

SUSTAINING THE BENEFITS OF ACTION RESEARCH IN DECISION SUPPORT TOOLS DEVELOPMENT

Lessons from an African Water Utility



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WHAT IS ACTION RESEARCH?

- ▶ Involves partnership between researchers and practitioners for the purpose of addressing a problem issue while simultaneously generating scientific knowledge.
- ▶ In AR, the researcher seeks to create organizational change and simultaneously to study the process.
- ▶ The research takes place in real-world situations, rather than contrived experimental ones, and aims to solve real problems.

WHY EMPLOY ACTION RESEARCH?

- ▶ AR recognizes that propagation of scientific knowledge should not be a top-down transfer from the university “ivory tower” to the community of practice.
- ▶ Rather, it should be a two-way relationship in which the tacit and/or heuristic knowledge of practitioners is also taken into account.
- ▶ Thus, a cornerstone of AR is the understanding that knowledge is derived from practice, and practice informed by knowledge, in an ongoing process.

FEATURES OF ACTION RESEARCH

- ▶ AR attempts to integrate researchers' and practitioners' interests by implementing research on the basis of jointly conceived problems.
- ▶ AR rejects the notion of researcher neutrality, recognizing that the most active researcher is one who has a stake in resolving a problem situation.
- ▶ AR involves collaborative learning through participation; the researcher contributes to the knowledge of the practitioner but also brings back insights to the research community.

CHALLENGES IN IMPLEMENTING AR

- ▶ Sustaining the long-term involvement of researchers with practitioners, given the constraints of an academic research programme;
- ▶ Moving from "praxis" to theory, or from action to learning;
- ▶ Rigorous evaluation of induced changes in people and processes over time may be difficult (how to show that learning has indeed taken place);
- ▶ Lack of methodological precision/controllability, and a tendency towards subjectivity or bias.

ACTION RESERACH: A CASE STUDY

- The organization: National Water and Sewerage Corporation (NWSC), Uganda.
- A public utility owned by the Government of Uganda.
- Mandated to provide piped water supply and sewerage services for 23 urban centres in Uganda.
- Operates autonomously on a commercial and financially viable basis.
- Aspires to be a leader in the utility sector in Africa.



KAMPALA:

ONE OF THE **23** TOWNS MANDATED TO NWSC



FACT FILE:

- Water production capacity - 220,000 m³/d
- Water distribution network - ~ 950km of pipes equal to or greater than ND40mm; predominantly steel and uPVC
- 145,000 water connections, of which 7,000 are public standpipes serving the poor; water coverage- ~70%
- WWTP capacity is 34,000 m³/d. 12,000 sewer connections; sewer coverage - <10%.
- Administratively and hydraulically divided into eighteen Branches and five supply zones respectively.

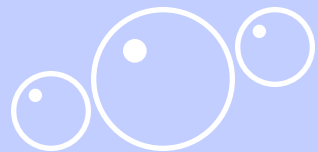



FACT FILE:

- Piped water supply system established in 1930, during period of British colonial rule.
- Population at that time was between 30,000 and 50,000.
- The city has since experienced rapid geographical expansion, most notably over the last 20 years.
- A corresponding drastic increase in demand for piped water supply.
- As a result, a number of challenges are faced in managing the



MAIN STUDY OBJECTIVE:

**To achieve improvement
in decision-making
within a real-life
organization through
development and
implementation of
appropriate decision
support tools.**



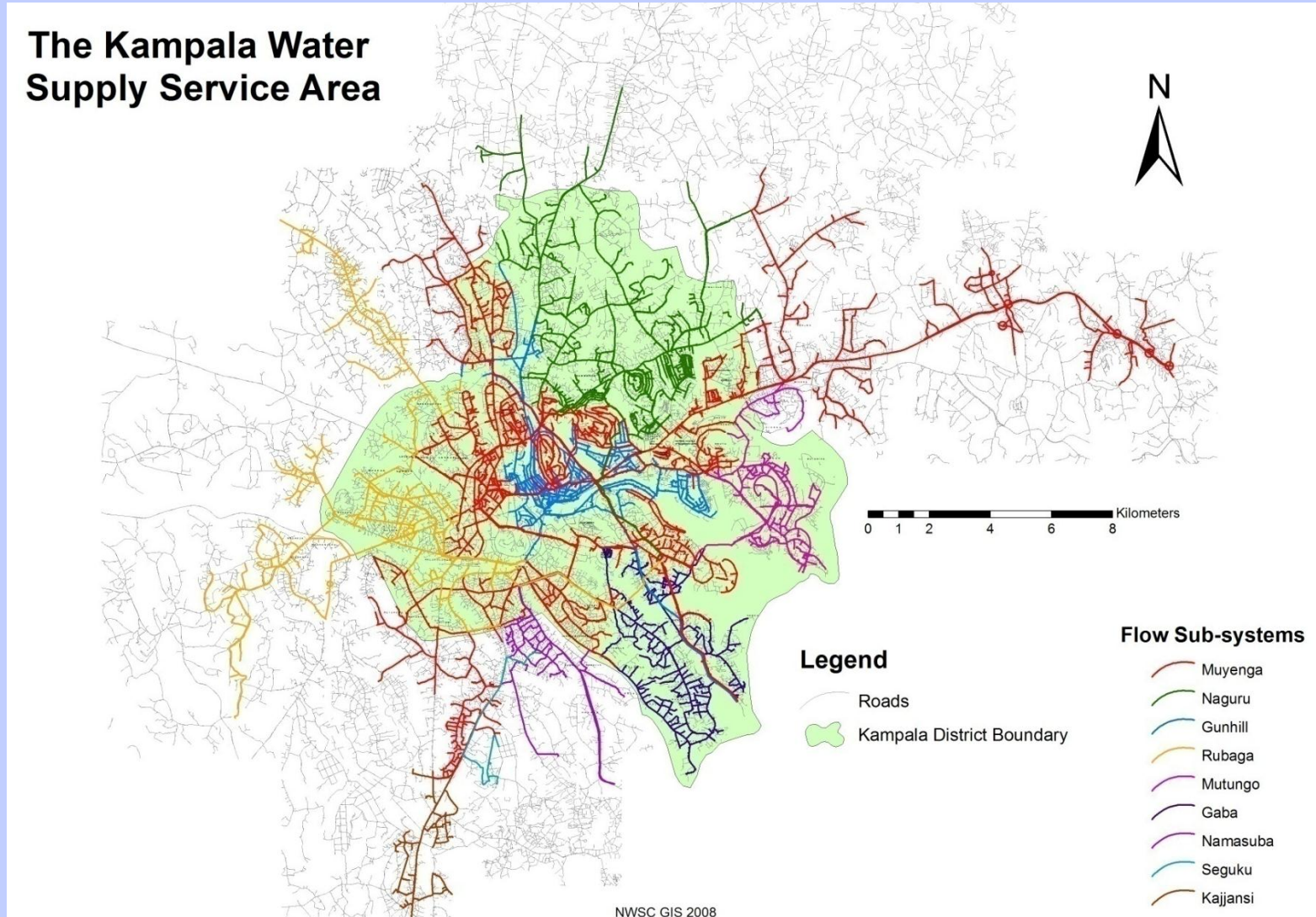
THE ACTIONS

Four problem cases:

- ▶ Investigation of water distribution bottlenecks (Case 1);
- ▶ Water loss management (Case 2);
- ▶ Territorial management of customer accounts (Case 3);
- ▶ Budget implementation monitoring and control (Case 4).

CASE 1: WATER DISTRIBUTION BOTTLENECKS

Rapid, unplanned network expansion over the years



CASE 1: WATER DISTRIBUTION BOTTLENECKS

PARTICIPATORY PROCESSES: Establishment of a Technical Think Tank (T-Cube)

Welcome to TECHNICAL THINK TANK (T-Cube), Kampala Water's forum for participatory problem structuring and decision analysis of technical issues!

As engineers and technicians in Kampala Water, we have a big problem. While NWSC in general and KW in particular have made major achievements on the commercial and customer care front, there is a question that is rather annoyingly becoming more frequently asked by the public out there:

“Are there engineers in NWSC?!?”

Of course, the reasons for this are plain: We are plagued with a network that seems to worsen every day, with dry zones spreading like a cancer. And as long as people out there have no water, we really have no business being here.

