5 ways to use GIS for managing NRW

- *Dr. Edwin Nyirenda (UNZA)*
- *Mutinta Chowe (SWSC)*
- *Daniel Schmidt-Eisenlohr (NWASCO)*

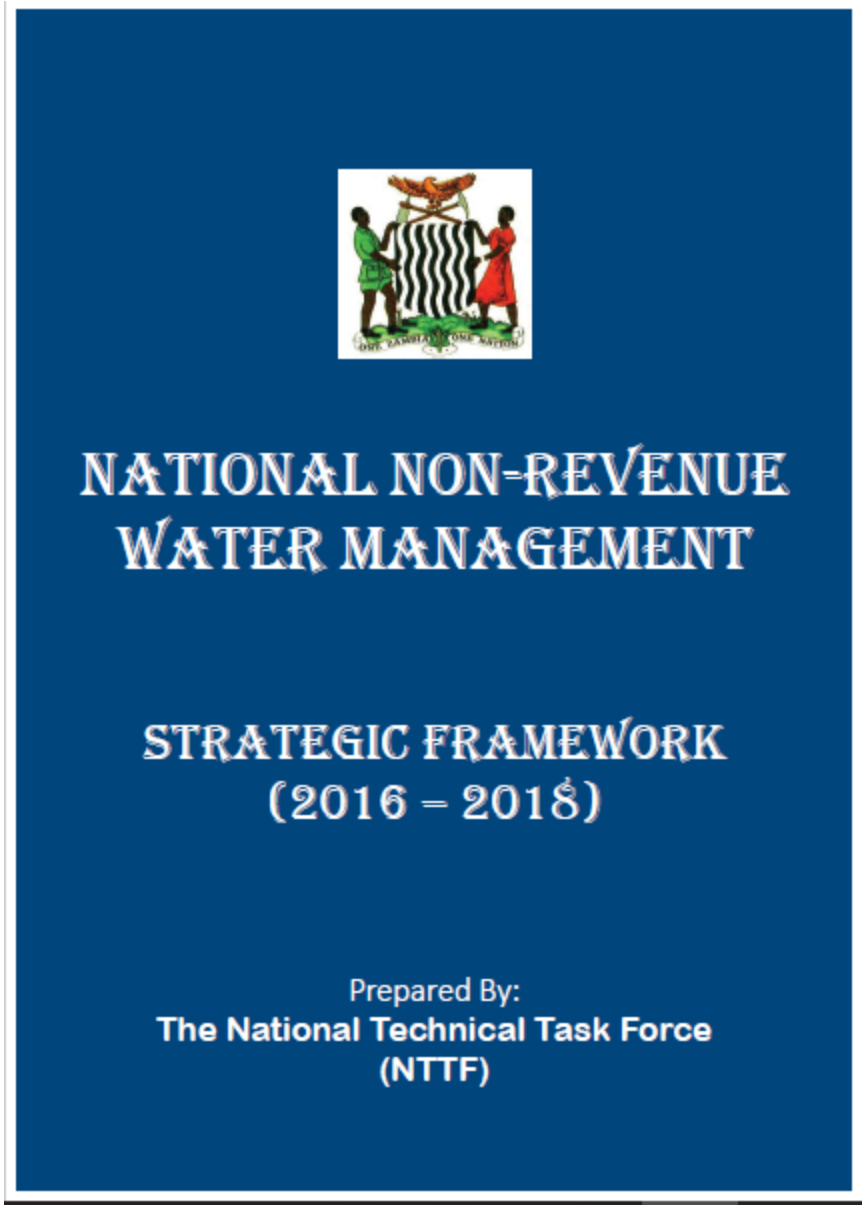
- *ZaWaFE, 13/06/2017*

Outline

A few examples of how GIS can assist in managing NRW in a CU.
A portfolio of applications and products which can be applied to each town in Zambia developed.

