandou town.

For areas such as Thohoyandou town, the Blue Drop and Green Drop programs play a vital role in monitoring and enhancing the quality of water services. These programs establish standards for water quality and require municipalities to regularly evaluate and report on their performance (Zhou *et al.*, 2023). An argument raised by Kelly, (2021) argued that obtaining Blue Drop and Green Drop certification can boost public confidence in the quality of municipal water services and ensure that water is delivered in a way that safeguards public health and the environment however, Zhou *et al.*, (2023) also makes a point that these certificates can either be good or bad for the municipalities who provide water services as they can lead to laziness as they would have assumed that they are already at a good level in terms of water service delivery.

3.6.4 Challenges in achieving certification

A study done by Botai *et al.*, (2024) indicated that the Blue Drop and Green Drop programs are equally important, but the biggest challenge is that many municipalities in

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South Africa, including Vhembe District Municipality, continue to face struggles in obtaining and keeping the certification. Some of the challenges that Botai *et al.*, (2024) realized are the insufficient infrastructure, limited technical skills, and financial limitations need to be addressed to ensure that water services in Thohoyandou meets the necessary standards for quality and sustainability.

3.7 Challenges and gaps in the policy and legislative framework

While South Africa's policy and legislative framework for water service provision is comprehensive, several challenges and gaps remain, particularly in the context of implementing these policies at the municipal level. Here are key challenges extracted from a paper written by Motsoeneng, (2022) include:

Table 3.1: Challenges in policy gaps and legislative framework.

Challenge	Description
1. Capacity Constraints	Many municipalities, such as Vhembe District Municipality, lack the technical capacity and financial resources to effectively implement national policies and meet legislative requirements.
2. Governance Issues	Political interference, corruption, and mismanagement of funds are significant governance challenges undermining the effectiveness of water service provision in Thohoyandou town.
3. Inadequate Infrastructure	Aging infrastructure and inadequate investment in maintenance and upgrades contribute to the persistent challenges of water service delivery in Thohoyandou.
4. Coordination and Integration	Lack of coordination and integration between different levels of government and across sectors, leading to fragmented and inefficient water service provision.

Source:(Motsoeneng, 2022)

3.8 A detailed profile of the study area.

Thohoyandou town is the administrative centre of the Vhembe District Municipality, located in the Limpopo Province of South Africa. It is a rapidly growing town that serves as the political, economic, and cultural hub of the region. Thohoyandou falls under the jurisdiction of the Thulamela Local Municipality, which oversees local governance,

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including infrastructure development and service delivery, while the Vhembe District Municipality functions as the Water Services Authority (WSA), responsible for ensuring compliance with the National Water Act and the Spatial Planning and Land Use Management Act (SPLUMA).

The climate of Thohoyandou town is subtropical, with hot, humid summers and mild winters. Average temperatures range between 16°C and 28°C, with the warmest months being December to February (Chikoore *et al.*, 2021). Rainfall is highly seasonal, with most precipitation occurring during the summer months between November and March. The area receives an average annual rainfall of approximately 800 to 1200 mm, though this is often erratic, leading to periodic droughts and exacerbating water supply challenges (Rapholo, 2020). This unpredictability necessitates robust water service provision strategies that can accommodate both surplus and scarcity conditions. Vegetation in the Thohoyandou town is primarily characterized by lush subtropical forests, particularly in the surrounding rural areas. Within the town, continuous rural developments have led to a reduction in natural green spaces. The region is part of the Soutpansberg Mountain Range, which influences its biodiversity, hosting a variety of indigenous plants and wildlife. Conservation efforts in nearby nature reserves also play a role in the town's environmental planning.

Thohoyandou's population has seen a significant increase over the past few decades, driven by both rural-urban migration and natural growth. The town's current population is estimated to be at over 69,453 people (Census, 2011). This reflects a diverse demographic profile that includes a mix of indigenous Venda people and migrants from other parts of Limpopo and beyond. The growing population, particularly in unplanned settlements, has placed immense pressure on the town's water and sanitation infrastructure, which has struggled to keep pace with the demand. The administrative structure, climate, and rapid population growth of Thohoyandou town contribute to the complexities of water service delivery in the town. As the town expands, the need for spatial planning strategies to assist in the sustainable provision of water services becomes critical, particularly in the development of water infrastructure that can meet the current and future needs of the growing population. The Vhembe District Municipality's

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ability to coordinate land-use planning, governance, and infrastructure development will be key to addressing the water service challenges in Thohoyandou town, ensuring that sustainable water service provision is achieved despite the town's ongoing growth.

3.10 Chapter summary

In this chapter I have examined the central policies and legislative frameworks that regulate the provision of municipal water services in South Africa, focusing on their relevance to Thohoyandou town and the Vhembe District Municipality. The discussion emphasizes the importance of integrating water services with spatial planning, as required by national policies such as the National Water Act, Water Services Act, and SPLUMA. However, I have also identified significant challenges and deficiencies in the current policy and legislative framework, particularly in terms of implementation at the local level. These challenges include capacity constraints, governance issues, and inadequate infrastructure, which impede the municipality's ability to provide sustainable water services. The next chapter will outline the research methodology used in this study.

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CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

This chapter presents a discussion of the research methodology that was used to collect and analyse data. In this chapter I provide a detailed overview of the methods and approaches employed in this study to fulfil the research objectives and address the research questions. It comprehensively discusses the research design, approach, study population, sampling procedures, data collection methods, and the specific techniques used for data analysis. The chapter further delves into ethical considerations and acknowledges potential limitations of the study.

4.2 Research philosophy adopted

This study is based on the pragmatism research philosophy, prioritizing practical solutions and outcomes over abstract theorizing. Polishchuk, (2020) defines the pragmatism research philosophy as a research philosophy that emphasizes the practical application of research and the use of methods that best address the research problem. Dube, (2024) concurs with Polishchuk, (2020) and affirms that instead of strictly following positivism (focused on objective, measurable facts) or interpretivism (focused on subjective experiences), pragmatism prioritizes what works in real-world contexts. In pragmatism, the research question determines the choice of methods, techniques, and procedures, allowing for the use of both quantitative and qualitative methods as needed. It is not tied to a particular philosophical stance but emphasizes the research outcomes and how they can be applied in practice (Luo, 2024). Luo, (2024) also described pragmatism as one way that allows the researcher to use qualitative and quantitative methods to address the research problem flexibly and adaptively and this research aligns with this approach because it will employ the mixed methods approach which is a combination of both qualitative and quantitative approach. This philosophy is especially relevant for this study as it focuses on developing actionable strategies for improving water service provision in a real-world context and proposes a framework that is applicable in municipalities that are water service authorities.

4.3 Research design

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Xue and Fang, (2020) define a research design as a crucial element that guides the study, ensures a methodological rigor in the examination of the research problem. It involves describing and documenting various aspects of a situation as they occur naturally. Takona (2023) in his study described a research design as a tool that primarily addresses 'what' questions, such as current conditions, trends, or characteristics of a population or phenomenon, providing detailed accounts of situations without delving deeply into the 'why' or 'how' aspects. This study, focusing on municipal household water service provision in Thohoyandou Town, employed a descriptive research design. This design, chosen for its ability to provide a comprehensive understanding of the existing conditions, enables a systematic portrayal of the existing conditions, highlighting specific factors that influence water service provision clearly and comprehensively (Vajpayee *et al.*, 2021). The descriptive research design is complemented by a case study approach. A case study approach is a research method that involves a thorough investigation of a specific instance, event, or phenomenon (Murkin *et al.*, 2022). The mere fact that this research is focusing on Thohoyandou town as a representative example of towns in developing districts facing similar challenges allows for this approach. Dilberto, (2024) used this approach in their study and suggested that they had chosen this approach for its ability to provide a detailed and contextualized account of the factors influencing water service provision, encompassing infrastructure, governance, and environmental conditions. They further enunciated that it is imperative to use a descriptive research design to describe the phenomena under study. This approach will assist in making sure that I can describe results for each of my objectives.

4.4 The research approach adopted.

The British Limb Reconstruction Society Research Collaborative and Graham, (2024) defined a research approach as the overall strategy that guides the research process. It includes the methodologies and techniques used to collect and analyse data to address a research question or hypothesis. In this research study I used a mixed methods approach, using both qualitative and quantitative research methods. This approach integrates the strengths of both data types: numerical, objective data from quantitative methods and descriptive, subjective data from qualitative methods, allowing researchers to explore a topic from multiple perspectives (Sundström, et al, 2020). The mixed methods

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approach can be defined as a research methodology that combines both quantitative and qualitative research methods to provide a more comprehensive understanding of a research problem (Takona, 2023). Liu *et al.*, (2022) utilised this approach based on its ability to provide a thorough and comprehensive analysis of the research problem by integrating various data sources and analytical techniques.

4.4.1 Qualitative research approach.

In this research, I used a qualitative research approach. This allowed me to delve into the perceptions, experiences, and insights of key stakeholders involved in water service provision in Thohoyandou town, as well as the households. A qualitative research approach focuses on exploring and understanding a particular phenomenon's meanings, experiences, or perspectives (Phillips, 2023). Chang, et al, (2020) suggested that this approach is typically used when the researcher seeks in-depth insights into people's thoughts, feelings, behaviours, or interactions in their natural settings. This approach is open-ended and flexible, often involving non-numerical data collection methods. Qualitative data is gathered through interviews, observations, and document analysis, resulting in detailed and comprehensive information that aids in comprehending the intricate dynamics of water service provision (Takona, 2023). Qualitative data was gathered through interviews, maps, and official municipal documents which was then analysed using statistical techniques to generate objective and generalizable findings.

4.4.2 Quantitative research approach.

This study uses a quantitative research approach. A quantitative research approach is a type of approach that uses numerical data to identify patterns, test hypotheses, and generalize about a population (Amini, 2024). This approach is used to measure the current state of water service provision in Thohoyandou town, evaluate resident satisfaction, and identify patterns and trends that relate to water services provision. This objective and structured approach relies on statistical analysis to draw conclusions from measurable variables (Trivedi, 2023). Quantitative data was gathered through questionnaires, which was analysed using statistical techniques to generate objective and generalizable findings.

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4.5 The study population.

According to Sadeghi *et al.*, (2023), a study population can be defined as the group of people in a study. Godeberge *et al.*, (2022) define the study population as the target population available for study. The study population consists of all residents of Thohoyandou Town, which has a total population of approximately 69,453 people according to StatsSA 2011, this is because the district statistician has alluded that their recent statistics has not yet been published. However, this study focuses on people who live in Thohoyandou town. The study population also includes technical and spatial planning officials from the Vhembe District Municipality, vital in providing water services and spatial planning services. A study population can be defined as the group of people in a study (see sec 4.5). the study population as the target population available for study. This study focuses on two main groups described below. The *first group*; comprises the households in Thohoyandou town that receive municipal water services. Understanding their experiences, satisfaction levels, and challenges is essential to evaluate the current water service provision and come up with a sustainable framework inclined with spatial planning to provide efficient and sustainable water services. These townships (households) are set out in the following table 4.1.

Table 4.1 Table Description of the study population.

Unit description (Township/household)	Grand Total/Frequency
Tshifura	1544
Mbilwi Block Q	1455
White Area	802
Sibasa	396
Makwarela	6113
Mbaleni	1745
Ha-Magidi	3772
Miluwani Unit C	6207
Thohoyandou C	1059
Thohoyandou D	477
Thohoyandou G	1906
Mbaleni Extension	4128
Thohoyandou K	5573
Thohoyandou F	5130
Thohoyandou SP	20
Thohoyandou P West	1307
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Thohoyandou P East	2448
Muledane J	13772
Thohoyandou L	2689
Thohoyandou M	5383

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Thohoyandou J	1428
Technical services officials (Vhembe District Municipality)	6
Spatial planning officials (Vhembe District Municipality)	4
Thohoyandou	69463

Source: StatsSA (2011)

The *second group*: includes technical and spatial planning officials from the Vhembe District Municipality responsible for planning, managing, and implementing water service provision in Thohoyandou town. They are critical in this study because they allow for a deep understanding of the municipality's plans and their integration. The Table above shows the total population of this study.

4.6 Sampling procedures

According to Reinhold and Hopkins, (2021), sampling can be defined as the process of selecting a proportion that will represent the entire population. It is not possible to study the entire population due to resource constraints. Given the large population size of Thohoyandou town, it is therefore impractical to study every household and official in Thohoyandou town. Therefore, a sampling strategy was used to select a representative subset of the population for the study. The research findings from the study sample can be generalized to the whole population (Suwaydi *et al.*, 2024). This study used representative sampling methods tailored to each sample group:

4.6.1 Sampling of Thohoyandou town residents.

This study used simple random sampling to select households of Thohoyandou town. According to Shashi Bhushan, (2024) simple random sampling can be defined as an approach that assumes that every individual in the population has an equal chance of being selected. This helps reduce bias and improve the representativeness of the sample. In simple random sampling, the sample size is typically determined using a specific formula to ensure that the sample accurately reflects the population within a certain margin of error and confidence level. This technique is commonly used in studies where the population is well-defined and accessible for sampling (Chung *et al.*, 2023). This sampling technique is chosen because it allows for a sample to have an equal probability of being chosen and to be equally represented. This sampling technique has been outlined in a form of statistical formulas and calculations for the sample size below (see

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sec 4.6.2).

4.6.2 Statistical formulas and variables

For the researcher to get an estimate of the sample size, the following statistical formula will be applied for Thohoyandou town households:

$$n = \frac{N \cdot Z^2 \cdot p \cdot (1-p)}{e^2.(N-1) + Z^2.p.(1-p)} = n = \frac{69453 \cdot 1.96^2 \cdot 0.5 \cdot (1-0.5)}{5\%^2.(69453-1) + 1.96^2.0.5.(1-0.5)} = \sim 382 \text{ participants}$$

Where:

N is the population size (69453),

Z is the Z-score for a 95% confidence level (1.96),

p is the estimated population proportion (0.5),

e is the margin of error (5%).

This statistical formula guides the sampling to ensure that there is a reliable generalization of results across the population. The estimated sample size for this study will be approximately 382 participants, using a 95% confidence level and a 5% margin of error. This sample size will be sufficient to provide reliable results that can be generalized to the larger population of Thohoyandou town.

4.6.4 Sampling of municipal officials

This study used purposive sampling to select the other elements, such as the municipal officials. Singha, et al, (2023) also defined purposive sampling as a form of non-probability sampling where the researcher only relies on his own judgement when choosing members of the population to participate in their studies. This sampling technique is chosen to ensure that municipal officials who are found in the target population are represented in the sample for the purposes of clarifying or understanding of the plans, challenges and current provisions of municipal water. The researcher also purposively selected (6) technical services municipal officials and (4) spatial planning municipal officials from the Vhembe District Municipality. Purposive sampling ensures that there is an inclusion of all relevant stakeholders with specific knowledge on water service

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provision. A total of 2 elements was therefore purposively selected. The table below shows the study sample distribution table.

Table 4.2 Study sample distribution table

Unit description	Population size	Sampling procedure	Sample size (Frequency)	% Sample size (Frequency)
Households of Thohoyandou town	69453	Simple Random Sampling	382	382/392x100 = 97%
Officials	10	Purposive sampling	10	10/392x100 = 3%
Total	69463		392	100%

Source: Mudavhi (2024)

4.7 Data collection procedures

According to Lozano and Tien, (2023) data collection refers to measuring and gathering information on your variables of interest. Data collection procedures are therefore defined as the procedures used to collect data for a particular purpose or study (Tienibid, 2023).

4.7.1 Types of data

Lozano, (2023) also define data can be referred to as materials by which those doing research work with and he also highlighted in his study that there are mainly two types of data namely, the primary and secondary data. Johnston et al., (2024) primary data can be referred to as the firsthand data gathered by the researcher himself, whilst secondary data refers to data collected by someone earlier. This research used both primary and secondary data types to build a strong and convincing argument on sustainable municipal household water service provision. The primary data serves as credible evidence for this study whereas secondary sources indicate how this research is related to existing research studies. Each method of data collection is discussed separately below.

4.8 Data collection tools and procedures

This research uses both primary and secondary data collection procedures. The Primary data tools include interviews, mapping, and observations. Secondary data collection was conducted through reviewing municipal documents and other published material including

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books, maps and municipal infrastructure plans. For the researcher to link his data collection methods with the sample elements, there are specific tools that are assigned based on the type of data that is required from each sample group and have been categorized in this way.

4.8.1 Questionnaires

According to Gazzard *et al.*, (2021), a questionnaire can be defined as a document that is used to collect information that is personal from respondents and is given in a written form by the respondents. This method of data collection is chosen to make sure that there is comparability for the responses and to facilitate the analysis for the research objectives. This study had a total of 382 questionnaires distributed to representatives of households in the Thohoyandou town. The researcher administered the questionnaires to each sampled household. The participants were required to answer exactly to the same questions on the questionnaires in the same given order and given the same options for their responses. To ensure equal representation of each township, a total of 382 questionnaires was divided by 22 townships so that each township is equally covered. These options ranged from multiple choices, known as closed-ended questions or fixed alternative questions that was created by the researcher, and these also actually range from the simple to the difficult expressions of opinion. Questionnaires were designed to quantify the levels of satisfaction with water services, frequency of interruptions, and the household size.

4.8.2 Interviews

An Interview was used to collect data from the key informants at the Vhembe District Municipality (Department of Technical Services) and Spatial planning officials. According to Vaughan *et al.*, (2022), an interview is a structured conversation where one participant asks questions and the other respondent answers. The data from the municipality officials was useful as it assisted the researcher to get insight on how the municipality plans for the water service provision to households and what challenges they face by looking at their plans and other relevant documentation. This method of data collection was used because it allowed for the researcher to acquire first-hand information directly from the informants. A structured interview guide was used when asking questions to the municipal

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officials to get a guided and precise note of the answers given. The structured interviews with the officials captured qualitative insights into the municipality's water service plans, strategies, and challenges.

4.8.3 Observation

Fox *et al.*, (2022) define observation as a useful and an imperative way used to collect primary data. Observation ranges from non-participatory techniques that involve the recording of events and the activities in a particular organization (Wang *et al.*, 2020). In this study, observation was used to collect data and record the events that relate to the current conditions of water infrastructure. Lee *et al.*, (2024) argued in his study that observation makes it easy to get accurate information and, on this study, accurate information on pipeline conditions will be observed. Direct observation was conducted in different townships of Thohoyandou town mainly focussing on the professional behaviour of the Municipality in relation to water provision and used this information to develop a framework of spatial planning strategies for sustainable municipal household water service provision. Observation as a data collection method was employed in this study to gather valid and reliable data with no errors. The researcher was able to see how the pipeline conditions are in different households and took pictures whilst distributing the questionnaires.

4.8.4 Photography

According to Berard, (2021) photography refers to the use of photographs to analyse an existing situation and gain more deeper knowledge about the problem. This study used photography to conduct evidential information that can serve as proof of the conditions of infrastructure related to water service provision. Photographs were taken by the researcher to also analyse those who have established their own sources of water. This method is chosen because it allowed for the researcher to take photographs that are helpful in proving and validating data collected by other methods such as questionnaires, observation, and interviews.

4.8.5 Mapping

According to Lin, (2022), mapping is defined as a method that can be used to assist an

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individual in explaining their ideas in a pictorial form. The researcher used technical software called ArcGIS to draw maps. The role of these maps is to give more understanding about the area under research. The maps also helped in giving clarity on this research and gave enough a pictorial form of ideas that were thought of. This method is critical as maps can present information in a simple and visual way and enable those who understand visuals to get a much more granular detail of evidence presented as items such as a study area is easily located when shown in a form of a map.

4.9 Data analysis

Data analysis can be defined as a process that deals with inspecting, transforming, and modelling data with the aim of discovering useful information (Marcus, 2023). Data analysis is essential because it makes the studying of data simpler and more accurate. Researchers interpret data to avoid leaving anything out that can help them to extract insight from it (Ganzhur *et al.*, 2023). There are two data sets to be analysed which mainly are qualitative data and quantitative data.

4.9.1 Quantitative data analysis

The researcher analysed the data from the questionnaires as quantitative data. The study used the Likert scale to process and analyse data that was collected from the representatives of household residing in Thohoyandou town. According Wu *et al.*, (2020), the Likert scale is one of the mostly scale in surveys where people express their attitudes for example: agree/disagree that have been ranked along a continuum. This study focused on measuring the variables such as the current condition of water infrastructure. The study also took a strong focus on measuring how the lack of spatial planning strategies for sustainable municipal household water service provision affects households. Variables such as their household size, income level, the frequency and duration of service disruptions, satisfaction levels with water quality, and access to water frequency other variables such as pipeline status and its reliability, which was gauged through observation and documented visually for further analysis. This study used the Likert scale for measuring the multidimensional attitudes. Closed-ended questionnaires which was answered by the respondents using the Likert scale to help in understanding the condition of water service infrastructure. This study used other means for analysis,

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such as statistical computer software packages for recording quantitative data, such as Microsoft Excel 21 and the Statistical Package for the Social Sciences (SPSS) 27. Microsoft Excel 21 and SPSS 27 are currently the most used programs for the analysis of data in different academic fraternities (Wu *et al.*, 2020). They are complete statistical packages based on a point and click interface (G R *et al.*, 2024). They almost have all the features statistically readily available. Pie charts, tables, graphs were produced by SPSS and Microsoft Excel.

4.9.2 Qualitative data analysis

To analyse qualitative data collected through questionnaires, documents, photos, and interviews, the researcher did a deep textual analysis where he distilled information and meaning from text. The systems theory (See, sec 1.11 & chpt 2) entails interacting processes and the way they influence each other over time to permit the continuity of some larger whole, which will assist in identifying the systems in which the municipality operates and assist in analysing whether they are efficient and permit continuity which will lead to sustainable water service provision (Çelik, Baykal and Memur, 2020). Theories such as the New Urbanism theory (See, sec 1.11 & chpt 2) assisted in selecting relevant data, interpreting the data, and proposing explanations on issues concerning efficient and sustainable spatial planning strategies for municipal household water service provision. Data will be coded and then captured on a computer to proceed with the analysis. The collected data was organized and analysed to make enough sense of it via the graphical presentations and narratives.

4.10 Validity and Reliability

Validity can be defined as the extent to which a test or an instrument measures what the researcher wants to measure to ensure that the findings can be generalized (Savushkin, 2022). In this study, the validity was attained through an extensive literature review and the triangulation of a variety of sampling, data collection, and data analysis methods. According to Nishida et al., (2024) triangulation is using multiple methods in research to develop an understanding of the problem being studied. Findings were easily generalized to other relatable or similar situations since all the local municipalities are subjected to the same legislation or law which governs a municipality's water service provision by-laws.

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Reliability can be defined as the extent to which a measure shows the stability and the consistency within which the instrument measures the concept (Taylor, 2021). To show reliability this study should lead to similar results every time when similar methods are utilized by other researchers. A pilot study evaluated the reliability of data collection methods for research on household water service provision in Thohoyandou town. A small sample of households and municipal officials were selected to test the clarity and consistency of the questionnaire and interview tools.

4.11 Ethical considerations related to data collection

According to Spaans *et al.*, (2024), ethical consideration is an imperative aspect to consider since us as researchers continuously include people when it comes to collecting data. The University of Venda policy on ethical consideration was of paramount assistance. The policy emphasized that all studies conducted should be ethical in nature. The policy will be adhered to in the following ways.

4.11.1 Informed consent

All participants received information about the study's purpose, their role in it, and their rights. They provided informed consent before data collection began, ensuring that their participation was voluntary and based on a clear understanding of the research.

4.11.2 Anonymity

Participants' anonymity was safeguarded throughout the research process, and none of those participating in the study was revealed of their identity.

4.11.3 Confidentiality

Participants' personal information was and continues to be kept confidential, and data is presented in aggregate form to prevent the identification of individual participants. Secure storage methods have been used to protect the data from unauthorized access.

4.11.4 Transparency.

The research process was transparent, ensuring that all participants were treated with respect and dignity. The findings were reported honestly, and any potential biases or limitations were to be acknowledged.

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4.11.5 Fairness

The researcher has made sure that those who were participating were aware and in good understanding of their rights to participate in the research or not and made them aware of their right to terminate or go on with the research study at any time given without any force.

4.12 Limitations

While this study aims to provide a thorough analysis of water service provision in households of Thohoyandou town, it has some limitations. The study is limited to Thohoyandou town geographically and may not cater for all the challenges faced by other towns in the Vhembe District or elsewhere. The accuracy of the collected data may be influenced by relying on self-reported information from residents and officials, which could be affected by recall bias or social desirability bias. Some maps relating to the areas most affected by lack of water services are not easily accessible due to political information classification.

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4.13 Methodological summary matrix

Table 4.3 Methodological summary matrix

Component	Details
Research Philosophy	Pragmatism- focused on practical application of both qualitative and quantitative approaches to address real-world problems in water service provision.
Research Design	Descriptive research design with case study approach- Aimed at portraying existing conditions and understanding local context in Thohoyandou Town.
Research Approach	Mixed methods-integration of qualitative and quantitative methods to gain comprehensive insight into household and municipal water service issues.
Study Area	Thohoyandou Town, Vhembe District Municipality, Limpopo Province, South Africa
Study Population	▪ Households in Thohoyandou (N=69,453) ▪ Technical and Spatial Planning Officials (N=10)
Sampling Method	▪ Households: Simple Random Sampling (n=382) ▪ Officials: Purposive Sampling (n=10)
Data Types	Primary and Secondary Data
Data Collection Tools	▪ Questionnaires (Households) and Interviews (Municipal Officials), Observation and Photography ▪ Mapping (ArcGIS)
Data Analysis Methods	▪ Quantitative: Descriptive statistics using SPSS and Excel; Likert scale ▪ Qualitative: Textual analysis using coding and thematic interpretation
Ethical Considerations	Informed Consent, Anonymity, Confidentiality, Transparency, and Fairness (as per University of Venda policy)
Validity & Reliability	Triangulation, use of literature review for construct validity
Limitations	Geographic limitation to Thohoyandou; potential respondent biases (recall, social desirability)

Source: Mudavhi (2025)

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4.14 Chapter summary

In this chapter, I have described the research methodology used in this study. This includes the research design, approach, study population, sampling procedures, data collection methods, and data analysis techniques. I also addressed ethical considerations and potential limitations of the study. The methodology offers a strong framework for examining the challenges and opportunities related to municipal household water service provision in Thohoyandou town. The next chapter presents the analysis of the first research objective, focusing on the current state of water service provision in Thohoyandou town. This analysis lays the groundwork for understanding the challenges and opportunities explored in subsequent chapters.

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CHAPTER 5: ASSESSING THE CURRENT STATE OF MUNICIPAL HOUSEHOLD WATER SERVICE PROVISION IN THOHOYANDOU TOWN.

5.1 Introduction

This chapter seeks to address my first research objective, which is to assess the current state of municipal household water service provision in Thohoyandou Town. I assume that reliable, equitable, and efficient municipal household water service provision is essential for sustainable rural livelihoods, and disparities in this service provision will indicate underlying spatial inequalities. In this analysis the focus on key issues including (i) water accessibility, which deeply examine household access to municipal water service provision in terms of availability and reliability; (ii) service consistency in terms of the frequency of water service provision disruptions and the response times to maintenance issues; (iii) affordability reflecting on household perspectives on incumbent municipal water tariffs in relation to the service quality; and lastly (iv) the community satisfaction in terms of household experiences and grievances towards municipal household water service provision. A comparative discussion highlights similarities and disparities in service provision, and the chapter concludes with an overall summary, which offers insights into the municipal household water service provision from household experiences.

5.2 A methodological overview of assessing household perspectives on current state of municipal water service provision.

To address my first research objective, this chapter only focuses on the data that was gathered from 382 questionnaires from 22 townships of Thohoyandou town of the Vhembe District Municipality. In addition, ten interviews were conducted with the key informants or simply officials from the Vhembe District municipality who are the key officials in the spatial planning and technical services department and observations were also done to get the firsthand look at the dynamics under study. These officials were interviewed through a visit to their offices around November 2024. The study adopted a pragmatic research philosophy and utilized a mixed-methods approach to evaluate the current state of municipal household water service provision in Thohoyandou Town. A descriptive case study research design was employed to systematically capture the

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realities surrounding water service delivery, integrating both quantitative and qualitative methodologies. The study population comprised of households receiving municipal water services and municipal officials responsible for its provision. Data collection involved techniques such as structured questionnaires which were administered in households to gather information on water access, service reliability, and satisfaction levels. Semi-structured interviews were conducted with municipal officials to delve into governance frameworks and infrastructure challenges. Observational methods and photography were employed to document water infrastructure conditions across different areas. Lastly, document analysis was performed to review municipal reports and policies related to water services. Data analysis was conducted using Microsoft Excel and SPSS for quantitative data, with descriptive statistics, frequency distributions, and graphs illustrating trends in service delivery, while thematic analysis was used to examine qualitative data from interviews and document reviews. The triangulation of multiple data sources enhanced the study's validity, and a pilot study was conducted to improve the reliability of the data collection tools. The findings offered a comprehensive assessment of the current state of water services, revealing insights into infrastructure conditions, service interruptions, user satisfaction, and governance issues. This laid the groundwork for analysing challenges and proposing spatial planning strategies for sustainable municipal household water service provision.