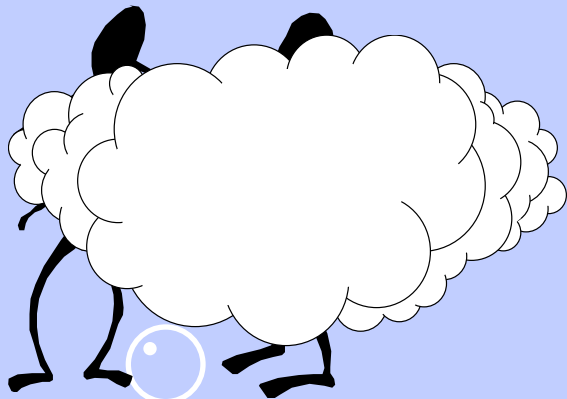
T-Cube is a new forum for us to put our heads together and ask ourselves some hard questions. What is the real problem? What can be done to resolve it/them, in the short and intermediate term? What alternative courses of action exist? How can we evaluate our alternatives and identify the most effective solution? Most importantly, how can we justify the “best” solution to the decision and policy makers in Kampala Water?

CASE 1: WATER DISTRIBUTION BOTTLENECKS

PARTICIPATORY PROCESSES:

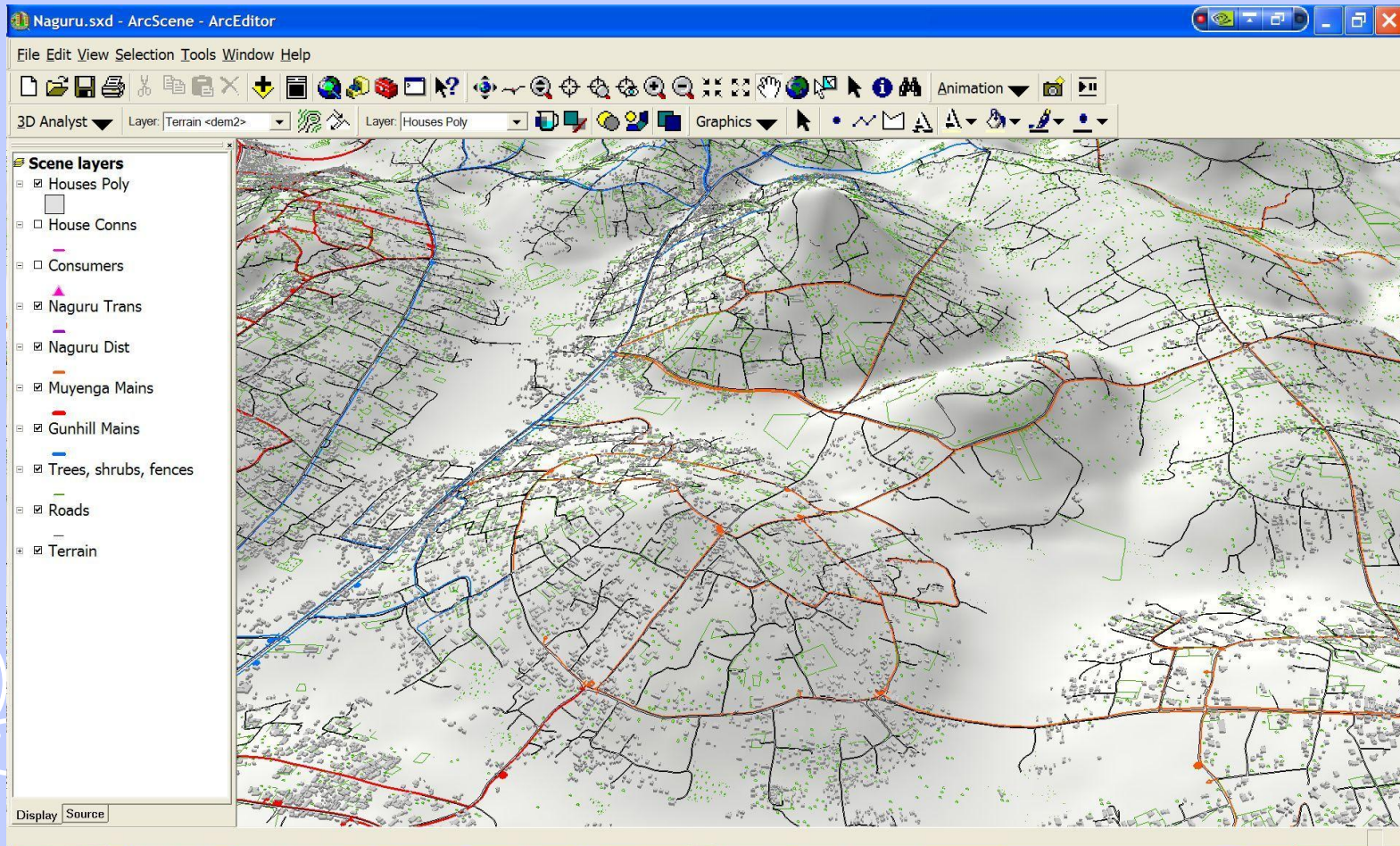
Discussions, Field Investigation Activities

- ▶ Fortnightly brainstorming meetings held.
- ▶ Several actions formulated and implemented.
- ▶ A number of tools developed and used to facilitate problem-structuring.



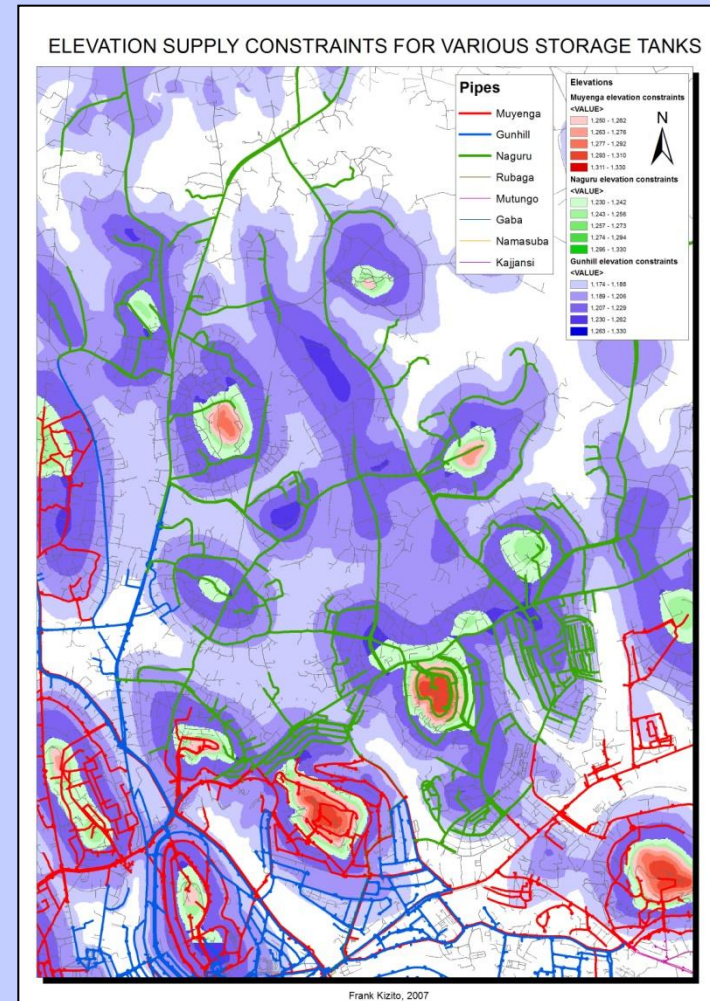
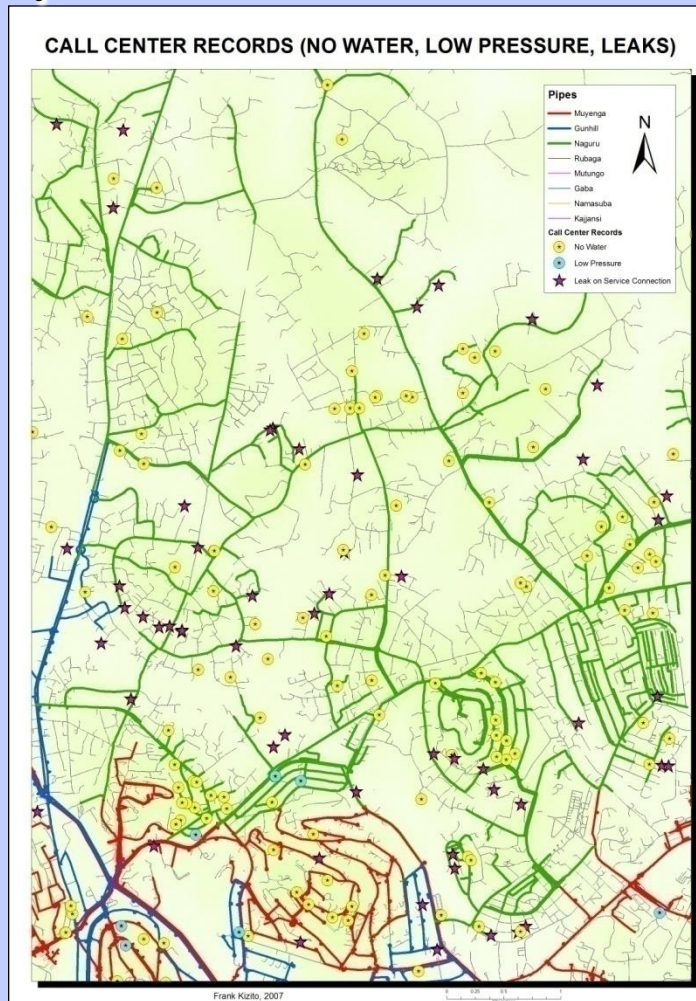
CASE 1: WATER DISTRIBUTION BOTTLENECKS

GEOVISUALISATION TOOLS DEVELOPED:
Digital Landscape Models ...