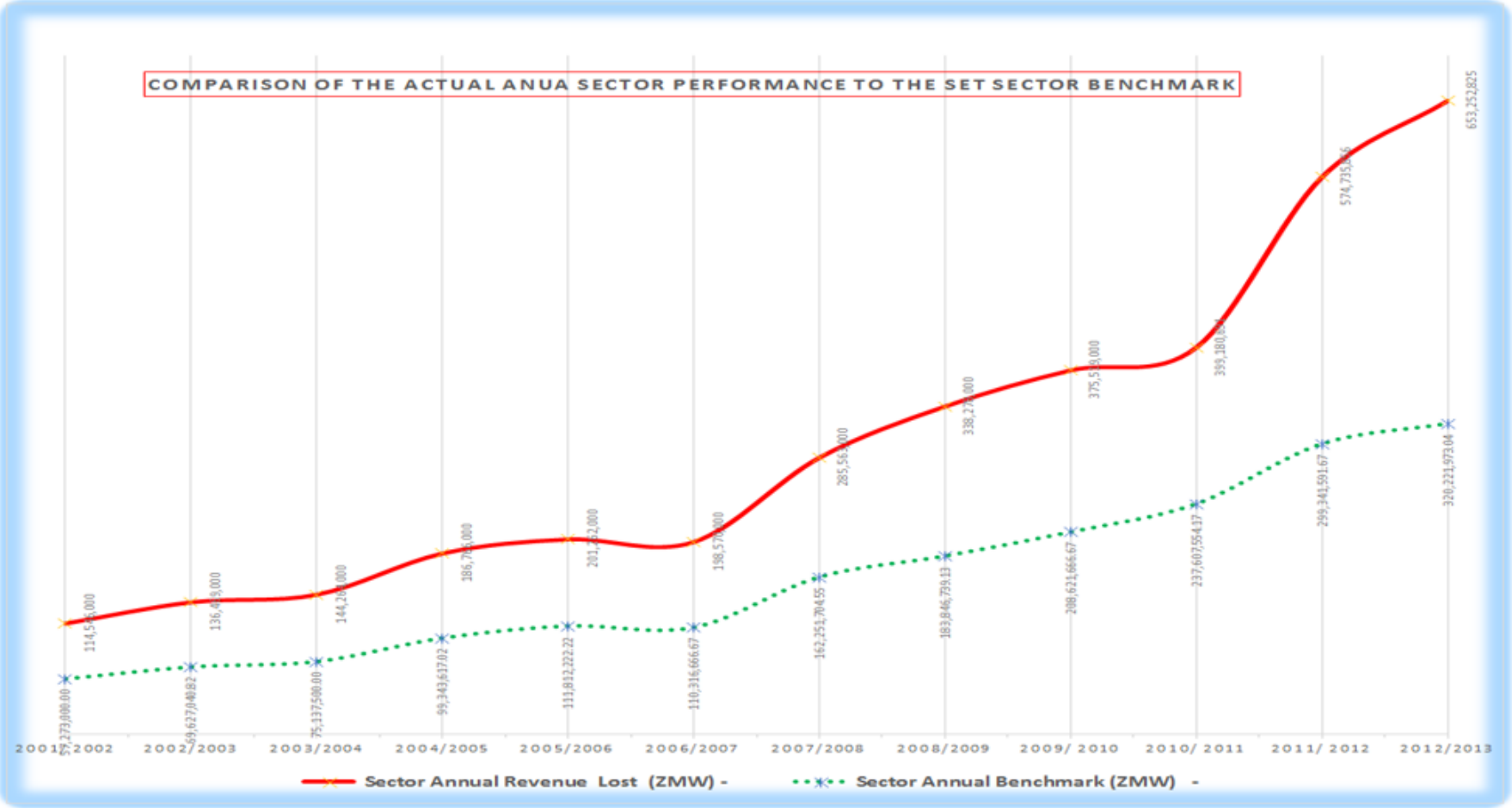
Introduction
1. Know your network
2. Know your customers
3. Know your customers' data
4. Record your leakages
5. Quantify your NRW
Summary/Conclusion
References

Introduction



Introduction

NRW graph from 2001 to 2013



Graphical representation of Annual Revenue loss Vs Sector Benchmark

Introduction

- ***NTTF Objectives:***

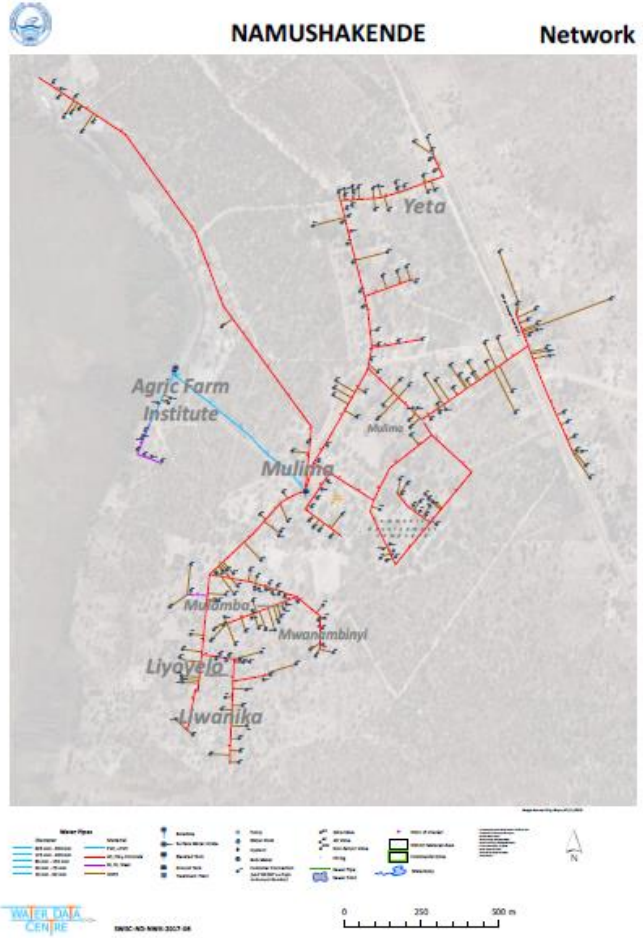
  (i) to act as a think tank on non-revenue water (NRW) and steer national strategy on NRW
- (ii) to assist the sector systematically move toward the national benchmark set for NRW
- (iii) advise Government on national activities relevant to NRW reduction
- (iv) assist commercial utilities (CUs) to develop strategic plans for management of NRW
- (v) assist CUs in capacity development and capacity building
- (vi) assist the sector in monitoring NRW activities and the assessment of their impacts, together with the dissemination of knowledge to stakeholders.