5.3 Primary sources of water for Thohoyandou Town residents

Thohoyandou town residents get their water from different sources and the following figure 5.1 highlights the different water sources available to the community and provides a clear indication of which sources are most utilized. This information is essential for understanding water accessibility and usage patterns within the town. Most households 110 (29%), from Thohoyandou town have indicated that their primary source of water is municipal supply followed closely by rainwater harvesting 94 (25%), boreholes 85 (22%) and other sources 93 (24%). These responses suggest that while municipal water services are the predominant option, a considerable number of households of the population still relies on non-municipal sources such as boreholes and rainwater harvesting. This can be attributed to challenges in the municipal water supply which continues to place a burden on these residents. This coincides with findings from

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Makalela's (2021) study on exploring the reliance of people on municipal water supply. Makalela (2021) found that people mainly rely on water supply from the municipality as it is mostly used, and they depend upon it.

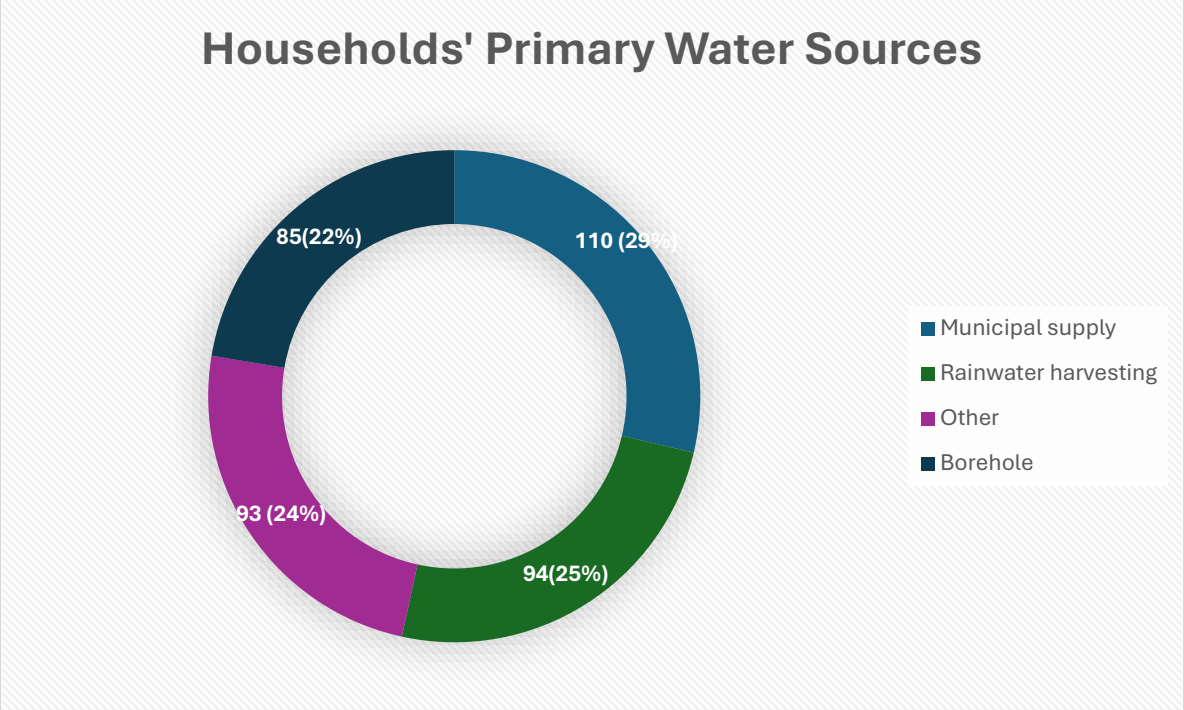


Figure 5.1: Thohoyandou Town households' primary sources of water

Source: Mudavhi NB (2025)

The following Photograph 5.1 shows the municipal water supply pipes in households, and this photograph was taken whilst I was doing my observations in households, and it really caught my attention as there was no running water at the time.



Photograph 5.1: Municipal water supply pipes in households

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Source: Mudavhi NB, (2025)

The findings highlight that municipal water services are the primary means of household water provision, however, the significant reliance on non-municipal sources highlights major gaps in the reliability and accessibility of the municipal supply system. According to the Systems Theory, (1937) water service provision functions within an interconnected framework of infrastructure, governance, and environmental factors. The use of alternative sources, such as rainwater harvesting and boreholes, indicates that households have adapted to systemic inefficiencies by integrating self-supply mechanisms to meet their daily water needs (Potgieter *et al.*, 2021). Poor allocation of water access points to deficiencies in spatial planning and infrastructure management, necessitating a more integrated and strategic approach to ensure sustainable water service provision (Ramaano, 2021).

According to Maziwisa, (2020), the reliance on rainwater harvesting and boreholes as supplementary water sources illustrates a response to the New Urbanism Theory, which emphasizes sustainable, community-driven, and resource-efficient urban development. The increasing dependence on non-municipal water sources reveals a bottom-up adaptation strategy, in which communities respond actively to infrastructural weaknesses rather than relying solely on municipal services. The Smart Growth Theory (1980) urban planning policies promote efficient infrastructure use and resilience; however, these findings give an indication that there is an urgent need for spatial planning strategies that enhance the sustainability of municipal water services, optimize resource allocation, and integrate alternative water sources into formal service delivery frameworks. Through the alignment of municipal policies with these theoretical principles, the Vhembe District Municipality can foster a more resilient and inclusive water service framework that not only prioritizes municipal provision but also acknowledges and supports alternative sources to enhance water security in Thohoyandou town.

5.4 Actors in municipal household water service provision in Vhembe District municipality.

The Vhembe District Municipality as a water service authority is the main actor in water service delivery at the local level but has various actors that work together to bring about

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good service to the people. An actor can also be defined as a party, such as an individual, organization, or system, that takes on a role or performs an action in a specific situation or process (Botai et al., 2024). In the Vhembe District Municipality, multiple stakeholders are involved in the management and delivery of water services. Key government entities include the Department of Water and Sanitation (DWS), responsible for regulation, and the Vhembe District Municipality, which oversees planning, policy implementation, and service provision. Community-based organizations, private contractors, and non-governmental organizations (NGOs) contribute by supporting service delivery, infrastructure development, and advocating for improved water access. Traditional leaders and local communities are also important, particularly in rural areas where communal water systems are widely used. The coordination and collaboration among these stakeholders play a crucial role in determining the efficiency, sustainability, and fairness of water supply services in the district.

In the Vhembe District Municipality, the Technical Services Department oversees household water services, ensuring infrastructure development and maintenance for reliable water access and sanitation. Lepelle Northern Water, a key regional water board, plays a crucial role in this system. Botai *et al.*, (2024) also suggested that these actors in local government play a critical role in bringing about services to the people and making sure that government runs its business efficiently. It extracts raw water from natural sources, treats it to meet safety and health standards, and then supplies it in bulk to municipal networks across Limpopo Province, including Vhembe District. The collaboration between the Technical Services Department and Lepelle Northern Water is essential in delivering efficient water services. Together, they work to meet the community's needs, providing a continuous and sustainable supply of safe water to households.

5.5 Frequency of municipal water supply and interruptions

The following figure 5.2 shows the frequencies in household's municipal water service interruptions and how they affect the people of Thohoyandou town, these issues comprise of the response rates of the households and the frequency of the interruptions that take place.

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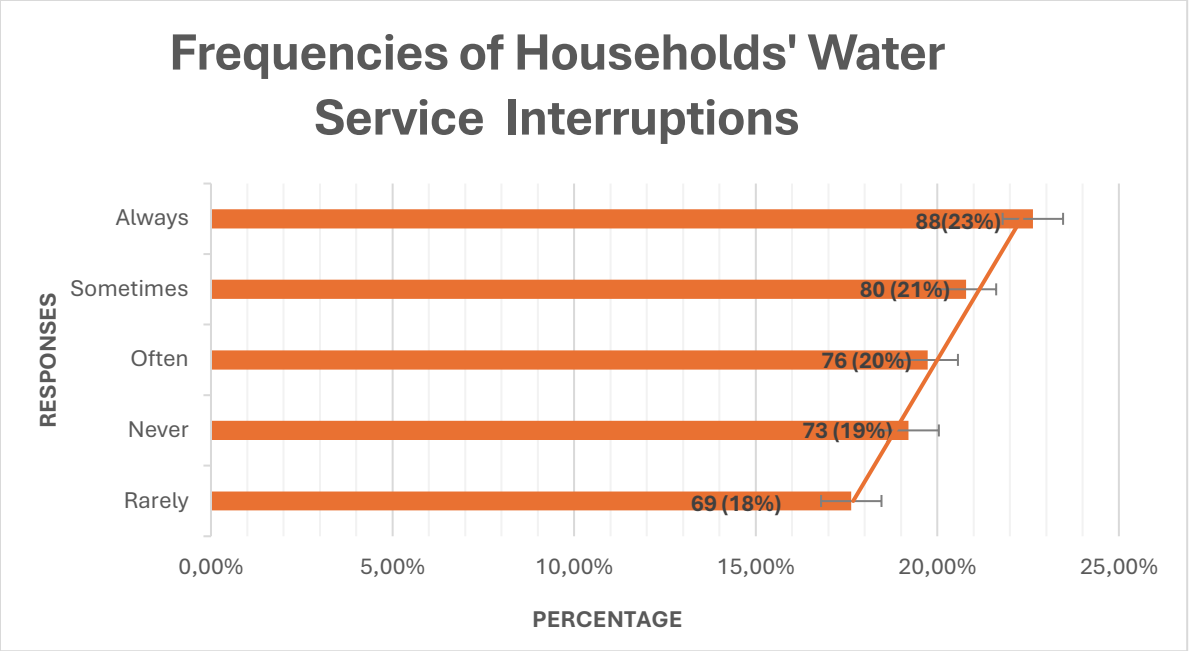


Figure 5.2: Frequencies of household's municipal water service interruption

Source: Mudavhi NB, (2025)

Most households in Thohoyandou Town indicated that they frequently endure interruptions in municipal water supply. interruptions in water supply emerge as an inconvenience to households' daily water needs and this highlights a pressing issue which requires urgent attention. The most prevalent response among residents indicates that the disruptions "Always," occur (23%). This suggests that the challenges presented by water supply interruptions are not only widespread, but also y impact the routines and well-being of the households.

These water shortages can lead to considerable inconveniences, prompting residents to develop various coping strategies. Many households' resort to storing water in JoJo tanks and drums when it is available, while others depend on alternative water sources, such as boreholes. Some may even turn to purchasing water from private vendors where some sell one drum of water at a fifty-rand rate, which can impose additional financial burdens. Photograph 5.2 depicts some methods that people use to store water ensuring that they remain with water when municipal supply fails to supply water.

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Photograph 5.2: Jojo tanks as water storage

Source: Mudavhi NB (2025)

The Systems Theory, (1937) underscores the intricate connections between municipal infrastructure, governance, and environmental factors in a way that these factors are interconnected and the unavailability of one affects the other. Mukonavanhu, (2024) submits that it has now become evident that the disruptions in Thohoyandou Town are indicative of underlying systemic inefficiencies. These may stem from poor planning, inadequate maintenance, or a shortage of water resources, all contributing to the erratic supply of water that residents have come to expect. The principles of Smart Growth Theory (1990) are pertinent as well, emphasizing the need for efficient infrastructure planning and investments in sustainable water management solutions. According to Luvhimbi *et al.*, (2022) the persistent interruptions in water service clearly signal the necessity for proactive spatial planning strategies that prioritize water security, which would involve integrating alternative sources and optimizing the performance of existing municipal services.

5.6 Household access to municipal water and coping strategies during interruptions.

The household responses on these indicated several issues which residents face in

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accessing water, including irregular supply schedules, low water pressure, and inadequate infrastructure maintenance. Many households struggle to obtain a consistent and sufficient water supply, causing them to seek alternative solutions. This reliance on stored or externally sourced water indicates that municipal service delivery cannot meet demand, leading to an increased dependence on self-supply methods such as boreholes and rainwater harvesting and areas such as Thohoyandou Town do not experience rainfall frequently which places a burden on the households. The following photograph 5.3 below shows households going to fetch water during times when water shortages or interruptions occur.



Photograph 5.3: Residents going to fetch water with containers and drums

Source: Mudavhi N.B (2025)

When people or households go to fetch water during times of water shortages or interruptions, it literally means that they are physically leaving their homes to find and collect water from available sources mainly because their usual supply such as piped municipal water is unavailable due to various either technical or operational reasons. This activity of fetching water often includes walking, sometimes over long distances, to public taps, private boreholes, or water delivery points and sometimes to even purchase water from those who have within their houses. This mere activity clearly reflects a disruption in the normal municipal water supply systems, thus forcing families to spend extra time and

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effort securing water for daily needs like drinking, cooking, and washing.

The Systems Theory, (1937), highlights that the interconnectedness of various elements within a system are critical in delivering services. In Thohoyandou Town's water provision case, municipal infrastructure, governance, and environmental conditions all contribute to service reliability. If any of these components are weak or inefficient, the entire system becomes vulnerable, resulting in frequent interruptions and service failures. Thus, the current state of the water supply in Thohoyandou reveals systemic inefficiencies that necessitate urgent spatial planning interventions to improve sustainability and reliability (Hofstetter, 2021). Zindi, (2022) suggests that when faced with water supply interruptions, residents adopt various coping strategies. Common practices they highlighted include the purchasing water from private vendors, storing large quantities of water in containers, and utilizing boreholes or rainwater harvesting systems. These strategies illustrate the need for self-sufficiency among households due to unreliable municipal service delivery. The growing dependence on decentralized water sources reflects the principles of New Urbanism Theory, (1980), which advocates for integrating diverse water access strategies into urban and semi-urban environments to enhance resilience.

While alternative water sources can mitigate the effects of supply failures, they may not always be sustainable, as not all households can afford the costs associated with private water vendors or borehole drilling (Chikozho, 2020). This creates socio-economic disparities, with wealthier residents enjoying better water security while lower-income households suffer more from municipal failures. The Smart Growth Theory, (1990) suggests that municipalities should focus on infrastructure planning that accommodates future growth and minimizes disruptions. The lack of long-term strategic planning in Thohoyandou has exacerbated the current water crisis, as population growth and urban expansion have intensified pressure on an outdated and poorly maintained supply system. These findings suggest that a more integrated, data-driven, and community-focused approach to water management is necessary to ensure equitable access to sustainable municipal household water services for all residents of Thohoyandou, regardless of socio-economic status.

5.7 Households' municipal water quality perceptions

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Figure 5.3 below indicates the households' municipal water quality perceptions and how these affect their daily lives as drinking water must always be clean for public consumption purposes.

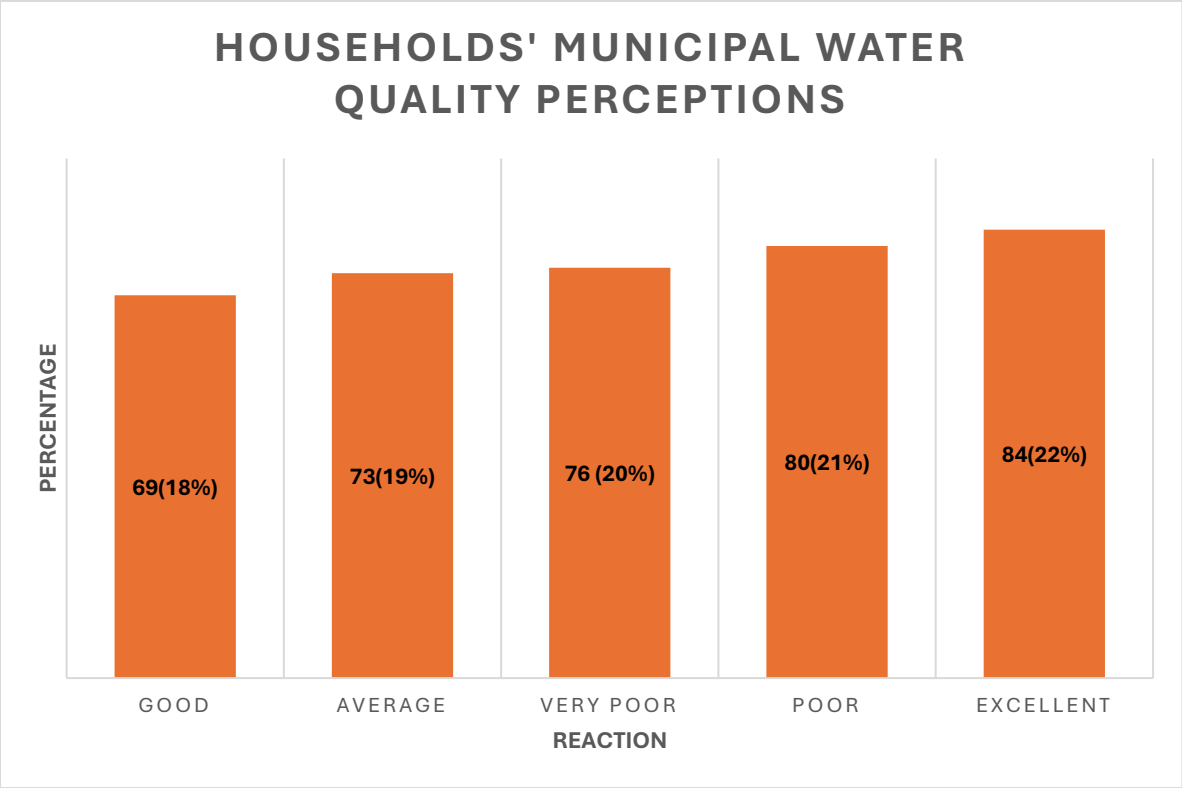


Figure 5.3 Households' municipal water quality perceptions

Source: Mudavhi NB (2025)

The perceptions on municipal water quality in Thohoyandou town vary among residents, reflecting a wide range of experiences with household water service provision. While 22% (84) of households rated the water quality as "Excellent" and 18% (69) considered it "Good," a significant number of people expressed dissatisfaction: 20% (76) rated it as "Average," 21% (80) as "Poor," and 19% (73) as "Very Poor." These perceptions indicate that, although some households receive reasonably high-quality water, many residents have concerns related to water safety, taste, and consistency. These perceptions were measured through a structured questionnaire distributed to residents across the different townships in the town. Respondents were requested to rate various aspects of water quality using a Likert scale. The indicators gave the insights into how residents perceive the current state of their municipal water while reflecting their level of satisfaction, concerns, and trust in the safety of the water.

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Water quality can be defined as the chemical, physical, and biological characteristics of water, typically in relation to its suitability for a specific purpose such as drinking (Dau, 2010). It is determined by assessing aspects such as pH level, turbidity, dissolved oxygen, presence of contaminants like heavy metals or pathogens, and overall clarity and taste. Good water quality implies that the water is safe, clean, and free from harmful substances that could pose a risk to human health or the environment. The standards for water quality are often set by health and environmental agencies to ensure public safety and ecological balance but in this can the turbidity level of the water can be assessed by residents just by mere looking into the water and its taste.

According to a study done by Dau, (2010) variation in water quality ratings implies spatial disparities in water distribution, whereby some areas of Thohoyandou town receive better-quality water than others. According to the New Urbanism Theory (1980), it is important to have equitable and sustainable urban services that promote quality living conditions for all residents. In rural areas such as Thohoyandou Town, water service provision appears to be unevenly distributed, causing dissatisfaction and potential health risks, especially in areas where water quality is perceived as poor (Ramaano, 2021). Concerns about contamination, discoloration, and odour indicate possible inefficiencies in water purification processes or issues within the distribution infrastructure, such as leaks and pipe corrosion. Consequently, residents are often forced to find alternative purification methods, such as boiling water or purchasing bottled water, which adds to their financial burden. The Systems Theory, (1937) ventilates that the effectiveness of municipal water provision is influenced by the complex interaction of infrastructure, governance, and environmental factors. Botai et al., (2024) suggests that any of these components are inefficient such as inadequate water treatment facilities or aging distribution networks, then the quality of water service becomes unreliable. This inconsistency suggests that the municipal system lacks a standardized and effective quality control mechanism, leading many residents to question the safety of the water they consume (Botai et al., 2024).

The Smart Growth Theory, (1937) suggests that there is a clear need for long-term planning and investment in critical infrastructure to ensure that urban/rural expansion

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does not compromise service quality. Without proactive planning, the growing demand for water services in Thohoyandou Town will continue to strain the existing system, worsening disparities in water quality across different neighbourhoods (Syväjärvi *et al.*, 2017). Addressing water quality concerns necessitates evidence-based policy recommendations, such as upgrading treatment plants, enhancing monitoring systems, and implementing transparent water testing practices, as well as increasing public engagement and community awareness programs on water conservation and safety, which will help residents better manage risks associated with water quality (Mhlanga *et al.*, 2021). These findings have highlighted the need for a strategic and adaptive approach to municipal household water service provision, ensuring that infrastructure investments and policy decisions are informed by real-life user experiences.

5.8 Health Issues related to the water quality in Thohoyandou town.

In Thohoyandou town, there are concerns about water quality that have been linked to significant health issues among households. The results in this study concur with those from a study done by Luvhimbi, (2020) of assessing the bacteriological quality of drinking water in Thulamela Municipality, which includes Thohoyandou town, suggested or found that while E. coli and total coliforms were absent at the water source, such contaminants were present in the samples from street taps and the household storage containers. Specifically, the total coliforms were detected in 62.5% of samples during the dry season and 87.5% during the wet season, with E. coli present in 10.4% and 13.2% of samples, respectively.

These findings also suggested that factors including but not limited to intermittent water supply and inadequate household water storage practices contribute to the microbial contamination, increasing the risk of waterborne diseases. While I did not find the specific hospital statistics for Thohoyandou town or the mere fact that they are not readily available, the presence of these pathogens in drinking water is a known risk factor for gastrointestinal illnesses, which can lead to increased hospital visits and pose serious health risks, especially to vulnerable households. This section and figure 5.4 ventilate the health issues that are prevalent in Thohoyandou town attributed to the water quality and how this affects the households and their daily lives.

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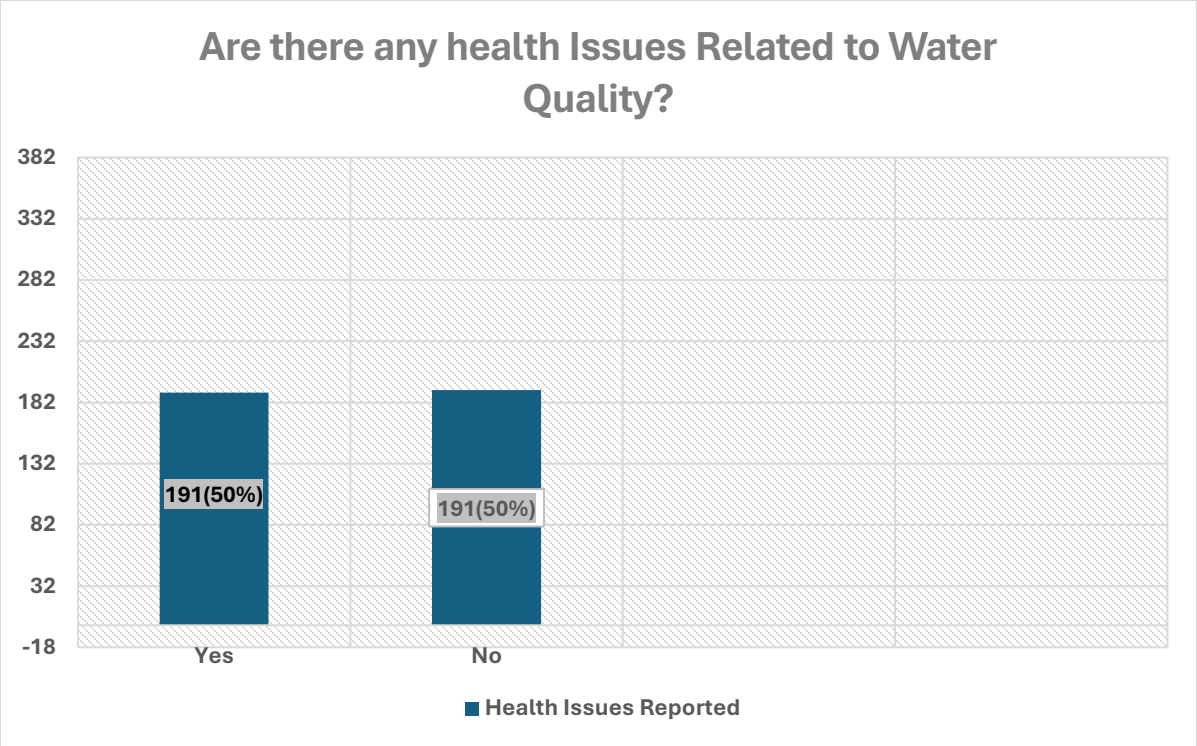


Figure 5.4: Health Issues related to the household water provided by the municipality in Thohoyandou town.

Source: Mudavhi NB (2025)

About 191 (50%) of the respondents indicated that they have experienced health complications associated with municipal water, including waterborne diseases such as cholera and skin conditions such as rashes, and eczema flare-ups. According to municipal records, these issues are prevalent, and the municipality is continuously trying to resolve the problem so that they become less prevalent in their communities. This significant finding underscores a pressing public health concern and highlights the urgent need for improved municipal water quality management. Safe drinking water is not only a fundamental human right but also essential for sustainable rural development (The Constitution of the Republic of South Africa, 1996). Therefore, these findings call for stricter water testing protocols, enhanced purification methods, and targeted public health interventions (Mwale *et al.*, 2021). Inadequate water quality impacts individual health and has broader socio-economic consequences, such as increased healthcare costs and diminished workforce productivity (Nyahunda, 2022). One of the principles of environmental justice, advocating for equitable access to clean water and the fair distribution of environmental risks across communities should be prevalent in towns such as Thohoyandou (Coolsaet, 2021).

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The prevalence of waterborne health illnesses in Thohoyandou indicates deficiencies in municipal service provision, reinforcing the necessity for spatial planning strategies that integrate water infrastructure development with public health considerations. Theories of ecological modernization support this approach, suggesting that technological innovations, such as smart water monitoring systems and decentralized purification units, can enhance water sustainability while reducing public health risks.

The Systems Theory, (1937) of urban and rural planning views municipal water supply as a complex, interdependent system shaped by governance structures, environmental conditions, and community behaviours. The high incidence of water-related illnesses points to a systemic failure to maintain water quality, necessitating coordinated efforts between municipal planners, water service providers, and health authorities. Addressing these challenges requires not only infrastructural investments but also participatory governance that actively involves communities in monitoring and decision-making processes. By applying these theoretical insights, the study emphasizes the importance of a strategic spatial planning framework that ensures sustainable and equitable water service provision in Thohoyandou town.

5.9 Households' perceptions on the Vhembe District Municipality's management of water service delivery

This section presents household perceptions of the Vhembe District Municipality's management of water service delivery in Thohoyandou town. Most of the residents have expressed their dissatisfaction and have mentioned that this is due to inconsistent water supply, and delays in addressing water-related problems. Figure 5.5 illustrates the distribution of responses, highlighting a significant proportion of households that rated the municipality's performance as poor. These views reflect broader concerns about the municipality's capacity to ensure reliable and safe water access. The findings of the study have highlighted the households' perceptions regarding the municipality's management of water services as one that varies significantly. About 199 (52%) of households perceive the municipality as transparent, whilst 183 (48%) express dissatisfaction. Many among the dissatisfied cite poor communication, slow responses to complaints, and insufficient infrastructure development as their primary concerns. This indicates that, although a

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portion of the population is confident in the municipality's management of water services, others feel that the municipality is not entirely transparent to the communities regarding water services when they voice their issues regarding water services.

