20th AfWA International Congress and Exhibition 2020
Breaking new grounds to accelerate access to water and sanitation for all in Africa

Assessment of physical conditions and proposed Best Management Practices of domestic storage tanks supplied by a water utility in a rapidly growing City

23rd – 24th February 2020, Kampala, Uganda

MAKOKO ENOCH WASOLO

PRESENTATION OUTLINE

- Study Background
- Study Objective
- Methodology
- Findings
- Suggested Best Management Practices (BMPs)
- Study Limitations
- Conclusions

STUDY BACKGROUND

- Need to have reliable potable water - Use of water storage facilities (Malanda & Louzolo-Kimbembe, 2014).
- Tank conditions - Ignored (EPA, 2002; Schafer & Mihelcic, 2012).
- Maintaining water quality - Challenge due to factors such as sediment, improper hygienic management (Chalchisa et al., 2017; EPA, 2002).
- Approx 80% of diseases worldwide - Use of unsafe drinking water or inadequate sanitation practices (WHO, 2003).
- Water quality in storage facilities of NWSC customers is questionable – Need for baseline information and tank management practices.
- Numerous complaints about contaminated water in Kampala - 2015. Over 80% were of water from storage tanks (NWSC, 2015).
- NWSC doesn't have mandate to monitor it (Water Act, 2000).
- Need to assess physical conditions and propose Best Management Practices of domestic storage tanks supplied by a water utility in a rapidly growing City – Kampala, Uganda.

STUDY OBJECTIVE

General Objective

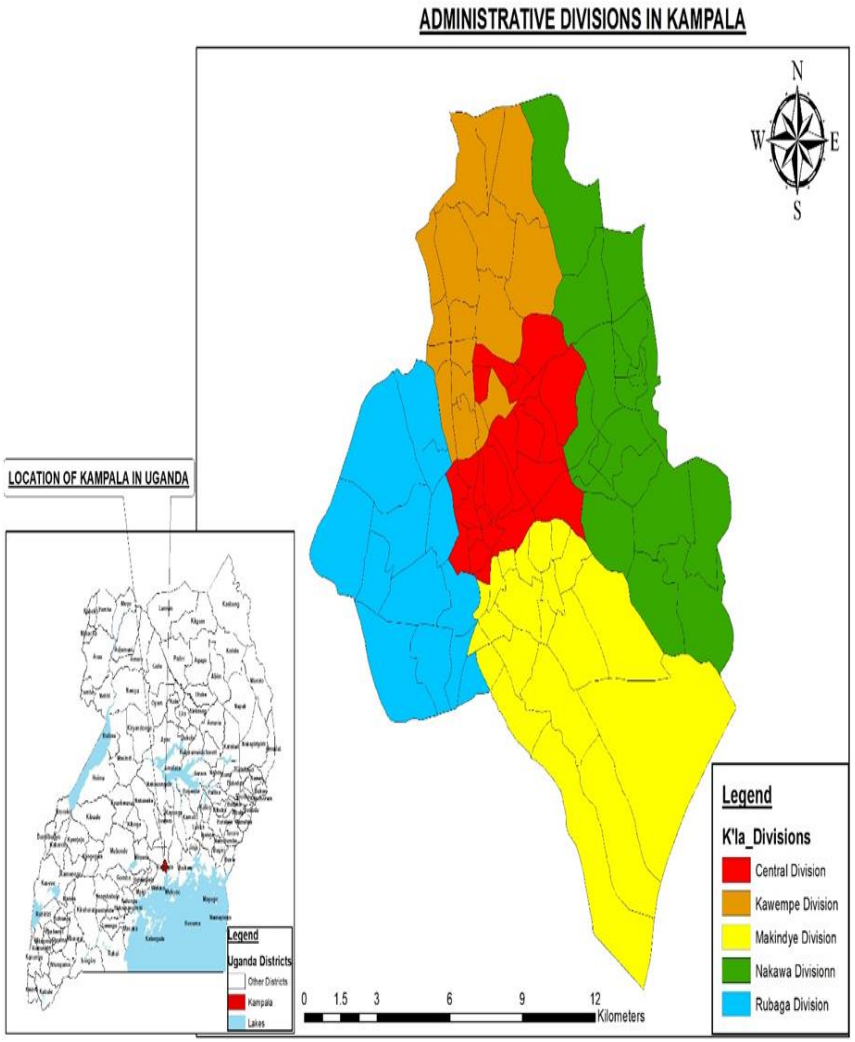
- Assess physical conditions and propose Best Management Practices of domestic storage tanks supplied by a water utility in a rapidly growing City - Kampala, Uganda.