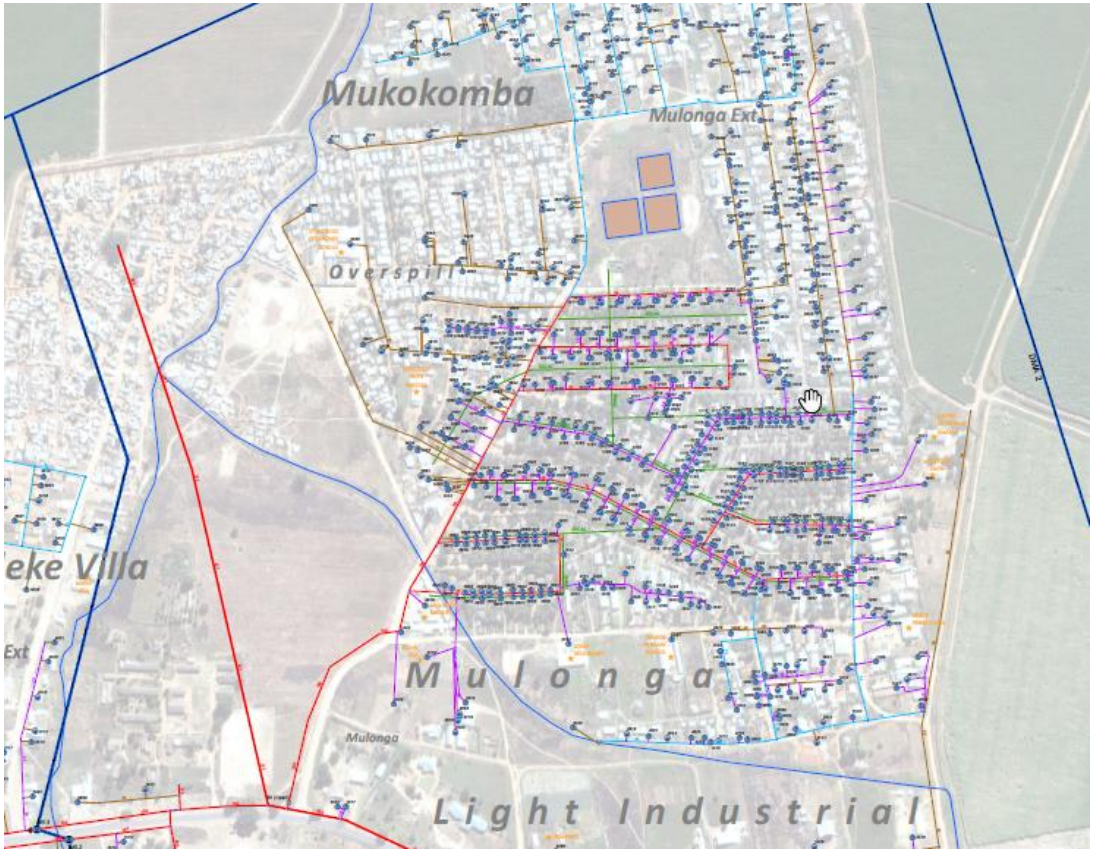
1. Know your network

Managing NRW water without proper knowledge of the water network is not possible. First step is to map the network.

- Using the knowledge of the district managers, plumbers and Customer Service Assistants (CSAs)
- Used printed satellite images and transferred information later into the GIS
- Using the techniques under discussion, eighteen water networks have been mapped to date in Southern and Western Province. Next to be tackled will be towns in Eastern Province.