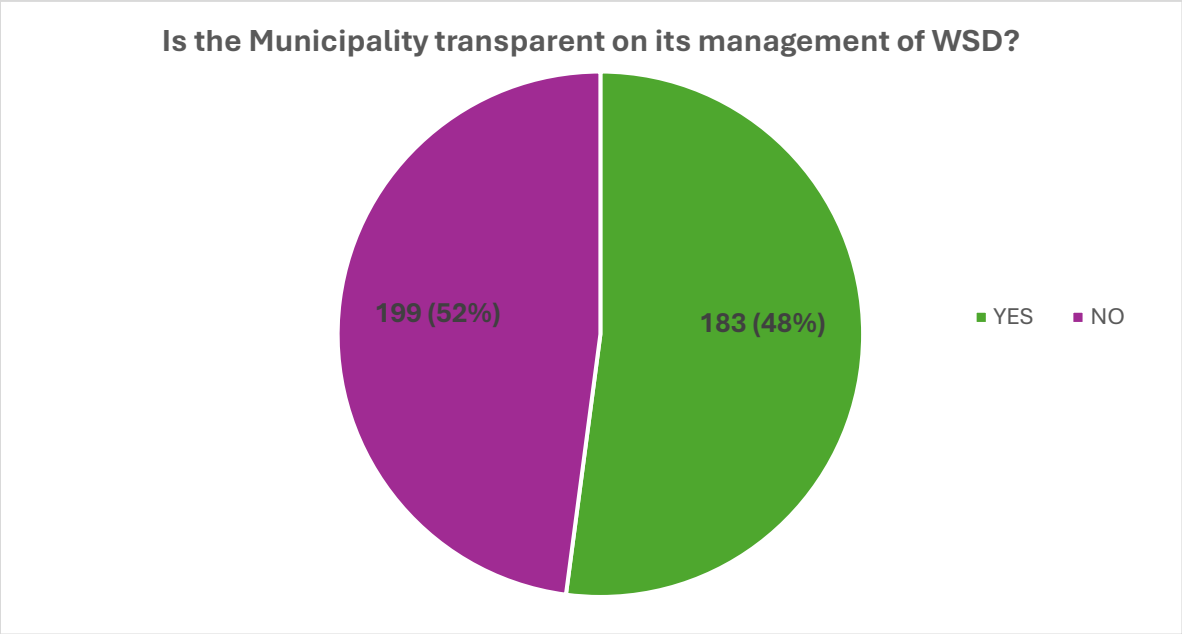


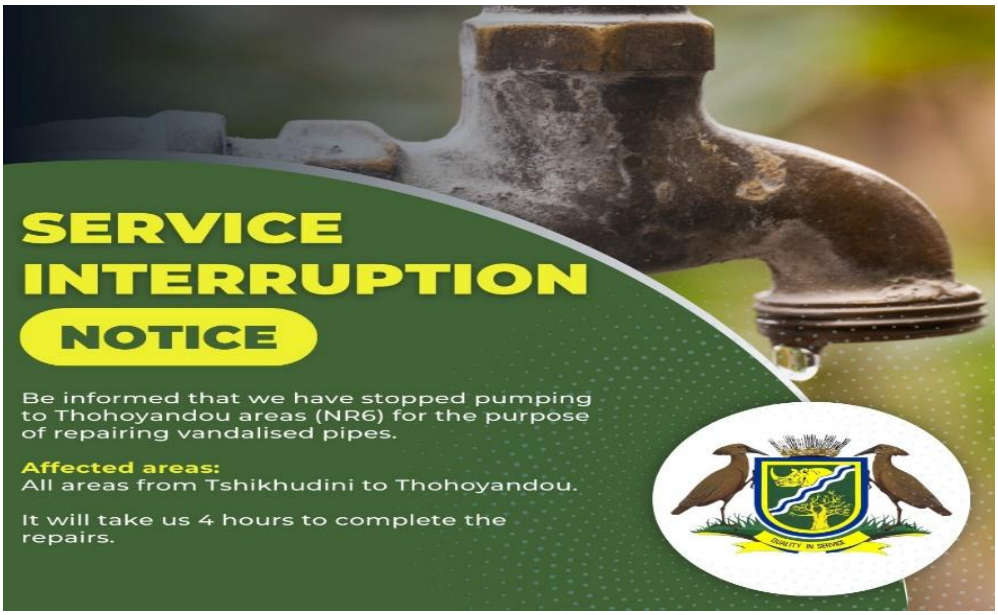
Figure 5.5: Perceptions of Municipality's Management of Water Service Delivery

Source: Mudavhi NB (2025)

To enhance public trust, the municipality must improve communication with residents, address complaints more promptly, and invest more in water infrastructure development. The Systems Theory, (1937) advocates that in urban/rural planning there is a clear need for various components of a city such as governance, infrastructure, and community needs to work harmoniously for effective service delivery. The sentiments of those who feel unheard highlight a disconnect between municipal planning and public expectations. To enhance water services, the municipality should actively involve the community in decision-making processes and leverage modern technology for complaint tracking and better management of water systems. The Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA) offers essential guidelines for enhancing municipal services. SPLUMA encourages equitable access to basic services, such as water, and advocates for municipal planning that benefits all residents. The significant dissatisfaction regarding water infrastructure development suggests that current municipal planning does not adequately address community needs. To rectify this, the municipality should adhere to

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SPLUMA's principles by integrating water infrastructure planning with rural development and ensuring community participation in the process. By doing so, the municipality can not only improve water services but also foster greater trust among residents. A study conducted by Xing, (2020) also found similar findings regarding SPLUMA (See section 3.3.4 on chpt 3). Some of the respondents have indicated that they do receive communications from the municipality via online communication channels and that is a simple way in which the municipality shows its transparency.The below image (photograph 5.4) depicts the communication relayed by the Vhembe District Municipality which is the water service authority and the municipality in question on water service interruptions that would take place and the areas affected.



Photograph 5.4: VDM Water Service Interruptions Communication

Source: VDM Communication.

In Thohoyandou Town, one of the most pressing challenges facing municipal water service delivery is the effective communication between the Vhembe District Municipality, the designated water service authority, and the residents who depend on its essential services. Clear and timely communication is crucial for keeping residents informed about planned service interruptions, the specific areas that will be affected, and the anticipated duration of these disruptions (Malele, et al, 2018). Unfortunately, many residents have voiced their dissatisfaction with the municipality's current communication practices.

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When disruptions occur due to maintenance, infrastructure failures, or water shortages, residents often find themselves in a frustrating state of uncertainty, unsure about when the water supply will be restored. This lack of timely and clear updates creates significant inconvenience, particularly for households and businesses that rely heavily on a consistent water supply for their daily activities. Implementing better communication strategies such as SMS notifications, radio announcements, and efficient updates via social media could significantly enhance the timely flow of information, enabling residents to adjust their plans accordingly during service interruptions.

Through systems thinking, an idea that urban and rural services operate as interconnected systems can be classified as a reality that those who operate or create these systems must align with to ensure efficient service delivery. According to Nekhavhambe, (2014) the delivery of water services transcends the mere provision of clean water; it also encompasses effective governance, infrastructure maintenance, and robust public engagements. When the lines of communication between the municipality and the residents break down, it hampers the overall efficiency of the entire system, resulting in a cascade of issues that affect the community.

The Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA) offers a legal framework that could play an important role in addressing these communication gaps. SPLUMA emphasizes the principles of spatial justice, sustainability, and efficiency, ensuring that crucial services like water are not only accessible but also managed equitably. The evident lack of communication regarding water service disruptions highlights a shortcoming in the Vhembe District Municipality's adherence to SPLUMA's principles of inclusive and transparent governance. To remedy this situation, municipal planning needs could merge water service management with rural development strategically. It is crucial that residents from all areas, whether urban, peri-urban, or rural, receive equitable attention in water service planning efforts. SPLUMA promotes the importance of public involvement, suggesting that the municipality should actively engage communities in meaningful discussions about water infrastructure projects and anticipated service disruptions (Stevens, 2017). Through the integration of the principles outlined in SPLUMA and embracing modern communication tools, the Vhembe District

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Municipality can enhance transparency, reduce resident complaints, and foster a more effective and responsive water service system in Thohoyandou Town. Through these improvements, the municipality can ultimately cultivate a more informed and engaged community, leading to a more resilient and efficient water service delivery framework.

5.10 The current state of water infrastructure in Thohoyandou Town according to water engineers at the Vhembe District Municipality.

In this section, I present the findings from the technical officials of the Vhembe District Municipality (water engineers) and give a detailed overview of the current state of infrastructure in Thohoyandou town. The technical officials at the Vhembe District Municipality have provided insights into the complexities of the water infrastructure in Thohoyandou town, revealing a combination of relatively modern installations alongside aging, stressed components, leading to a system that can only be considered moderately reliable. To begin with, the positive aspects, the Nandoni water supply scheme was a notable highlight. This scheme includes the Nandoni Dam and the main treatment plant, both of which are new having been constructed just over a decade ago and are currently in excellent condition. The infrastructure provides a robust foundation for the water supply in the area, capable of delivering high-quality water when the system operates at optimal efficiency (Iwara, *et al*, 2020). Several of the main reservoirs throughout Thohoyandou Town have either been constructed or refurbished in recent years, ensuring they remain structurally fit and functional.

It is important to make it clear that this study does not focus on the technical engineering assessment of the water distribution network, such as pressure flow, pipeline sizing, or hydraulic performance and the full use of engineering terms. Instead, the research captures insights shared by municipal officials and residents regarding the state of water infrastructure. The overall water distribution network has a concerning situation because from the responses that I got, the officials made an indication that a long part of this network, particularly the primary and secondary pipelines, was installed during the 1980s and 1990s, with some sections dating back even earlier. As a result, many pipes in operation today are over 30 to 40 years old, which significantly impacts their integrity and reliability. These aging pipes frequently experience bursts, particularly the older asbestos

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and steel varieties that are prone to corrosion and cracking. This deterioration translates into a physical network that is showing considerable signs of wear and under-capacity. According to Holland, (2012) the condition of the pump stations adds to the infrastructure's overall concerns. While a few stations have benefited from upgrades that include modern pumps and backup generators, many others continue to rely on outdated equipment that is both energy-inefficient and susceptible to breakdowns. For instance, the pump station associated with the Thathe Vondo dam has faced persistent challenges, largely due to the age of its pumps, which struggle to cope with fluctuating power supply conditions. The following Figure 5.6 shows the Nandoni bulk water supply scheme and how the water is supplied to the people of Thohoyandou town together with other areas.

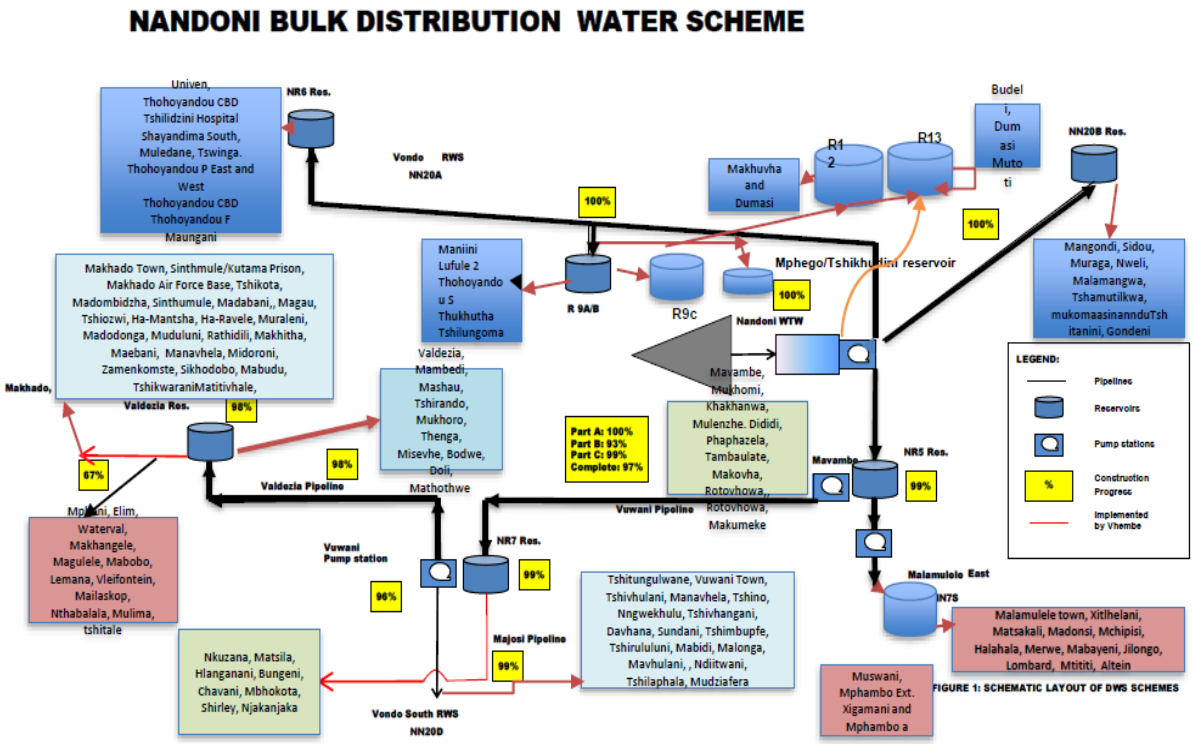


Figure 5.6: Nandoni Bulk Distribution Water Scheme

Source: VDM, Technical Services

Figure 5.6 illustrates that Thohoyandou gets its water from Reservoirs R6 and R9AB and this clearly shows the water connections and if those areas are within completed bulk water supply projects and as such Thohoyandou town has reservoirs that supply water

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but the situation from the people is quite different from what these municipal diagrams entail. In peri-urban areas, the situation is even more serious. The infrastructure tends to consist of rudimentary systems, often involving just a single borehole paired with a small plastic tank meant to supply an entire village. Unfortunately, many of these setups are either in disrepair or simply inadequate to meet the community's needs.

When conducting a comprehensive assessment of the overall water infrastructure, it is evident that the condition can be rated as fair to poor. There are critical vulnerabilities identified within the system one significant concern being the main bulk pipeline that stretches from Nandoni to Thohoyandou Town, which operates as a singular line. Given its past failures, any disruption to this line can lead to widespread outages across the area. The lack of redundancy in the infrastructure is notable; there are very few looped connections that would allow for water rerouting in the event that one pathway becomes compromised (Phungela *et al.*, 2022). The years of limited maintenance efforts characterized by an absence of routine valve replacements or updates to control systems have rendered the operation of the network increasingly challenging. For example, some valves have deteriorated to the point where they can no longer fully close, complicating attempts to isolate specific sections for necessary repairs. The state of the infrastructure necessitates a largely manual approach to oversight. Gaushell and Darlington (1987) suggest that the absence of a comprehensive SCADA (Supervisory Control and Data Acquisition) system means that technicians are required to check the reservoir levels and pump statuses physically daily. This lack of automated monitoring significantly heightens the risk that problems may go unnoticed until they escalate into more severe issues. While the core water source and treatment facilities are robust, the distribution infrastructure exhibits significant strain. Characterized by aging pipelines, inefficient pump operations, and insufficient extensions throughout all areas of the municipality, the current state of the system is a primary factor contributing to ongoing water shortages. There is a clear and pressing need for substantial investment to refurbish and expand the network, as without these interventions, they have indicated they will continue to manage a system that is patchily functioning, some parts resilient and capable, while others remain vulnerable and fragile.

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5.11 Monitoring and addressing infrastructural issues in municipal governance

This section addresses how the Vhembe District Municipality monitors and addresses its infrastructural issues as the water service authority. Officials at the district municipality's technical services department have stressed the importance of employing a variety of methods to monitor the condition and functionality of water infrastructure. While these efforts have been beneficial, they acknowledge that there is significant room for improvement in their monitoring processes. Currently, the municipality utilizes a mix of advanced technology and manual oversight to track and maintain key water infrastructure assets. For instance, critical locations such as reservoirs and pumping stations are equipped with basic telemetry systems, which include water level sensors and flow meters to provide real-time data. However, it is important to note that not all areas within the municipality are outfitted with these instrumentation systems, leaving gaps in comprehensive monitoring. The photograph 5.5 below depicts VDM technical officials working on the maintenance of water pipelines in Thohoyandou town.



Photograph 5.5: Technical officials working on the maintenance of water pipelines in Thohoyandou town.

Source: VDM Archives (2024)

To supplement/ the technological monitoring, regular inspections conducted by dedicated maintenance teams as shown in photograph 5.2 above. These teams perform essential checks on pump houses and conduct thorough visual assessments of main pipelines to

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detect any signs of leaks or deterioration. A significant portion of the monitoring activity also relies on community involvement; residents can report issues through a call centre, and ward councillors serve as vital links between the community and technical services (Loubser, 2021). In the event of reported issues, the municipality has established a structured response system. Emergency repair teams are mobilized to address serious problems, such as major pipe bursts that could disrupt service or pose safety risks. In contrast, less urgent issues are scheduled for maintenance later, ensuring a balanced approach to resource allocation. The municipality is diligent in logging all reported issues, allowing them to prioritize repairs based on severity and potential impact on the community. This system of prioritization ensures that the most critical problems are addressed promptly. They have indicated to be engaged in preventive maintenance practices, which include regular servicing of pumps and other equipment to reduce the likelihood of future failures. According to Makungo *et al.*, (2019) municipality compiles periodic infrastructure assessment reports that analyse the condition of the water system comprehensively. Annual audits are also conducted, which inform their budgeting processes and project planning efforts. By analysing data from various incidents and recurring issues, the municipality seeks to implement long-term solutions. For example, in areas with a history of frequent pipe bursts, they may install pressure-reducing valves to mitigate the risk of future disruptions. Through these efforts, the district municipality aims to enhance the resilience and reliability of its water infrastructure while fostering a collaborative relationship with the community it serves.

5.12 Governance dynamics on water service delivery in Thohoyandou town.

Effective governance is important when it comes to municipal water services, as it ensures that valuable resources are managed in a manner that is both transparent and equitable. The policy and governance landscape, shaped by the Spatial Planning and Land Use Management Act (SPLUMA), the Water Services Act 108 of 1997, and the Municipal Systems Act 32 of 2000, forms a solid foundation that compels municipalities to deliver safe and accessible water to every resident. These legislative measures underscore the importance of accountability, active public participation, and the obligations of local governments to provide high-quality services. However, a troubling disparity exists between these well-structured policy objectives and the real-life

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experiences of residents in Thohoyandou town. In the Vhembe District Municipality, residents often voice their dissatisfaction regarding the delivery of water services, primarily influenced by various governance issues. Many individuals reported frustrations with the municipality's inconsistent ability to supply safe and clean drinking water during the time in which i was handing out the questionnaires and sometimes during times when i interact with them whilst collecting my data. This dissatisfaction is particularly evident when it comes to frequent interruptions in water suppl. Numerous respondents lamented that, although the municipality is legally bound to provide these essential services, their actual experiences tell a different story characterized by delays in addressing service disruptions and a lack of communication concerning maintenance schedules. This disparity between governance policies and the perceptions of the public underscores a fundamental concern, the divergence between the laws established to regulate water service delivery and their practical enforcement at the local level. This discrepancy sheds light on the governance challenges within the municipality, particularly regarding the management of water delivery systems and the responsiveness to residents' concerns. Despite the clear guidelines set out in SPLUMA and the Water Services Act, inefficiencies in implementation and a failure to effectively engage with the community on critical issues such as service interruptions or water quality severely undermine residents' trust in their local government. To bridge this gap and foster improved service delivery in Thohoyandou town, it is important to strengthen local governance ways of doing things and equally promote more proactive communication with the public which is the constituency, ensuring that residents feel heard and valued in matters concerning their water services.

5.13 Areas most affected by inadequate water service provision in Thohoyandou town.

The peri-urban townships and settlements surrounding Thohoyandou town are experiencing significant challenges related to inadequate water services, making them the most affected areas in terms of access to reliable water supply. In contrast, the urban core of Thohoyandou, which encompasses the central business district and adjacent formal neighbourhoods, generally benefits from a more developed and maintained water infrastructure. This part of town features established pipelines and reservoirs that effectively service these areas due to their strategic importance, which includes critical

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facilities such as hospitals, universities, and various businesses. As a result, these areas often receive priority for maintenance and repair efforts. Muloiwa, (2022) also highlighted findings that resonate with this aspect (see section 3.4.1 in chapt 3). Despite this relative stability, even the urban core is not immune to water supply interruptions. Such disruptions typically occur in situations where the main water supply is low or during unexpected infrastructure breakdowns. However, it is the outlying communities specifically the peri-urban villages under the jurisdiction of Thulamela Municipality that experience chronic water shortages and supply issues. Villages such as Budeli, Dumasi, Mutoti, and Makhuvha, among others located on the periphery of Thohoyandou town, often find their water supply to be highly unreliable. Figure 5.7 below shows one of the affected area.

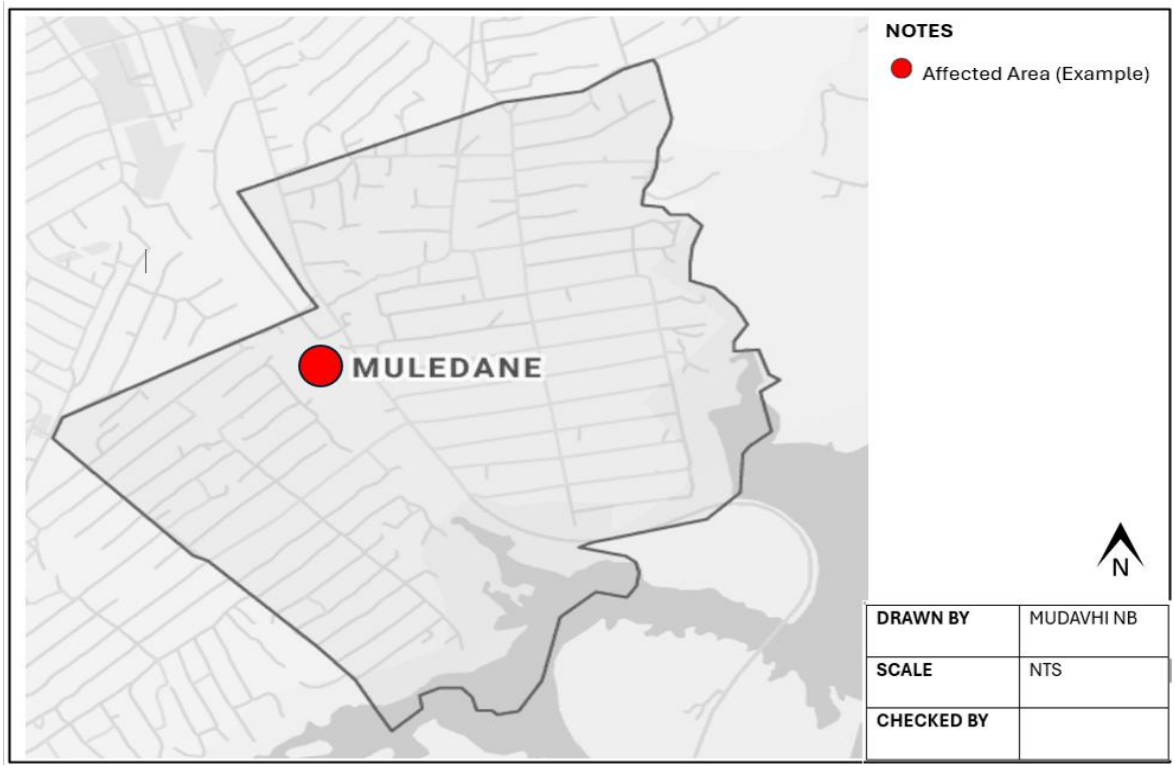


Figure 5.7 Map of affected area

Source: Mudavhi (2025)

Many residents in these peri-urban areas such as Thohoyandou Block J (Muledane) depend on communal taps, which are sparsely distributed, or on periodic deliveries from water tankers. Unfortunately, households in these communities can go days or even

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weeks without a consistent supply of water, leading to dire circumstances. A study done by Tuwani Petrus Malima, (2021) indicated that these areas often receive far below the basic standard of water availability, with some households averaging less than 50 litres per person per day significantly lower than national norms and standards. Photograph 5.6: shows the communal taps and water tankers at Makwarela Township.



Photograph 5.6: Communal Taps and water tankers at Makwarela Township

Source: Mudavhi NB (2025)

The geographical locations/distance of these townships from the main water distribution network, coupled with a historical lack of investment in infrastructure, has resulted in the presence of far fewer pipelines and storage facilities in these areas. The infrastructure that does exist tends to be outdated or insufficient to meet the needs of the growing populations, exemplified by situations where a single borehole is responsible for serving hundreds of families, or where one reservoir's water level can deplete rapidly due to high demand. The urban core of Thohoyandou Town boasts a more advanced and interconnected pipeline network that facilitates redundancy; if one route fails, others can often compensate, ensuring a steadier flow of water especially in areas such as the University of Venda (Masindi and Manjoro, 2024). Water pressure and treatment procedures tend to be more reliable in the urban center, contributing further to its comparative stability in water service delivery. It is also important to note that according

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to Arnold, (2013) within the CBD, low-income extensions or informal clusters may face water shortages similar to those encountered in peri-urban areas, particularly if they are situated at the outskirts of the network. When one considers the broader scope, the urban centre of Thohoyandou town such as Thohoyandou block K (Maniini) is generally better served in terms of water supply, while the surrounding suburban and rural settlements bear the brunt of these ongoing water service deficiencies. This discrepancy highlights a critical issue in water resource management and infrastructure development in the region.

5.14 Chapter summary

This chapter addressed my first research objective; assessing the current state of municipal household water service provision in Thohoyandou Town, focusing on accessibility, quality, reliability, governance and community satisfaction. While most households rely on municipal water, households' resort to rainwater harvesting and boreholes due to frequent service interruptions. These issues highlight problems with municipal household water infrastructure and management, as residents often store water or buy from private vendors. The chapter also examined water management in peri-urban and informal settlements, noting chronic shortages despite well-maintained main infrastructure like the Nandoni water scheme. Inefficient pipelines and pump stations contribute to service inconsistencies. The next chapter will analyse the challenges and opportunities in municipal household water service provision.

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CHAPTER 6: CHALLENGES AND OPPORTUNITIES UNDERLYING MUNICIPAL HOUSEHOLD WATER SERVICE PROVISION IN THOHOYANDOU TOWN.

6.1 Introduction

This chapter analyses the challenges and opportunities underlying municipal household water service provision in Thohoyandou town. This is an important second lens for understanding the complexities and opportunities within the discourse of municipal household water service provision. My argument in this chapter rests in the mere assumption that there are many challenges and opportunities that underlay the municipal household provision discourse while mainly echoing the same sentiments brought forward by Maziwisa, (2020) that “Municipal household water services are a complex system and boast a lot of challenges for improvement” (see chpt 5 sec 5.3). Opportunities and challenges are analysed from a holistic perspective of the Vhembe District Municipality in a case study as a key institution that is a water service authority. The preceding section outlines the chapter’s methodological overview. The third section analyses the opportunities and challenges underlying municipal household water service provision. The drivers of the opportunities and challenges of municipal household water service provision in Thohoyandou town and the potential benefits of upgrading existing water infrastructure are outlined in the third section. The fifth section provides a chapter summary.

6.2 A methodological overview of analysing challenges and opportunities underlying municipal household water service provision in Thohoyandou town.

To analyse and interrogate the emerging debates on municipal household water service provision’s opportunities and challenges, a mixed-method approach which is more qualitative rather than quantitative was used in this study. Information or data was acquired from in-depth interviews with 10 key officials from the Vhembe District Municipality; Observations on household water services provision infrastructure were done and 382 questionnaires were administered to households of different Thohoyandou townships. A Thematic analysis method was a prepotent method for the analysis of data, with descriptive quantitative data supporting the qualitative data. The key themes used in this analysis were distilled from the systems theory by Ludwig von Bertalanffy (1937); new

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urbanism theory by Andres Duany and Elizabeth Plater- Zyberk (1980); and the smart growth theory (1990), (see section 6.11 Chapter 1).

6.3 Challenges and opportunities underlying municipal household water service provision in Thohoyandou town.

This section explores the key challenges and opportunities associated with the provision of municipal household water services in Thohoyandou town. Understanding both the challenges and opportunities is essential for developing a potential framework on spatial planning strategies for sustainable municipal household water service provision in the district.

6.3.1 Challenges for municipal household water service provision

This study defines challenges as weaknesses that a municipality has or faces which deters them from delivering municipal household water services. The study found the following challenges:

6.3.1.1 Aging water infrastructure

The household interviews I did whilst collecting data revealed a resounding sense of frustration among residents regarding the failing water infrastructure including through word of mouth.



Photograph 6.1: Burst Pipe

Source: Households Archives (2025)

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Nearly every respondent shared their struggles with issues such as weak water pressure, frequent supply disruptions, and aging, deteriorating water infrastructure. Many households have endured prolonged periods that was sometimes lasting days without access to running water, often due to burst pipes, malfunctioning pumps, or delayed maintenance efforts. Photograph 6.1 depicts a burst pipe. This kind of breakdown reflects a deeper problem, suggesting the water supply system in Thohoyandou is fragile and aging. The results are in tandem with those from a study done by Sinthumule, (2021) who found that the pipes, pumps, reservoirs, and treatment plants including those connected to Nandoni Dam are simply not coping with the town's growing demand. Much of the infrastructure has exceeded its lifespan and suffers from a lack of routine, preventative maintenance. Fixes tend to be reactive, only happening after a major failure, which leaves families without water and further degrades the system (Takalani, 2022). The photograph 6.2 shows a dilapidated borehole.



Photograph 6.2: obsolete borehole

Source: Mudavhi (2025)

A dilapidated borehole can have severe implications for communities that rely on it as a primary or supplementary source of water (Mwale *et al.*, 2021). When a borehole falls into disrepair due to structural collapse as in photograph 6.2, the immediate consequence is a disruption in access to clean and safe water. This can force households to travel long distances in search of alternative sources, such as unprotected wells, which may expose

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them to waterborne diseases and other health risks. For vulnerable households, including children, the elderly, and those with compromised health, the lack of reliable water access exacerbates daily hardships and undermines basic hygiene and sanitation practices. The resulting tension over scarce water resources may lead to conflict among community members, particularly where alternative water infrastructure is lacking (Nyahunda and Tirivangasi, 2022). Therefore, maintaining boreholes and ensuring timely repairs is critical not only for meeting basic human needs but also for sustaining local economies and promoting social stability.

