WATER SECURITY AND VULNERABILITY OF SOUTH AFRICAN CITIES TO CLIMATE CHANGE LINKED WATER SUPPLY UNCERTAINTY

Research Team: Thokozani Simelane, Thandeka Dabata, Shingirirai Mutanga, Rodney Managa and Fhulufhelo Tshililo

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Introduction

Water availability in any city depends on **sufficient rainfall** (i.e. annual rainfall locally and in the designated area called catchment area) , **well managed catchment area**, **healthy river system** together with its **ecological systems and processes** as well as the **reliable infrastructure** in the form of dams, reservoirs, pipes and taps.

All these combines constitute a **system of water supply** in the household or industry

Water quality

The quality of water supplied and consumed is directly influenced by:-

a) the quality tests conducted by designated institutions.

b) Management of catchment areas.

c) provision and management of water supply infrastructure.

These are central to water supply system and are key to the security of water supply.

Water supply

By the design and planning, the security of water supply in South Africa has been limited to certain areas, with cities enjoying the guaranteed supply.

Over the past years there has been a noticeable shift in this pattern and the security of water supply to cities has become uncertain.

While this reality has been popularized by the city of Capetown, the trends point to the fact that almost all cities in South Africa are vulnerable to water insecurity.

This has been exacerbated by climate change and population increase in the cities due to migration and changes in the settlement patterns.

Government position

The Department of Water and Sanitation as a designated authority for water security and supply in the country has identified water scarcity in major cities as a threat and challenge that is directly linked to climate change.

It has acknowledged that most cities anchor country's economy, and therefore, require new investments to diversify country's water sources and mix to avert water crisis that may jeopardize economic growth and prospects of cities.

With the constant increasing demand for water in the cities and the real effect of climate change it is obvious that understanding cities' exposure and vulnerability to water insecurity is needed.

Objectives

This study has been conducted with the purposes of:

- Assessing existing levels of access to water as a basic.
- Measuring current levels of population exposure to water related challenges such as reliability of supply, open sewerage and waste water.
- Assessing how reported incidences of water related challenges are attended and managed by the authorities.
- Determining the levels of preparedness by the authorities to confront the water supply uncertainty linked to climate change.

Objectives

Through this assessment, evidence has been gathered regarding the vulnerability of the city to climate changed linked water insecurity.

Recommendations will be made on :-

a) how policies, plans, strategies and guidelines for water resource management can be adjusted to accommodate threats posed by climate change.

b) How key institutions and players can collaborate to develop emergency plans and strategies for water supply under uncertainty linked to climate change.

c) how bottlenecks for water management can be ameliorated.

d) how communities perceive services provided by authorities.

e) which coping mechanisms are emerging among the communities where shortage of water supply exist.

Approach

Data Collection Methods	Instrument	Sample Size	Sampling Procedure
Household survey	Questionnaire	Census ? Sample =XX	Stratified random sampling

Sample size estimation

- Formula to determine the appropriate sample size for households for this baseline study (Naing et al, 2006; Suresh and Chandrashekara, 2012).

- $N = \frac{Z^2_{\propto/2} * P(1-p) * D}{E^2}$

- Where E = margin of error = 2% ,
- Confidence level = 95% ,
- Therefore Zα/2 is 1.96.
- Design effect (D) =1 (for simple random sampling) but in this study a value of 2 proposed because stratified random sampling .
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- The value of P is normally taken from previous studies using a similar population.

- If we cannot find in literature we will use P of 50% as the prevalence or proportion for some of the indicators (e.g. incidence of diarrhoea).

- The incidence of diarrhoea was, for example 2% in children under the age of five years (Stats SA, 2010).