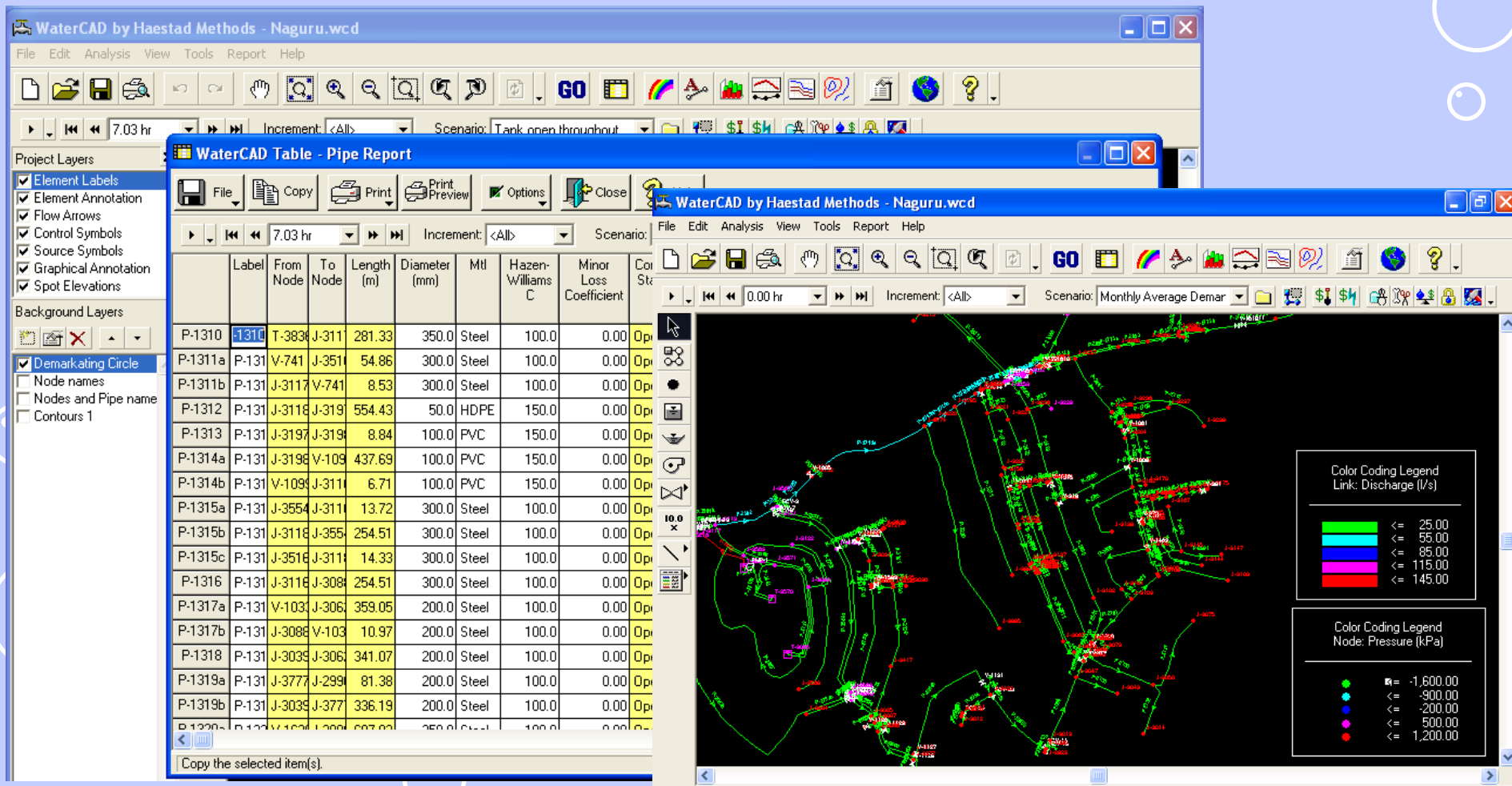
CASE 1: WATER DISTRIBUTION **BOTTLENECKS**

GEOVISUALISATION TOOLS DEVELOPED: Maps ...



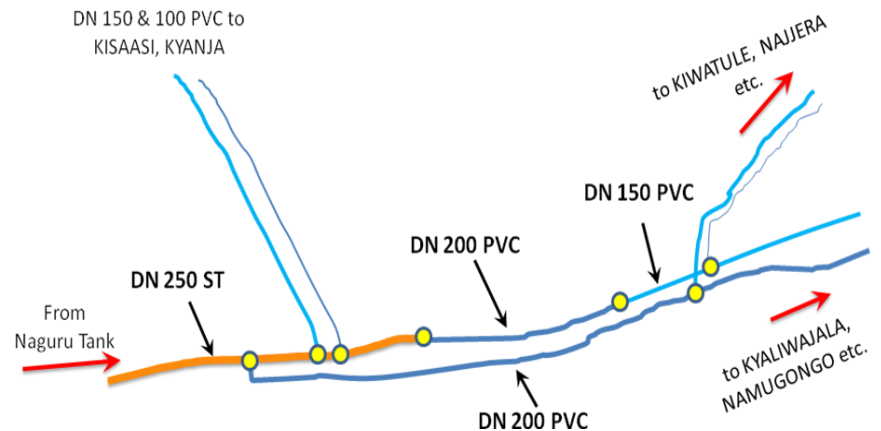
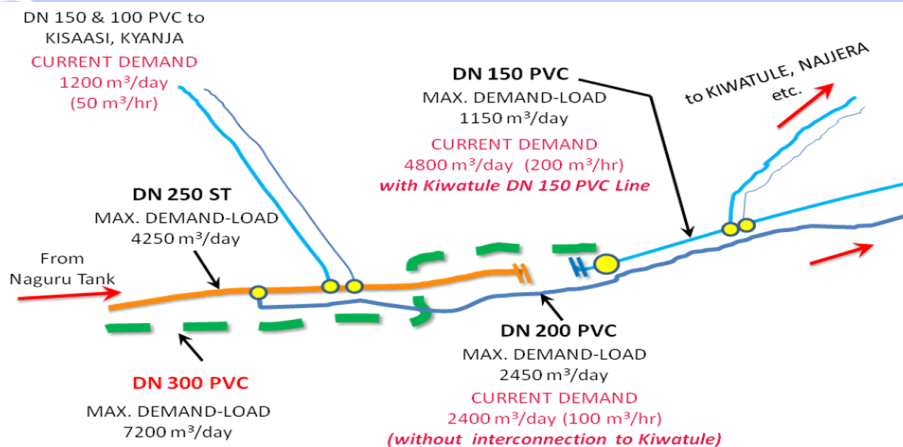
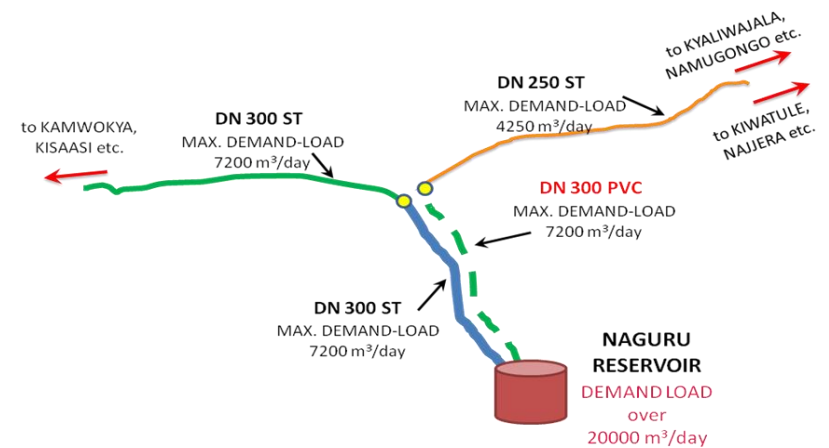
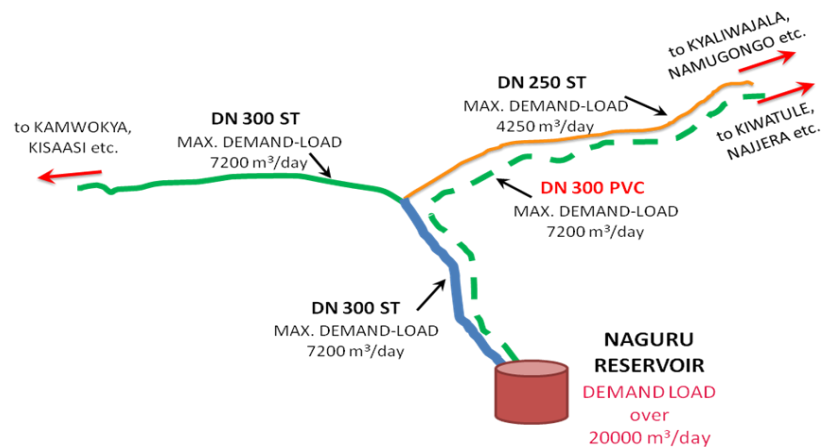
CASE 1: WATER DISTRIBUTION BOTTLENECKS

MODELLING TOOLS: Establishment of Hydraulic Models ...