6.3.2.2 Lack of contingency measures during water outages

One pressing concern for the town is its lack of contingency measures in times of water scarcity. Emergency water tankers, designed to provide water during shortages, are alarmingly scarce and suffer from poor coordination. During the most severe outages, many households reported a shocking absence of tanker deliveries, leaving them without any access to water. The existing boreholes, which could potentially serve as alternative water sources, are often plagued by unreliability and inadequate maintenance. Nephawe *et al.*, (2021) found that as the town expands these areas frequently grapple with inconsistent water supply or, in some instances, no water at all. This is largely due to pressure issues and aging, overstretched pipelines, which struggle to meet the demand of a growing population. Thohoyandou has witnessed its population more than double over recent decades, yet its infrastructure has failed to keep pace with this rapid growth. The study has highlighted that newer and more remote neighbourhoods are particularly underserved when it comes to water access (see chapt 5 Section 5.13). While households in the central business district may enjoy slightly better conditions than their peri-urban counterparts in Vhembe, many still confront daily challenges related to their water supply, making access to this essential resource a constant struggle for numerous families.

6.3.2.3 Lack of proper communication from the municipality regarding water outages

Another key issue raised by households was the lack of transparency and poor communication from the municipality about water issues. Residents often feel left in the dark when water outages occur. Many households alluded that there's no advance notice when taps run dry, no explanation for the problem, and no updates about when water will

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be restored. As a result, people rely on word-of-mouth or social media to find out what's happening. Tshikovha, (2014) argue that lack of communication erodes trust and adds to the frustration of already difficult circumstances. When services fail, people want to feel seen and informed. But in Thohoyandou town, official channels are often silent. Even during serious outages like the one in Blocks B to G residents said they only got answers after threatening to protest. Many felt disrespected, saying they pay for services that are either not delivered or poorly managed. Interviews with municipal staff revealed that they are aware of the problem. Officials admitted they lack a proper system for informing the public. Field reports about pipe bursts or equipment failures often get stuck in bureaucratic processes, and by the time information is shared, residents have already been without water for hours or days.

However, there's recognition among officials that this can and should change. Simple measures like SMS alerts, regular social media updates, or WhatsApp groups with community leaders could help bridge the gap. Some local leaders have already proposed setting up these communication channels, which could be used not only for outage notifications but also for public feedback. This corresponds with Mbulaheni, (2021) suggests through her study that repeating community meetings or "imbizo" which means a gathering of people usually called by the king or a traditional leader could also help. These forums allow the municipality to explain its challenges from drought to budget constraints and give residents a platform to voice concerns. This type of engagement aligns with South Africa's Batho Pele principles, which emphasize openness, transparency, and service to the people. If implemented well, improved communication could go a long way toward rebuilding trust and encouraging cooperation such as adherence to water restrictions or prompt reporting of leaks. Transparency is not just about information, it is about inclusion and respect (Tjebana, et al, 2020).

6.3.2.4 Community's unawareness of water related policies and programs

The households through the word of mouth also highlighted issues to do with how aware they are of local water policies and whether they believe these policies are working. The results were mixed, but the general trend was clear: while many residents know about their constitutional right to water, few are familiar with the specific programs in place to

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deliver it or doubt their effectiveness. Take the Free Basic Water (FBW) policy, for example. This initiative guarantees a minimum amount of free water each month to indigent households. While some residents had heard of it, most didn't know how to register or whether they were eligible. And even if they were eligible, the benefit felt meaningless during weeks when no water flowed at all. The municipality has launched water conservation campaigns, but few people recall them. Those who did mention generic messages on the radio not community-based programs or educational workshops. No one reported receiving water saving tools or pamphlets. This gap suggests that outreach efforts have been weak, and many potentially helpful programs are going unnoticed and unused. Even infrastructure development projects such as new pipelines or upgrades to the water treatment plant are largely unknown to residents. Few people could name an ongoing project or explain what improvements were underway. This lack of visibility fuels the perception that nothing is being done, even when work is in progress. Opportunities exist to change this. Community workshops, held in partnership with local institutions like the University of Venda, could improve awareness and help ensure that those who qualify for support (like FBW) receive it. More inclusive planning where residents are invited to be part of oversight committees or project monitoring could improve accountability and trust. If the municipality better promoted its progress, for example Mothiba *et al.*, (2023) suggests that announcing when a project is completed or showcasing new infrastructure), it would change the narrative from one of failure to one of action. People judge effectiveness by what they see and experience so making programs more visible and responsive is key.

6.3.2.5 Challenges in maintaining and upgrading water infrastructure (technical officials' perspective)

While households deal with the visible effects of unreliable water, empty taps, low pressure, and costly workarounds municipal technical officials face the behind-the-scenes struggle of trying to keep the water system running under difficult conditions. Their interviews revealed a series of compounding challenges that echo what residents are experiencing, while also shedding light on the institutional and operational roadblocks. One major issue is that much of Thohoyandou towns` water infrastructure is simply

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outdated. The pipes, pumps, and treatment facilities have aged beyond their intended lifespan. Officials described a constant cycle of emergency repairs rushing to fix one burst pipe only for another to fail somewhere else. These recurring crises make it difficult to carry out planned maintenance, creating a situation where they're “putting out fires” rather than systematically managing the system. The technical team made it clear that the budget they receive is far too small to cover both today’s operations and the long term upgrades the system desperately needs. Most of the funds go toward emergency fixes, leaving little room for proactive investments. On top of that, many residents either don’t pay their water bills or pay very little, particularly in peri urban areas, leading to low revenue collection. It becomes a vicious cycle poor service discourages payment, and low payment leaves the municipality without resources to improve service.



Photograph 6.3: Vondo water reservoir

Source: Mudavhi NB (2025)

Human resources are also stretched thin. Skilled engineers and technicians are in short supply, and the municipality struggles to attract or retain them. With only a handful of technical staff on hand, and limited opportunities for training, even when equipment is available, progress can be delayed simply because there aren’t enough people to do the work. Another frustrating challenge is vandalism and illegal connections. Officials reported that infrastructure is often tampered with electrical cables stolen from pump stations, valves damaged, or people tapping illegally into water mains. These actions disrupt

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services, cost money to repair, and reduce the amount of water available to paying users. Capital projects like building new reservoirs or upgrading pump stations face slow procurement processes and contractor issues. Photograph 6.3 shows the Vondo reservoir constructed a few years ago. The Vondo reservoir project stalled for months due to contractor disputes and bad weather. These delays undermine the benefits that new infrastructure is meant to provide and is something that should always receive attention and be solved accordingly as residents are forever waiting to get water from the municipality as a water service provider.

6.3.2.6 Mismatch between water demand and supply

As Thohoyandou town expands rapidly, fuelled by new housing developments, and the influential presence of the University of Venda, the demand for water has surged beyond the town's available supply. The community primarily relies on surface water harvested from local dams, reservoirs, as well as groundwater extracted from numerous boreholes scattered throughout the area. Despite the existence of crucial treatment plants like those at Vondo and Nandoni, these facilities often struggle to keep pace during peak demand periods. During high water-traffic times, residents frequently experience a significant drop in water pressure, and in some instances, water supply must be rationed. As a result, even families fortunate enough to have piped connections find themselves enduring days without reliable access to water. This situation compels them to resort to storing water in buckets and drums, a practice that highlights the broader challenges faced by Limpopo's water service infrastructure (See chapt 5 sec 5.5).

6.3.2.7 Financial and institutional constraints

The Vhembe District is currently grappling with significant financial constraints that impact its ability to provide essential services. A considerable portion of the local population either cannot afford to pay for water or believes that access to water should be a fundamental right provided at no cost.

“Rine ari koleki tshelede na nthihi ubva kha vhathu ngauri vhathu vhanzhi avha badeli madi hafha kha tshitiriki tsha Vhembe” Which directly translates to “We do not collect revenue at all in the district because people do not pay for water but use it at no cost as

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one of the research participants indicated". This perception has resulted in alarmingly low revenue collection, which in turn hampers the municipalities' ability to fund necessary programs and initiatives as the officials have reported through word of mouth that many people do not pay for water in these communities. Without adequate revenue, the municipalities face challenges in maintaining existing infrastructure, let alone upgrading systems to meet modern standards. This neglected infrastructure can lead to further deterioration, resulting in unreliable access to clean water for residents. There is a pressing shortage of skilled personnel within the district. The lack of qualified engineers, technicians, and maintenance personnel exacerbates the situation, delaying essential repairs and improvements. As a result, the lack of professional oversight over water treatment plants can compromise water quality and reliability, posing potential health risks to the community. Overall, these financial and institutional constraints create a cycle of inefficiency and challenge the sustainability of municipal household water service provision in the town.

6.3.2.8 Community protests and social frustration

For years, residents in the sight of the Nandoni Dam have had issues with unreliable water service, leading to a significant build-up of frustration and discontent. Despite living near a large body of water, communities such as Budeli and Mutoti have found themselves without adequate access to this essential resource, triggering a series of protests which means that for areas like Thohoyandou town it will be extra difficult to get water reticulation. For example, photograph 6.4 shows residents marching to VDM to demand end to water crisis as water shortages in many communities across the Vhembe district are a significant concern. On Monday, June 3rd,2024 more than 700 people, primarily members of the newly formed political party Economic Liberators Forum South Africa (ELF-SA), marched through the streets of Thohoyandou to the offices of the Vhembe District Municipality (VDM) to demand action on these issues.

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Photograph 6.4: Residents marching to VDM to demand end to water crisis

Source: Zoutnet (2024)

Protestors gather in the streets to voice their demands for equitable access to the dam's water supply, emphasizing the irony of their situation. In Thohoyandou town technical personnel also engage in protests and voice their demands through switching off water for days until the municipality yields to their demands which poses a very serious challenge to residents. photograph 6.5 shows the communal tap in Thohoyandou Block B que of water containers as water flows.



Photograph 6.5: Thohoyandou Block B Communal Tap Que

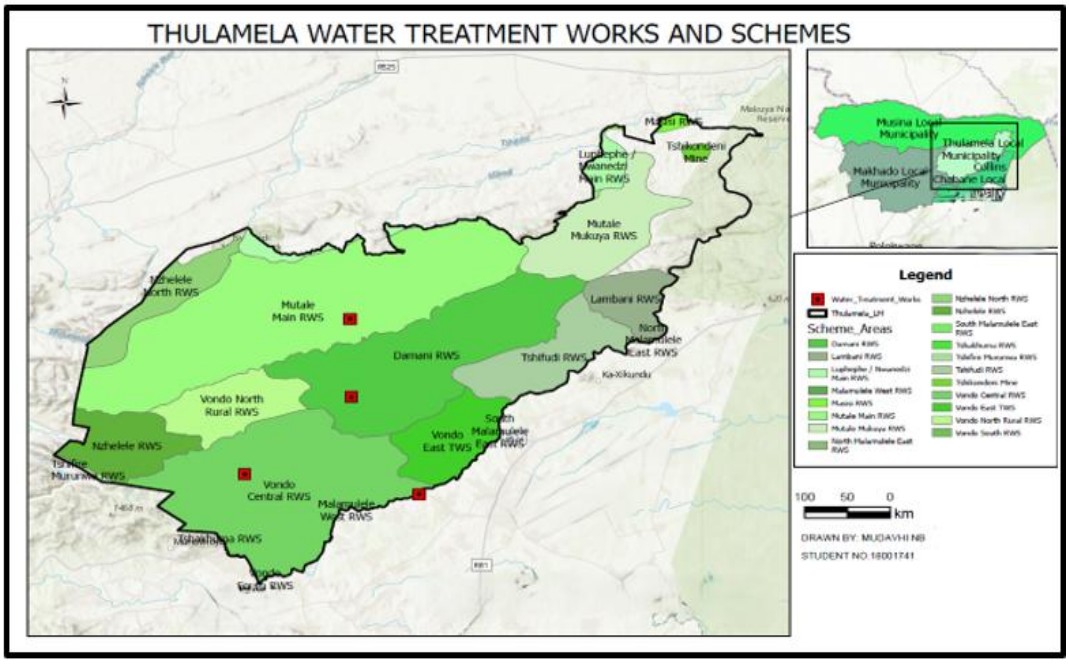
Source: Capricorn FM News (2021)

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The water crisis takes place vividly in the daily lives of the residents. Long queues are often seen at communal taps (photograph 6.5) which are available and there is running water, and residents sometimes wait for hours at water tankers, with only one tap available to serve more than 100 households. This scarcity not only exacerbates the struggle for basic needs but also leads to heightened tensions within the community. The lack of reliable water access adversely affects children's school attendance and hampers the operations of small businesses, which often depend on a consistent water supply. These challenges strain relationships among community members as some continuously blame those who are politically affiliated for not advocating for their needs, creating a sense of urgency for solutions to the ongoing water crisis.

6.3.2.9 Uneven spatial distribution of water treatment works

Most of the treatment plants in the Vhembe District municipality specifically those that are within Thulamela local municipality which Thohoyandou town falls under are clustered in the central and western regions, especially around Damani, Vondo, and Malamulele West. The map of water treatment works (WTWs) across Thulamela Local Municipality shows a clear imbalance in how infrastructure is spread throughout the area (Figure 6.1). This suggests that WTWs tend to be in areas with higher population densities and better-developed road networks and services.



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Figure 6.1 Map of Thulamela water treatment works and schemes

Source: Mudavhi NB (2025)

Figure 6.1 depicts a series of water treatment works (WTWs) across Thulamela Local Municipality and one can denote that this map shows a clear imbalance in how infrastructure is spread throughout the area. Most of the treatment plants are clustered in the central and western regions, especially around Damani, Vondo, and Malamulele West. This suggests that WTWs tend to be in areas with higher population densities and better-developed road networks and services. But this uneven spread raises some concerns particularly about accessibility and fairness. In the northern and eastern parts of the municipality, areas like Masisi, Tshifudi, and Lambani don't have nearby treatment plants. That means they likely rely on distant facilities, which can lead to longer pipelines, higher maintenance costs, and a less reliable water supply especially if there's a mechanical issue or a water shortage. Some populated places do not seem to have nearby WTWs at all. Communities like Tshikondeni Mine, Tshifudi, and parts of North Malamulele East might be facing ongoing service gaps, which often hit rural or peri-urban areas the hardest. From a planning perspective, this shows the need to better align infrastructure with the actual service demands across the district. Building more localized treatment systems in underserved areas backed by solid technical planning and active community involvement could make water services more reliable and more equitable. This would also help strengthen the system's resilience in the face of climate change and increasing strain on infrastructure.

6.3.2 Opportunities for municipal household water service provision.

This study defines opportunities as those strengths that municipalities can use to encourage sustainable municipal household water service provision. The study found the following opportunities:

6.3.2.1 Multiple water sources

Thohoyandou town enjoys a prime location that provides access to a variety of water sources, a critical advantage for its growing community. One of the main reservoirs is the Nandoni Dam, which was completed in 2005 and boasts a huge capacity of 164 million cubic meters of water. This vast reservoir feeds into Thohoyandou via the NR6 supply

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pipeline (see chapt 5, sec 5.10). Exciting developments are underway as upgrades to the treatment plant are set to enhance its capacity, allowing for a projected increase in output to 120 million litres per day by 2028 according to their Integrated Development Plan 2022/2027. Photograph 6.6 shows the Nandoni dam.



Photograph 6.6: Nandoni dam

Source: Mudavhi NB (2025)

The Nandoni dam can make a huge difference as a water source if it is used to its full capacity. To add to surface water, groundwater plays a critical role in sustaining the households. Sinthumule, (2021) revealed that nearly half of the communities within the Vhembe District rely on this underground resource for their daily water needs. Recent efforts have led to the successful rehabilitation of 96 boreholes, significantly improving the water supply for these communities. Looking ahead, there are ambitious plans to incorporate borehole water into the municipal water system, further ensuring that residents have reliable access to this essential resource through their infrastructure and maintenance plan.

6.3.2.2 Policy support and free basic water policy

South Africa's Free Basic Water (FBW) policy is a major step toward reducing inequality in water access and ensuring fair service delivery, especially in poorer communities. Through this policy, every household is entitled to 6,000 litres of water per month at no

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cost (Tewari D, 2009). For a family of eight, that works out to about 25 litres per person each day enough to cover essential needs like drinking, cooking, and basic hygiene. Rooted in Section 27 of the Constitution, which recognizes access to sufficient water as a human right, the policy is designed to support low-income households, protect human dignity, and ease the burden of water poverty. If implemented properly, it has the potential to significantly improve water security in underserved areas, such as Thohoyandou, where many residents struggle with unreliable water supply and limited financial means. The success of the FBW policy hinges on how well local municipalities can identify and consistently support the people who need it most (Muller, 2023). One helpful tool in this process is the municipal indigent register system used to track households that can't afford to pay for basic services. These registers allow local governments to offer targeted assistance, such as partial or full bill waivers, protection from service disconnections, and priority access during water shortages. This focused approach helps ensure that limited resources go to the most vulnerable residents and prevents them from falling deeper into hardship.

Still, there are real challenges. Some indigent registers are outdated or incomplete, communication with beneficiaries can be poor, and maintaining steady water service is difficult especially in areas with aging infrastructure or limited water supply. Without addressing these issues, the policy's potential to meaningfully improve lives and promote long-term socio-economic upliftment could fall short. So, while the FBW policy lays a strong foundation for inclusive water access, its true impact will ultimately depend on how well municipalities can bring it to life on the ground adapting it to the needs and realities of the communities they serve.

6.3.2.3 Institutional support and funding

Water issues in Thohoyandou town have become an increasing concern at both national and provincial levels, prompting the government to step in with more funding and technical support. The town has long struggled with outdated infrastructure and an unreliable water supply, and these challenges have finally caught the attention of higher-level institutions such as the Department of Water and Sanitation (DWS). As a result, significant resources are now being directed toward much-needed upgrades like

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replacing old pipelines, expanding water treatment facilities, and improving distribution systems. These improvements are not just technical; they're essential for making sure every resident can access the basic right to water, as guaranteed by the South African Constitution {(section 27) (1)}. To address these issues, financial support has come from various national infrastructure grants and loans, including those from the Development Bank of Southern Africa (DBSA). These funding streams have made it possible to launch key capital projects such as bulk water supply expansion and the repair of worn-out infrastructure even in the Vhembe District municipality. On top of that, conditional grants like the Municipal Infrastructure Grant (MIG) and the Regional Bulk Infrastructure Grant (RBIG) have been vital for helping local governments like the Vhembe District and Thulamela Municipality carry out service delivery projects effectively.

Alongside government investment, there's growing interest in the role that public-private partnerships (PPPs) could play in improving water services in Thohoyandou town. These partnerships offer a mix of public oversight and private sector innovation, investment, and expertise particularly in tackling issues like non-revenue water, where water is lost through leaks or poor billing. I am of the view that through bringing private companies to handle things like meter installation, leak detection, and digital monitoring, municipalities such as the Vhembe District Municipality could cut losses and boost their revenue. Ahmed, (2019) argues that for PPPs to truly work, strong regulatory frameworks, transparent contracts, and active community involvement are key to ensuring they're accountable and sustainable soon.

6.3.2.4 Environmental and sustainability potential

Water shortages in places like Thohoyandou have really opened people's eyes to the importance of using water wisely. As climate change continues to throw off rainfall patterns and reduce the amount of surface water available, communities are becoming more aware of just how crucial it is to protect what we've got. This growing awareness is leading to practical changes like installing low-flow taps and showers, fixing leaks quickly, and encouraging everyday water-saving habits. These might seem like small steps, but when a whole community gets on board, they can make a big difference in easing the load on the municipal water supply.

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Baiyegunhi, (2015) revealed that is not just about what happens inside homes but restoring natural ecosystems is a huge part of securing water for the long term. Wetlands, for example, naturally filter water, store it, and help manage its flow and quality. Protecting and restoring these areas as well as vital river systems like the Luvuvhu River is key to keeping Thohoyandou town's water sources sustainable. That said, these ecosystems are under real threat from things like urban development, pollution, and poor land use. Solving these issues takes teamwork, with government, civil society, and local communities all playing a role. Piwowar-Sulej, (2022) in one of the environmental strategies in his study alluded that bringing environmental strategies into local government services isn't just good for the planet it is a smart move for innovation too. By weaving conservation goals into infrastructure planning, regulations, and public education, municipalities can build a water system that is more resilient to future challenges. This also opens doors to funding and partnerships focused on adapting to climate change. In the bigger picture, managing water sustainably isn't just a policy choice, it is a foundation for long-term growth, ensuring that people's needs are met while nature stays healthy.

6.3.3 Drivers of challenges and opportunities in Thohoyandou's water service provision

This study defines drivers as the core factors that influence and shape how household water service provision in Thohoyandou town evolves. To truly understand both the problems and possibilities in Thohoyandou town's household water service provision, I needed to look at what's driving them, and the study found the following drivers:

6.3.3.1 Rapid population growth

One of the biggest pressures is population growth. As Thohoyandou transforms from a small town into a regional hub, the number of people relying on municipal services keeps rising. This creates obvious challenges: more people need water, but the infrastructure has not kept pace. Still, this growth also brings opportunities. Larger populations attract political attention, justify bigger infrastructure investments, and demand better services. That is why projects like the Nandoni pipeline expansion are gaining momentum.

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6.3.3.2 Environmental factors and climate change

Climate variability is another major driver. Thohoyandou town experiences seasonal rainfall and occasional droughts, both of which affect surface and groundwater supplies. During dry seasons, boreholes can run dry, while intense rains sometimes damage pipelines and flood reservoirs. These climate shifts are making water service harder to manage but they've also triggered a push for more resilient systems. For example, municipalities are now blending different water sources (like dam and borehole water) and promoting rainwater harvesting (Nyadzani *et al.*, 2023).

6.3.3.3 Economic dynamics

Thohoyandou town's economic context is deeply intertwined with its water issues. Many residents are employed but report that they earn little, which affects their ability (and willingness) to pay for water services. Figure 6.2 shows the percentage distribution of households.

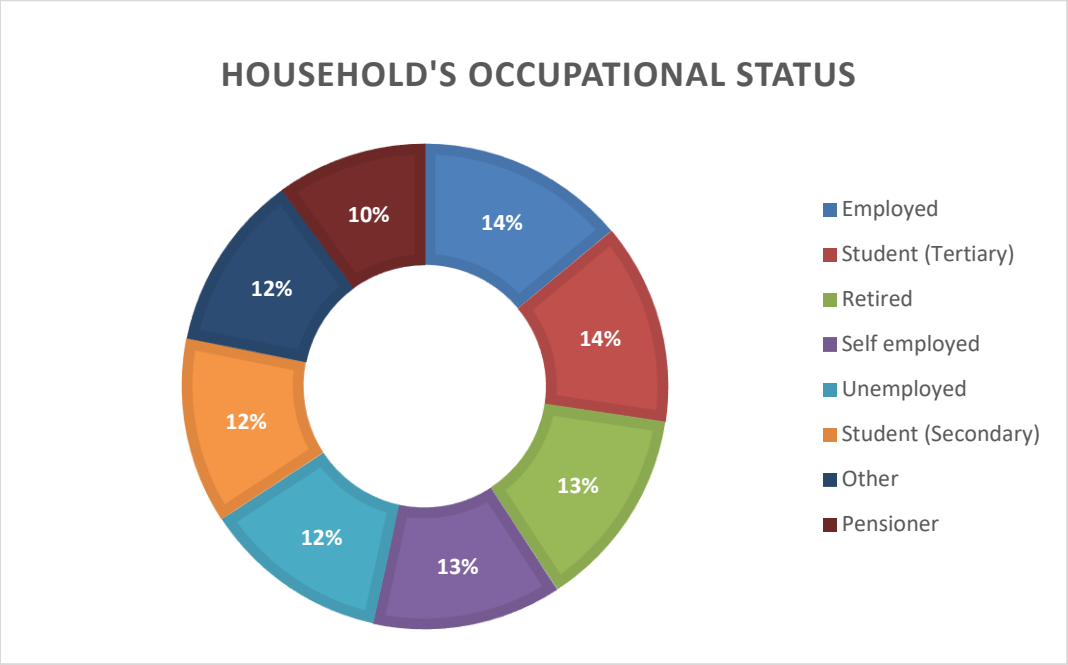


Figure 6.2 households' occupational status

Source: Mudavhi NB (2025)

A total percentage of 14% of households have indicated that they are employed and have also through their word of mouth stated that they earn less and thus can't afford to

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purchase water services (specifically those who pay for water in their households). This, in turn, leads to low revenue collection for the municipality, reducing funds available for maintenance and upgrades as many people do not want to pay for water services and some would do anything to evade paying for water services including tampering with meter readers where available. On the flip side, there's increasing recognition that reliable water is critical for economic development whether for tourism near Nandoni Dam, local businesses, or public institutions like the University of Venda. This evolving perception is helping unlock new financial resources and push for the prioritisation of water projects higher up on the agenda for development.

6.3.3.4 Governance and policy

South Africa's strong legal and policy frameworks such as the Water Services Act and Free Basic Water policy should be major enablers. And they are, when implemented properly. But gaps in governance have often held back progress. For example, Thohoyandou town falls under both the local Thulamela Municipality and the district-level Vhembe Municipality, which can lead to poor coordination. However, public pressure and community mobilization have started to improve accountability. Political leaders are increasingly stepping in to demand results through members of the mayoral council (MMCs), and funding agencies are tying grants to performance targets such as the grants MIG AND RBIG. Good governance is proving to be the key to unlocking real change.

6.3.3.5 Skills and technology

Technology is a double-edged sword. In the past, the lack of modern tools like automated monitoring systems contributed to slow response times and inefficient water use. But today, advances in remote sensing, smart metering, and mobile communication are changing the game. The spread of smartphones means residents can quickly report problems and get updates. New treatment technologies are allowing plants to expand capacity without huge physical footprints. Still, these innovations only work if there are skilled people to operate and maintain them something that is still lacking in many local water departments. Building technical capacity is essential to making tech-based solutions stick.

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6.3.4 Benefits of upgrading Thohoyandou Town's water infrastructure

This study defines benefits as those critical aspects that produce good/better results, the study found the following drivers:

6.3.4.1 Consistent and reliable supply

When old pipes are replaced and pumps repaired, breakdowns become less frequent and service interruptions decrease. More consistent water delivery means households no longer need to store large quantities or wait for tankers when possible. With the Nandoni treatment plant's capacity set to double by 2028 (see sec 6.3.2.1), the hope is that rationing will become a thing of the past.

6.3.4.2 Access expansion

Upgrades allow the municipal network to reach areas that currently rely on communal taps or have no service at all. For areas near the Nandoni pipeline that have long protested their exclusion, this means finally gaining direct access to water. Extending coverage also supports the principle of equity ensuring that all residents, not just those in urban centres, enjoy their constitutional right to water.

6.3.4.3 Local development and economic growth

Businesses, especially small ones like car washes, food stalls, and salons, depend on water (Odeku, 2022). When supply is reliable, these businesses can operate without disruptions supporting livelihoods and boosting the local economy. Larger industries and institutions like the University of Venda also require dependable water for long-term planning and operations. Infrastructure projects themselves create jobs during construction and open the door to more investment down the line.

6.3.4.4 Community trust and social stability

When water becomes more accessible and dependable, the tension it creates disappears. No more long queues at public taps. No more protests. People feel heard, and the relationship between residents and the municipality improves. Di Napoli, Dolce and Arcidiacono, (2019) asserts that trust is built not through promises, but through

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delivery and argued that when residents trust the system, they're more likely to pay for services, report leaks, and protect infrastructure from vandalism.

6.4 Chapter summary

Chapter six investigated the challenges and opportunities underlying household water service provision in Thohoyandou town. Using questionnaires, word of mouth, interviews, and observations, it paints a clear picture of the day-to-day realities people face. Major challenges are highlighted like aging infrastructure, weak emergency planning, limited technical expertise, and a lack of meaningful public involvement all of which contribute to unreliable water access and growing community frustration. But it is not all negative. The chapter also spotlights key opportunities like multiple water sources are available, supportive policies like the Free Basic Water initiative exist, government funding is accessible, and there are ongoing efforts to promote environmental sustainability. It also emphasizes that broader drivers such as population growth, shifting climate conditions, economic trends, and governance quality play a major role in shaping both the obstacles and the opportunities. The preceding chapter (chapter 7) unveils the spatial planning strategies can be developed to ensure sustainable municipal household water service provision.

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CHAPTER 7: A PROPOSED FRAMEWORK ON SUSTAINABLE SPATIAL PLANNING STRATEGIES.

7.1 Introduction

This chapter discusses the proposed framework on sustainable spatial planning strategies for sustainable municipal household water service provision in Thohoyandou town and other local municipalities of the Vhembe District. The framework can be adopted by other district municipalities that are bestowed with the responsibility of being water service authorities (WSAs) and are experiencing similar conditions. After this introduction, the sections that follow outline the basis and rationale for this proposed framework drawing on findings from earlier chapters and relevant theories (see chapt 1, sec 1.11). The third section of this chapter proposes and discusses the framework and its key elements. The fourth section describes how municipalities that are water service authorities such as the Vhembe District municipality can utilise the framework. The fifth section deliberates on the limitations of the framework while the sixth section tests the framework. The last or proceeding section is the chapter summary.

7.2 The basis for the proposed framework on sustainable spatial planning strategies for sustainable municipal household water service provision.