Specific Objectives

- Assess physical conditions of the domestic water storage tanks for NWSC Customers in Central Division of Kampala City.
- Propose the Best Management Practices for domestic water storage tanks for a water utility Customers.

METHODOLOGY

- Study Area
- Conducted in East Africa, Uganda, Kampala District, Kampala Capital City, in the Central Division.
- 5 divisions of; Central, Kawempe, Makindye, Lubaga & Nakawa.
- Central Division – 6 wards of; Old Kampala, Nakasero, Kololo, Kamwokya, Kisenyi & Industrial Area



METHODOLOGY

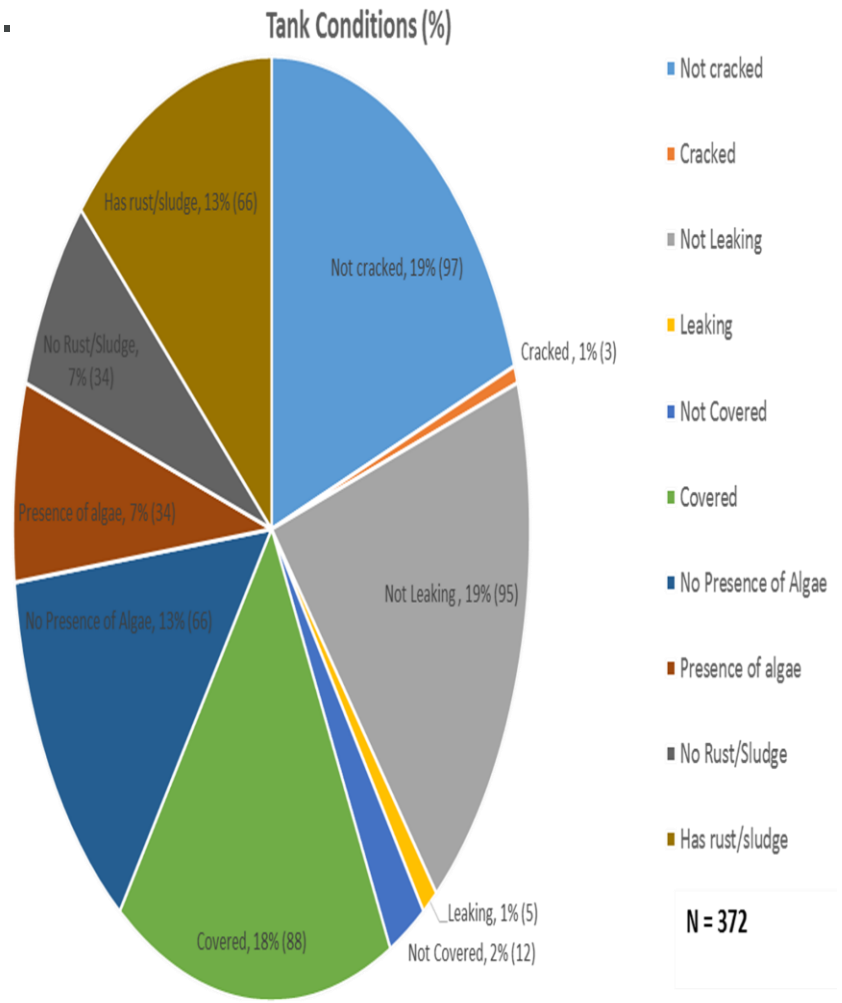
- Data Acquisition and Analysis

Data collection	Data Collection Sheet (DCS)	Sanitary Inspection Form (SIF) Risk Scores: Range of 0-10, 0=low and 10=critical. Total risk – Summed risk scores; 0-17 (Low), 18-35 (Medium), 36-53 (High), 54-70 (Critical).
Geographical coordinates	Handheld Global Positioning System	
Laboratory work	(NWSC) - Gaba Water Treatment Complex Laboratory.	
Sample analysis	Standard Methods for Examination of Water and Wastewater" (APHA, 2015).	
Data analysis	STATA software version 13.0 (StataCorp, 2013), & ArcGIS software version 10.2.1 (ESRI, 2014).	