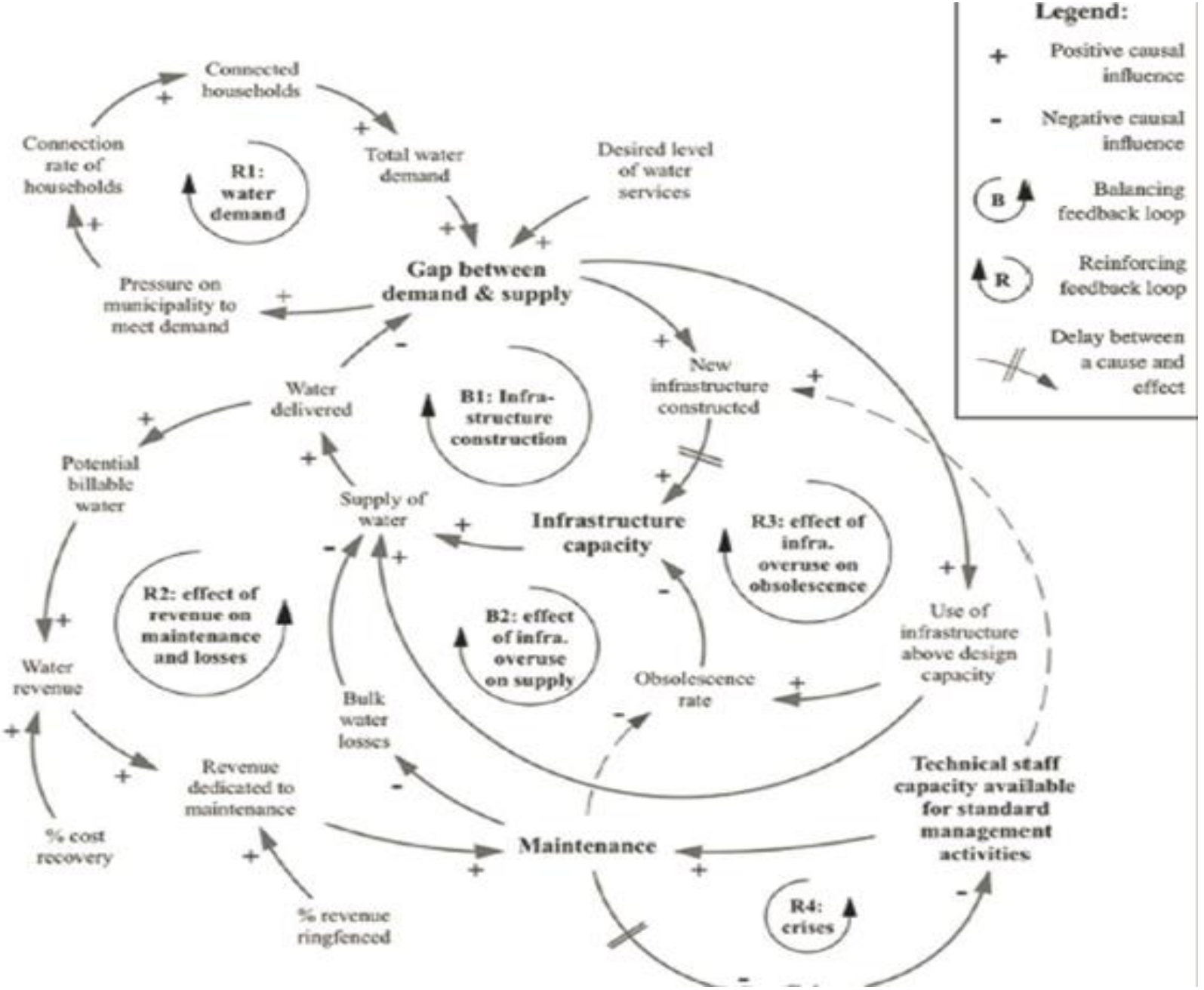
Areas visited

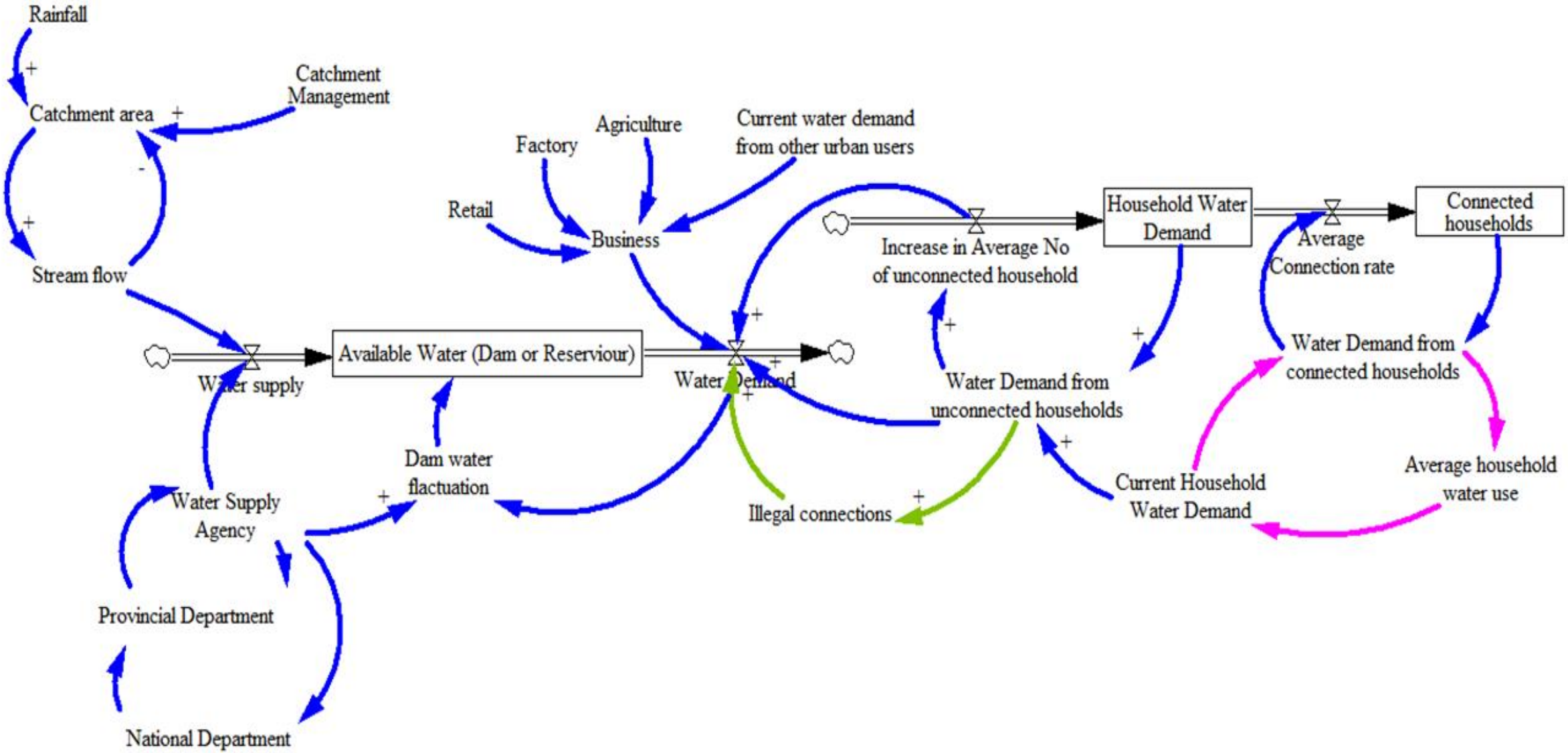
- Kwanyamazane
- Matsulu
- Kabhokweni
- Msholozi
- Phumulani
- Kwamaguga
- Ngodini
- Ngodwana
- Zwelisha
- KwaThekwane