The proposed framework is grounded on both academic theory and the real-life challenges of providing sustainable household water services in Thohoyandou town and nearby areas in the Vhembe District. The framework draws on three main theories at its core, Systems Theory, New Urbanism, and Smart Growth. Systems Theory, introduced by Ludwig von Bertalanffy in 1937, encourages us to look at service delivery as part of a bigger picture. It highlights how everything physical infrastructure, community behaviour, governance structures, and environmental resources is deeply connected. When applied to water services, this means moving beyond just technical fixes and understanding how social patterns, institutional systems, and environmental limits all influence how water services are delivered. Alongside systems thinking, the framework also draws from New Urbanism and Smart Growth to better connect how space is used with how services are delivered. New Urbanism linked to planners like Andrés Duany and Elizabeth Plater-Zyberk advocates for dense, walkable neighbourhoods that are easier and more cost-

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effective to service with infrastructure like water. Smart Growth, which gained traction in the 1990s, pushes for development to be focused in existing urban areas, helping to protect natural resources while ensuring that land use and infrastructure planning go together. Both approaches push back against the kind of scattered, unplanned development seen in parts of Thohoyandou town, where communities have grown without the necessary water infrastructure in place. This often leads to unequal access and puts added strain on already stretched water service systems. I also want to stress out that the need for the framework lies in the gaps and limitations in the current spatial and service delivery approach. Despite the availability of bulk water sources like Nandoni Dam, many communities remain underserved due to fragmented infrastructure, aging assets, poor maintenance, and lack of coordinated spatial planning (see chapter 6, sec 6.3.1). The existing governance structure, with Vhembe District as the Water Services Authority, is also characterized by limited institutional capacity and weak alignment with local development patterns (see chapter 6, sec 6.2.3.5). Financial and community engagement challenges are still battling the district. These issues justify a comprehensive, integrated framework that brings together planning, infrastructure, governance, and community participation to ensure reliable and sustainable water service provision.

7.3 The proposed framework and it's key elements on sustainable spatial planning strategies for sustainable municipal household water service provision.

This study defines a framework as a comprehensive, multi-faceted approach of strategies that tackle water service delivery from several angles at once inclusive of spatial planning, infrastructure, governance, community involvement, finance, and environmental considerations. Around the world, some of the best practices indicate that successful water systems rely on integrated spatial planning, strong community involvement, and solid financial foundations. Cities like Curitiba in Brazil and Windhoek in Namibia are great examples of how this can work well in practice. However, there are some common gaps like weak coordination in governance, inefficiencies in managing finances, and limited community engagement that continue to show up in many places. The framework being proposed tackles these issues head-on. It brings governance and spatial planning together, encourages planning that truly involves local communities, and builds

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transparent, policy-based financial systems. The goal is to create a framework that is not just effective today, but also flexible and sustainable for the future. Figure 7.1 shows the conceptual flow diagram of the framework on sustainable municipal household water service provision. The core idea is that progress in each of these areas, when well-coordinated, makes the overall water system more resilient, efficient, and better equipped to meet long-term population needs.

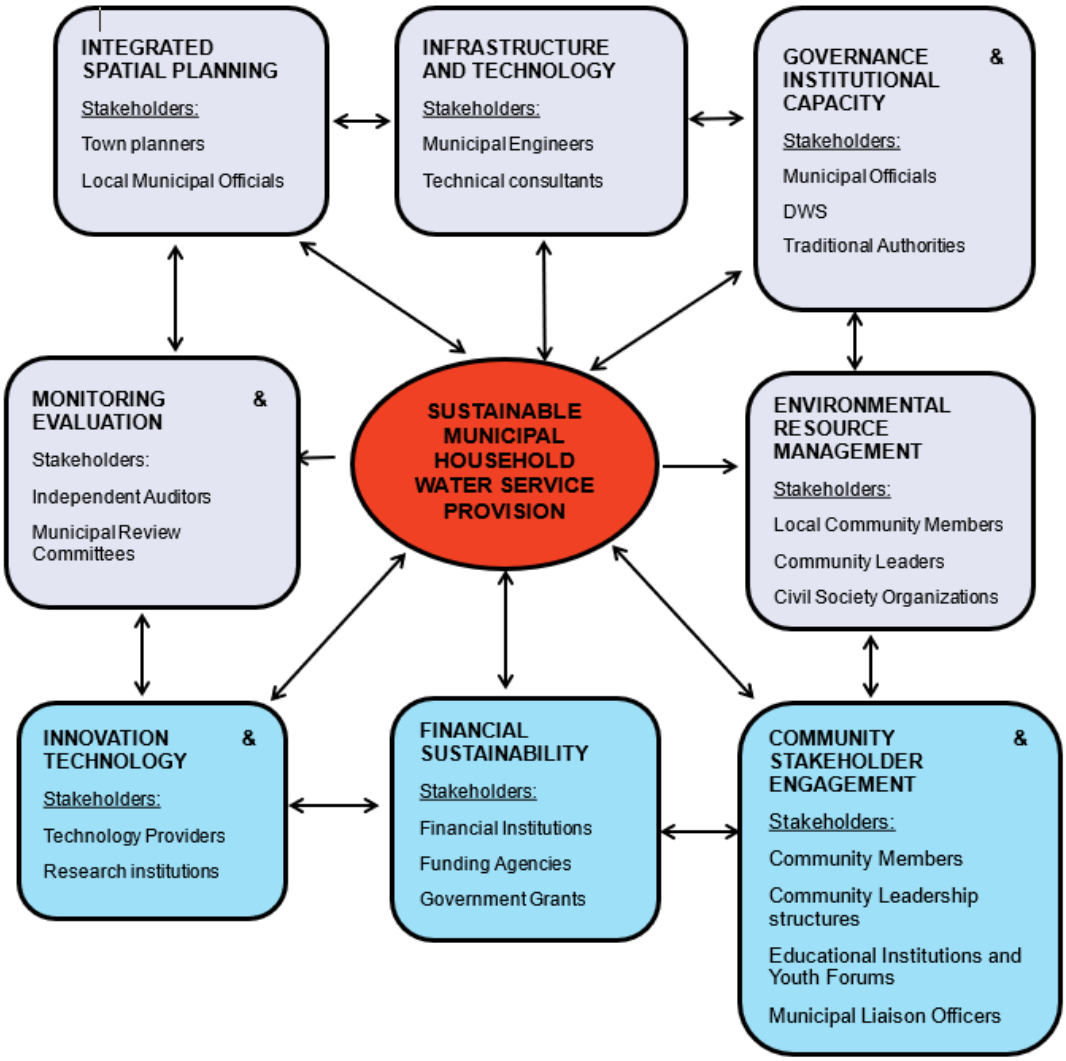


Figure 7.1: Conceptual flow diagram of the spatial planning strategies framework

Source: Mudavhi NB (2025)

I would like to indicate that Figure 7.1 presents a conceptual flow diagram of the strategies (herein referred to as the framework). Innovation and technology, monitoring and

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evaluation are well covered by the other elements and therefore I see no need for repeating them but also want them to appear as separate elements on the diagram as they have been grouped for ease of reference. This framework shows how all the parts of a water service system work together to ensure that households have reliable and sustainable access to water. It starts with Integrated Spatial Planning, which helps figure out where key infrastructure like pipes and storage tanks should go. This works closely with Infrastructure and Technology, the systems that deliver the water. But planning and pipes alone aren't enough. These need to be backed by strong Governance and Institutional Capacity meaning the local government and institutions must have solid leadership and the right systems in place to make everything happen effectively. Community and Stakeholder Engagement. Getting input and involvement from residents, community leaders, and other stakeholders is crucial. It builds trust, encourages cooperation, and helps make sure the services meet real needs. Environmental Resource Management ties into all of this, because sustainable water supply depends on protecting natural sources and using them wisely with community involvement being key here, too. On the financial side, none of this is possible without proper funding.

Financial Sustainability keeps the system running, whether the money comes from government, donors, or other sources. Innovation and Technology bring in modern solutions like smart meters or tools for detecting leaks that make water services more efficient and responsive. Monitoring and Evaluation acts like a feedback loop. They track how well things are working and help guide improvements in planning, governance, and funding. All these elements are interconnected. When they work in harmony, they strengthen the entire system and make it more effective in the long run. With such a framework, I want to reflect a systems thinking approach, where progress in one area helps drive progress in others. Rather than a step-by-step process, I can safely say it is a dynamic and evolving system. I will now unpack each element in the context of an integrated framework:

7.3.1 Integrated spatial planning

To put this strategy into action, municipalities would update their development strategies to specifically include water services. That means revising documents like the Spatial

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Development Framework and zoning rules to ensure that any new construction only happens where there's enough water supply to support it. In the case of Thohoyandou town, future growth would be guided toward areas that already have water infrastructure in place, or where it can be easily expanded. Informal settlements would either be upgraded with proper services or replaced by better housing options in areas that are already connected to essential infrastructure. This approach lines up with national policies aimed at stopping urban sprawl and making sure all residents have access to basic services at an affordable cost. A key part of the plan would be to create a Spatial-Water Coordination Committee. This group made up of planners and water engineers would review all new development proposals to ensure they will not strain water resources. It is a way to keep land-use planning and water availability working hand in hand, solving the current disconnect between the two.

7.3.2 Infrastructure & technology

As part of this framework, a full-scale Infrastructure Improvement Program would be rolled out. This program would start by noting down all existing water infrastructure, identifying what needs urgent upgrades, and putting a clear maintenance schedule in place to prevent future problems. Take Thohoyandou town as an example: in areas like Sibasa, the program could involve replacing outdated asbestos cement pipes with modern PVC ones to cut down on leaks. Tshilungoma pump station might be repaired or upgraded to maintain steady water pressure, and new storage reservoirs could be added on higher ground to help meet peak water demand. Technology would play a key role here. The plan supports the use of smart tools like pressure sensors and flow meters to keep a constant eye on the system and quickly spot leaks or breakdowns. It would also use GIS (geographic information systems) to map the entire water network alongside settlement areas. This makes it easier for planners to pinpoint where service is lacking and understand how adding new connections might affect the system. Through a combination of investments in infrastructure with modern technology, the goal is to build a stronger, more reliable water system and manage it more efficiently and sustainably.

7.3.3 Governance and institutional capacity

As part of the framework, the municipality would roll out key institutional reforms and build

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internal capacity to manage water services more effectively. One practical move would be to set up a dedicated Water Services Unit or strengthen the one already in place within Vhembe District staffed with skilled engineers, urban planners, and community liaison officers. To support this, training programs would be introduced, potentially in partnership with local institutions like the University of Venda. These programs would focus on boosting the technical know-how of system operators and managers so they can handle more advanced infrastructure and technology with confidence. The framework also emphasizes better coordination between different levels of government. It proposes forming a Water Services Steering Committee made up of representatives from Vhembe District, Thulamela Local Municipality, the Department of Water and Sanitation (DWS), and community leaders. This group would meet regularly to track water service performance, align planning efforts like syncing housing developments with water supply plans and jointly solve any issues that come up. This kind of collaboration brings to life the cooperative governance principles that South Africa promotes. Stronger governance would also help with enforcement like reducing illegal water connections by offering legal options, and making sure water tanker deliveries, when necessary, follow a clear and transparent schedule. Overall, this part of the framework is about creating the right conditions both institutionally and socially for all the other improvements to work.

7.3.4 Community & stakeholder engagement

This part of the framework focuses on getting communities directly involved in managing their own water supply. One way to do that would be by setting up Water User Associations or Committees in each ward of Thohoyandou town and the surrounding evolving townships. These groups would include residents, ward councillors, traditional leaders, and women's representatives which is especially important since women often carry the greatest burden when water access is limited. The committees would meet regularly to discuss water issues in their area, help manage community water points, quickly report leaks or vandalism, and serve as a bridge between residents and the municipal Water Services Unit. They would also receive training to help them understand how water systems work and how to promote good water-saving and conservation habits. Together with this the municipality would run public awareness campaigns on local radios,

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in schools, and through community workshops to educate people about why paying for water helps to keep the system running, how to use water more wisely, and the health risks of unsafe water. In Thohoyandou town, this kind of engagement is quite important. Golub, Neto Henriques and Gouveia Nunes, (2021) in their study found that even as it stands many people still see water as a service that should always be free and provided entirely by the government. By involving communities in decisions like when to schedule water rationing or where to install new communal taps the framework helps build a stronger sense of ownership and responsibility. This approach isn't just theoretical. Around the world, communities that take part in managing their water systems tend to use water more responsibly and take better care of the infrastructure (Kupika, Mahlatini and Nyachowe, 2022). In many cases, local water committees have played a key role in keeping rural water schemes running smoothly. One key part of making this framework work is getting communities actively involved in planning and setting priorities. Tools like participatory budgeting forums and community-led workshops will help make sure that infrastructure projects reflect what people on the ground need. When communities have a real say in how projects are shaped, it builds a sense of ownership and responsibility and that kind of local buy-in is essential for long-term success and sustained engagement.

7.3.5 Financial sustainability

To make the framework work in practice, Vhembe District municipality would need to work on how it manages the finances of its water services. A good starting point would be analysing the real costs of delivering water especially comparing urban and rural areas and then adjusting tariffs to better reflect those differences. One possible approach is a rising block tariff. Under this system, everyone gets a basic amount of water such as, 50 litres per person per day either free or at a very low cost, in line with South Africa's Free Basic Water Policy. Once usage goes beyond that, the cost would go up in tiers. This will help in promoting water conservation while making sure the system can recover its costs. To tackle the widespread issue of non-payment, the municipality would have to put a solid revenue collection plan in place. That could include fixing broken meters, updating the customer database, and installing prepaid meters in areas where they make sense. They could also offer rewards for paying on time or apply penalties for persistent non-payment,

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while still protecting vulnerable households through indigent support programs. But this isn't just about billing, it is also about trust. When communities see reliable, consistent water service and are actively involved in decisions, Lin, Zhu and Chen, (2022) indicates that people are far more likely to pay for what they use. So, community engagement is a big part of this financial strategy.

The framework also encourages looking beyond local revenues. It suggests applying for targeted national grants to help upgrade infrastructure in underserved villages, or exploring public-private partnerships say, bringing in private firms to help manage water treatment plants by contributing capital and technical expertise. Financial planning would go together with spatial planning. Before expanding services to new areas, the municipality would conduct a proper business case to make sure the investment is financially sustainable in the long run. If done well, this approach can create a positive feedback loop: better systems reduce water losses and improve efficiency, which boosts revenue. That extra money can then be reinvested into the network, helping keep services reliable and expanding access over time. Financial sustainability in this framework is strategically aligned with the national and provincial laws like the National Water Act of 1998 and the Municipal Finance Management Act of 2003. It supports structured tariff adjustments, ensures that revenue collection follows legal guidelines, and promotes the smart use of national grants. This isn't just about ticking boxes, but this approach actively helps maintain infrastructure, improves transparency in how funds are used, and strengthens accountability across the system.

7.3.6 Environmental management

When I look through the lens of environmental sustainability, the framework pushes the municipality to not just manage water but to protect and diversify where it comes from. In practice, this would mean working closely with the Department of Water Services and environmental agencies to keep a close eye on the health of the Luvuvhu River catchment, which feeds into Nandoni Dam, and Vondo Dam which serves as one of the district's main water sources (see chapt 5, sec 5.3). It would also mean cracking down on harmful activities like illegal sand mining in riverbeds or unregulated water use upstream, things that pollute the water or reduce the amount that flows into the system. But it is not

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just about protecting what we have it is also about preparing for what's coming. Desha, et al, (2021) argue that climate change is already making rainfall less predictable, therefore this framework calls for climate resilience planning. That could mean responsibly tapping into groundwater as a backup or building more storage tanks to capture and save water during the rainy season for use when it is dry. The framework also backs smarter water use. That includes cutting down on leaks (covered in the infrastructure section) but also rolling out water-saving initiatives at the household level like encouraging people to install low-flow taps and toilets, collect rainwater from their roofs, or reuse greywater for things like gardening.

Climate adaptation plans already recommend looking into alternative sources like greywater reuse, and this framework takes that advice seriously. For example, as a pilot project, the municipality could install rainwater harvesting systems on public buildings like schools or municipal offices. The water collected could be used for irrigation or flushing toilets, easing pressure on the main treated water supply. When all these actions come together, the benefits add up. Not only does it take the load off the main water system, but it also makes the entire service more resilient in the face of droughts and other environmental challenges. At its core, this approach ensures that we're not solving today's water problems at the expense of tomorrow's resources staying true to the principles of sustainability. This framework isn't just a collection of separate projects it is a full package of reforms across planning, engineering, governance, finance, community engagement, and environmental management. The key is that all these parts work together, reinforcing each other to create real, lasting change. If you had to sum up the shifts it aims to bring: Thohoyandou town and the broader Vhembe District would move from a reactive, piecemeal approach to a proactive, coordinated one. I would say.

- Instead of water infrastructure constantly playing catch-up to development, it would become the foundation that guides and supports it.
- Instead of communities feeling left out and taking matters into their own hands, they'd become active partners in the system's success.
- Instead of the municipality working in isolation with limited capacity, it would collaborate with stakeholders from national departments to local leaders following

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clear, shared plans.

- And instead of scrambling to fix problems only when they explode, the system would have a reliable, preventive maintenance plan in place.

At its heart, this is about turning things around building a water service that is sustainable, inclusive, and strong enough to support future growth. That is the real vision behind this framework.

7.4 Application in Thohoyandou town and local municipalities of Vhembe District.

The framework in Figure 7.1 is conceptual but to bring this framework to life, I can imagine a step-by-step rollout in Thohoyandou town, which could then serve as a model for scaling up across other local municipalities in Vhembe like Makhado, Musina, and Collins Chabane that are grappling with similar challenges (Tshamano and Shopola, 2021). The implementation would be phased over time, but with a key principle in mind: each phase should tackle several elements of the framework at once. That means progress on infrastructure, governance, finance, and community engagement would move forward in parallel not in isolation so that each reform supports and strengthens the others. Figure 7.2 indicates in a step-by-step scenario how this framework can be implemented.

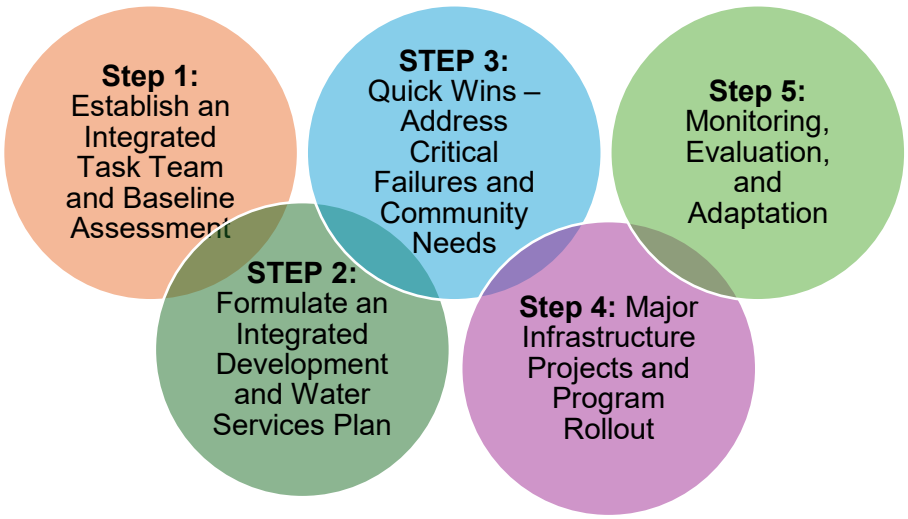


Figure 7.2: Step-by-step implementation plan for Thohoyandou town

Source: Mudavhi NB (2025)

Figure 7.2 outlines the step-by-step implementation plan for the framework in

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Thohoyandou town and the steps are as follows;

7.4.1 Step 1: establishment of an integrated task team and baseline assessment

The first step is to secure political and administrative backing. Vhembe District would start by pulling together a dedicated task team, think of town planners, water engineers, financial experts, and local authority community members (possibly forming the core of the proposed Water Services Steering Committee). Their first job? A thorough baseline assessment. They'd map out the current water infrastructure, track service levels, population spread, available water sources, and how everything is being managed. In Thohoyandou town's case, that could mean pulling together all the existing reports like the DWS All Towns study and IDP stats to identify problem spots. This might include areas like parts of Thohoyandou Unit D or nearby villages like Tswinga that are facing major shortages or water losses. The data would help set clear targets for improvements and guide smarter spatial planning.

7.4.2 Step 2: formulation of an integrated development and water services plan

With the baseline data in hand, the task team moves on to updating the Spatial Development Framework (SDF), weaving in a detailed Water Services Development Plan (WSDP) that aligns with it. For instance, if the SDF points to the future growth of Thohoyandou town expanding northwards, the WSDP would outline the need for a new reservoir and major water pipelines in that area. On the flip side, if certain remote settlements are found to be too expensive to service sustainably, the plan might suggest long-term, voluntary relocation strategies using incentives to encourage densification in areas where services can be provided more efficiently. The team combines spatial and infrastructure planning into one coordinated effort. This integrated plan would then go through a round of stakeholder workshops, bringing in voices like traditional leaders in rural areas, civic groups, and other community representatives to make sure local perspectives shape the final strategy. By the end of this step, the district has a clear, community-backed roadmap of priority projects and policies to guide water services over the next 5 to 10 years.

7.4.3 Step 3: address critical failures and community needs- quick wins

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In the early stages of implementation, the plan would focus on some “quick wins” to build momentum and earn public trust. In Thohoyandou town, that might mean fixing a well-known broken pipeline that is left a village without water for weeks, or installing communal taps in areas that currently have none. A strong example could be connecting Ha-Mutoti village where there was a recent protest to the Nandoni pipeline. Not only would this improve water access there, but it would also show that the municipality is listening and responding. At the same time, the municipality could roll out community forums in each ward to explain what’s coming and gather direct input like pinpointing households with no water connections. These early, visible actions will not fix everything overnight, but they send a clear message: the framework is about inclusion, real change, and tackling the biggest service gaps head-on.

7.4.4 Step 4: major infrastructure projects and program rollout

With the planning phase complete and urgent fixes already underway, the municipality can start rolling out the larger, long-term projects outlined in the integrated plan. These are the kinds of initiatives that take more time and resources, but they lay the groundwork for sustainable water services. For example:

- Building a new pipeline loop around Thohoyandou town to connect existing water networks. This would boost system resilience so if one section goes down, water can still be rerouted from another direction.
- Drilling new boreholes in areas where underground water sources look promising (based on hydrogeological surveys), creating a backup supply for peak demand or emergencies.
- Upgrading the Thohoyandou Water Treatment Works (or the Nandoni Water Plant) to expand capacity and modernize treatment processes, helping maintain high water quality even as demand increases.
- Installing district meters and pressure control valves across various supply zones to better monitor flow, reduce losses, and manage pressure more effectively.

Because these kinds of projects require time and funding, they’d likely be rolled out in phases possibly with support from sources like the national Municipal Infrastructure Grant. Throughout, the framework emphasizes transparency and coordination: keeping

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communities informed about construction timelines, and working with departments like traffic and roads to minimize disruption when digging takes place. Over time, these investments would significantly improve both the volume and reliability of water reaching households. Inline with the physical upgrades, “soft” programs would also be introduced. A demand management campaign might distribute free water-saving devices like low-flow showerheads, potentially funded by the Department of Water and Sanitation paired with community education on water conservation. On the financial side, the billing system could get a full revamp. That might include a modern IT system to manage customer accounts and meter readings, plus a smart incentive like interest waivers for residents who settle outstanding bills helping rebuild a culture of payment without being overly punitive about past arrears. Together, these efforts highlight the framework’s comprehensive approach combining infrastructure with community engagement, governance, and practical support for long-term sustainability.

7.4.5 Step 5: monitoring, evaluation, and adaptation

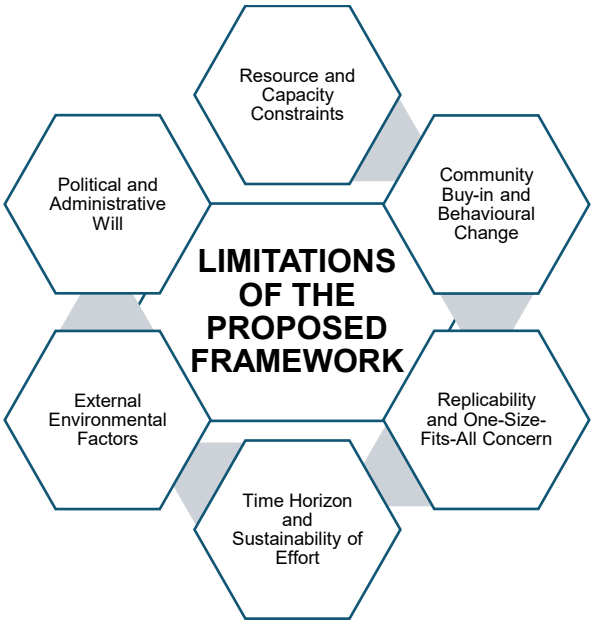
As the framework starts to take effect, it is essential for the task team or steering committee to keep a close eye on progress tracking clear, measurable indicators. These could include things like how many hours a day water is available in each zone, how many new household connections have been made, the percentage of leaks that have been repaired, and how well revenue is being collected. For example, a specific goal might be to increase the share of households in Thohoyandou town with at least a yard tap from 60% to 85% over five years. To track how people are experiencing the improvements, annual surveys or even mobile phone reporting tools could be used to gather feedback and flag any gaps. Let’s say, for instance, a village still struggles with low water pressure monitoring might reveal a previously undetected bottleneck in the system, which can then be addressed directly. The strength of the framework lies in its adaptability. It is not a rigid plan it encourages learning and adjusting along the way. If one strategy isn’t working like if prepaid meters are met with resistance the municipality could shift gears and try a different approach, such as using trusted local revenue collectors to improve payment rates. And because all the elements of the framework are interconnected, if one area hits a snag (say, financial shortfalls), others can help balance things out for example, by

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mobilizing community support to boost compliance. By applying the framework in this dynamic, people-centered way, Thohoyandou can steadily transform its water service delivery. And once it is working well, the model can be adapted and rolled out in other municipalities across Vhembe. In a more rural area like Collins Chabane Local Municipality, for example, community engagement would likely take center stage since water users are more scattered and informal channels of communication might be stronger. Meanwhile, in a more urban context like Makhado Local Municipality, the focus might shift toward modernizing aging water treatment plants and managing the challenges of rapid rural growth. What makes the framework powerful is its flexibility it is rooted in core principles that apply everywhere, plan strategically, build the right infrastructure, ensure strong governance, engage the people you serve, and protect both the environment and financial sustainability.

7.5 Limitations of the proposed framework on sustainable spatial planning strategies for sustainable municipal household water service provision.

This study defines limitations as those factors that will hinder the implementation of the proposed framework on sustainable spatial planning strategies for sustainable municipal household water service provision. Figure 7.3 shows the limitations on the proposed framework.



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Figure 7.3 Limitations of the proposed spatial planning strategies framework

Source: Mudavhi NB (2025)

Despite that the framework covers a lot of ground, it is not without flaws or limitations. It is important to be upfront about these, since they represent risks that need to be carefully managed during implementation of this framework. Figure 7.3 outlines these limitations in a digramatic representation and I unpacks each limitation in detail below.

7.5.1 Resource and capacity constraints

Rolling out the entire framework will take a lot of resources money, skilled people, and the right technology. For a district like Vhembe, where resources are already stretched thin, securing enough funding for big infrastructure projects or hiring new staff could be a real challenge. There's also a chance that only parts of the plan will get off the ground. For instance, the physical projects might move ahead, but things like community programs or policy changes could fall behind due to limited budgets or not enough capacity. Because the framework is designed to work as a whole, missing or underfunded pieces could end up weakening the entire effort. On top of that, the framework assumes a certain level of expertise like experienced engineers or strong project managers that VDM may not currently have. Bacon *et al.*, (2024) argue that building up a strong capacity takes time and that means in the meantime, older systems and inefficient practices usually continue to slow things down.

7.5.2 Political and administrative will

The success of this framework really depends on strong, consistent support from local leadership. It is not just about starting strong it is about staying the course over time (Milon and Shapira-Lishchinsky, 2021). That can be tricky, especially with political shifts. After elections, new leaders might bring different priorities, which could derail the long-term vision. Inside government, there could be pushback too. Some officials might feel uneasy about increased community involvement or more transparent processes especially if it means giving up control or being held accountable for past shortcomings. There's also the issue of departments working in silos. When planners and engineers don't collaborate, important connections get missed, and progress slows down. Changing these entrenched ways of working isn't easy. Without clear leadership, internal

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champions, or even incentives to work across departments, the integrated approach could struggle to take hold. It is a familiar challenge in cooperative governance: the policies may be in place, but putting them into practice often takes much more effort.

7.5.3 Community buy-in and behavioural change

The framework places a lot of emphasis on getting communities involved to help drive better results but that is not something that can be taken for granted. Shifting long-held beliefs like the idea that water should always be free and unlimited takes time. So does changing behaviors like non-payment or vandalism, especially if there's been a breakdown in trust between the community and the municipality in the past. Even if the quality of service improves, there's a chance people still will not start paying right away. Real change might only come once a new sense of mutual responsibility basically, a new social contract is firmly in place (Bojrab-Wray *et al.*, 2023). Getting communities involved in managing water services also has its own set of challenges. Local power dynamics can create tensions like who gets a seat on a water committee and disagreements can easily surface. Making sure that everyone gets a fair voice will take skilled and sensitive facilitation. As Makasi *et al.*, (2022) reflect in his study that the end of the day, people are unpredictable. Not every community will respond the same way to engagement efforts, and that variability adds another layer of complexity to implementation.