CASE 1: WATER DISTRIBUTION BOTTLENECKS

MODELLING TOOLS: Simulation Modelling and Scenario Analysis.



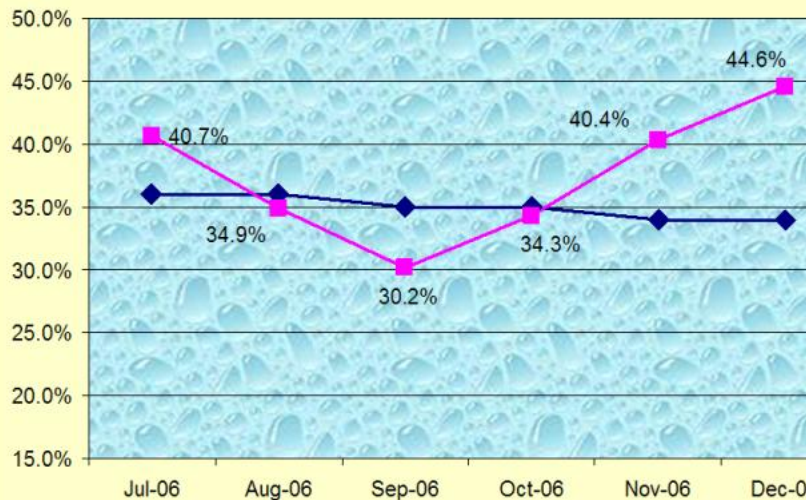
CASE 2: WATER LOSS MANAGEMENT

Uncontrollably high Non-Revenue Water levels

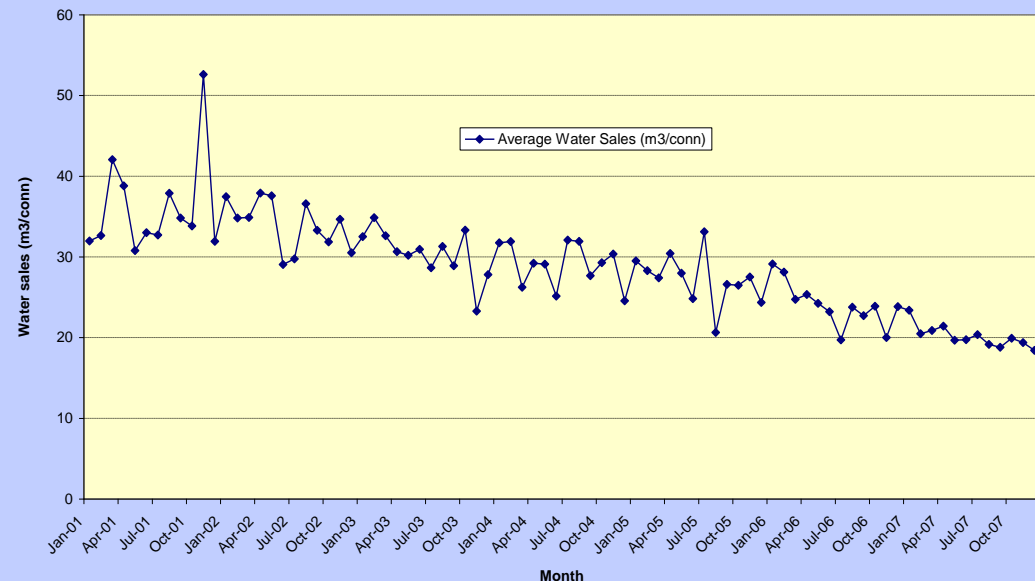
SYSTEM INPUT VOLUME	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	REVENUE WATER
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	NON-REVENUE WATER
			Unbilled Unmetered Consumption	
	Water Losses	Apparent (Commercial) Losses	Unauthorised use (Theft)	
			Metering Inaccuracies	
	Real (Physical) Losses		Leaks	
			Bursts	



NRW Performance Trends (July-December 2006)



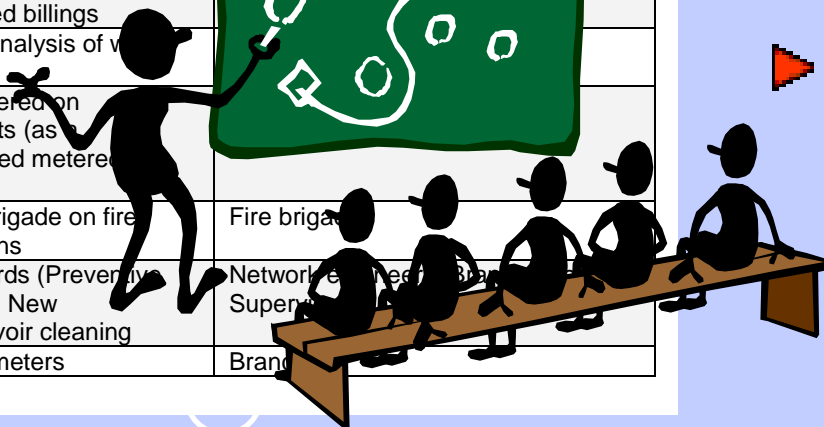
Historical Average Water Sales (m3/conn)



CASE 2: WATER LOSS MANAGEMENT

PARTICIPATORY PROCESSES: Brainstorming Workshops

Category of Data	Source
1. Customer complaints (leaks, bursts, etc) – nature, frequency and distribution	Call Centre database, to be correlated with branch records of complaints handled
2. Data on field anomalies reported by Marketing Assistants – nature, frequency, distribution	Branch commercial and billing officers
3. Demand/consumption analysis	Billing database
4. Records from Illegal Use Reduction Unit (IURU) – location and nature of cases handled	IURU
5. Meter servicing records (nature, frequency and distribution of faults)	Large Meters, meter workshop
6. Production/Reservoir records	Reservoirs&Boosters engineer/superintendent
7. Property refs (customer locations)	GIS office
8. Un-updated new connections (obtain lists, correlate with billing)	Branch surveyors
9. Un-updated old connections – correlate with billing	GIS office
10. New connection records (numbers, updating, billing analysis)	Branch surveyors
11. Analysis of estimated billings	Branch commercial and billing officers
12. Branch-by-branch analysis of sales trends	Branch commercial and billing officers
13. Consumption registered on suppressed accounts (as a component of unbilled metered consumption)	Branch commercial and billing officers
14. Records from fire brigade on fire fighting consumptions	Fire brigade
15. Mains flushing records (Preventive Maintenance, O&M, New connections); reservoir cleaning	Network & Reservoirs Branch Superintendent
16. Records on stolen meters	Branch commercial and billing officers



► Two workshops held.

► Compiled historical data and presented it to workshop participants to inform the subsequent group discussions.

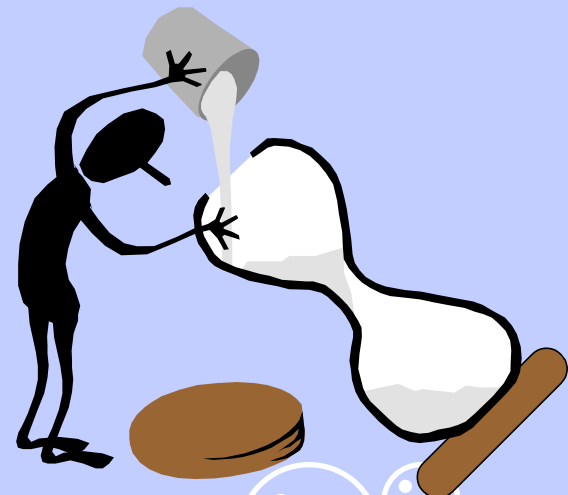
► Educated participants on the various components of the IWA Water Balance.