RESULTS AND DISCUSSION

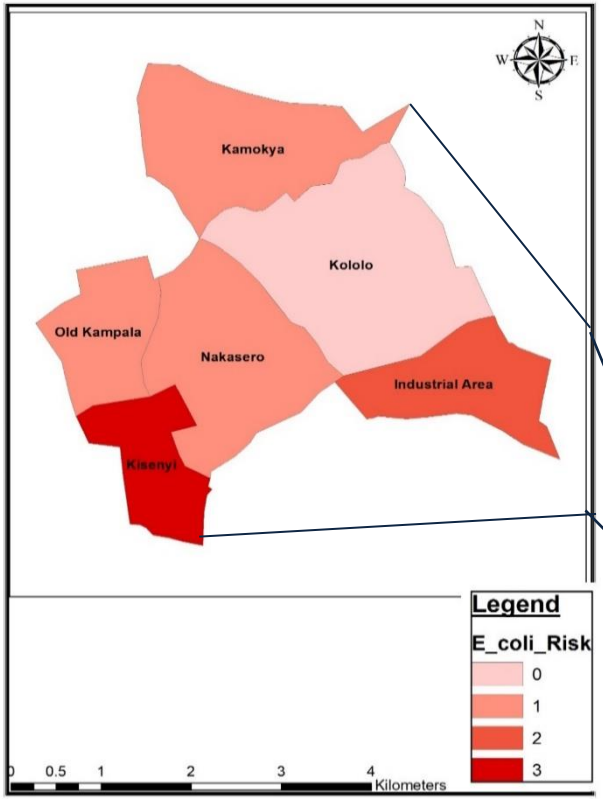
Sanitary Condition (n =372)		Water Quality Conforms to standards				p - value
		Yes		No		
		Number	%	Number	%	
Type of tank	Concrete	23	92	2	8	0.001*
	Metallic	8	44	10	56	
	Plastic	279	85	50	15	
Position of tank	Elevated	257	82	55	18	0.279
	Ground	32	84	6	16	
	Underground	21	94	1	5	
Age of the tank	0 - 5	133	86	21	14	0.019*
	5 - 10	88	88	12	12	
	>10 years	89	75	29	25	
Cleaning frequency	Never	196	77	60	23	0.001*
	Once a year	102	98	2	2	
	More than once	12	100	0	0	
Cracked	No	306	85	54	15	0.001*
	Yes	4	33	8	67	
Leaking	No	303	85	52	15	0.001*
	Yes	7	41	10	59	
Covered	No	4	9	39	91	0.001*
	Yes	306	93	23	7	
Presence of algae	No	238	97	9	3	0.001*
	Yes	72	58	53	42	
Rust or Sludge	No	122	97	4	3	0.001*
	Yes	188	76	58	24	

RESULTS AND DISCUSSION



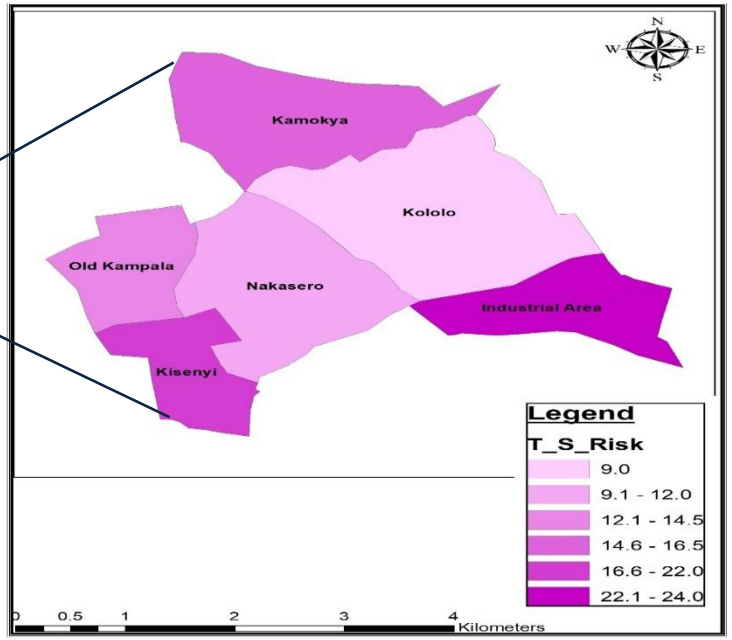
- Most tanks in the study area were plastic (88%), elevated (84%), and below 5 years old (41%). 69% of the domestic water storage tanks were not cleaned, 3% of the tanks were cracked, 5% were leaking, 12% were not covered, 34% had algal growth, and 66% had rust or sludge.
- Plastic tanks are frequently used for domestic water storage, perceived to be durable, safe, cost-effective and easily available in a wide range of sizes (Aish, 2013).
- There was a statistically significant relationship (p=0.001) between tank physical conditions and quality of stored water.
- Two of six Wards had high levels of water contamination in relation to poor sanitary conditions and *E. coli* contamination.