7.5.4 External environmental factors

Unpredictable climate conditions and environmental surprises could also throw a wrench into the framework's success. For example, if a severe, multi-year drought were to hit something that is already happened in other parts of South Africa even the most well-designed infrastructure might struggle to keep up with water demand. That kind of strain can lead to service disruptions, which in turn could shake public confidence. The same goes for sudden contamination events like pollution in a key river source which could halt progress until the issue is resolved. While the framework does account for environmental risks through management strategies, there's always an element of uncertainty. With droughts expected to become more frequent in the region, the system needs to be especially resilient. But even with strong planning, extreme scenarios could still push it beyond its limits.

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7.5.5 Time horizon and sustainability of effort

The real benefits of the framework will not show up overnight they'll take time, possibly 5 to 10 years or more, to fully come to life. That creates a risk: if people whether it is politicians, the public, or even funders don't see visible improvements in the short term, they might lose interest or confidence in the process. Keeping the momentum going over that long stretch is a serious challenge. It means constant monitoring, adapting where needed, and staying committed even when progress isn't obvious. If focus shifts due to budget cuts, new political priorities, or emerging crises it is possible that efforts could stall, or worse, that things slide back into the old, less effective ways of doing things. Some of the most meaningful changes, like groundwater recovery or shifts in public behavior, take time to show up. That means everyone involved needs to trust the process and stay the course even when the results aren't immediately visible. And that kind of patience and belief isn't always easy to maintain.

7.5.6 One-size-fits-all concern and replicability issues

Although the framework is well-suited for Thohoyandou town and other similar municipalities in the Vhembe District, it is important not to assume it can be applied everywhere exactly as it is. Each municipality has its unique mix of cultural, geographic, and infrastructure-related challenges that need to be considered. For example, a place like Musina, which deals with cross-border water issues involving Zimbabwe, might require a much stronger emphasis on international cooperation something the current framework only lightly touches on. So, while the framework offers solid guidance, it is not a one-size-fits-all solution. It should be seen more as a flexible template that needs to be shaped around local realities. The key for implementers is to adapt it thoughtfully, rather than trying to apply it wholesale without adjustments.

7.6 Testing the framework and hypothesis

This framework was tested throughout this study from problematising the study to the analysis of all the study objectives (see chapt 1, sec 1.5). One of the ways in which I tested how well the proposed framework works, I used a practical mixed-methods approach, as outlined in Chapter 4. This involved 382 household questionnaires, interviews with 10 municipal officials, and on-the-ground observations in Thohoyandou

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town. By combining both numbers and narratives, I was able to get a clearer picture of the prevailing conditions. Using a descriptive case study design also made it possible to cross-check different sources of data, helping ensure that each part of the framework reflects real-world challenges. The goal was not just to create a strong theoretical framework, but one that is usable on the ground. Chapters 5 and 6 shed light on major issues facing Thohoyandou town's water service provision systems such as frequent water service disruptions, outdated infrastructure, and weak governance. Because the municipal water supply is unreliable, residents have had to come up with their own solutions, like installing JoJo tanks, using boreholes, or buying water.

These struggles point to deeper issues like aging infrastructure, poor maintenance, lack of coordination between government levels, and weak communication with the public. But there's also hope: resources like the Nandoni Dam, existing policies such as Free Basic Water, and opportunities to involve the community offer a solid starting point for change. In response, Chapter 7 lays out a framework built on Systems Theory, New Urbanism, and Smart Growth theories. It includes six key components such as Integrated spatial planning, Infrastructure and technology, governance, community engagement, environmental resource management and Financial Sustainability. Each one addresses a specific challenge uncovered in the field. For instance, infrastructure improvements target frequent pipe bursts, governance changes aim to fix coordination problems, and community engagement focuses on giving residents a voice. This proves/echoes a hypothesis I made, that implementing a spatial planning strategy (herein referred to as a framework) will lead to improvement on the sustainability of municipal household water service provision in Thohoyandou town (see chapt 1, sec 1.7).The result is a framework that is not only grounded in solid theory, but also shaped by what's really happening on the ground making it a realistic and effective tool for improving water services in Thohoyandou town.

7.7 Chapter summary

In this chapter, I introduced a framework for sustainable spatial planning strategies aimed at improving municipal household water service provision in Thohoyandou town and other local municipalities within the Vhembe District. I laid the ground of the framework by

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drawing from both theory and practice through examining current water service challenges while building on foundational ideas. Theoretical lenses such as Systems Theory, New Urbanism, and Smart Growth provided a basis for advocating a holistic, integrated approach. These perspectives emphasize aligning infrastructure with spatial development and applying systems thinking to address complex problems. This chapter also outlined how district and local municipalities that are WSAs can leverage this framework in a step-by-step scenario and concluded by recognising the limitations thereof towards the framework. These issues outlined in this chapter and the previous ones make it crystal clear that a new, more responsive framework was needed and they directly informed the design and focus of the proposed strategy. The preceding chapter concludes the thesis.

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CHAPTER 8: SUMMARY OF FINDINGS, RECOMMENDATIONS, AND CONCLUSION.

8.1 Introduction

The aim of this study was to propose spatial planning strategies for sustainable municipal household water service provision in Thohoyandou Town under the Vhembe District Municipality of Limpopo Province in South Africa. Municipal household water service provision in district municipalities continues to face significant challenges. As a result, most rural local municipalities of Vhembe District Municipality face household water service delivery protests. In South Africa, provisioning of water service is a prerogative of some district and local municipalities. According to the Water Services Act of 1997 (Act No. 108), a "water services authority" refers to any municipality that has the authority to provide water services within its jurisdiction. The Act states that both local and district municipalities can be given the function of water services authority. This responsibility is determined by the capacity of the municipality to manage and provide these services effectively and in this case Vhembe District Municipality holds the jurisdiction to provide water to Thohoyandou Town and is a water service authority. This research therefore seeks to propose a framework on spatial planning strategies for sustainable municipal household water provisioning in small rural towns such as Thohoyandou. These issues were addressed through research objectives as indicated in chapter 1, section 1.5. These prevailing concerns were done in Thohoyandou; a town located in the south of the Vhembe District northwest on the R524 main road between Louis Trichardt and the Kruger National Park. The Vhembe District Municipality is a category C municipality found in the northern part of the Limpopo Province and seeks to be developmental municipality focusing on Sustainable Service Delivery and socio-economic development towards an equal society by 2030, but the issues of water inadequacy are clearly apparent. To get a full picture of the situation, the study used a case study approach that included questionnaires to residents, interviews with key stakeholders, and on-the-ground observations and used a mixed methods research design. This data was collected and analysed using statistical analysis tools such as Excel and SPSS. This chapter is organised in five distinct sections; the first section summarises the findings from the research objectives. The second section gives the recommendations while on the third

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section I give my contribution to knowledge and the areas for further research. The fifth section concludes the thesis.

8.2 Summary of findings on spatial planning strategies for sustainable municipal household water service provision, a case study of Thohoyandou town.

The research findings are organized according to the themes emanating from the research objectives as guided by the spatial planning strategies framework shown in Figure 7.1 in Chapter 7.

8.2.1 Assessment of the current state of municipal household water service provision in Thohoyandou town.

The study's assessment of the current state of water service provision in Thohoyandou town revealed a municipal system under pressure one that is struggling to meet the daily needs of households consistently. While most homes are formally connected to the municipal piped water network, alternative sources like groundwater (herein other chapters referred to as boreholes) and rainwater are still commonly used as backup options. Residents face frequent supply disruptions, and many have had to adopt coping strategies such as storing water in containers, collecting rainwater, or relying on private boreholes. This suggests that the real issue isn't the lack of infrastructure, but rather that the existing system is unable to deliver water consistently or reliably. The research found that these problems are not due to an overall shortage of water as Thohoyandou is technically supplied by the large Nandoni Dam regional scheme but instead stem from inefficiencies in infrastructure and poor operational management. Issues like leaks, pump breakdowns, and inconsistent distribution schedules mean that even when water is available at the treatment plant, it doesn't always make it to households (See chapt 5, sec 5.10).

A major finding was the spatial inequality in water service across different areas of the town. The urban centre including the CBD and nearby townships tend to receive more regular service and has better infrastructure (see chapt 5, sec 5.13). These areas benefit from a more connected pipeline network and are closer to main storage reservoirs, which helps maintain water pressure and ensure backup in case of disruptions. The situation is

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much worse in the town's outer areas, especially in semi-rural settlements and peripheral townships. These communities often depend on shared standpipes or occasional water deliveries by tanker and can go days or even weeks without municipal water. In some cases, people through word of mouth indicated that people in these areas received less than 50 litres of water per person per day, falling below the basic minimum standard. This disparity is partly due to historical underinvestment in outlying areas and reflects a "distance decay" effect areas farther from the water source tend to suffer from weaker pressure and are first to experience cuts during shortages. Even within serviced areas, poorer neighbourhoods on the town's fringes report more frequent outages than central, higher-income zones (see chapter 5, section 5.13). This uneven distribution of service is a serious concern and points to a wider planning issue. The town's growth has outpaced infrastructure development, leaving those on the margins with the most unreliable access. Many have lost confidence in the municipality's ability to address these problems, and some have taken matters into their own hands digging wells or buying water from private suppliers just to meet basic needs.

8.2.2 Analysis of the challenges and opportunities underlying municipal household water service provision in Thohoyandou town.

The study's analysis of the root causes of Thohoyandou town's water service challenges revealed a complex mix of technical, managerial, and socio-economic issues (see in chapter 6). One of the core problems lies in the condition of the infrastructure (see chapter 6, section 6.3.2.5). Much of the town's water distribution network is old, with some pipes and pumps dating back several decades. These systems have not been adequately upgraded to handle the growing population and rising demand. As a result, frequent pipe bursts and pump failures disrupt supply and lead to significant water losses. Maintenance tends to be reactive rather than preventative, and delays are common leaks were sometimes left unattended for extended periods, further damaging infrastructure and undermining public trust. Infrastructure capacity is also a growing concern. Storage reservoirs and treatment plants are operating close to their maximum design limits, so even small faults or spikes in demand can result in system failures. These technical weaknesses are worsened by a lack of coordination between urban planning and

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infrastructure development. New settlements and expansions have often outpaced upgrades to water systems, leaving newly developed zones poorly served. In some cases, settlements have been built in hard-to-reach locations or are connected to overstretched supply lines, meaning they receive inconsistent or inadequate service.

Beyond infrastructure, institutional challenges were also found as a major issue. The Vhembe District Municipality lacks the technical skills, staffing, and budget needed to manage the water system effectively (see chapter 6, section 6.3.2.5). Coordination between the district (which provides water services) and the local municipality (which oversees land use planning) is weak, resulting in fragmented and siloed decision-making. Financial constraints make matters worse. Many households do pay for water services, leading to low revenue collection. This limits the municipality's ability to invest in infrastructure repairs and expansion. Community engagement around water planning is minimal. Many residents feel excluded from decision-making processes, which has contributed to mistrust and sometimes even led to protests. Poor communication during outages such as the lack of early warnings or updates has only deepened public frustration. In some cases, official responses came only after public pressure or demonstrations, proving to have a reactive rather than a proactive approach. Structural drivers further intensify these problems. One major factor is rapid town growth: Thohoyandou town's population increased by about 44% between 2016 and 2022 (See chapter 4, sec 4.5) due to rural migration and natural population growth. Infrastructure development hasn't kept pace, creating a growing gap between supply and demand. Environmental pressures also play a role in periods of drought stress water sources, while intense rainfall can damage pipes or contaminate supply points. These climate-related challenges highlight the need for more resilient, adaptive management practices. Socio-economic constraints prevent many households from paying water fees, which not only affects service quality but also leads to unauthorized connections and illegal water use. Low levels of local economic activity limit the municipality's ability to raise funds for major infrastructure projects, making it dependent on external grants. The problems extend beyond intermittent supply they're tied to systemic issues in planning, governance, and finance that need to be addressed in a coordinated way.

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Despite the scale of the challenges, the study also identified several opportunities that Thohoyandou town can leverage to improve its water services. First, the town has access to substantial water resources. The nearby Nandoni Dam provides a stable regional water source, and its treatment plant is being expanded. In addition to this surface water, the area has a strong groundwater potential. Between 2017 and 2021, nearly 100 boreholes were rehabilitated, and there are plans to better integrate groundwater into the municipal supply network. This offers an opportunity to diversify sources and build resilience by using dam water, groundwater, and even rainwater harvesting at the household level, the municipality can reduce its dependence on any single supply.

There's a supportive policy environment in place. South Africa's Free Basic Water (FBW) policy guarantees every household a minimum of 6 kilolitres of water per month at no cost, recognizing access to water as a constitutional right. If implemented effectively through systems like updated indigent registries and accurate distribution the policy can ease the burden on poor households and assist to ensure basic access for all. Another promising factor is growing civic engagement. During the study, residents, traditional leaders, and community groups demonstrated high levels of concern and involvement in water issues. This presents a real opportunity to create participatory approaches to service delivery, such as neighbourhood water user committees or local reporting systems for leaks and outages. Government funding opportunities exist. National and provincial initiatives like the Municipal Infrastructure Grant (MIG) could be tapped to support system upgrades. Thohoyandou town's water infrastructure needs to align closely with national priorities around improving basic services in underdeveloped areas, which increases the likelihood of securing external resources and technical support.

8.2.3 A proposed framework on spatial planning strategies.

In response to the challenges identified and building on the opportunities available this study developed a framework of spatial planning strategies aimed at achieving sustainable household water service provision in Thohoyandou town. These strategies presented in Chapter 7 (figure 7.1), bring together possible infrastructure improvements, better policy and planning alignment, and stronger community involvement. The framework recognizes that isolated or short-term fixes will not suffice. Instead, a

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coordinated, long-term plan is needed to address the multifaceted nature of the town's water service issues. At the heart of this framework is the integration of water service planning with spatial (land-use) planning. In practical terms, this means aligning the town's Spatial Development Framework (SDF) with its Water Services Development Plan (WSDP), so that decisions about where and how the town grows are made with a clear understanding of water supply capacities. This would help avoid situations where new housing developments are approved without proper water infrastructure in place, or where settlements emerge in areas that are difficult and costly to service. Meanwhile, in remote or sparsely populated zones, the strategy suggests encouraging densification closer to existing service networks to make infrastructure provision more efficient.

In the immediate term, the framework focuses on targeted interventions in high-priority areas. This includes repairing frequently failing pipes, fixing malfunctioning pumps, and ensuring emergency access to water through more communal tap stands and water tankers in hard-hit neighbourhoods (see chapter 6, section 6.3.1.1). Quick solutions in these areas are critical not only to improve conditions, but to rebuild trust. To support this, the study proposes setting up ward-level water forums where municipal staff and residents can meet regularly to discuss outages, repairs, and progress on projects. Open, transparent communication is key to showing responsiveness and engaging the public early in the process. In the medium to long term, the strategy focuses on strengthening the overall resilience of the water system. This involves major infrastructure upgrades, such as expanding the piped network and storage capacity to underserved areas and introducing system redundancies to avoid disruptions. Findings indicated that there is an over-reliance on a single water source, the framework also emphasizes developing supplementary water supplies to avoid this. This includes establishing new boreholes in peri-urban areas and integrating rainwater harvesting at the household level. The framework additionally recommends completing the upgrade of the Nandoni Dam treatment plant to its full capacity of 120 ML/day to meet rising population needs. Technology plays a key role in the proposed solutions. The strategy (herein referred to as the spatial planning strategies framework) calls for the adoption of smart water management tools, such as installing district metering areas (DMAs) equipped with flow and pressure sensors. These allow for real-time monitoring of the network, making it

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easier to detect leaks or abnormal water loss. Automated telemetry systems could also be used to alert engineers when pumps fail or reservoir levels drop, speeding up the response time. Pressure management tools particularly reducing pressure during off-peak hours could help lower stress on aging pipes and reduce water loss. Together, these innovations would not only improve efficiency but also reduce the amount of water lost before it even reaches homes.

The framework moves beyond infrastructure to address the institutional and social aspects of water service sustainability. One key aspect is to strengthen community education and involvement. Awareness campaigns on water conservation, training of local “water stewards,” and incorporating water discussions into existing ward committees are all suggested. The aim is to build a culture of shared responsibility where residents play an active role in protecting water infrastructure and ensuring services run smoothly. Financial and governance reforms are also central to the plan. To improve revenue collection, the municipality should invest in accurate metering and billing systems, make payments more accessible, and offer incentives for timely payment to encourage residents to pay up in time. As water supply becomes more reliable, public willingness to pay is expected to increase but only if the billing process is fair, clear, and efficient. The framework also recommends seeking external funding and partnerships for larger infrastructure projects. This could involve applying for increased grants, partnering with private firms on specific investments (such as borehole drilling or solar-powered pumping systems), or tapping into national technical assistance programs. Building institutional capacity is another key piece: municipal staff should receive training in modern water management techniques, and departments must work more collaboratively. To break down silos between water services, urban planning, and finance, the study suggests setting up interdepartmental committees and joint budgeting mechanisms. The spatial planning strategies framework introduces a robust monitoring and evaluation (M&E) system to track progress. Performance indicators such as daily supply hours per zone, the percentage of households with direct connections, non-revenue water levels, and billing recovery rates should be monitored regularly. This data-driven approach allows the municipality to see what’s working, adjust where needed, and stay accountable. Community feedback should also be part of the evaluation process, ensuring that the user

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experience is guiding implementation.

8.3 Recommendations

This section provides key recommendations that are useful to local and district municipalities as key water service providers, as well as other key stakeholders who are involved in the provision of water services. It is crucial to note that these recommendations are also applicable for consideration by water service authorities experiencing similar challenges in South Africa, as well as other developing countries with similar contexts.

8.3.1 Strengthening spatial planning-policy integration

Findings from this study indicated the need to institutionalize the integration of spatial planning and water services planning. The case of Thohoyandou town clearly illustrates how disjointed planning processes can lead to serious service delivery gaps. To address this, formal mechanisms should be established to ensure that decisions about land use and urban development are closely coordinated with water infrastructure planning. In practical terms, this means fostering collaboration between the local municipality which oversees spatial planning and development control and the district water authority, which is responsible for water service provision. A crucial first step would be to establish a joint planning task team made up of town planners, water engineers, and budget officers. This team would be tasked with aligning key planning documents such as the Spatial Development Framework (SDF), Integrated Development Plan (IDP), and Water Services Development Plan (WSDP) so that they share common targets, timelines, and assumptions.

For example, if the SDF earmarks certain areas for future housing developments, the WSDP should simultaneously outline what water infrastructure (such as pipelines, reservoirs, or boreholes) will be needed to support these developments. These infrastructure needs must then be factored into budget planning and infrastructure rollout programs to ensure alignment between plans and implementation. This integrated approach can prevent common mismatches for instance, where settlements are approved without an adequate water supply, or where infrastructure is built but ends up underutilized due to changes in land-use plans.

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Strengthening policy integration also means revisiting and updating development control regulations to explicitly incorporate water service considerations. It is recommended that all major new developments in Thohoyandou town undergo a mandatory assessment of water service availability as part of the planning approval process. No new township, subdivision, or significant land-use change should be approved without a clear, funded plan for how water will be supplied. In fringe or hard-to-reach areas, developers could be required to contribute to the cost of extending water infrastructure such as laying new mains or developing boreholes as a condition for project approval.

8.3.2 Enhancing infrastructure management and innovation

Improving the physical water supply infrastructure and how it is managed is central to achieving sustainable service delivery in Thohoyandou town. The study demonstrated that much of the town's water supply issues stem from aging, inefficient infrastructure, making a comprehensive upgrade and renewal program a top priority. As a first step, the municipality and district water authority should undertake a thorough audit of the entire water supply system to identify critical vulnerabilities. Pipelines that frequently burst or experience significant leakage should be prioritized for replacement or rehabilitation. Outdated or undersized pumps, valves, and control systems at treatment plants and booster stations should be upgraded to improve operational reliability. Moving forward, a shift from reactive to proactive maintenance is strongly recommended. Rather than only responding to breakdowns, the water department should implement regular maintenance cycles such as scheduled pipe inspections, pump servicing, and reservoir cleaning to help prevent failures before they occur. Although this approach may require greater upfront budget allocations for routine maintenance, it is cost-effective over time, reducing emergency repair needs and minimizing supply disruptions.

8.3.3 Encouraging participatory planning and community engagement.

The relationship between the community and the water service provider emerged as a critical factor in ensuring the long-term sustainability of water services. As such, this study recommends a series of actions aimed at strengthening community engagement and fostering participatory planning in service delivery. First and foremost, the municipality needs to improve its communication with residents around water-related issues.

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Transparent, timely, and accessible information can go a long way in building public trust and managing expectations particularly during service disruptions. To achieve this, practical measures could include establishing an SMS alert system, using social media to issue real-time updates, and placing notice boards in public spaces. In areas with limited internet or phone access, the use of public loudhailers remains effective. Clear communication is especially vital during severe shortages, where households need advance notice of when and where emergency water (such as tanker deliveries) will be available, so they can plan accordingly. However, improving communication should not be limited to one-way announcements. Active participation by residents in water service planning and decision-making is highly encouraged.

The establishment or revitalization of Water User Committees and ward-level service delivery forums would provide structured platforms for residents to express concerns, propose ideas, and collaborate with officials. Regular community meetings (such as imbizos) could allow municipal representatives to update communities on water service performance and receive direct feedback. Involving traditional leaders who play a key role in Thohoyandou would also enhance community engagement, as their influence can help secure buy-in and participation, particularly for public campaigns like water conservation Imbizo. Incorporating community inputs into project planning can further improve the relevance and effectiveness of interventions. Residents possess valuable local knowledge about which areas experience the most severe shortages, how people currently cope, and what infrastructure already exists informally. Participatory mapping exercises and community surveys can be used to gather this insight and guide planning decisions. When communities are involved early, the resulting infrastructure projects are more likely to be appropriate, accepted, and maintained over time.

8.4 Study's contribution to knowledge and the areas for further research

This section outlines the contribution of this research to the broader body of knowledge and outlines areas that need further research.

8.4.1 Contribution to the broader body of knowledge

This study contributes a spatial planning strategies framework, as presented in Chapter

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7, Section 7.3 (Figure 7.1). This framework is going to be useful for guiding planners, policymakers, technical service officials, water service authority institutions and researchers in understanding and addressing the use of spatial planning to create sustainable municipal household water service provision by offering a structured approach to integrate spatial considerations into their planning processes, the framework provides practical tools for improving municipal water services. This spatial planning strategies framework has not been used elsewhere but has been tested and will surely work (see in chapter 7, section 7.6).

8.4.2 Areas for further research

While this study has provided meaningful contributions to the state of municipal water service provision in Thohoyandou town and proposed strategies for sustainable improvement, some areas require further research to deepen understanding or expansion of the findings. Future research could do a follow-up study to track how the spatial planning strategies framework is working when put into practice either in Thohoyandou town (VDM) or other towns/water service authorities.

8.5 Conclusion

This thesis has explored the provision of municipal household water services in Thohoyandou town through the lens of spatial planning, revealing both the scale of existing challenges and the opportunities for meaningful reform. The findings confirmed that persistent issues such as unreliable supply, aging infrastructure, unequal access, and institutional limitations are closely tied to patterns of spatial development and governance. Grounded in empirical evidence and informed by planning theories, this study proposed a framework that offers a structured way to assess and respond to service delivery challenges. The strategies proposed within this framework aim to establish a more spatially just and resilient water system one that ensures every household, regardless of location, receives a reliable and equitable level of service. They demonstrate that when municipalities place water at the centre of spatial planning and governance recognizing it as both a basic right and a critical urban service, they are better positioned to meet the challenges of urbanization, climate change, and social inequality. The path to sustainable household water service provision is not a one-time fix, but an ongoing process of

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reflection, adaptation, and shared responsibility. The experience of Thohoyandou town offers a valuable case study, one that can inform other municipalities seeking to fulfil the promise of safe, reliable, and equitable water access for all. By employing these proposed spatial planning strategies for sustainable municipal household water service provision, a sustainable water supply in South Africa is possible.

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REFERENCES

Agustina, I.H., Fardani, I. and Aji, R.R. (2021) 'Cultural Substance Actualization in Spatial Planning: Case of Cirebon City, Indonesia', *IOP Conference Series: Earth and Environmental Science*, 830(1).

Ahmed, A. (2019) *Private Public Partnerships (PPPs) As a Policy Tool to Achieve the United Nations 2030 Agenda for Sustainable Development* (1 online resource (59 pages) vol). Bradford, West Yorkshire: Emerald Publishing Limited (World Journal of Science, Technology and Sustainable Development Ser, v. 3).

Ahmed, T. *et al.* (2022) 'Consumer Perception and Behavior Toward Water Supply, Demand, Water Tariff, Water Quality, and Willingness-To-Pay: A Cross-Sectional Study', *Water Resources Management: An International Journal - Published for the European Water Resources Association (EWRA)*, 36(4), pp. 1339–1354.

Al-Mafarji, D.A.T. and Alsaadi, S.A.R.A. (2023) 'The Physiological Effect of Different Types of Water used to Thermally Stressed Ewes During the Summer Season', *IOP Conference Series: Earth and Environmental Science*, 1262(7).

Albert, C. (2021) 'Human security as biosecurity Reconceptualizing national security threats in the time of COVID-19', *Politics & Life Sciences*, 40(1), pp. 83–105.

Amini Farsani, M. and Barzegar, R. (2024) 'Tracing sampling in applied linguistics: the case of quantitative research approach', *Quality & Quantity: International Journal of Methodology*, pp. 1–13.

Arnold, N.M. (2013) 'The role of Thulamela Municipality in creating an enabling environment for informal traders in Thohoyandou', *Journal of Management & Administration*, 11(1), pp. 116–135.

Artz, C., Pyron, M. and Bowley, L. (2020) 'Long-term Macroinvertebrate Assemblages of the West Fork White River, Indiana Improve Following the Clean Water Act', *The American Midland Naturalist*, 184(2), pp. 233–247.

Ba-Alawi, A.H., Nguyen, H.-T. and Yoo, C. (2024) 'Coordinated operation for a resilient and green energy-water supply system: A co-optimization approach with flexible strategies', *Energy*, 304.

© University of Venda

Bacon, C.T. *et al.* (2024) 'Building Leaders for an Equitable and Inclusive Future', *The Journal of nursing administration*, 54(3), pp. 137–138.

Baiyegunhi, L.J.S. (2015) 'Determinants of rainwater harvesting technology (RWHT) adoption for home gardening in Msinga, KwaZulu-Natal, South Africa', *Water SA*, 41(1), pp. 33–39.

Bapela, L.C. (2017) An evaluation of the relationship between water infrastructure financing and water provision in South Africa.

Berard, B. (2021) 'Photography', *Canadian Journal of Communication*, 46(3), pp. 723–731.

Bhowmick, P. and Lanzon, A. (2021) 'Applying negative imaginary systems theory to non-square systems with polytopic uncertainty', *Automatic*, 128

Bojrab-Wray, M. *et al.* (2023) 'Community Buy-in and Client Engagement in a Produce Prescription Program', *Journal of the Academy of Nutrition and Dietetics*, 123(9), p. A46.

Bondarde, P. *et al.* (2025) 'Advancements in biological reconstruction of proximal humerus tumour: A case study and review of literature', *Journal of Orthopaedic Reports*, 4(3), pp. 100400-.

Botai, C.M. *et al.* (2024a) 'Assessment of rural livelihoods, health and wellbeing in Vhembe District Municipality, South Africa and Narok County, Kenya: A water-energy-food nexus perspective', *Environmental Science and Policy*, 159.

Botai, C.M. *et al.* (2024b) 'Assessment of rural livelihoods, health and wellbeing in Vhembe District Municipality, South Africa and Narok County, Kenya: A water-energy-food nexus perspective', *Environmental Science and Policy*, 159.

Brettenny, W. and Sharp, G. (2016) 'Efficiency evaluation of urban and rural municipal water service authorities in South Africa: a data envelopment analysis approach', Water SA, 42(1), pp. 11–19.

Brink, H., Van der Walt, C. (Christa), Van Rensburg, G.H., 2018. Fundamentals of research methodology for health care professionals, Fourth edition. ed. Juta and Company (Pty) Ltd., Cape Town, South Africa.

British Limb Reconstruction Society Research Collaborative and Graham, S.M. (2024) 'Identifying Research Priorities in Limb Reconstruction Surgery in the United Kingdom', *Strategies in Trauma and Limb Reconstruction*, 19(1), pp. 1–8.

© University of Venda

Bruno F. Abrantes, 2018. Intrapreneurial Dynamics: A Case Research at the Insurance Industry in Portugal. Int. J. Entrap. Knowl. 6, 61–75.

Case, A., Dilberto, E. and Thiede, A. (2024) 'Importance of an interdisciplinary approach to terminal paediatric cancer patients', *Archives of Physical Medicine and Rehabilitation*, 105(4), pp. e66–e67.

Çelik, H., Baykal, N.B. and Memur, H.N.K. (2020) 'Qualitative Data Analysis and Fundamental Principles', *Journal of Qualitative Research in Education*, 8(1), pp. 379–406.

Chalastani, V.I. *et al.* (2021) 'A bibliometric assessment of progress in marine spatial planning', *Marine Policy*, 127.