Target population size: 450 households

Results: Systems perspective

From a systems perspective the management of water has environmental, socio-political, economic and technical dimensions, which frequently interweave in a ‘wicked web’ that presents significant challenges to planners, policy makers and networks of citizens.


Legend:
+ Positive causal influence
- Negative causal influence
B Balancing feedback loop
R Reinforcing feedback loop
Delay between a cause and effect
Connected households
Connection rate of households
R1: water demand
Total water demand
Desired level of water services
Gap between demand & supply
Pressure on municipality to meet demand
Water delivered
B1: Infra-structure construction
New infrastructure constructed
Potential billable water
Supply of water
Infrastructure capacity
R3: effect of infra. overuse on obsolescence
R2: effect of revenue on maintenance and losses
B2: effect of infra. overuse on supply
Use of infrastructure above design capacity
Water revenue
Bulk water losses
Obsolescence rate
Revenue dedicated to maintenance
Technical staff capacity available for standard management activities
% cost recovery
Maintenance
R4: crises
% revenue ringfenced


Rainfall
Catchment area
Catchment Management
Stream flow
Factory
Agriculture
Current water demand from other urban users
Retail
Business
Increase in Average No of unconnected household
Household Water Demand
Average Connection rate
Connected households
Water supply
Available Water (Dam or Reserviour)
Water Demand
Water Demand from unconnected households
Water Demand from connected households
Dam water flactuation
Water Supply Agency
Illegal connections
Current Household Water Demand
Average household water use
Provincial Department
National Department

Stakeholder perspectives

Budget allocation

- R 367.3 m. Provincial = R275m and Municipality = R123m.
- Regional Bulk Infrastructure Grant and Water Services Infrastructure Grant
- This is based on Municipality's plan as well as business plan for the water supply and treatment treatment e.g. Hoxani project for an upgrade of water supply.
- Refurbishment and repair
- Money is allocated to the municipality to identify areas for water projects and submit business plans for funding.

Stakeholder perspectives

Great concern on supply and demand, which is approaching a point where demand may exceed supply

Increase in household demand due to increase in socio-economic status of people

Development that does not factor in water as an aspect of socio-economic development

Obvious reduction in the amount of precipitation that is directly linked to climate change