CASE 2: WATER LOSS MANAGEMENT

PARTICIPATORY PROCESSES: Action Plan Formulation

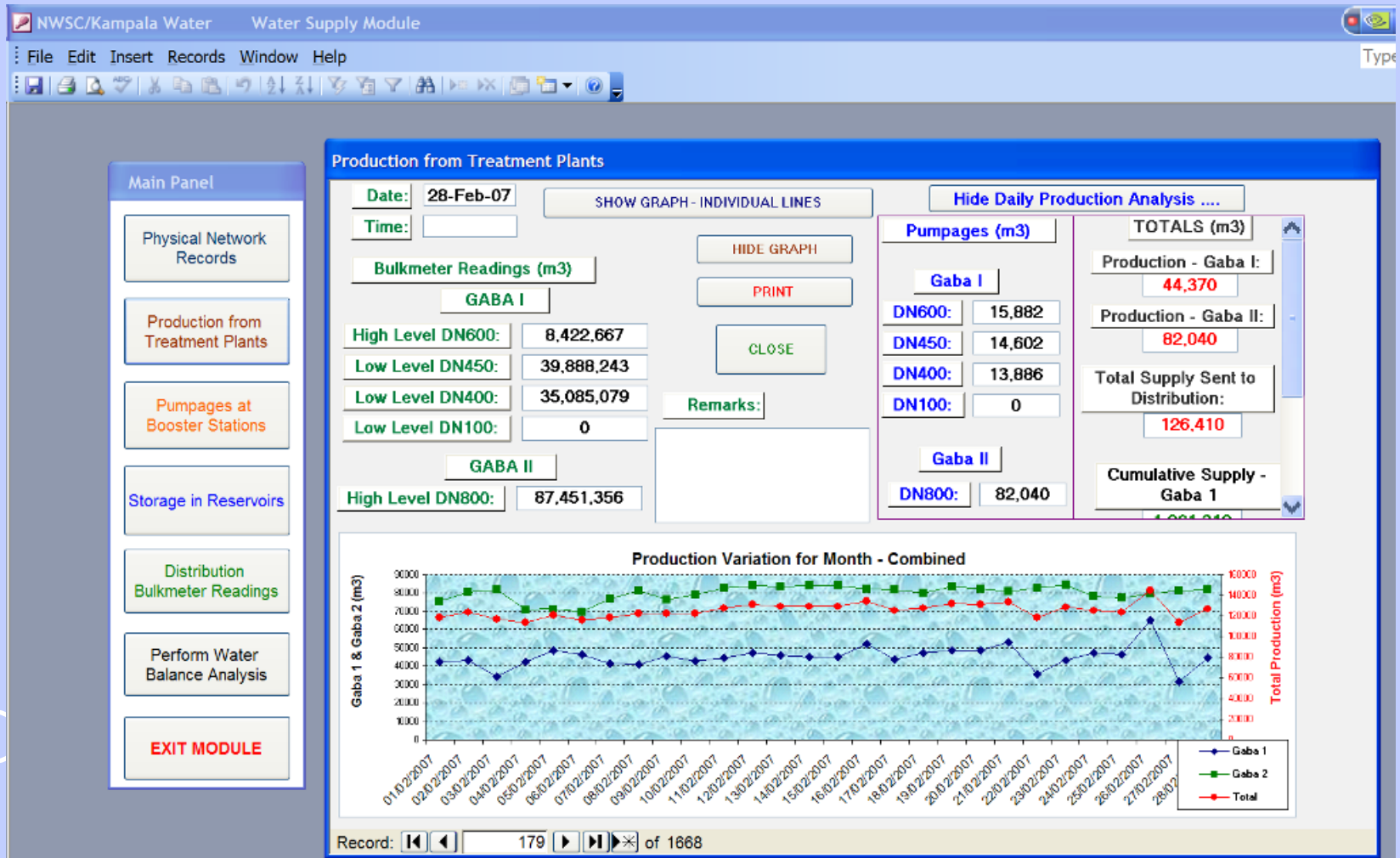
NRW Reduction Action Plan Implementation Schedule (July 2006 to June 2008)								
Action Plan Item	2006		2007				2008	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
(A) REDUCTION OF PHYSICAL LOSSES								
Rehabilitation of problematic sections of the network infrastructure								
Identification and replacement of aged pipes and fittings								
Relocation of exposed pipes and pipes prone to damage by traffic								
Reduction of pipe damage due to civil works activities by other utilities and service providers								
Improvement of coordination of works and information flow with other utilities								
Improved marking of locations of pipes and fittings (concrete markers for pipes, marker posts and plates for fittings)								
Improvement of workmanship in pipe laying, new connection implementation and O&M activities								
Provide periodic refresher training for field staff								
Institute stringent mechanisms for works certification and job implementation quality control								
Reduction of vandalism of network fixtures								
Engraving of fixtures								
Construction of protective lockable chambers								
Public awareness and sensitisation campaigns								
Pressure Management								
Procure services for a pressure management study								
Implement pressure management controls in affected areas								
Proactive leak detection								
Carry out a proactive leak detection campaign covering all branches								
Institute leak search reconnaissance teams in branches								
(B) REDUCTION OF COMMERCIAL LOSSES								
Meter Management								
Procure services for a meter management study and establish an effective meter management framework								
Replace aged meters								
Conduct a meter resizing campaign								
Illegal consumption								
Institute mechanism for routine verification of supply status of suppressed accounts								
Institute mechanism for regular audit of meter readings								
Strengthen and streamline activities of Illegal Use Reduction Unit, particularly with respect to proactive illegal use detection								
Minimise fire hydrant abuse, through construction of lockable chambers and metering of fire hydrants								
(C) REDUCTION OF UNBILLED AUTHORISED CONSUMPTION								
Mains Flushing								
Introduce and enforce rationalised schedules for planned periodic mains flushing and reservoir cleaning								
Introduce sufficient isolation/sectional valves in network to prevent emptying of large portions of it during repairs								

▶ Thereafter, compiled and presented a comprehensive Action Plan for NRW reduction.



CASE 2: WATER LOSS MANAGEMENT

DATA MANAGEMENT TOOLS DEVELOPED: Water Supply Module ...



CASE 2: WATER LOSS MANAGEMENT

DATA MANAGEMENT TOOLS DEVELOPED: Action Plan Implementation Monitoring Tool ...

Water Supply Department - Task Monitor Dry Zones Action Plan

STRATEGIES

Group/System: Low Level: Branch 1, Branch 6 (Bugolobi), parts of Branch 3 and Type: Hardware Date Due: 28/02/2009

Issue: Pipe replacement in Kisugu [MULTIPLE VIEW ...](#)

Strategy: Replace spaghetti pipelines with sub-mains to improve pressures and reduce leakages in Kisugu area

By Who: BM1/WSM Status: Pending - No Action Taken Yet

By When: 28/02/2009 Reason:

Cost ('000 Ushs): 10,000 Date Completed:

Actual Cost:

Status Updates:

Date	Description	Reported By

[REPORTS ...](#)