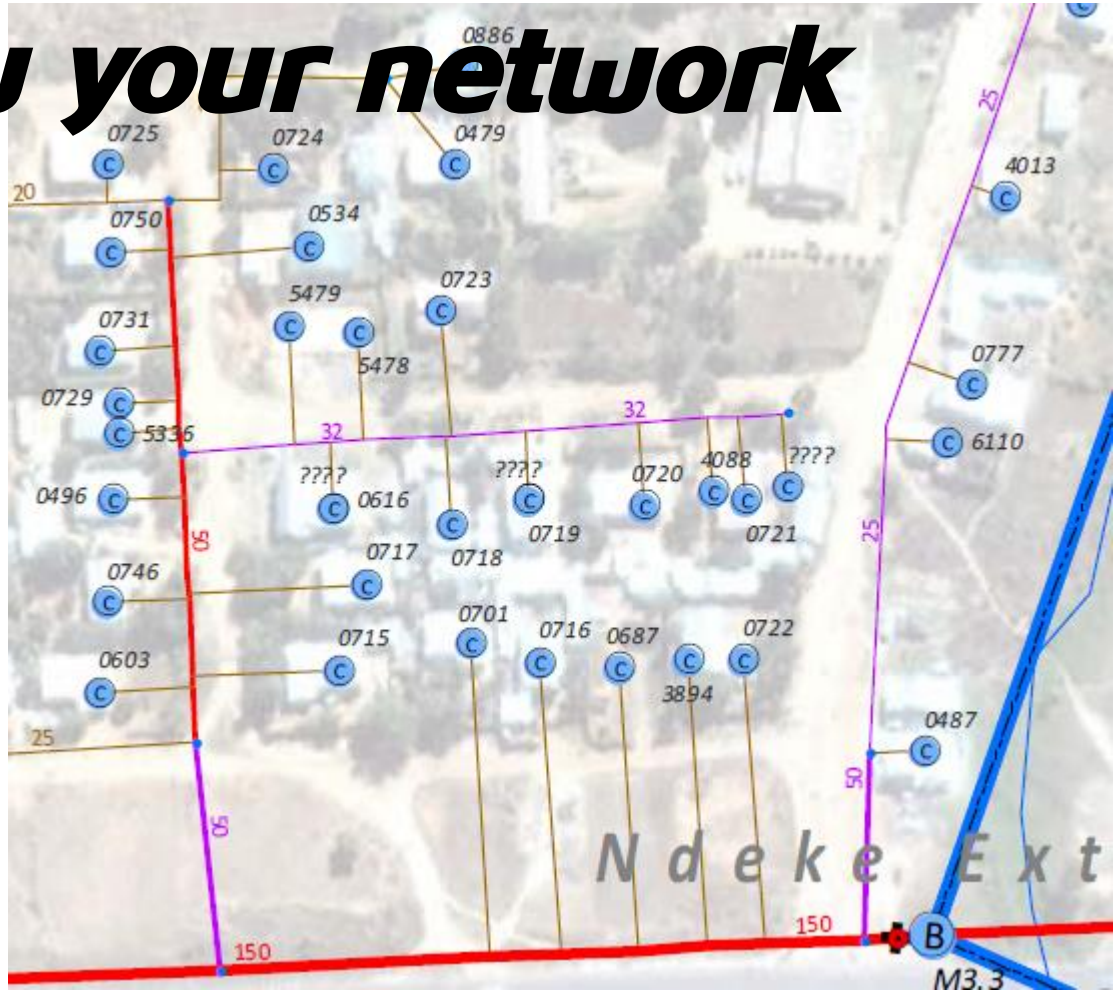
1. Know your network





1. Know your network

- ***Analyze***
- ***Update***
- ***Create DMAs***



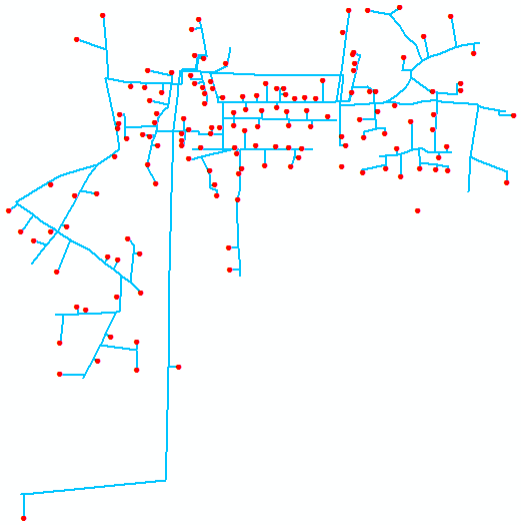
Water Pipes

Diameter	Material
325 mm - 600 mm	PVC, uPVC
175 mm - 300 mm	AC, Clay, Concrete
90 mm - 150 mm	GI, DI, Steel
40 mm - 75 mm	HDPE
13 mm - 32 mm	

- Borehole
- Surface Water Intake
- Elevated Tank
- Ground Tank
- Treatment Plant
- Pump
- Water Kiosk
- Hydrant
- Bulk Meter
- Customer Connection *(add 'MAZ000' as Prefix to Account Number)*
- GV Gate Valve
- AV Air Valve
- NRV Non-Return Valve
- Fitting
- Sewer Pipe
- Sewer Pond