Cross border complexities

Status of Water Provision

- 89% access to water (91% Cogta)
- Backlog – 11 – 15%

Water and sanitation status

- Provision – 97%
- Backlog – 3%

The long term target is to achieve zero bucket system

Level of preparedness

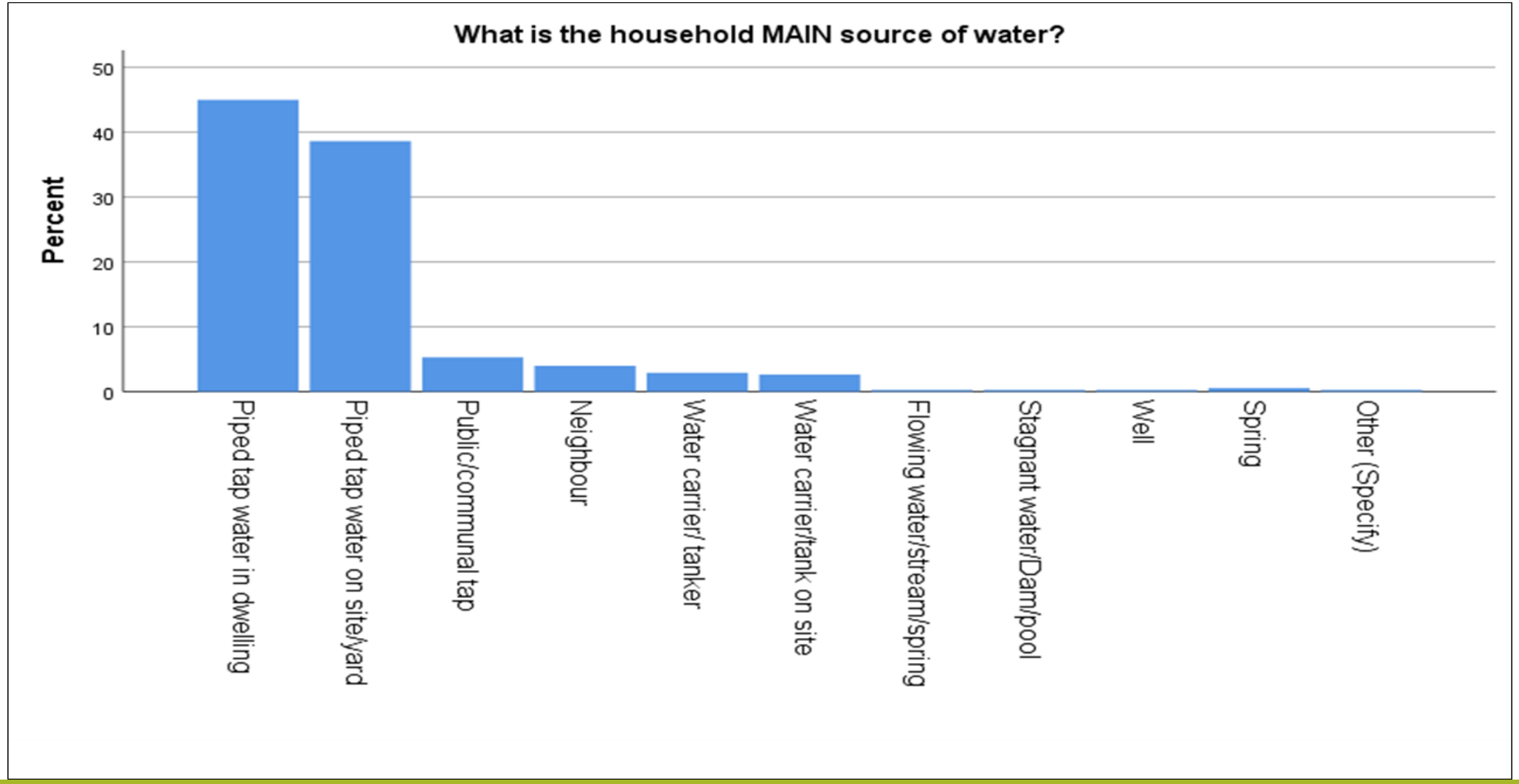
Climate change Vulnerability and mitigation strategies

This being driven by climate change officers at the Provincial Level

Constant training on the awareness of effects of climate change

- However, at the community level, awareness is uncertain.
- Resilience strategy developed - under review
- Vulnerability assessment model drafted