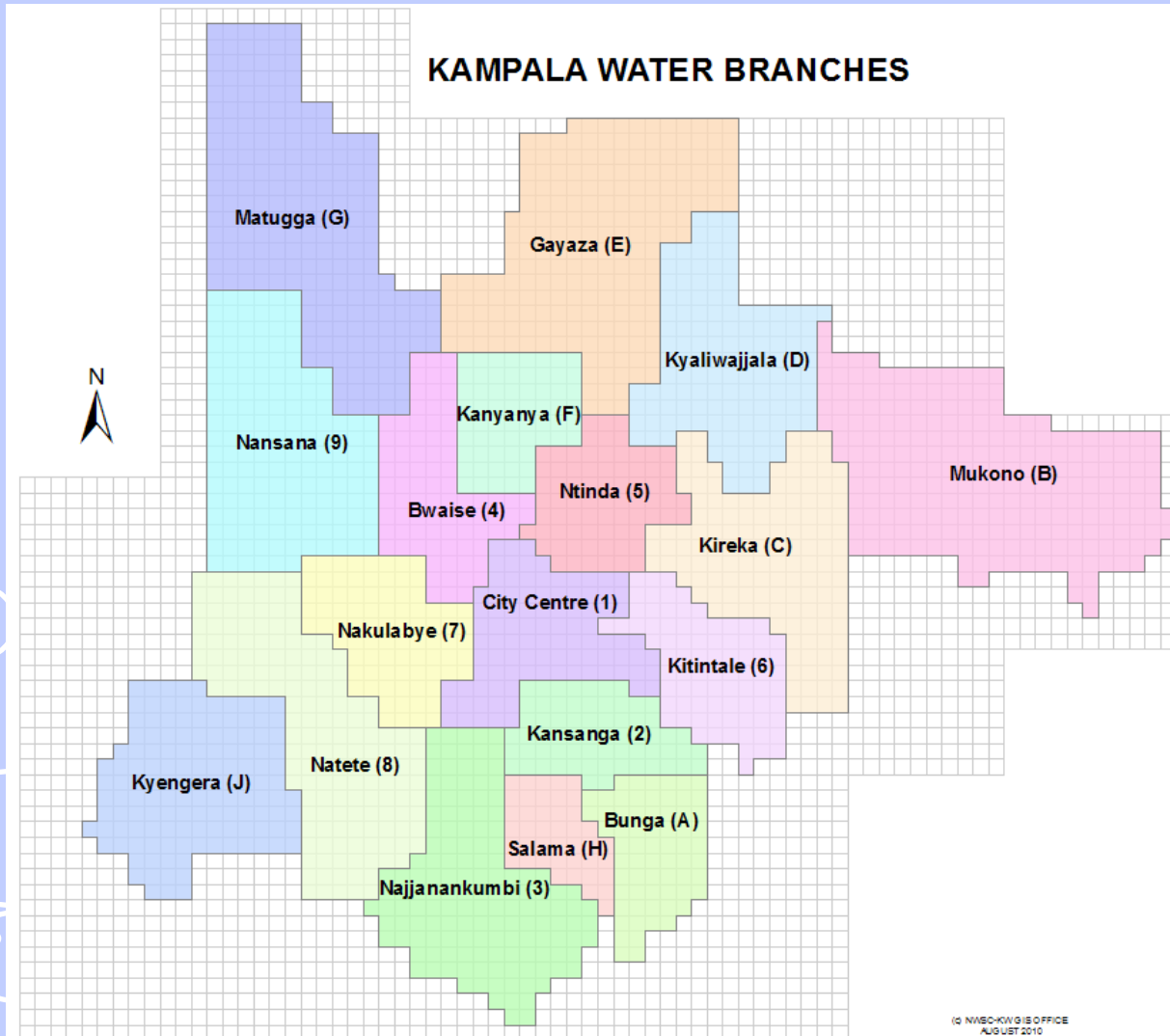
[VIEW BY GROUP/SYSTEM](#) [VIEW BY TYPE \(HARD/SOFT\)](#) [VIEW BY PERSON RESPONSIBLE](#) [VIEW BY DUE DATE](#) [VIEW BY STATUS](#)

[RETURN TO CONTROL PANEL](#)


Record: 16 of 141

CASE 3: TERRITORIAL MANAGEMENT OF CUSTOMER ACCOUNTS

Supporting the "Territorial Management" concept

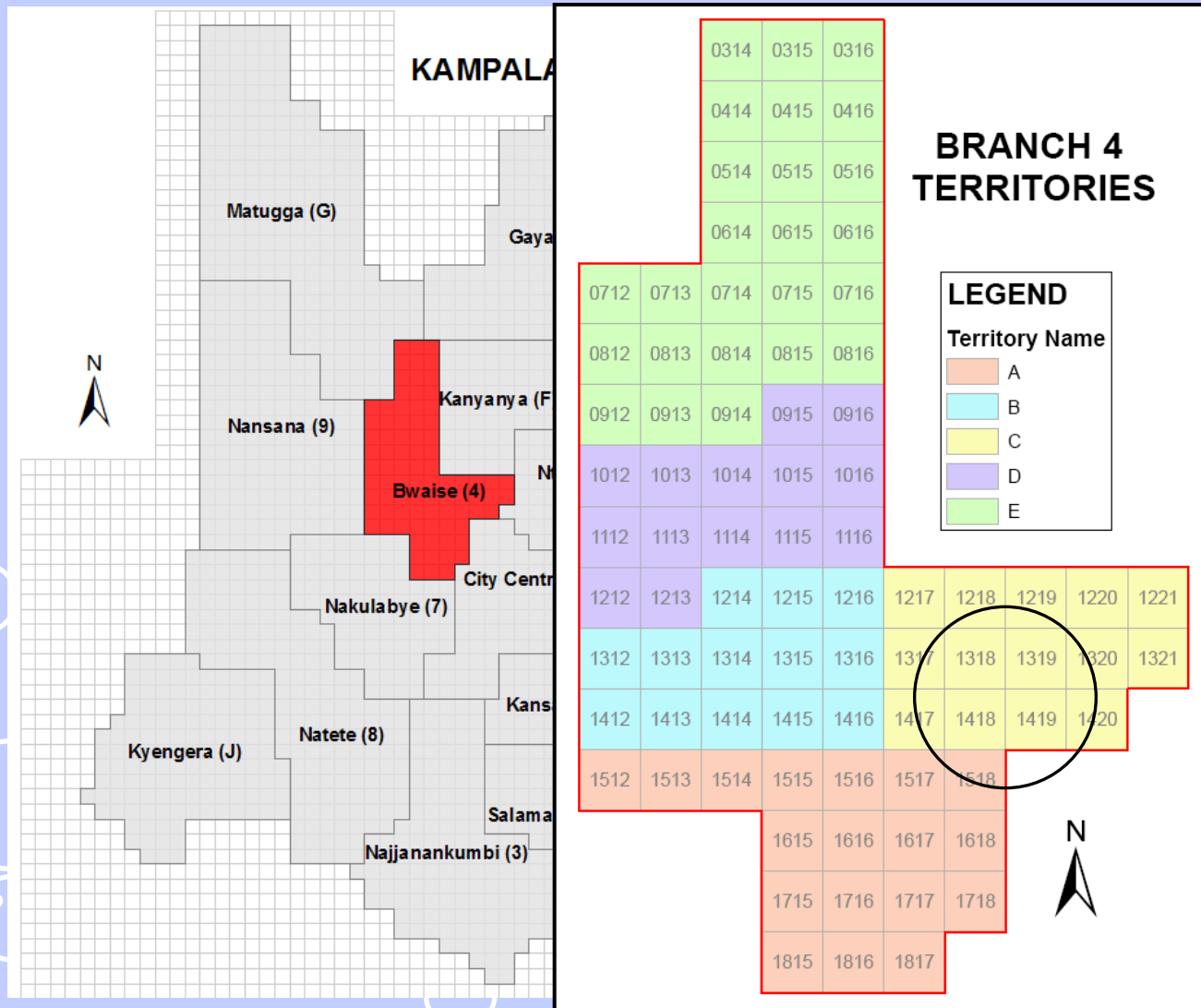


**EIGHTEEN
BRANCHES...**



CASE 3: TERRITORIAL MANAGEMENT OF CUSTOMER ACCOUNTS

Supporting the "Territorial Management" concept



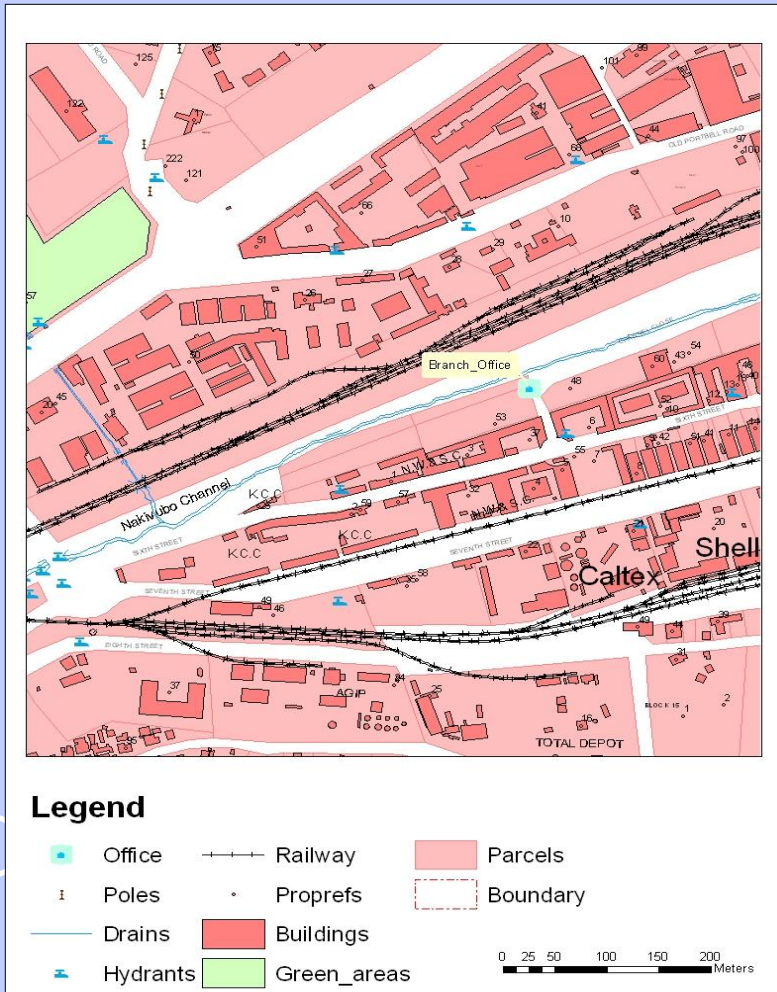
~ 15-20
**BLOCKS PER
TERRITORY.**

GEOVISUALISATION TOOLS: Migration from CAD ...