RESULTS AND DISCUSSION



Map showing *E. coli* contamination risk score for combined (dry and wet) seasons

- Two of six Wards had high levels of water contamination in relation to poor sanitary conditions and *E. coli* contamination.



Map showing sanitary conditions risk score for both wet & dry seasons

SUGGESTED CONSUMER STORAGE TANK BEST MANAGEMENT PRACTICES (BMPS)

- **Best Practice Manual for Domestic Water Storage Tanks**
- Monitoring Tools;
- 1)Daily Duties (By Owner, Responsible Person)

DAILY CHECKLIST			
Date: ..... Check	Response	Possible Cause	Corrective Action Taken by Owner/Responsible Person
Is the tank overflowing?	Yes ☐ No ☐		
Is the tank leaking?	Yes ☐ No ☐		
Is water level within the required range?	Yes ☐ No ☐		
Are the warning lights in normal operating mode?	Yes ☐ No ☐		

SUGGESTED CONSUMER STORAGE TANK BEST MANAGEMENT PRACTICES (BMPS)

- 2)Weekly Duties (By Owner, Responsible Person/Technician)

WEEKLY CHECKLIST Date:				
No	**Defects Check**	**Nature of defect**	**Repairs Done**	**By Who**
1				
2				
3				
Comments:				

- 3)Monthly Duties (By Owner, Responsible Person/Technician/Entity)

MONTHLY CHECKLIST Date:					
Water Quality Check					
#	Water Level (m^3)	No of samples	Analysis needed	Parameters for analysis:	Sample Analysis Lab Name
1				Bacteria (B)	.....
2					Certified for potable water

SUGGESTED CONSUMER STORAGE TANK BEST MANAGEMENT PRACTICES (BMPS)

- 4)Quarterly Duties (Owner, Technical/Responsible Person/Entity)

QUARTERLY INSPECTION REPORTING			
Inspection By (Owner, Technical/Responsible Person/Entity):.....		**Inspection Date:**	
Sanitary Inspection Checklist	**Was examination performed?**	**Inspection Results**	
		Unsanitary Condition	**Corrective Action Taken**
Examine all tank openings (if any) such as vents, overflows) if they are properly screened.	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
Examine for blockage or tears of vents and screens	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
Examine for any deterioration in the tank walls or	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

SUGGESTED CONSUMER STORAGE TANK BEST MANAGEMENT PRACTICES (BMPS)

- **Inspection Protocol**

GENERAL INFORMATION			
Area:			
Contact Person:	Address:		
Tank ID:			
Tank Location:		Tank Material:	
Tank Age:			
Building Occupancy: ☐ Multiple Dwelling	☐ Commercial	☐ Mixed Use	☐ Other:

INSPECTION REPORTING		
Was a tank inspection performed? ☐ Yes ☐ No	**Inspection By** (Person, Entity/firm): ……	**Inspection Date:** ……

Sanitary Inspection	Was examination	Inspection Results

SUGGESTED CONSUMER STORAGE TANK BEST MANAGEMENT PRACTICES (BMPS)

- **Risk Prediction Checklist**

GENERAL INFORMATION	
Area:	
Tank Name:	Tank ID:
Tank Location: Tank Material:	
Tank Age:	
Proposed Checking Date:	Actual Checking Date:
Name of Person Checking:	Title of Person Checking:
I certify that this information is complete and accurate:	Date:

OVERALL TANK CONDITION		
Risk Check	**Response**	**Risk Score**
Is the tank covered?	Yes ☐ No ☐	

CONCLUSION AND RECOMMENDATION

- Physical conditions of domestic water storage tanks for Customers of a water utility had an effect on the water quality, causing it not to meet the required Uganda Standards and WHO Guidelines for drinking water under certain conditions.

- Regular multi-level maintenance and routine water quality checks following proposed Best Management Practices should be done.

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