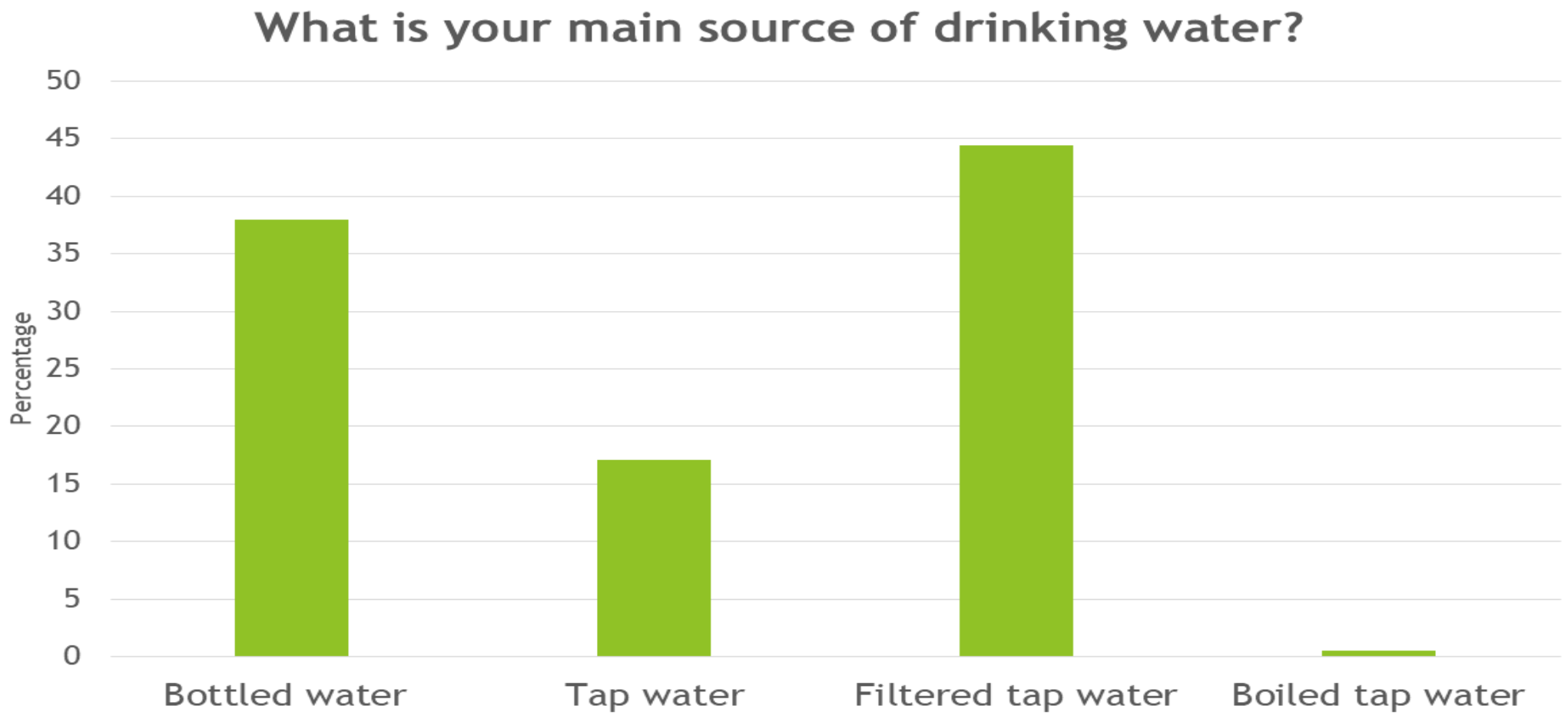
Community perspectives



Community Perspectives

		Frequency	Percent
Valid	Water source is in dwelling	127	34.0
	Less than 200 metres	216	57.9
	201 - 500 metres	30	8.0
	Total	373	100.0

Community Perspectives



Community Perspectives

Is your main source of drinking water supplied by the municipality?`

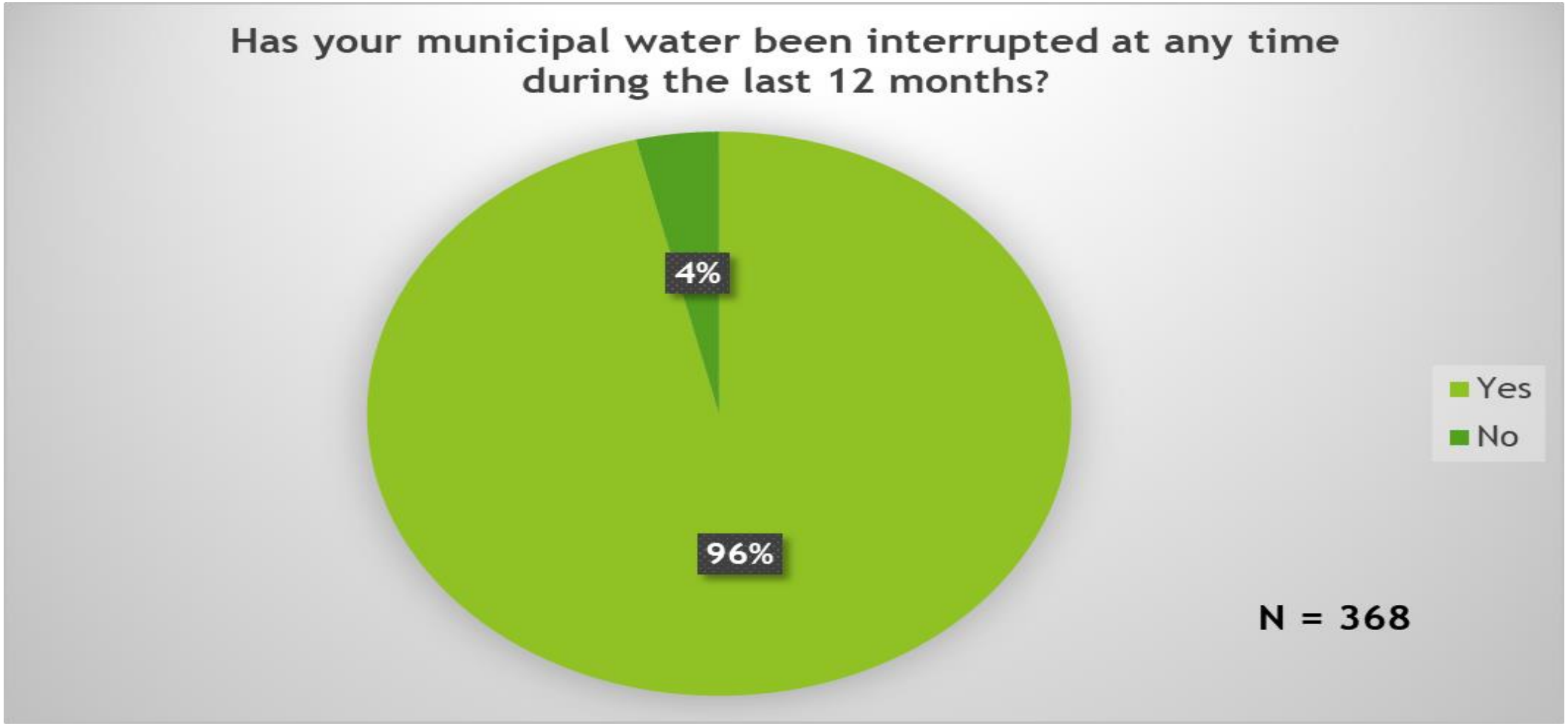
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	350	92.6	93.1	93.1
	No	13	3.4	3.5	96.5
	Don't know	13	3.4	3.5	100.0
	Total	376	99.5	100.0	
Missing	System	2	.5		
Total		378	100.0		