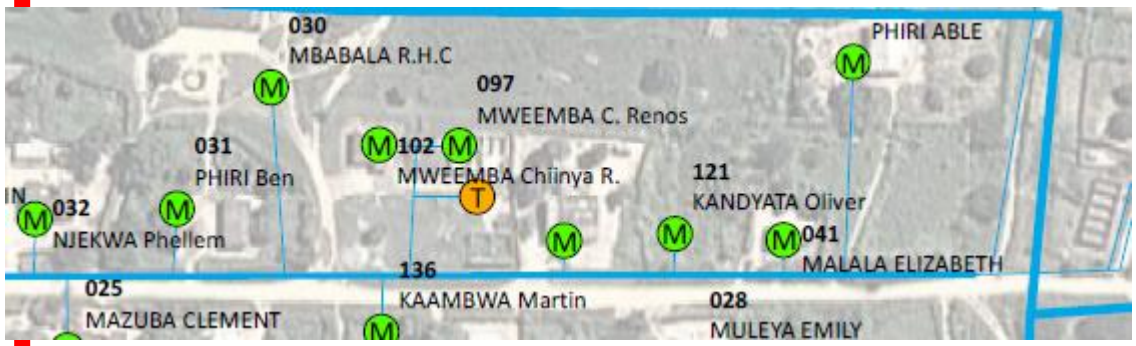
2. Know your customers

AccNo	Name	MeterReadingCode	GLAmount	StartDate	MeterReadingDa
MBL0000001	SIACHISA TEMBA	07	0.00	4/21/2016	5/20/
MBL0000002	NZOBOKELA JUSTINE	07	0.00	4/21/2016	5/20/
MBL0000003	MUNKOMBWE JAMES	07	0.00	4/21/2016	5/20/
MBL0000004	SICHOMBO THOMAS	07	0.00	4/21/2016	5/20/
MBL0000006	LIKANDO Charles Mubuyaeta	07	0.00	4/21/2016	5/20/
MBL0000007	PHIRI (ZP)	07	0.00	4/21/2016	5/20/
MBL0000008	Muuma Dorothy	07	0.00	4/21/2016	5/20/
MBL0000009	KUNDA ELTON	07	0.00	4/21/2016	5/20/
MBL0000010	NYUMBA CHARLES	07	0.00	4/21/2016	5/20/
MBL0000011	Cou	07	0.00	4/21/2016	5/20/
MBL0000012	Mweetwa Loveness	07	0.00	4/21/2016	5/20/
MBL0000013	Katambo Mary	07	0.00	4/21/2016	5/20/
MBL0000014	MWEEMBA SEBASTIAN	07	0.00	4/21/2016	5/20/
MBL0000015	Munyama M.	07	0.00	4/21/2016	5/20/
MBL0000016	MBABALA YOUTH CENTRE	07	0.00	4/21/2016	5/20/
MBL0000017	SIANONGO CRESCENT	07	0.00	4/21/2016	5/20/
MBL0000018	NASILELE Priscillar	07	0.00	4/21/2016	5/20/
MBL0000019	MBABALA BASIC SCHOOL	07	0.00	4/21/2016	5/20/
MBL0000020	CHILUNGU JANET	07	0.00	4/21/2016	5/20/
MBL0000021	SIMUCHE Lwiindi	07	0.00	4/21/2016	5/20/
MBL0000022	SIKULUNGWA Felix	07	0.00	4/21/2016	5/20/
MBL0000023	BANDA JOYCE	07	0.00	4/21/2016	5/20/
MBL0000024	KAPALU	07	0.00	4/21/2016	5/20/
MBL0000025	MAZUBA CLEMENT	07	0.00	4/21/2016	5/20/
MBL0000026	MANONGWA SAMUEL	07	0.00	4/21/2016	5/20/
MBL0000027	SIAKAMBOLE Mudenda Rodinah	07	0.00	4/21/2016	5/20/
MBL0000028	MULEYA EMILY	07	0.00	4/21/2016	5/20/

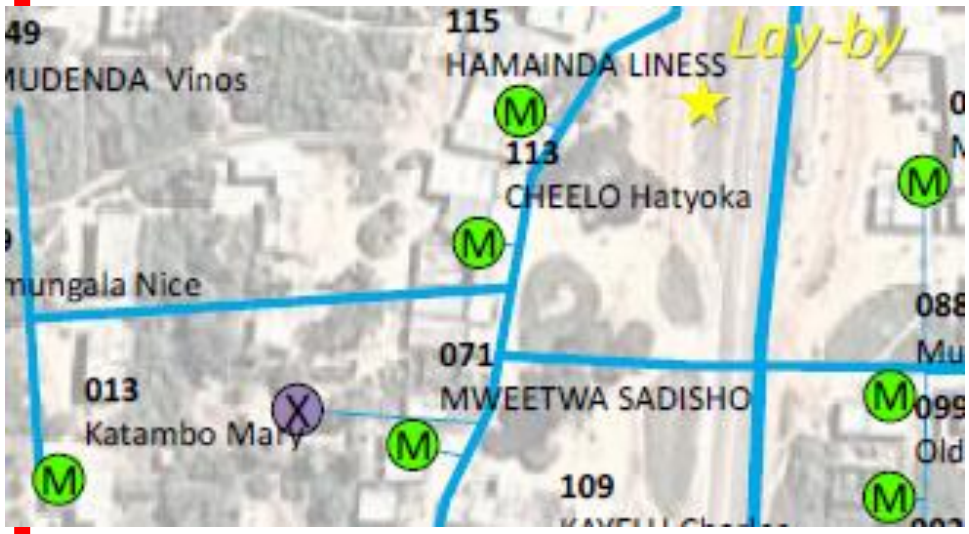


Apart from having the customer accounts recorded in the billing database, we also need to know their location.

As part of the mapping exercises in the 5 towns we collected the location of each customer account along with the account number.



- ***Analyze***
- ***Update***
- ***Verify/clean billing DB***



Account Number
(add MBL0000 as Prefix)
144
S. Phiri
Account Name

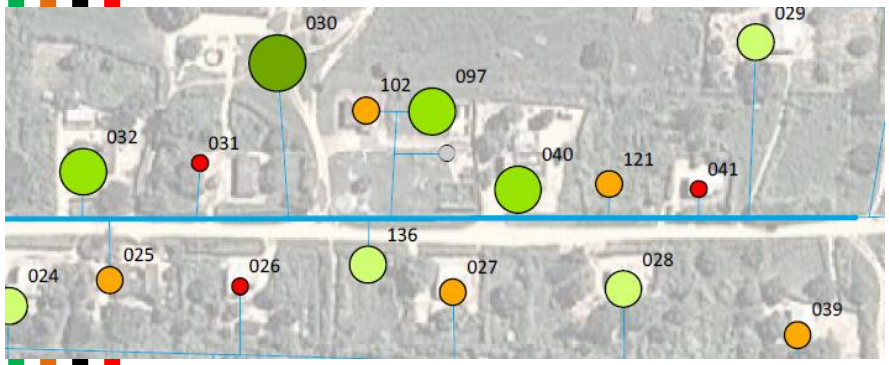
- Storage Tank
- Borehole
- Metered Connection
- Unmetered Connection
- Disconnected Connection
- Unregistered Connection
- Point of Interest

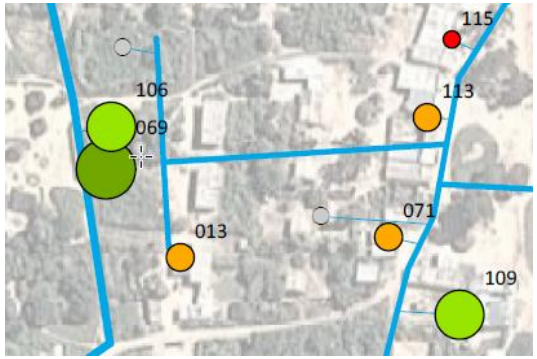
The location of all customer connections is mapped. The GIS is linked to the customer register in the billing database.