Chang, S.-I., Chang, L.-M. and Liao, J.-C. (2020) 'Risk factors of enterprise internal control under the internet of things governance: A qualitative research approach', *Information & Management*, 57(6).

Chen, M. *et al.* (2022) 'Identifying interlinkages between urbanization and Sustainable Development Goals', *Geography and Sustainability*, 3(4), pp. 339–346.

Chikoore, H. *et al.* (no date) 'Synoptic structure of a sub-daily extreme precipitation and flood event in Thohoyandou, north-eastern South Africa', *Weather and Climate Extremes*, 33.

Chikozho, C., Dabata, T. and Managa, R. (2020) 'Ensuring access to water for food production by emerging farmers in South Africa: what are the missing ingredients?', *Water SA*, 46(2), pp. 225–233.

Christmann, G.B. *et al.* (2020) 'Innovations in spatial planning as a social process – phases, actors, conflicts', *European Planning Studies*, 28(3), pp. 496–520.

Chung, J. *et al.* (2023) 'Elbow to digit measurements as a preoperative adjunct tool to aid intramedullary femoral nail selection - the rule of thumb', *Injury*, 54(2), pp. 683–686.

Coolsaet, B. (2021) *Environmental justice: key issues* (1 online resource (xxii, 341 pages): illustrations. vol). Abingdon, Oxon: Routledge (Key issues in environment and sustainability).

Cronk, R., Tracy, J.W. and Bartram, J. (2024) 'The influence of seasonality and multiple water source use on household water service levels', *Cleaner Water*, 1.

Dagnino, F.-M., Dimitriadis, Y., Pozzi, F., Rubia-Avi, B., Asensio-Pérez, J.-I., 2020. The Role of Supporting Technologies in a Mixed Methods Research Design. Coman. Media Educ. Res. J. 28, 53–62.

© University of Venda

Dasgupta, P., Dasgupta, A. and Barrett, S. (2021) 'Population, Ecological Footprint and the Sustainable Development Goals', *Environmental and Resource Economics: The Official Journal of the European Association of Environmental and Resource Economists*, 84(3), pp. 659–675

Dau, S.V. and Ahwireng-Obeng, F. (2010) *Evaluating the delivery of water and sanitation services in the Thulamela Municipality of Limpopo Province*.

Davies-Coleman, H.D., Fox, H.E. and Haigh, E.H. (2010) 'Framework for local government to implement integrated water resource management linked to water service delivery', Water SA, 36(4), pp. 475–486.

Stevens, S. (2017) 'SPLUMA: A Practical Guide, Adv Nic Laubscher, Lizette Hoffman, Dr Ernst Drewes & Jan Nysschen', *Stads- en Streeksbeplanning = Town and Regional Planning*, 2017(71), pp. 36–37.

DeWalt, K.M., DeWalt, B.R., 2011. Participant observation: a guide for fieldworkers, Second edition. Altamira Press, a division of Rowman & Littlefield, Lanham, Maryland.

Di Napoli, I., Dolce, P. and Arcidiacono, C. (2019) 'Community Trust A Social Indicator Related to Community Engagement', *Social Indicators Research*, 145(2), pp. 551–579.

Drew, M. and Crase, L. (2023) '"More Crop per Drop" and water use efficiency in the National Water Policy of Pakistan', *Agricultural Water Management*, 288.

Du Plessis, K. et al. (2017) 'Supplementary household water sources to augment potable municipal supply in South Africa', Water SA, 43(4), pp. 553–562.

Duane, B. *et al.* (2022) 'The environmental impact of community caries prevention - part 3: water fluoridation', *British Dental Journal*, 233(4), pp. 303–307.

Federation, W.E. (2017) The Water Reuse Roadmap (1 online resource (212 p.) vol). Chicago: Water Environment Federation.

Feodorov, A.F. (2022) 'Pragmatisms Prophets of Community: On Peirce and Royce', *Transactions of the Charles S. Peirce Society*, 57(4).

Food and Agriculture Organization of the United Nations and Food Wastage Footprint (Project) (2013) Food wastage footprint: impacts on natural resources: summary report (1 online resource (61 pages): colour illustrations vol). Rome: FAO.

Fox, J. *et al.* (2022) 'Observation Versus Cast Treatment of Toddler's Fractures', *Journal of paediatric orthopaedics*, 42(5), pp. e480–e485.

© University of Venda

Frank, K.A. *et al.* (2023) *Quantifying the Robustness of Causal Inferences: Sensitivity Analysis for Pragmatic Social Science*.

Dan. *et al.* (2024) 'Lifecycle Cost Analysis (LCC) in Ready-Mix Concrete Plant using SPSS tool (statistical package for the social sciences): A Case Study considering Just-in-Time (JIT) with a delivery radius of 60 km', *E3S Web of Conferences*, 559.

Ganzhur, M. *et al.* (2023) 'Data analysis using system modelling', *E3S Web of Conferences*, 389. Available at: https://doi.org/10.1051/e3sconf/202338907005.

García Laborda, J., Otero de Juan, N., Bakieva, M., 2015. Co-Participation in Oral Paired Interviews: Preliminary Findings of the OPENPAU Project.

Gaushell, D.J. and Darlington, H.T. (1987) 'Supervisory control and data acquisition', *Proceedings of the IEEE*, 75(12).

Gazzard, G. *et al.* (2021) 'A Scoping Review of Quality-of-Life Questionnaires in Glaucoma Patients', *Journal of glaucoma*, 30(8), pp. 732–743.

Godeberge, C. *et al.* (2022) 'Maternal Intensive Care Unit Admission as an Indicator of Severe Acute Maternal Morbidity: A Population-Based Study', *Anaesthesia and analgesia*, 134(3), pp. 581–591.

Goldblatt, M. (1996) 'Making the cup run over - the challenge of urban water supply for South Africa's Reconstruction and Development Programme', *Geoportal*, 39(1), pp. 21–26.

Golub, M., Neto Henriques, R. and Gouveia Nunes, R. (2021) 'Free-water DTI estimates from single b-value data might seem plausible but must be interpreted with care', *Magnetic Resonance in Medicine*, 85(5), pp. 2537–2551.

Govender, T. and Mammon, N. (2020) 'A clash of rights in the legal and spatial planning contexts: the case of the Philippi Horticultural Area', *Journal for Juridical Science*, 45(2), pp. 98–127.

Green-Lott, A.-M. *et al.* (2020) 'Hairy Cell Leukaemia and Ground Water Contamination With Industrial Solvents: a Case Report', *Military medicine*, 185(7–8), pp. e1338–e1340.

Grenni, S., Horlings, L.G. and Soini, K. (2020) 'Linking spatial planning and place branding strategies through cultural narratives in places', *European Planning Studies*, 28(7), pp. 1355–1374.

Hoek Spaans, R. *et al.* (2024) 'Ethical considerations related to drone use for environment and health research: A scoping review protocol', *PloS one*, 19(1), p. e0287270.

© University of Venda

Hofisi, C. (2022) 'Intergovernmental Relations and Service Delivery in South Africa: Towards Policy Integration for Effective Governance', *African Renaissance*, 19(1), pp. 59–78.

Hofstetter, M., Van Koppen, B. and Bolding, A. (2021) 'The emergence of collectively owned self-supply water supply systems in rural South Africa - what can we learn from the Tshakhuma case in Limpopo?', *Water SA*, 47(2), pp. 253–263.

Holness, S.D. *et al.* (2022) 'Using systematic conservation planning to align priority areas for biodiversity and nature-based activities in marine spatial planning: A real-world application in contested marine space', *Biological Conservation*, 271.

Hutete, C. and Sibanda, M.M. (2022) 'Water service provision and social equity in a South African rural district municipality', Africa's Public Service Delivery and Performance Review, 10(1).

Intason, M., Coetzee, W. and Lee, C. (2021) 'The development, implementation and challenges to water-saving practices in a water-stressed destination: a case study of the Songkran Festival, Thailand', *International Journal of Event and Festival Management*, 12(3), pp. 279–296.

Iwara, I.O., Zuwarimwe, J. and Kilonzo, B. (2020) 'Analysis of exogenous factors associated with enterprise performance in rural areas of Vhembe District, South Africa', *African Journal of Development Studies (formerly AFFRIKA Journal of Politics, Economics and Society)*, 10(4), pp. 143–168.

Jacobs-Mata, I., Mukuyu, P. and Dini, J. (2021) 'A review of trends in scientific coverage of water governance in South Africa and what this means for agenda-setting of public investment in water governance R&D', *Water SA*, 47(1), pp. 10–23.

Jansen van Vuuren, R. (2012) 'South Africa's next "greatest" challenge: strain on water supplies', *IMIESA*, 37(3), pp. 9–11.

Jørgensen, C. *et al.* (2023) 'Application of hydraulic modelling and quantitative microbial risk assessment (QMRA) for cloudburst management in cities with combined sewer systems', *Water science and technology: a journal of the International Association on Water Pollution Research*, 88(4), pp. 799–813.

Joshua, M., James, M. and Titos, K. (2022) 'Coalition Governance and Service Delivery in South Africa: A Case Study of Tshwane, Johannesburg and Ekurhuleni Metropolitan Municipalities', *Journal of Public Administration*, 57(2), pp. 272–283.

© University of Venda

Kelly, K. (2021) 'Blue Drop and Green Drop certification programme revitalised', *Water&Sanitation Africa*, 16(4), pp. 52–53.

Khaile, F.T., Roman, N.V. and Davids, G.J. (2021) 'The Role of Local Government in Promoting a Sense of Belonging as an Aspect of Social Cohesion: A Document Analysis', *African Journal of Governance and Development*, 10(1), pp. 8–33.

Kim, H.J. *et al.* (2020) 'Starting from Home: Development of a Sustainable Parenting Education Program for Caregivers with Young Children in Rural Malawi', *Early Childhood Education Journal*, 49(6), pp. 1113–1123.

Kinseng, R.A. *et al.* (2023) 'Natural resource-based social conflict and principles of sustainable landscape approach: case study of kelola sendang project, South Sumatera, Indonesia', *IOP Conference Series: Earth and Environmental Science*, 1220(1).

Kotoku, G. and Kumasi, T.C. (2022) 'Rethinking the sustainability of rural water delivery under the community ownership and management model', *Sustainable Water Resources Management*, 8(5).

Kotzé, P. (2023) 'Reflecting on 25 years of the National Water Act of - what has been achieved?', *Water Wheel*, 22(5), pp. 10–13.

Kupika, O.L., Mahlatini, P. and Nyachowe, T. (2022) 'How local communities access, utilise and evaluate inland fisheries, and their influence on fishery conservation status in northern Zimbabwe', *Water SA*, 48(3), pp. 227–239.

Lavrakas, P.J., 2019. Experimental methods in survey research: techniques that combine random sampling with random assignment, Wiley series in survey methodology. Wiley, Hoboken, NJ.

Ledger, T. (2021) 'Changing municipal leadership will not end one of the toughest challenges in local government', *New Agenda: South African Journal of Social and Economic Policy*, 2021(82), pp. 8–11.

Lee, K. *et al.* (2024) 'Observation weights matching approach for causal inference', *Pattern Recognition*, 154.

Li, X. *et al.* (2021) 'Evaluating water provision service at the sub-watershed scale by combining supply, demand, and spatial flow', *Ecological indicators*, 127, pp. 107745-.

© University of Venda

Lin, B., Zhu, R. and Chen, Y. (2022) 'How "Informing Consumers" Impacts Willingness to Pay for Renewable Energy Electricity in China', *Journal of Global Information Management (JGIM)*, 30(1), pp. 1–23.

Lin, H.-W., Mead, G. and Blake, G.A. (2022) 'Mapping', *Physical Review Letters*, 129(20).

Liu, W. *et al.* (2022) 'A New Approach for Quantitative Definition of Asymmetrical Loading Tunnels', *Iranian Journal of Science and Technology, Transactions of Civil Engineering*, 47(1), pp. 457–468.

Loubser, C., Chimbanga, B.M. and Jacobs, H.E. (2021) 'Intermittent water supply: a South African perspective', *Water SA*, 47(1), pp. 1–9.

Lozano, J.-M. and Tien, I. (2023) 'Data collection tools for post-disaster damage assessment of building and lifeline infrastructure systems', *International Journal of Disaster Risk Reduction*, 94.

Luo, G. (2024) 'The Contributions of John Dewey's Philosophy of Pragmatism to an Understanding of Education and Its Reform', *Journal of Education and Educational Research*, 10(2), pp. 224–228.

Luvhimbi, N. *et al.* (2022) 'Water quality assessment and evaluation of human health risk of drinking water from source to point of use at Thulamela municipality, Limpopo Province', *Scientific Reports*, 12(1).

Luwe, K. *et al.* (2022) 'Perceptions of Inclusivity and Sustainability in Urban Sanitation in Global South Cities', *Environmental Health Insights*, 16.

Madikizela-Madiya, N. (2021) 'The question of access and spatial justice in universities in sub-Saharan Africa: A capabilities approach', *Transformation in Higher Education*, 6(1).

Magagula, D.N. *et al.* (2022) 'The role of district municipalities in service provision in South Africa: Dissecting challenges faced by Ehlanzeni District Municipality', *Africa's Public Service Delivery and Performance Review*, 10(1).

Maimaiti, B. *et al.* (2021) 'Urban spatial expansion and its impacts on ecosystem service value of typical oasis cities around Tarim Basin, northwest China', *International Journal of Applied Earth Observation and Geoinformation*, 104.

Makalela, K.I. (2021) 'Water Service Provision in Lepelle-Nkumpi Local Municipality in South Africa', Journal of Public Administration, 56(3), pp. 524–538.

Makasi, T. *et al.* (2022) 'A Typology of Chatbots in Public Service Delivery', *IEEE Software*, 39(3).

© University of Venda

Makgopela, P.S. and Radikonyana, P.S. (2023) 'Drinkable and Potable Water in Hammanskraal, Tshwane Metropolitan Municipality: A Service Delivery Challenge or a Fallacy?', *Journal of Public Administration*, 58(2), pp. 284–299.

Makungo, R. *et al.* (2019) 'Hydrological hazards in Vhembe district in Limpopo Province, South Africa', *Jamba: Journal of Disaster Risk Studies*, 11(2), pp. 1–13.

Malakoana, M., Qwabe, B.R. and Zondi, S.I. (2020) 'Customer Expectations and Perceptions of Water Service Quality', Administratio Publica, 28(1), pp. 44–66.

Malele, R.H.M., Netswera, F.G. and Lethoko, M. (2018) *Living without water: the experiences of Mokgolobotho villagers in Greater Tzaneen Municipality in Limpopo Province*.

Malima, T.P., Kilonzo, B. and Zuwarimwe, J. (2022) 'Challenges and coping strategies of potable water supply systems in rural communities of Vhembe District Municipality, South Africa', *Journal of Water and Land Development*, pp. 148–157.

Maphela, B. and Cloete, F. (2020) 'Johannesburg's implementation of the National Water Act, 1998 in Soweto, South Africa', *Development Southern Africa*, 37(4), pp. 535–552.

Marcus, M.A. (2023) 'Data analysis in spectroscopic STXM', *Journal of Electron Spectroscopy and Related Phenomena*, 264.

Marosa, L.D., Mukonza, R.M. and Molepo, J.N. (2022) 'Management of Climate Change Through Intergovernmental Approach: Analysing the Role of Provincial Government in Assisting Municipalities Cope with Climate Change Effects in Limpopo Province', *Journal of Public Administration*, 57(1), pp. 39–53.

Masekesa, L.K. (2022) 'A human rights-based approach to implementing Target 11.6 of Sustainable Development Goal 11 in Zimbabwe', *African Human Rights Law Journal*, 22(1), pp. 241–265.

Mashabela, K. et al. (2022) 'Assessing accessibility and availability of portable water supply in selected communities of Lepelle-Nkumpi local municipality, Limpopo Province of South Africa', Physics and Chemistry of the Earth, 127.

Masindi, F. and Manjoro, M. (2024) 'A survey of water quality at two rural water treatment plants and various points-of-use in Vhembe District Municipality, South Africa', *South African Geographical Journal = Suid-Afrikaanse Geografiese Tydskrif*, 106(3), pp. 309–322.

Masiya, T., Mazenda, A. and Davids, Y.D. (2019) 'Effective Public Participation in Municipal Service Delivery', Administration Publica, 27(3), pp. 27–47.

© University of Venda

Mavhungu, T.J. et al. (2021) 'Characterization of women and youth smallholder agricultural entrepreneurs in rural irrigation schemes in Vhembe district, South Africa', South African Journal of Agricultural Extension, 49(3), pp. 104–122. Available at: https://doi.org/10.17159/2413-3221/2021/v49n3a12848.

Maziwisa, M.R. and Lenaghan, P. (2020) 'Rethinking the right to water in rural Limpopo', *African Human Rights Law Journal*, 20(1), pp. 233–260.

Maziwisa, M.R. and Lenaghan, P. (2020) 'Rethinking the right to water in rural Limpopo', *African Human Rights Law Journal*, 20(1), pp. 233–260.

Mbulaheni, M.H. (2021) *The role of management in implementing service delivery initiatives for community development in Vhembe District Municipality, Limpopo Province*.

Mekonnen, M.M. and Hoekstra, A.Y. (2020) 'Sustainability of the blue water footprint of crops', *Advances in Water Resources*, 143.

Mengistu, M.G. *et al.* (2021) 'Spatial and temporal analysis of the mid-summer dry spells for the summer rainfall region of South Africa', *Water SA*, 47(1), pp. 76–87.

Mensah, F., Yu, Q. and Shi, G. (2022) 'Fostering land-sharing scheme as alternative resettlement to the inevitable Old Fadama evictions and challenges in Ghana', *South African Geographical Journal = Suid-Afrikaanse Geografiese Tydskrif*, 104(4), pp. 397–426.

Mhlanga, S. *et al.* (2021) 'Exploring the Utilisation of Indigenous Knowledge by Medicinal Plant Vendors as a Livelihood Strategy: A Case Study of Thohoyandou, Vhembe District, South Africa', *African Journal of Religion, Philosophy and Culture*, 2(2), pp. 59–81.

Miguel Serra, Sophia Psarra, Jamie O'Brien, 2018. Social and Physical Characterization of Urban Contexts: Techniques and Methods for Quantification, Classification and Purposive Sampling 3, 58–74.

Milon, L. and Shapira-Lishchinsky, O. (2021) 'Authentic leadership as a mediator between professional identity, ethical climate, citizenship behaviour and political behaviour', *International Journal of Educational Management*, 35(4), pp. 741–753.

Mirnezami, A., Knight, B., Moran, B., Noble, F., Branagan, G., Primrose, J., Pearson, K.,

Moerman, J., Braaksma, J., van Dongen, L., 2021. Reliable introduction of critical assets: an explorative case study in railways. J. Qual. Maint. Eng. 27, 537–549.

Moolman, H. (2021) 'Land occupations and the legal requirements for human settlements', *Stockfarm*, 11(8), p. 61.

© University of Venda

Mothelesi, G.A., Marumo, P.O. and Sebolaaneng, M. (2022) 'Impact Analysis of Violent Protests on South Africa's National Development Plan 2030', *Journal of Nation-building & Policy Studies*, 2022(si1), pp. 41–56.

Mothiba, D.P. *et al.* (2023) 'Assessing the Occurrence of Host-Specific Faecal Indicator Markers in Water Systems as a Function of Water, Sanitation and Hygiene Practices: A Case Study in Rural Communities of Vhembe District Municipality, South Africa', *Pathogens (Basel, Switzerland)*, 13(1).

Motsoeneng, R.P. (2022) 'Public Sanitation Challenges in South African Local Government', *Administration Publica*, 30(4), pp. 186–207.

Mukonavanhu, T. and Nel-Sanders, D. (2024) 'Improved water delivery infrastructure in the Vhembe District Municipality, South Africa', *African Journal of Public Administration and Environmental Studies*, 3(2), pp. 111–130.

Mukonavanhu, T. and Nel-Sanders, D. (2024) 'Improved water delivery infrastructure in the Vhembe District Municipality, South Africa', *African Journal of Public Administration and Environmental Studies*, 3(2), pp. 111–130.

Muller, M. (2023) 'Water and welfare: Free basic water revisited', *Development Southern Africa*, 40(6), pp. 1365–1379.

Muloiwa, M., Dinka, M.O. and Nyende-Byakika, S. (2022) 'Analysis of domestic water consumption in peri-urban South Africa: The case study of Thohoyandou in Limpopo province, South Africa', *African Journal of Science, Technology, Innovation and Development*, 14(6), pp. 1546–1559.

Mupindu, W. and Thakhathi, R.D. (2012) 'The challenges of potable water service delivery system in the City of Kwekwe, Zimbabwe', Administration Publica, 20(2), pp. 70–88.

Murkin, C. *et al.* (2022) 'What should be included in case report forms? Development and application of novel methods to inform surgical study design: a mixed methods case study in parastomal hernia prevention', *BMJ Open*, 12(10).

Mwale, M. *et al.* (2021) 'Developing Resilient Small-scale Farmers against Water Scarcity in Rural-based Crop Production Farms, South Africa', *African Renaissance*, 18(1), pp. 203–222.

© University of Venda

Mwale, M. *et al.* (2021) 'Developing Resilient Small-scale Farmers against Water Scarcity in Rural-based Crop Production Farms, South Africa', *African Renaissance*, 18(1), pp. 203–222.

Mwale, M. *et al.* (2021) 'Developing Resilient Small-scale Farmers against Water Scarcity in Rural-based Crop Production Farms, South Africa', *African Renaissance*, 18(1), pp. 203–222.

Moribane. (2023) 'Developmental Challenges in Local Government: A Reflection from Capricorn District Municipality, South Africa', *African Renaissance*, 20(1), pp. 57–75.

Nave, A., do Paço, A. and Duarte, P. (2021) 'A systematic literature review on sustainability in the wine tourism industry: insights and perspectives', *International Journal of Wine Business Research*, 33(4), pp. 457–480.

Ndiritu, J. et al. (2011) 'Yield-reliability analysis for rural domestic water supply from combined rainwater harvesting and run-of-river abstraction', Hydrological Sciences Journal, 56(2), pp. 238–248.

Nealer, E.J. and Mtsweni, D. (2013) 'The perceptions of municipal water service officials on the Blue Drop Certification Programme', Administration Publica, 21(2), pp. 37–56.

Nekhavhambe, M.M. (2014) 'The role of municipal councillors and traditional leaders in service delivery: the case of Thulamela Local Municipality', *Journal of Public Administration*, 49(4), pp. 1139–1152.

Nephawe, N. *et al.* (2021) 'Water-related Challenges in Crop Production: Insights from Under-Resourced Small-scale Farmers in Limpopo Province of South Africa', *African Renaissance*, 18(2), pp. 147–163.

Nishida, Y., Watanabe, S. and Watanabe, Y. (2024) 'Triangulation of diagonally dominant min-plus matrices', *Discrete Event Dynamic Systems: Theory and Applications*, 34(2), pp. 297–332.

Nyadzani, M. *et al.* (2023) 'An Exploration of African Indigenous Knowledge Systems for Nature Conservation in Thohoyandou', *African Journal of Development Studies (formerly AFFRIKA Journal of Politics, Economics and Society)*, 13(3), pp. 27–54.

Nyahunda, L. and Tirivangasi, H.M. (2022) 'Adaptation strategies employed by rural women in the face of climate change impacts in Vhembe district, Limpopo province, South Africa', *Management of Environmental Quality: An International Journal*, 33(4), pp. 1061–1075.

© University of Venda

Nylen, N.G. (2021) 'Surface Water Quality Regulation as a Driver for Groundwater Recharge', *Case Studies in the Environment*, 5(1).

Odeku, K.O. (2022) 'The Impact of Electricity Insecurity on Women-Owned Small Businesses in South Africa Amid Spiralling Covid-19 Pandemic', *Gender and Behaviour*, 20(2), pp. 19353–19357.

Pamla, A., Thondhlana, G. and Ruwanza, S. (2021) 'Persistent Droughts and Water Scarcity: Households' Perceptions and Practices in Makhanda, South Africa', *Land*, 10(6), pp. 593-.

Pande, B. and Adil, G.K. (2022) 'Assessment of the current state of sustainability in a manufacturing firm', *International Journal of Productivity and Performance Management*, 71(4), pp. 1254–1276.

Phillips, M.J. (2023) 'Towards a social constructionist, criticality, Foucauldian-informed qualitative research approach: Opportunities and challenges', *SN Social Sciences*, 3(10).

Phungela, T.T. *et al.* (2022) 'The impact of wastewater treatment effluent on Crocodile River quality in Ehlanzeni District, Mpumalanga Province, South Africa', *South African Journal of Science*, 118(7), pp. 1–8.

Pienaar, J.M., Johnson, E. and Du Plessis, W. (2020) 'Land Matters and Rural Development: 2019', *Southern African Public Law*, 35(1), pp. 1–30.

Piwowar-Sulej, K. (2022) 'Environmental strategies and human resource development consistency: Research in the manufacturing industry', *Journal of Cleaner Production*, 330.

Popovici, R. *et al.* (2022) 'Maladaptive learning in Peru's integrated water resources management', *Environmental Science and Policy*, 127, pp. 209–217.

Potgieter, N. *et al.* (2021) 'WASH infrastructure and practices in primary health care clinics in the rural Vhembe District municipality in South Africa', *BMC Family Practice*, 22(1).

Pounis, G., 2019. Analysis in nutrition research: principles of statistical methodology and interpretation of the results. Academic Press, an imprint of Elsevier, London, United Kingdom.

Pragmatism: An Essential Philosophy for Mixed Methods Research in Education | University of Limpopo Library (no date).

Rakgogo, T.J. and Zungu, E.B. (2022) 'A blatant disregard of Section 6 (1) of the Constitution of South Africa by higher education institutions and language authorities: An onomastic

© University of Venda

discrepancy', *Literator: Journal of Literary Criticism, Comparative Linguistics and Literary Studies*, 43(1).

Ramaano, A.I. (2021) 'Potential for tourism to promote indigenous resources for community development in Musina Municipality, Vhembe District, Limpopo Province, South Africa', *Forestry Economics Review*, 3(1), pp. 53–78.

Rapholo, M.T. and Diko Makia, L. (2020) 'Are smallholder farmers' perceptions of climate variability supported by climatological evidence? Case study of a semi-arid region in South Africa', *International Journal of Climate Change Strategies and Management*, 12(5), pp. 571–585.

Reiman, A., 2021. Human factors and maintenance in delivery transportation: drivers' work outside the cab in focus. J. Qual. Maint. Eng. 27, 465–482.

Reinhold, S. and Hopkins, C. (2021) 'Sampling procedures on reception plates to quantify structure-borne sound power from machinery', *Applied Acoustics*, 172.

Reutener, I., 2016. The SMART review of non-motorised transport: transportation engineering. Civ. Eng. Siviele Ingeniousness 2016, 26–29.

Ruiters, C. and Matji, M.P. (2015a) 'Water institutions and governance models for the funding, financing and management of water infrastructure in South Africa', Water SA, 41(5), pp. 660–676.

Ruiters, C. and Matji, M.P. (2015b) 'Water institutions and governance models for the funding, financing and management of water infrastructure in South Africa', Water SA (Online), 41(5).

Sadeghi, H. *et al.* (2023) 'Dietary omega-6/omega-3 fatty acids and risk of prostate cancer; Is there any potential interaction by organophosphate insecticides among the agricultural health study population', *Cancer Epidemiology*, 85.

Sangai, A. (2019) 'From housing to city: on the possibilities of the right to the city in South Africa and India', Constitutional Court Review, 9(1), pp. 161–193.

Sasank Kuntamukkula, V., Khanna, S., Salokhe, O., Chandra Tiwari, R., Tiwari, H., 2021. Knowledge and apprehension of dental health professionals pertaining to COVID in Southern India: A questionnaire study. J. Pharm. Bio allied Sci. 13, 448–451.

Savushkin, S.M. and Khramov, A.A. (2022) 'Vailidity of prohibitions and obligations established for convicts to imprisonment', *Law Enforcement Review*, 6(1), pp. 216–228.

© University of Venda

Schindler, S. and Kanai, J.M. (2021) 'Getting the territory right: infrastructure-led development and the re-emergence of spatial planning strategies', *Regional Studies: The Journal of the Regional Studies Association*, 55(1), pp. 40–51.

Sethunya, B. (2022) 'Examining the Factors that Lead to Poor Service Delivery in Post-Apartheid South Africa: Insight(s) from Modimolle-Mookgophong Local Municipality, Limpopo Province', *African Renaissance*, 19(3), pp. 33–55.

Sieben, E.J.J. *et al.* (2022) 'The alignment of projects dealing with wetland restoration and alien control: A challenge for conservation management in South Africa', *South African Journal of Science*, 118(1–2), pp. 23–29.

Singha, A., Chakrabarti, D. and Arora, V. (2023) 'Sampling', *Physical Review D*, 108(7).

Sinthumule, N.I. (2021) 'Window of Economic Opportunity or Door of Exclusion? Nandoni Dam and Its Local Communities', *Sustainability*, 13(5), p. 2502.

Sirayi, M. and Sifolo, P.P.S. (2022) 'Urban and Rural Planning in South Africa: Time for Integration?', *African Journal of Development Studies (formerly AFFRIKA Journal of Politics, Economics and Society)*, 12(2), pp. 183–206.