Community Perspectives

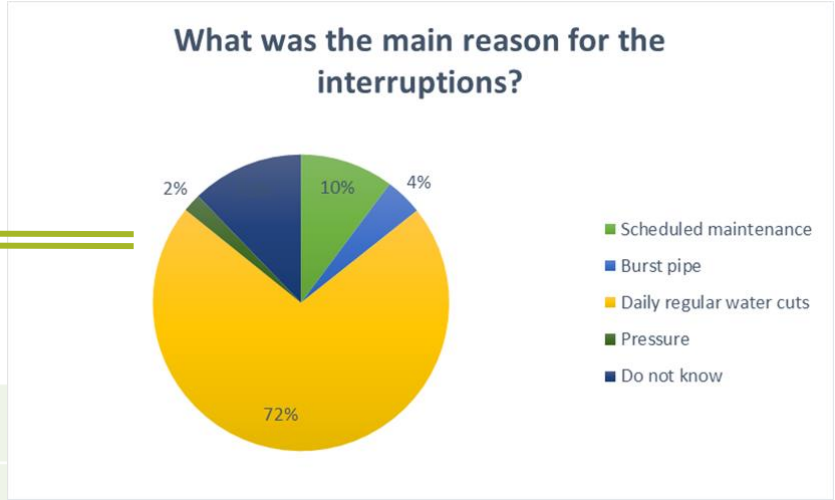
Does the household pay for municipal water? If cost of water is include in the levy/rent paid to a housing complex/owner/landlord, the response should be no

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	108	28.6	28.7	28.7
	No	250	66.1	66.5	95.2
	Don't know	18	4.8	4.8	100.0
	Total	376	99.5	100.0	
Missing	System	2	.5		
Total		378	100.0		