This information is utilized to display it on the map: We can differentiate between metered, unmetered, disconnected and unregistered customer accounts.

3. Know your customers' data

- **Consumption**

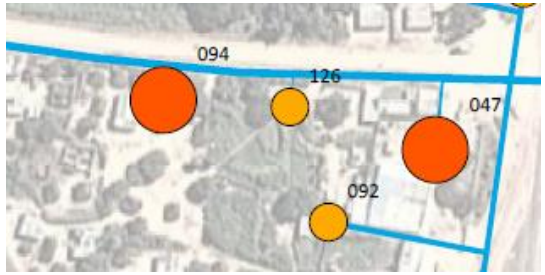




Consumption

- No consumption
- below 5 m3
- 5-10 m3
- 10-20 m3
- above 20 m3
- Not metered

- **Payments**



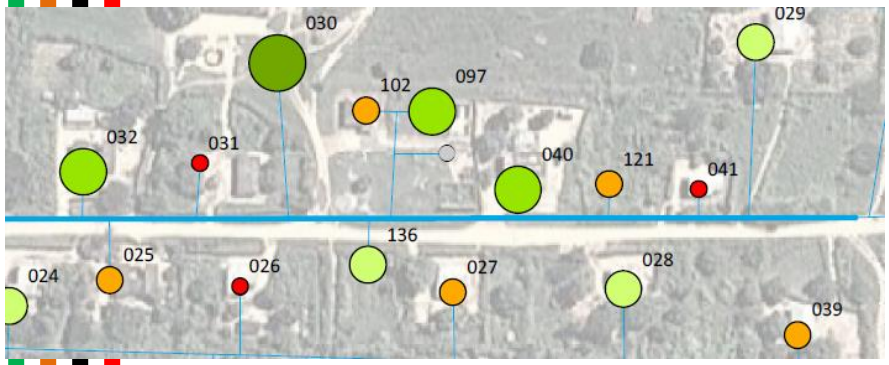
Outstanding Balance

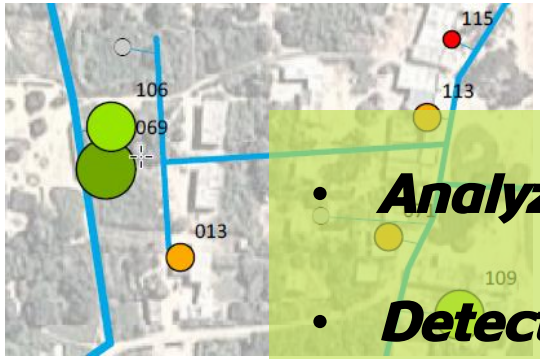
- Negative
- 1 ZMW - 250 ZMW
- 251 ZMW - 1.000 ZMW
- more than 1,000 ZMW

When we talk about knowing customer data, we are mainly interested in water consumption and the willingness to pay for the consumed water

3. Know your customers' data

- **Consumption**





Consumption

- No consumption
- below 5 m3
- 5-10 m3
- 10-20 m3
- above 20 m3

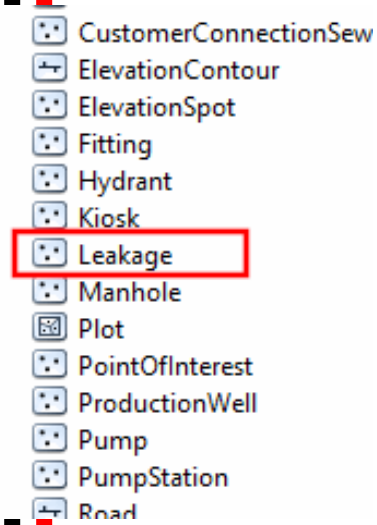
- **Analyze**
- **Detect patterns**
- **React**

- **Payments**

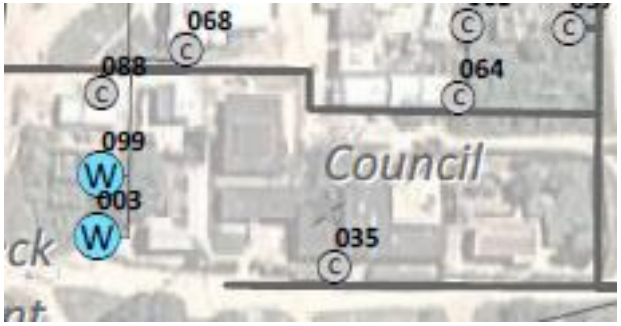
Outstanding Balance

- Negative
- 1 ZMW - 250 ZMW
- 251 ZMW - 1.000 ZMW
- more than 1,000 ZMW

4. Record your leakages



WorkOrderID
Image
LeakageStartDate
LeakageRepairDate
LeakagePart
LeakRate



Complaint

- Billing
- Leakage
- Sewer
- Water Meter
- Water Quality
- Water Supply

- Water Sampling
- Leak

The data model developed has a provision for recording leaks.
We can capture the start date, repair date, part, rate, work order ID and an image along with the location of the leak. Maps can be created.