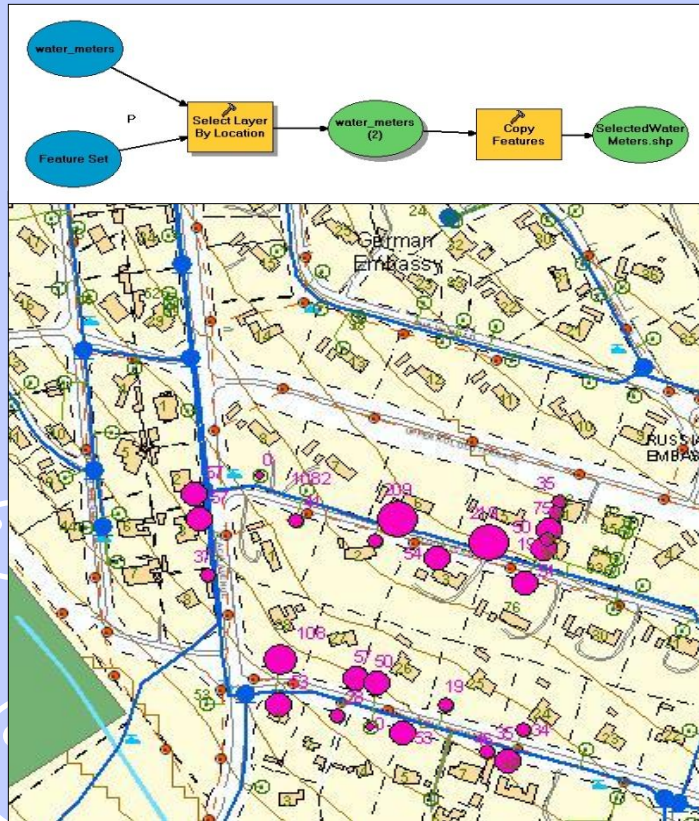
CASE 3: TERRITORIAL MANAGEMENT OF CUSTOMER ACCOUNTS

GEOVISUALISATION TOOLS: ... to GIS Base Maps

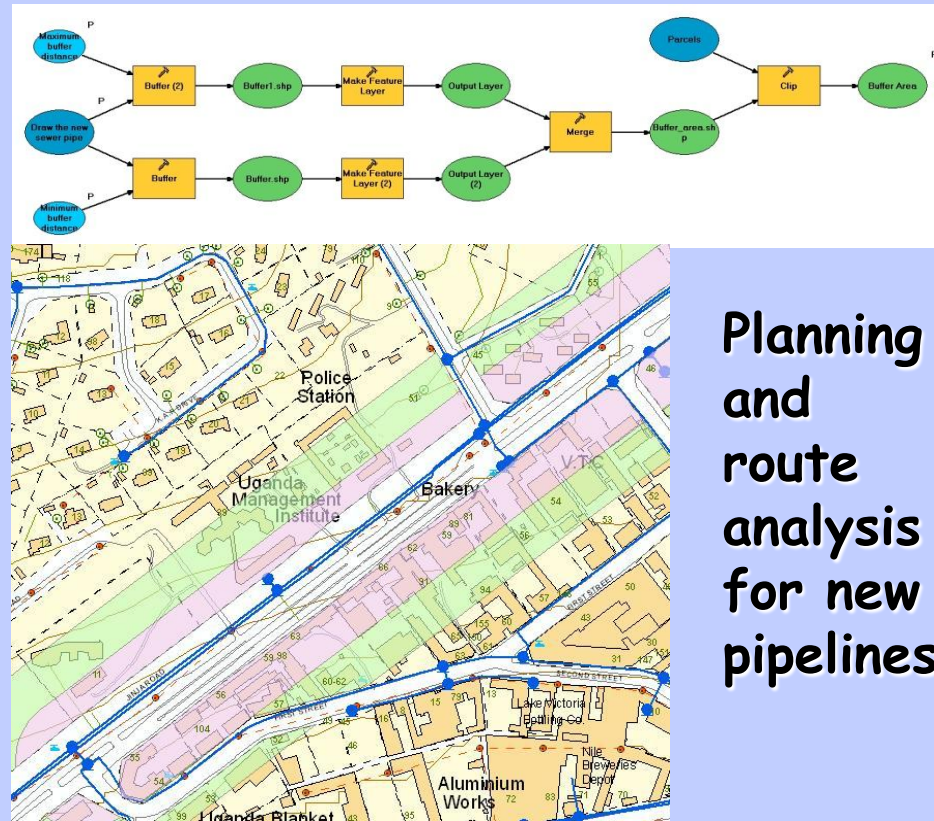


CASE 3: TERRITORIAL MANAGEMENT OF CUSTOMER ACCOUNTS

GEOVISUALISATION TOOLS: Geoprocessing Models



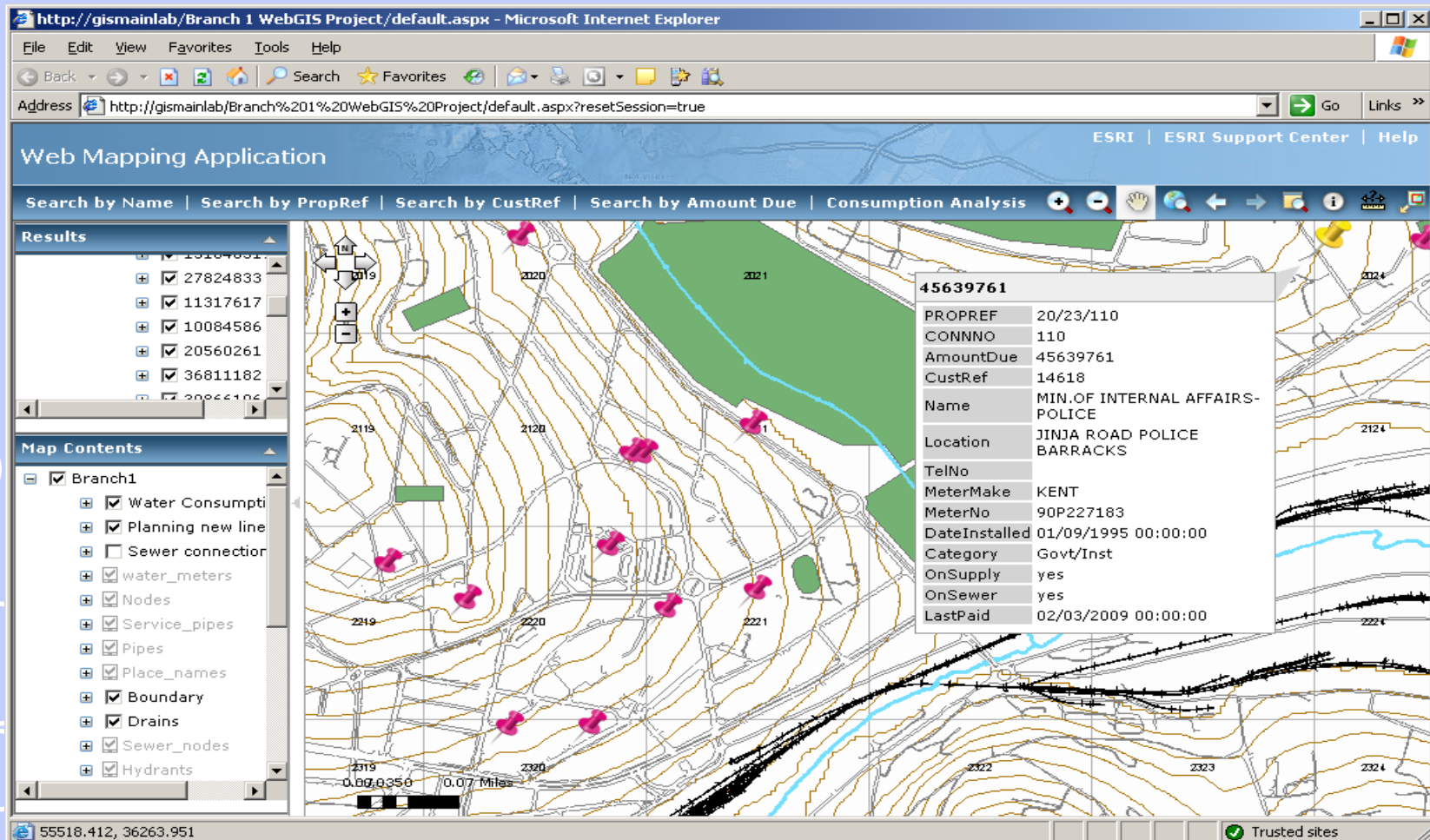
Consumption
Analysis



Planning
and
route
analysis
for new
pipelines

CASE 3: TERRITORIAL MANAGEMENT OF CUSTOMER ACCOUNTS

GEOVISUALISATION TOOLS: Web-mapping Applications



CASE 3: TERRITORIAL MANAGEMENT OF CUSTOMER ACCOUNTS

DATA MANAGEMENT TOOLS: Account Management Module

NWSC/Kampala Water Account Management Module

File Edit Insert Records Window Help

Type a question for help

Account Status - Arrears on Active Accounts - Territorial Breakdown

Branch: Kitintale Territory: View All Territories Consumer Category: All Categories