Community Perspectives



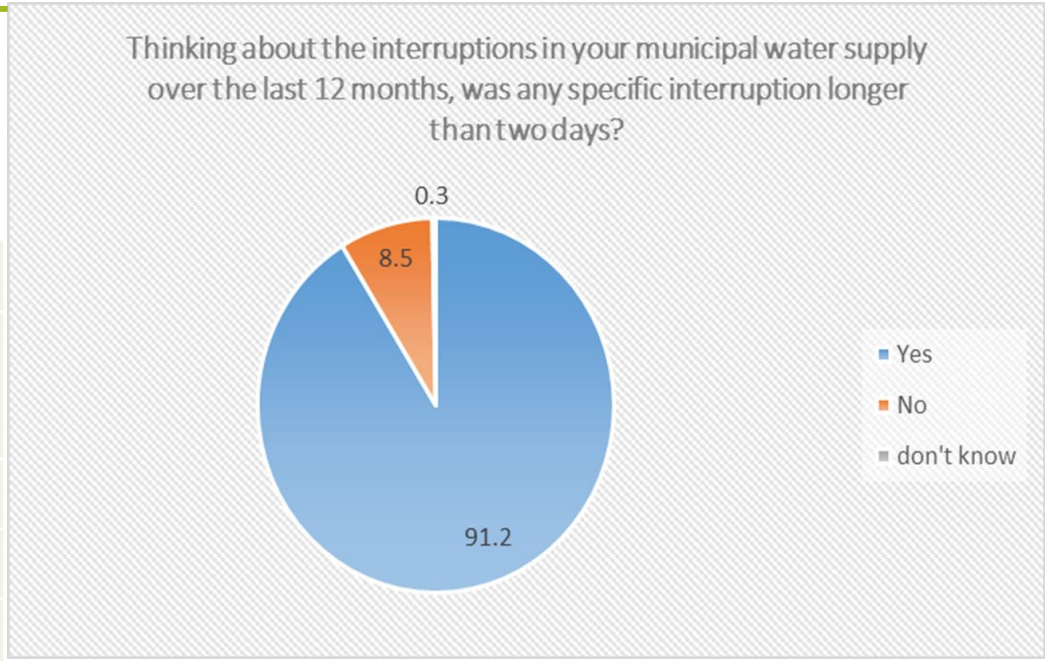
Community Perspectives



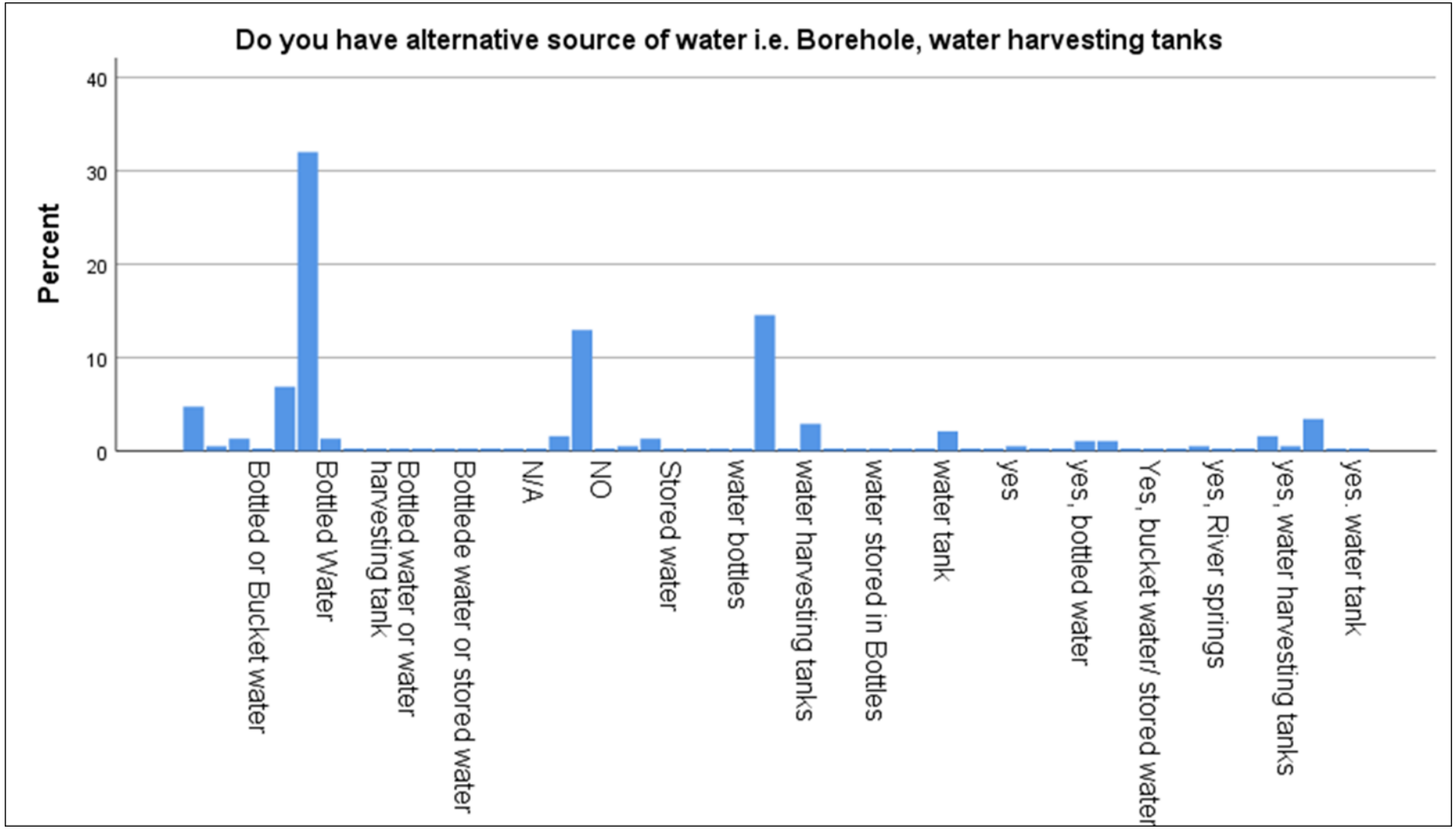
What was the main reason for the interruptions?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Scheduled maintenance	5	1.3	10.2	10.2
	Burst pipe	2	.5	4.1	14.3
	Daily regular water cuts	35	9.3	71.4	85.7
	Pressure	1	.3	2.0	87.8
	Do not know	6	1.6	12.2	100.0
	Total	49	13.0	100.0	
Missing	System	329	87.0		
Total		378	100.0		

Community Perspectives

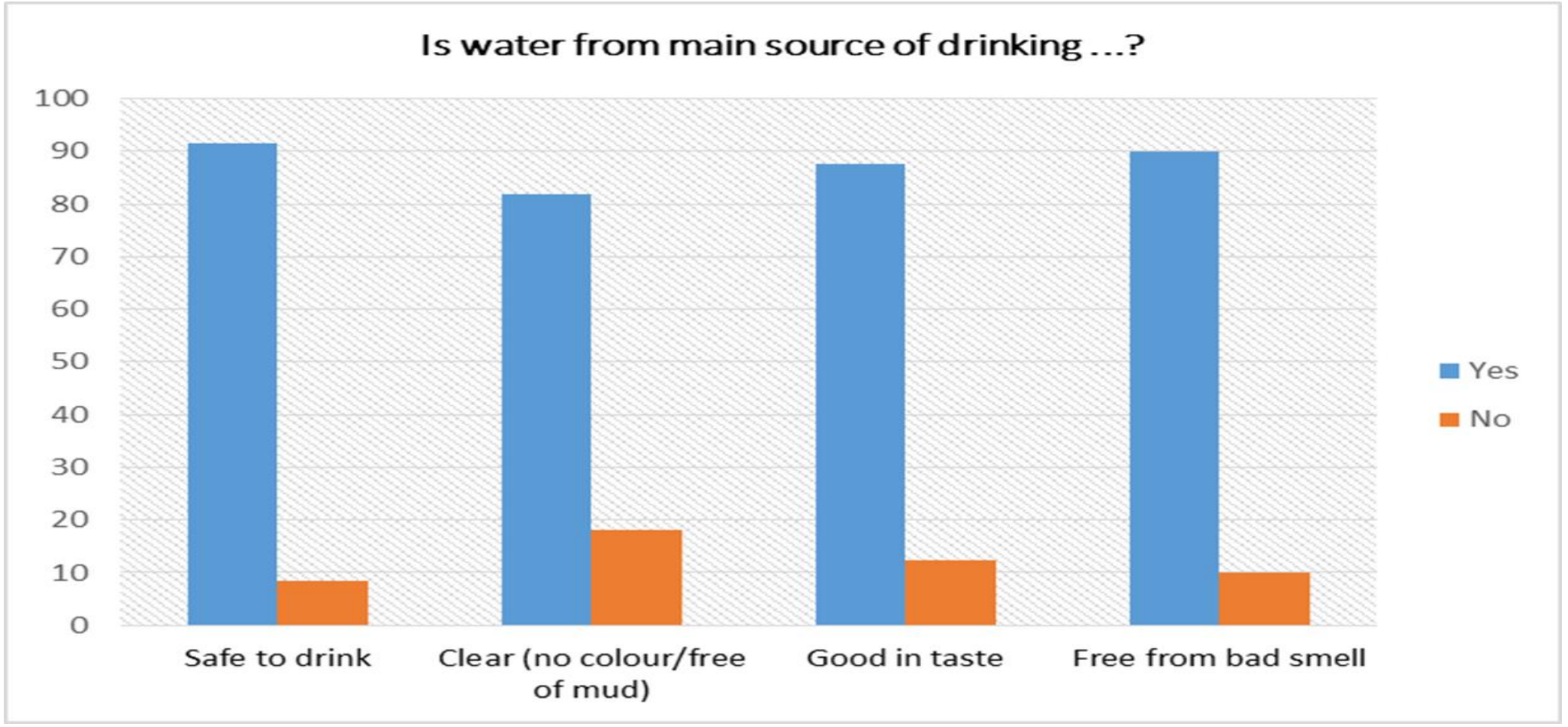
How often do you get water interruptions in a month?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 times	208	55.0	58.4	58.4
	4-5	148	39.2	41.6	100.0
	Total	356	94.2	100.0	
Missing	System	22	5.8		
Total		378	100.0		