4. Record your leakages

- CustomerConnectionSew
- ElevationContour
- ElevationSpot
- Fitting
- Hydrant
- Kiosk
- **Leakage**
- Manhole
- Plot
- PointOfInterest
- ProductionWell
- Pump
- PumpStation
- Road

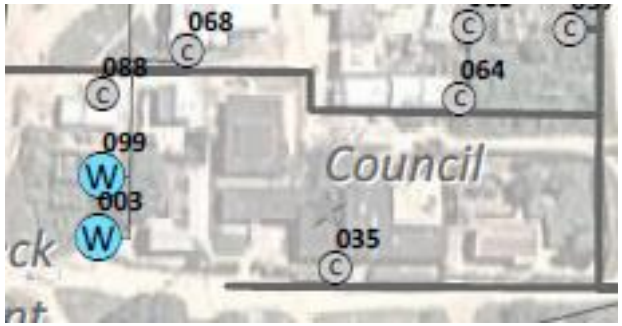
→

WorkOrderID
Image
LeakageStartDate
LeakageRepairDate
LeakagePart
LeakRate

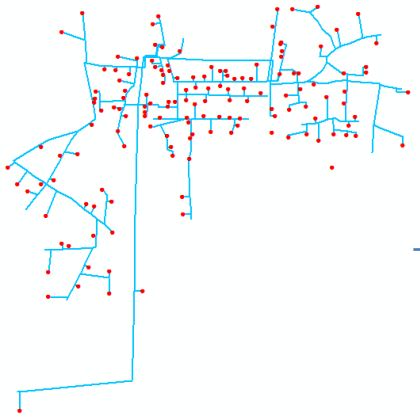
- ***Analyze***
- ***Detect patterns***
- ***React***
- ***Plan***

Complaint
- Billing
- Leakage
- Sewer
- Water Meter
- Water Quality
- Water Supply

- Water Sampling
- Leak



5. Quantify your NRW



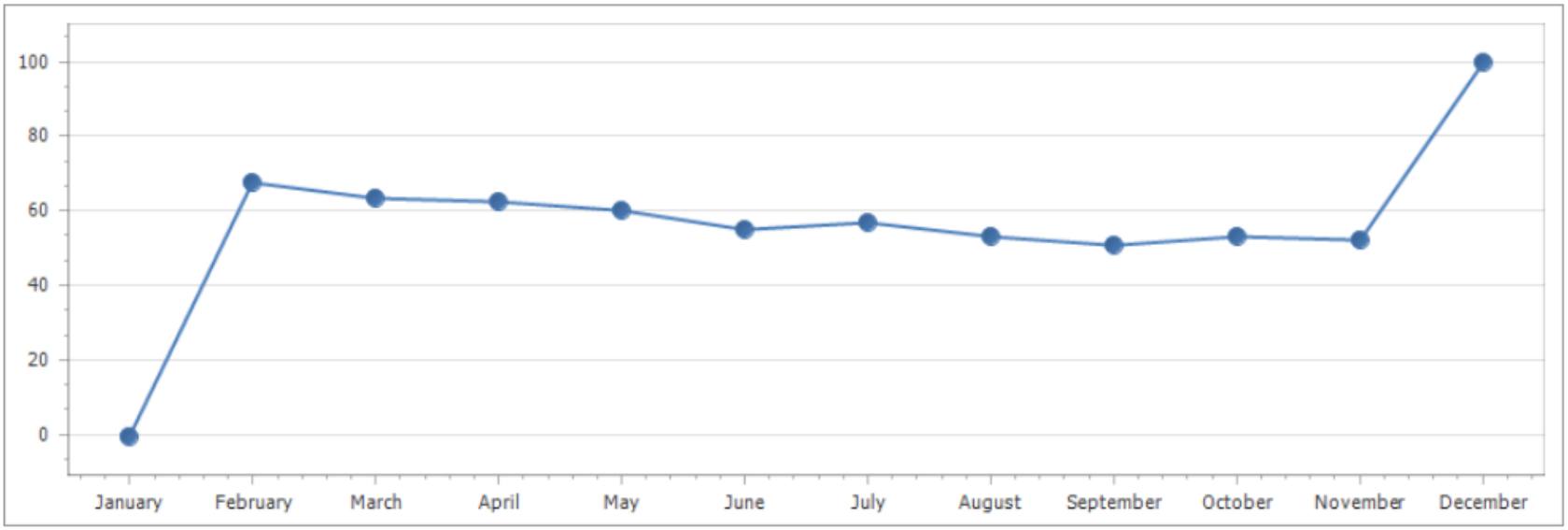
KML, XLS

NetWatBalL

Quantify your NRW: Data is output by an interface from the GIS model another system, the Network Water Balance Locale.