Snel, M. (2018) *Doing a systematic literature review in legal scholarship*. The Hague, The Netherlands: Eleven International Publishing.

Stithou, M., Kourantidou, M. and Vassilopoulos, V. (2023) 'Sociocultural ecosystem services of small-scale fisheries: challenges, insights and perspectives for marine resource management and planning', *Aquatic Ecosystem Health and Management*, 25(3), pp. 22–33.

Sun, H. *et al.* (2022) 'A novel single-stage ceramic membrane moving bed biofilm reactor coupled with reverse osmosis for reclamation of municipal wastewater to NEWater-like product water', *Chemosphere*, 268.

Sun, S. (2023) 'Transformation from Urban and Rural Planning to Territory Spatial Planning', *Frontiers of Urban and Rural Planning*, 1(1).

Sundström, A., Hyder, A.S. and Chowdhury, E.H. (2020) 'Market-oriented CSR implementation in SMEs with sustainable innovations: an action research approach', *Baltic Journal of Management*, 15(5), pp. 775–795.

Suwaydi, M.A. *et al.* (2024) 'Sampling Procedures for Estimating the Infant Intake of Human Milk Leptin, Adiponectin, Insulin, Glucose, and Total Lipid', *Nutrients*, 16(3).

© University of Venda

Synthetic imputation methods for domain mean under simple random sampling | University of Limpopo Library (no date).

Syväjärvi, A. *et al.* (2017) 'The Latitude of Information Management in Local Government: Views of Local Government Managers', *International Journal of Electronic Government Research (IJEGR)*, 13(1), pp. 69–85.

Takalani, T. (2022) *An assessment of the aquatic health of river systems that drain into Nandoni Dam in the Luvuvhu River catchment, Vhembe District Municipality, Limpopo Province, South Africa*. [University of Johannesburg].

Takona, J.P. (2023) 'Research design: qualitative, quantitative, and mixed methods approaches / sixth edition', *Quality & Quantity: International Journal of Methodology*, 58(1), pp. 1011–1013.

Taylor, J.M. (2021) 'Reliability', *The Journal of nursing education*, 60(2), pp. 65–66.

Tebogo, M.S. (2023) 'State's capacity and government performance since the adoption of South Africa's National Development Plan', *African Journal of Democracy and Governance*, 10(3–4), pp. 43–62.

Tewari D D (2009) 'Free basic water and economic development: can they co-exist?', *The Water Wheel*, 8(1), pp. 33–35.

Tian, P. *et al.* (2022) 'The pattern of virtual water transfer in China: From the perspective of the virtual water hypothesis', *Journal of Cleaner Production*, 346.

Tiyasha, T. et al. (2021) 'Dual Water Choices: The Assessment of the Influential Factors on Water Sources Choices Using Unsupervised Machine Learning Market Basket Analysis', IEEE Access, 9.

Tiyasha, T. *et al.* (2021) 'Dual Water Choices: The Assessment of the Influential Factors on Water Sources Choices Using Unsupervised Machine Learning Market Basket Analysis', *IEEE Access*, 9.

Tjebana, M., Papiki, Rachidi, M.F. and Mokoena, S.K. (2020) *Impact evaluation of Batho-Pele Principles in delivery of housing services: a case study of CoGHSTA in Limpopo Province*.

Trivedi, H. and Chan, K.H. (2023) 'Quality over quantity: How qualitative research informs and improves quantitative research', *Journal of Paediatric Urology*, 19(5), pp. 655–656.

© University of Venda

Tshamano, N.W. and Shopola, M.A. (2021) 'Local Government and Climate Change: How Are Rural-Local Municipalities in Limpopo Province Coping with the Effects of Climate Change?', *African Renaissance*, 2021(si1), pp. 147–166.

Tshikovha, N.C. and Kanyane, M.H. (2014) *The role and effectiveness of integrated development planning (IDP) on service delivery in Vhembe District Municipality*. University of Limpopo (Turfloop Campus).

Tuwani Petrus Malima (2021) 'The Intervention Strategies for rural water supply system in Vhembe District South Africa', *Journal of Agribusiness and Rural Development*, 60(2).

Vajpayee, V. *et al.* (2021) 'L $_1$-Adaptive Robust Control Design for a Pressurized Water-Type Nuclear Power Plant', *IEEE Transactions on Nuclear Science*, 68(7).

Vallance, S. and Edwards, S. (2021) 'Charting New Ground: Between Tactical Urbanism and Strategic Spatial Planning', *Planning Theory & Practice*, 22(5), pp. 707–724.

Van Houtven, G.L. *et al.* (2017) 'What are Households Willing to Pay for Improved Water Access? Results from a Meta-Analysis', *Ecological economics*, 136, pp. 126–135.

van Koppen, B. *et al.* (2024) 'Principles and legal tools for equitable water resource allocation: prioritization in South Africa', *International Journal of Water Resources Development*, 40(4), pp. 555–577.

Van Olmen, D. and Šinkuniene, J. (2021) *Pragmatic markers and peripheries* (1 online resource (vi, 452 pages): illustrations (some colour). vol). Amsterdam: John Benjamins Publishing Company (Pragmatics & beyond; new ser., 325; volume 325).

Vaughan, M. *et al.* (2022) 'Managing interviews in high-stake crime cases: practice guidance for developing suspect interview strategies using a LOST WEBSITES framework', *The Journal of Forensic Practice*, 24(4), pp. 420–435.

Walker, S., Newby, T. and Tsubo, M. (2013) 'Plant species richness, soil properties and grazing effects in semi-arid grassland of South Africa', South African Journal of Botany, 86, p. 174.

Wang, H. *et al.* (2020) 'Observation Constrained Aromatic Emissions in Shanghai, China', *Journal of Geophysical Research: Atmospheres*, 125(6).

Wang, J., Zou, J. and Wang, H. (2022) 'Sampling with Replacement vs Poisson Sampling: A Comparative Study in Optimal Subsampling', *IEEE Transactions on Information Theory*, 68(10).

© University of Venda

Wang, L. *et al.* (2023) 'Assessing urban smart growth in China based on the sustainable development goals framework', *Environment, Development and Sustainability: A Multidisciplinary Approach to the Theory and Practice of Sustainable Development*, 26(8), pp. 19627–19657.

Water Environment Federation (2015) Advances in water quality trading as a flexible compliance tool: a special publication (1 online resource (xxviii, 342 pages) : illustrations, maps vol). Alexandria, VA: Water Environment Federation.

Holland, M. (2012) 'Can groundwater be successfully implemented as a bulk water resource within rural Limpopo Province? Analysis based on GRIP datasets', *Water SA*, 38(3), pp. 391–397.

Wen, Y. and Xu, J. (2017) 'Scientific Importance of Water-Processable PEDOT–PSS and Preparation, Challenge and New Application in Sensors of Its Film Electrode: A Review', *Journal of Polymer Science Part A: Polymer Chemistry*, 55(7), pp. 1121–1150.

West, M., Curtis, N., Pucher, P., Cutress, R., Pugh, S., Underwood, T., Pan Wessex Study Group, Wessex Surgical Trainee Research Collaborative, 2019. Population based observational study of acute pancreatitis in southern England. Ann. R. Coll.

Wöhler, L. *et al.* (2020) 'The grey water footprint of human and veterinary pharmaceuticals', 7.

Wong, C. (2022) 'Spatial thinking and policymaking in the UK: a spatial planning perspective', *Space and Polity*, 26(2), pp. 135–142.

Wu, N. *et al.* (2023) 'Distribution and drivers for blue water dependence in crop production in China, 1999-2018', *Agricultural Water Management*, 290.

Wu, Y.-L. *et al.* (2020) 'Quantitative Data Analysis in Single-Molecule Localization Microscopy', *Trends in Cell Biology*, 30(11), pp. 837–851.

Wu, Z.S. *et al.* (2023) 'Strategic leadership in spatial planning formulation: the practice in Hainan Province', *Frontiers of Urban and Rural Planning*, 1(1).

Xing, W. (2020) 'Spatial Layout Planning of High-Density Urban Green Space along the Coast and Its Empirical Analysis', *Journal of Coastal Research*, 104(sp1), pp. 925–929.

Ying Xue and Xuelian Fang (2020) 'Research Design of Intelligent Toothbrush for Preschool Children Based on KANO Model', 1631(1).

Zhou, W. *et al.* (2023) 'The win-win interaction between integrated blue and green space on urban cooling', *Science of the Total Environment*, 863.

© University of Venda

Zindi, B. and Shava, E. (2022) 'COVID-19 and the attainment of Sustainable Development Goal 6 (clean water and sanitation) in South Africa', *Journal of Local Government Research and Innovation*, 3(1).

Zungu, M.M. *et al.* (no date) 'Factors affecting the occupancy of forest mammals in an urban-forest mosaic in EThekwini Municipality, Durban, South Africa', *Urban Forestry & Urban Greening*, 48.

Zvobgo, L. (2020) 'Performance evaluation of water supply services in Chitungwiza: how water supply services mirror poor governance and lack of management', *Journal of Local Government Research and Innovation*, 1(1), pp. 1–11.

Zvobgo, L. (2021) 'Consumer ability and willingness to pay more for continuous municipal water supply in Chitungwiza', Sustainable Water Resources Management, 7

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Appendix A: Proof of registration

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PROOF OF REGISTRATION
To Whom It May Concern

16-Apr-2025

It is hereby confirmed that the under mentioned person is a registered student at University of Venda PRODI41.

Student Number:	18001741
Student ID Number:	9907295425083
Name:	NYADZANI BRIAN MUDAVHI
Registered for Period:	06-Jan-2025 - 31-Dec-2025
Study Level:	2ND YEAR
Qualification:	ESMURP MASTER OF URBAN AND REGIONAL PLANNING
Offering Type :	MASTERS (SUCCESIVE) FULL TIME

Subject	Description	Qual.	Class Group	Exam Year	Exam Month	Registration Date	Cancel Date	Stats Credits		Amount
URP6390	H3 MASTERS STUDENTS RESEARCH AND DISSERTATION 6390	ESMURP	A	2025	11	06-Feb-2025		1.000		19640.00
									Subtotal:	19640.00
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NB. The costs reflected in this document apply only to the current academic year's registration and do not constitute a financial statement of account. Registration fees, SRC levies, and residence costs are not included here but will appear on the financial statement of account.

DR. J.J BALOYI
UNIVERSITY REGISTRAR

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16-Apr-2025
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Appendix B: Letter for proofreading and language editing

Language Editing Report

Date: 7 May 2025

To whom it may concern.

This letter serves to confirm that I, B N Rumutsa, proofread and edited a dissertation entitled: **"SPATIAL PLANNING STRATEGIES FOR SUSTAINABLE MUNICIPAL HOUSEHOLD WATER SERVICE PROVISION: A CASE STUDY OF THOHOYANDOU TOWN IN VHEMBE DISTRICT MUNICIPALITY OF LIMPOPO, SOUTH AFRICA."**, by **NYADZANI BRIAN MUDAVHI** (Student Number, **18001741**), to be submitted to the Department of Urban and Regional Planning, Faculty Of Science, Engineering And Agriculture, University of Venda.

I carefully read through the dissertation, focusing on language and grammatical construction errors that needed corrections to the best of my ability. Neither the dissertation content nor the author`s intentions were altered in any way during the editing process.

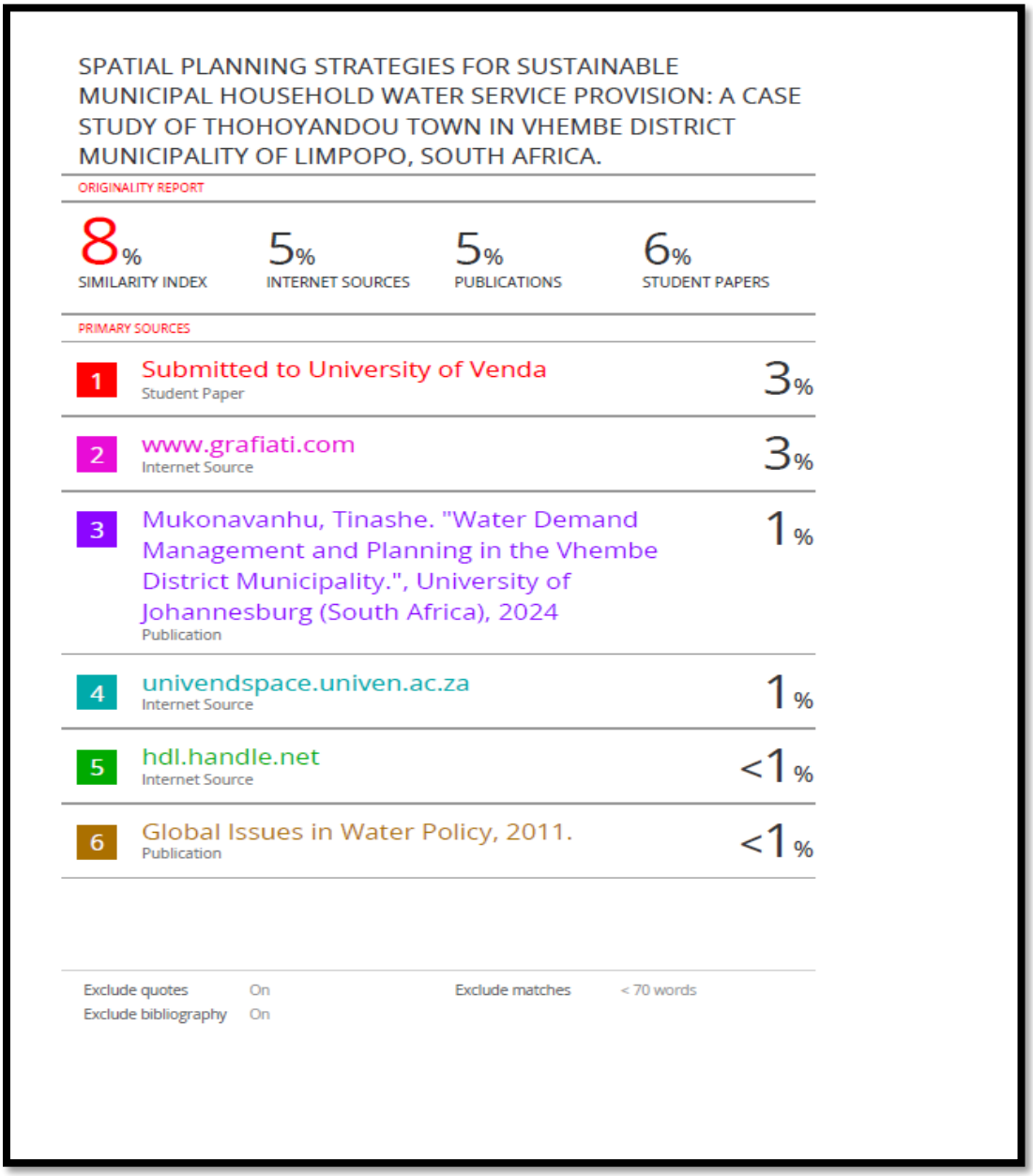
Yours sincerely

Dr B. N Rumutsa
(Language editor)

Email: nyeverwai@yahoo.com

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Appendix C: Turn-it-in report



SPATIAL PLANNING STRATEGIES FOR SUSTAINABLE MUNICIPAL HOUSEHOLD WATER SERVICE PROVISION: A CASE STUDY OF THOHOYANDOU TOWN IN VHEMBE DISTRICT MUNICIPALITY OF LIMPOPO, SOUTH AFRICA.

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Appendix D: Research ethical clearance letter

ETHICS APPROVAL CERTIFICATE

ETHICS APPROVAL CERTIFICATE

FACULTY OF SCIENCE, ENGINEERING AND AGRICULTURE
RESEARCH ETHICS COMMITTEE

NAME OF RESEARCHER/INVESTIGATOR: MUDAVHI NB

STAFF/STUDENT NO: 18001741

PROJECT TITLE: Spatial Planning Strategies for Sustainable Municipal Household Water Service Provision: A Case Study of Thohoyandou Town in the Vhembe District Municipality of Limpopo Province in South Africa.

ETHICAL CLEARENCE NO: FSEA/24/URP/51

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr E Ingwani	University of Venda, Urban and Regional Planning	Supervisor
Prof J Chakwizira	University of Venda, Urban and Regional Planning	Co-Supervisor

Type: MSc research

Risk: Minimal risk to humans, animals, or environment (Category 1)

Approval Period: March 2025 – March 2026

The Faculty Research Ethics Committee (FREC) of the Faculty of Science, Engineering and Agriculture hereby approves your project as indicated above.

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950, LIMPOPO PROVINCE, SOUTH AFRICA
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ETHICS APPROVAL CERTIFICATE

General Conditions

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following.

- The project leader (principal investigator) must report in the prescribed format to the REC:
  - Annually (or as otherwise requested) on the progress of the project, and upon completion of the project
  - Within 48hrs in case of any adverse event (or any matter that interrupts sound ethical principles) during the project.
  - Annually, research projects may be randomly selected for auditing.
- The approval applies strictly to the protocol as stipulated in the application form. Should a change to the protocol be deemed necessary during the project, the project leader must apply for approval of these changes before their implementation. Should there be a deviation from the study protocol, without the necessary approval for the change, the ethics approval is automatically forfeited.
- The date of approval indicates the earliest date that the project may begin. Should the project have to continue after the expiry date; a new application must be made, and a new approval received before or on the expiry date.
- In the interest of ethical responsibility, the FREC retains the right to:
  - Request access to any information or data at any time during the course or after completion of the project,
  - To ask further questions; Seek additional information; Require further modification or monitor the conduct of your research or the informed consent process.
  - withdraw or postpone approval if:
  - Any unethical principles or practices of the project are revealed or suspected.
  - It becomes apparent that relevant information was withheld from the REC or that information has been false or misrepresented.
  - The required annual report and reporting of adverse events was not done timely and accurately,
  - New institutional rules, national legislation or international conventions deem it necessary

ISSUED BY:
FACULTY OF SCIENCE, ENGINEERING AND AGRICULTURE RESEARCH ETHICS COMMITTEE

Date considered: March 2025



Chairperson: Prof. L.C Murulana

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Appendix E: Research support letter to Vhembe District Municipality

FACULTY OF SCIENCE, ENGINEERING AND AGRICULTURE
Department of Urban and Regional Planning

To: The Municipal Manager
Vhembe District Municipality
Old Government Complex
Tusk Venda Street
Thohoyandou, 0950

06 November 2024

Dear Sir

Ref: Request for Permission to Conduct Research at the Vhembe District Municipality

I am writing to formally request for permission to allow Mr Brian Mudavhi to conduct research within the Vhembe District Municipality. Mr Brian Mudavhi is a registered student pursuing a Masters in Urban and Regional Planning at the University of Venda (Student Number 18001741 and ID number 9907295425083). The research is titled, "Spatial Planning Strategies for Sustainable Municipal Household Water Service Provision: A Case Study of Thohoyandou Town in Vhembe District Municipality of Limpopo, South Africa."

The aim of this study is to propose spatial planning strategies for sustainable municipal household water service provision in Thohoyandou Town under the Vhembe District Municipality of Limpopo Province in South Africa. The findings can contribute to improved planning frameworks that support efficient and sustainable water service delivery in the district.

Mr Mudavhi is committed to conducting this study in compliance with municipal policies, and is prepared to collaborate closely with relevant municipal departments to ensure minimal disruption to their daily activities. He is also open to presenting findings to the municipality if desired.

Yours faithfully

Dr Emaculate Ingwani

Private Bag X5050, Thohoyandou, 0950 . Limpopo Province . South Africa
Telephone (015 962 8635 . Fax (015) 962 8597 Cell: 073 519 1522
Email: emaculate.ingwani@univen.ac.za
Website: www.univen.ac.za

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Appendix F: Permission to conduct research from Vhembe District Municipality



VHEMBE DISTRICT MUNICIPALITY
PRIVATE BAG X5006, THOHOYANDOU, 0950
TEL: 015 960 2000, FAX: 015 962 1017
Website: www.vhembe.gov.za

Enq: Nethanani N.
Municipal Manager's Office

Dear **Mr Mudavhi B**

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH AT VHEMBE DISTRICT MUNICIPALITY: Mr Mudavhi B

1. The above matter bears reference
2. This writing serves to confirm that Vhembe District Municipality grants you permission to conduct research on: *'Spatial Planning Strategies for Sustainable Municipal Household Water Service Provision: A Case Study of Thohoyandou Town in Vhembe District Municipality of Limpopo, South Africa.'*
3. It is further emphasised that your data collections should be done in accordance with ethical requirements of the research failure which would jeopardise your opportunity.
4. Your findings should be shared with Vhembe District Municipality as they would expand knowledge base within the district.
5. Vhembe District Municipality wishes you the best in your endeavour.
6. It is hoped that this will meet your expectations.

Kindly regards

MUNICIPAL MANAGER
KUTAMA Z.N.

11/11/2024
DATE

"A developmental municipality focusing on sustainable service delivery and socio-economic development towards an equal society"

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Appendix G: Questionnaire for Thohoyandou town residents

UNIVERSITY OF VENDA
FACULTY OF SCIENCE ENGINEERING AND AGRICULTURE
DEPARTMENT OF URBAN AND REGIONAL PLANNING

HOUSEHOLD QUESTIONNAIRE

A masters research project titled: spatial planning strategies for sustainable municipal household water service provision: a case study of Thohoyandou town in Vhembe district municipality of Limpopo, South Africa.

Introduction

This questionnaire is part of a research study on spatial planning strategies for sustainable municipal household water service provision: a case study of Thohoyandou town in Vhembe district municipality of Limpopo, South Africa. The study aims to identify challenges and opportunities in water service delivery and propose strategies for sustainable water management. Your participation is entirely voluntary, and you are free to withdraw at any time. All responses will remain strictly confidential and will be used solely for academic purposes. No identifying information will be linked to your answers. Your input is invaluable to the success of this research.

Thank you for taking the time to participate in this important study.

SECTION A: ADMINISTRATIVE

Interviewer: _____

Date: _____

Questionnaire Number: _____

Village/Location: _____

SECTION B: BIO- DEMOGRAPHIC DATA

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1. **Who is the head of the household?**

Father	Mother	Other

2. **Gender**

Male		Female	

3. Language

Tshivenda	English	Sepedi	Zulu	Tswana	Sotho	Swati	Ndebele	Tsonga	Other

3.1 If other, please specify

4. Race

African		White		Asian		Other	

5. Age Group

19-25		26-35 years		36-45 years		46-55 years	56 years and more

6. Occupational status

Employed		Student (Tertiary)		Retired		Pensioner	
Unemployed		Student (Secondary)		Other		Self employed	

6.1 If other, please specify_____

7. Marital status

Married		Never married		Divorced		Widowed		Living together	

8. Size of household

1-4 members	5-9 members	10-14 members	15 members and more

9. Type of dwelling unit

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Detached	Semi detached	Flat	Government house
Backyard room on formal property	Backyard room on informal property	Shanty/shack	Other

10. Ownership status of dwelling unit?

Rental		owned		Permission to occupy		Other	

10.1 If renting how much do you pay per month R_____

11. Household income

R5000.00 and below	R5001.00 – R10000.00	R10001-R15000.	R15000.00 - R20000.00	R20001.00 and more

12. Sources of income

Formal employment	Grant	Pension	Farming	Informal trading	Other

SECTION C: ACCESS TO WATER SERVICES

13. What is your primary source of water?

Municipal supply		Borehole		Rainwater harvesting		Other (specify):	

14. How often do you experience interruptions in municipal water supply?

Never		Rarely		Sometimes		Often	Always	

15. Can you describe any specific challenges you face regarding to access municipal water for household use?

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_____

_____

16. What do you do when there is interruption in supply of municipal household water?

Report to the municipality	Look for alternative providers	Get water from other sources such as rivers and wells	Other

SECTION C: WATER QUALITY AND SATISFACTION

16. How would you rate the quality of municipal household provided?

Excellent		Good		Average		Poor	Very Poor	

17. Can you elaborate on your satisfaction or dissatisfaction with the water services?

_____

_____

_____

_____

18. Have you experienced health issues related to water quality?

No		Yes	

If yes (please describe): _____

SECTION D: GOVERNANCE AND INFRASTRUCTURE

19. Are there any any policies or programs related to water service provision in your township?

Yes		No	

20. How well do you think the municipality manages water service delivery?

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Very well		Well		Neutral		Poorly	Very poorly	

21. What infrastructural challenges related to municipal household water services have you observed in your area?

_____

_____

_____

_____

22. Do you feel the municipality is transparent about household water service issues and challenges?

Yes		No	

SECTION E: SUSTAINABILITY AND COMMUNITY INVOLVEMENT

23. Are you aware of any community initiatives or programs related to water conservation?

Yes		No		If yes, please specify

24. How do you currently conserve water in your household?

_____

_____

25. What role do you think the community can play to improving municipal water service delivery in your village?

_____

_____

_____

_____

SECTION F: RECOMMENDATIONS

26. What changes or improvements would you recommend for better water service provision?

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_____
_____
_____
_____

27. How can the municipality better involve the community in decision-making about water services?

_____
_____

28. What suggestions do you have for improving the infrastructure to ensure sustainable water supply?

_____
_____

29. What improvements would you like the municipality to implement?

THE END: THANK YOU FOR PARTCIPATING

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Appendix H: Structured interview guide for technical officials at Vhembe District

UNIVERSITY OF VENDA

FACULTY OF SCIENCE ENGINEERING AND AGRICULTURE

DEPARTMENT OF URBAN AND REGIONAL PLANNING

Brief Interview Guide for Municipal Technical Officials

Disclaimer

This interview aims to gather insights into the technical aspects of water service provision in Thohoyandou. Your responses will help identify challenges, opportunities, and strategies for improving water service delivery. All information provided will remain confidential and used solely for research purposes. Participation is entirely voluntary, and you may withdraw at any time without any repercussions. Thank you for your valuable input.

Key Questions:

1. Background Information:

1.1 Can you describe your role in managing household water service infrastructure in Thohoyandou town?

1.2 How long have you been in this position?

1.3 Can you please describe the kinds and nature of household water service provision infrastructure available in Thohoyandou Town?

1.4 How often is household water service provision infrastructure maintained or replaced?

1.5 Is the household water service provision infrastructure adequate?

2. Water Service Infrastructure:

2.1 What is the current state of water infrastructure in Thohoyandou Town?

2.2 Are there any specific challenges related to maintaining and upgrading infrastructure?

2.3 Is such infrastructure adequate?

2.4 How does the municipality monitor and address infrastructural issues?

3. Governance and Collaboration:

3.1 How do you collaborate with other departments or agencies in water service

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provision?
3.2 What governance frameworks guide your operations in water service delivery?

4**. Opportunities and Innovations:**
4.1 Are there any recent innovations or opportunities for improving water infrastructure?
4.2 What role can spatial planning play in enhancing technical operations?

4.3 Do you often experience water service delivery protests in Thohoyandou Town?

5. Recommendations:
5.1 What changes would you recommend improving the technical aspects of the water service provision?

Thank you for your time and input!

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Appendix I: Structured interview guide for spatial planning officials at Vhembe District.

UNIVERSITY OF VENDA

FACULTY OF SCIENCE ENGINEERING AND AGRICULTURE

DEPARTMENT OF URBAN AND REGIONAL PLANNING

Brief Interview Guide for Spatial Planners

Disclaimer:

This interview seeks to understand the role of spatial planning in addressing challenges and opportunities related to municipal water service provision in Thohoyandou Town. Your input will contribute to developing strategies for sustainable water service delivery. All information shared will remain confidential and will be used exclusively for academic purposes. Participation is voluntary, and you may withdraw at any time. Thank you for your time and insights.

Key Questions:

1. Background Information:

1.1 What is your role in spatial planning for municipal services in Thohoyandou?

1.2 How does your department provide water service management?

1.3 How do you ensure that there is adequate household water service provision in Thohoyandou Town?

1.4 Can you please describe the main water sources of household water service provision in Thohoyandou Town.

1.5 Are these viable, if not why?

2. Spatial Challenges and Opportunities:

2.1 What spatial challenges affect municipal water service provision in Thohoyandou Town?

2.2 Are there any underutilized areas or resources that could support water service improvement?

2.3 How does urbanization and migration impacts water service provision in Thohoyandou Town?

2.4 Which suburban areas are most affected by lack of water or inadequate water service - provision? [Urban core, peri-urban villages]?

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2.5 What is being done by the municipality about this?

2.6 How do you ensure that water is adequately provided to all households in Thohoyandou Town even though they are spatially disaggregated?

2.7 How is the municipality assisting households with ensuring that they access adequate water in Thohoyandou Town?

3. Policy and Strategy:
3.1 What spatial policies or strategies currently in place to address household water service provision in Thohoyandou Town?
3.2 How effective are these policies in ensuring sustainable service delivery to households in Thoyondou Town?

4. Integration and Coordination:
4.1 How do you coordinate spatial planning with technical teams and municipal governance?
4.2 Are there gaps in this coordination that hinder service efficiency?

5. Future Planning:
5.1 What are your views on the integration of spatial planning strategies to address water service issues?
5.2 Can you propose specific strategies that could be effective in Thohoyandou town?

6. Recommendations:
6.1 What spatial interventions do you believe would most improve water service provision?

Thank you for your time and input!

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