Community Perspectives



Community Perspectives



Community Perspectives

Do household member treat the water used for drinking? This may include, adding chlorine or other chemicals such as JIK, filtering?

Frequency	Percent (%)	
Yes, always	19	5.0
Yes, sometimes	81	21.4
No, Never (Go to 3.4)	278	73.5
Total	378	100.0

Are there any tests done on the water you use in the household?

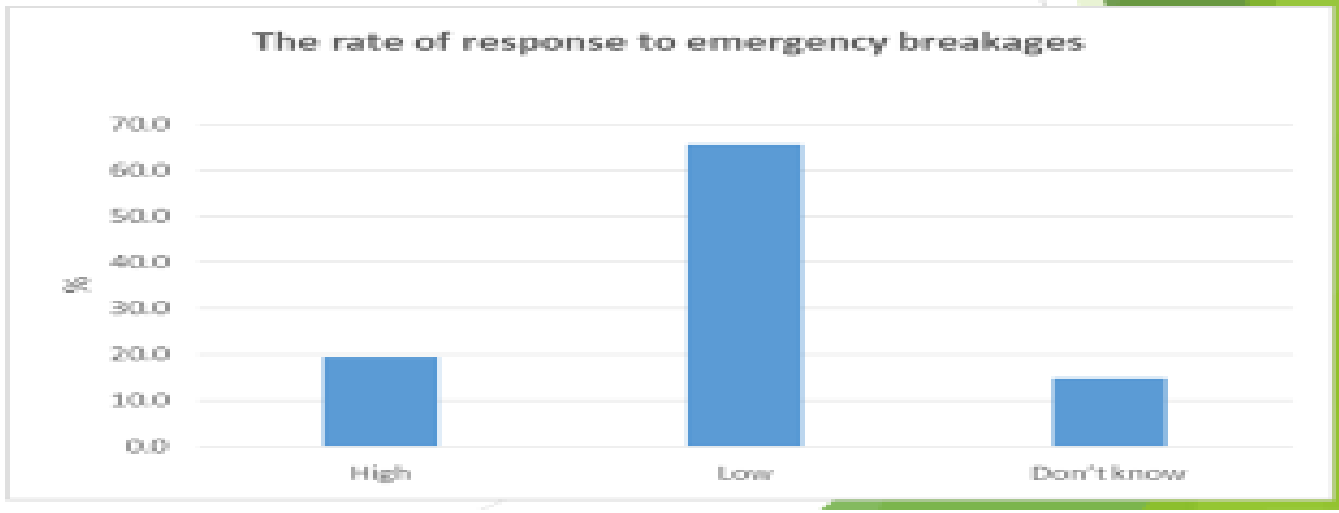
Frequency		Percent
Yes	72	19.1
No	304	80.9
Total	376	100.0

Community Perspectives

What is the general prevalence of waste water / sewage spill/debouching?

		Frequency	Valid Percent
Valid		374	98.9
	none	3	.8
	None	1	.3
	Total	378	100.0

Rate of Response



Concluding remarks

The obvious challenges seems to be a lack of reconciliation between water demand and availability of supply.

This is might be worsened by the some constraints linked to human resources capacity.

When the potential effects of climate change are considered long-term strategies for water management in the city and the surrounding areas become critical.

Overall South Africa's prolonged drought conditions and arid environment are increasingly highlighting the vulnerabilities of cities to water security.

This calls for the exploration of alternative and nonconventional sources of water beyond the traditional surface and groundwater resources.

Concluding remarks

The modelling process being undertaken highlights the interaction with stakeholders, moving from individuals to sectors, to cross-sectoral interactions.

This reflects the use of models as boundary objects where 'evolving representations create a shared focus, lend themselves to multiple interpretations, and serve as memory anchors for complex iterative conversations about dependencies.

"*Public participation remains a craft, not a science… it [deals with] the messy emotional stuff of intense human interaction, struggles for power, and strongly- held beliefs about what's good for the societies*".

References

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