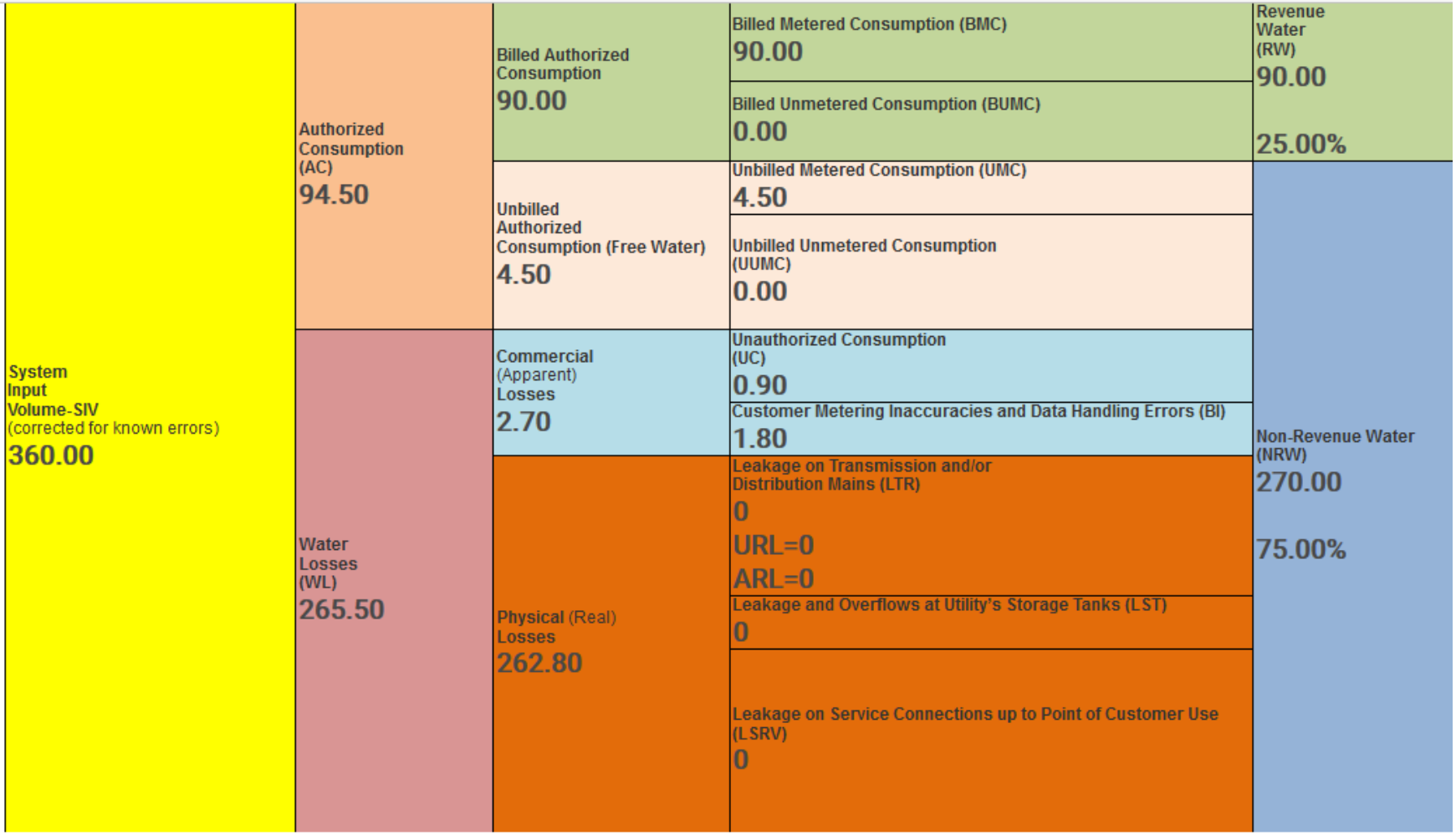
What is exported from the GIS can be used in Google Earth and we are working on using them in Epanet as well.

5. Quantify your NRW



Screenshot of the trend of non-revenue water for a DMA over several months.

5. Quantify your NRW



Physical Losses (Top Down) = 262.80
Physical Losses (Bottom Up) = 0
Out of Balance Figure = 262.8
Infrastructure Leakage Index = Infinity

IWA water balance as calculated by NetWatBalL

Summary

To deliver on the objectives of the NRW-NTTF in a consistent manner nationwide, a number of systems have had to be put in place to facilitate the process

- A GIS data model for the urban water sector has been created
- The Network Water Balance Locale has also been developed.
- Together these systems achieve the following tasks
  - Knowing the water distribution network,
  - Knowing the customers,
  - Knowing the customer data,
  - Recording the leakages,
  - Quantifying non-revenue water and establishing the trends to assess the impacts of the non-revenue water reduction interventions.
- With this background firmly laid, the six-fold objectives of the NRW-NTTF will now be implemented.
- Commitment and the willingness to financially support the data collection are the main factors in order to achieve the aforementioned objectives

References

- National Water Supply and Sanitation Council, 2014. Non-Revenue Water Guidelines. Lusaka, ZAMBIA.
- Non-Revenue Water National Technical Task Force, 2015. National Non-Revenue Water Management Strategic Framework (2015 – 2017). Ministry of Local Government and Housing, Lusaka, ZAMBIA.
- Strategic Alliance for Water Loss Reduction - District Metered Areas (DMAs) [WWW Document], n.d. URL http://www.waterloss-reduction.com/index.php/en/solutions/district-metered-areas-dmas (accessed 6.11.17).

Thank you very much