Cust Ref	Prop Ref	Name	Location	Territory	Category	ARREARS	Collections	Last Paid On:
71794	20/28/27	MAGEMBE MOHAMMED	KISWA	C	Domestic	22,039	0	20/03/2007
48831	14/39/29	OSINGILIO JUSTINE	OFF JINJA ROAD	D	Domestic	22,027	0	23/04/2007
72250	21/31/387	OJAMBO MICHAEL	MUTUNGO	C	Domestic	22,022	-17,000	03/05/2007
27403	26/35/88	KAYEMBA MUNIR	15 KOME DRIVE	F	Domestic	21,993	-30,000	08/05/2007
54015	20/33/54	AGUKU ALEX	MUTUNGO	E	Domestic	21,988	-40,000	03/05/2007
58997	13/34/131	BUKENYA JOHN BOSCO	KAMULI	A	Domestic	21,986	0	22/07/2006
44383	14/38/193	MALYABE JONATHAN	BWEYOGERERE	D	Domestic	21,975	-20,000	08/05/2007
87484	22/35/87	OULA DAVID	MUTUNGO	E	Domestic	21,975	0	14/04/2007
49022	25/34/17	BAMURIHO WINFRED	LUZIRA	F	Domestic	21,945	0	28/04/2007

Credit Balance: 0 to 100,000 100,000 to 200,000 200,000 to 500,000 500,000 to 1,000,000 1,000,000 to 5,000,000 More than 50,000 More than 100,000 More than 200,000 More than 500,000 More than 1,000,000 More than 5,000,000

View all accounts for selected category

A/C DETAILS ... STATEMENT ... STATUS LOG ... PRINT OR EXPORT LIST ... CLOSE

SEARCH BY CUST REF ... SEARCH BY PROPREF ... SEARCH BY NAME ... SEARCH BY LOCATION ... FILTER BY DEBT AGE ...

Territorial Performance for the Selected Category:

Total arrears on active accounts:	2,149,562,488
Collections to date (water sales):	205,517,397
Target total arrears:	
Target total collections:	

Overall Branch Performance to Date:

Total Arrears (both active and suppressed accounts):		3,055,761,215	
Target total arrears for this month:		1,915,975,000	
Collections to date (incl. VAT):			
Active A/cs	Suppressed A/cs	Sundry Colls	TOTAL COLLS
205,517,397	6,673,730	6,309,200	218,500,327
Target total collections for this month (incl. VAT):			649,080,240

Record: 8420 of 13302

Main Panel

Kitintale

LAST UPDATED: 19/05/2007

Arrears Status

Water Sales

Connection Status

Metering Status

Large Accounts

Summary Statistics

Administration

UPDATE BILLING RECORDSET

EXIT MODULE

Arrears

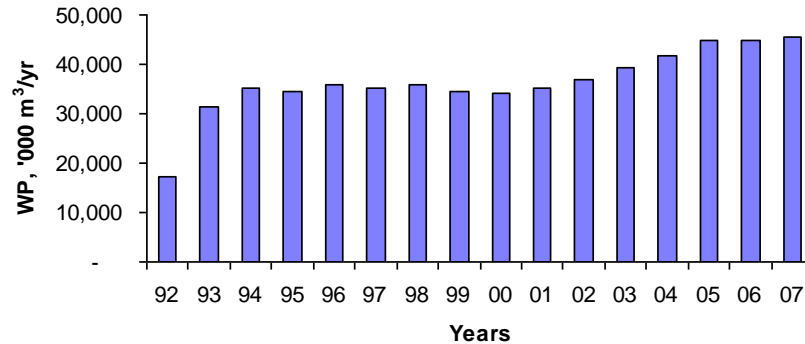
Arrears on Active Accounts

Arrears on Suppressed Accounts

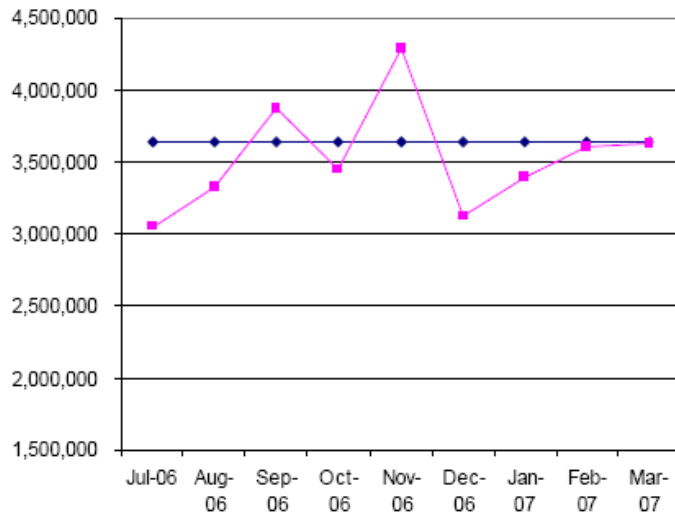
Close

CASE 4: BUDGET IMPLEMENTATION MONITORING AND CONTROL

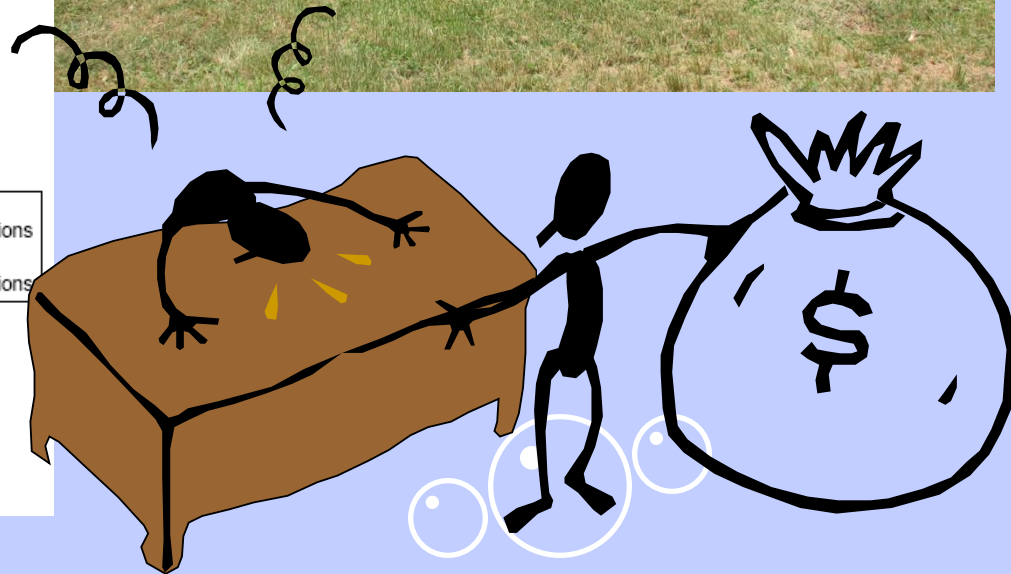
Ggaba Water Production 1992 -2007



Revenue Collections (Ushs '000' excl VAT)



Target Collections
Actual Collections



CASE 4: BUDGET IMPLEMENTATION MONITORING AND CONTROL

DATA MANAGEMENT TOOLS: Budget Tracker

NWSC/Kampala Water Budget Tracker

File Window Help

Type a query

MAIN PANEL

CAPEX

OPEX

REPORTS

EXIT

CAPEX

NON-CASH REQUISITIONS

Track PR

Track PO

Track Invoice

Track Payments

View Global Status

CASH REQUISITIONS

Track Cash Requests

Track Accountabilities

CLOSE

PAYMENT TRACKER - CAPEX

Select a Business Unit ... Water Supply Department

Select a Budget Code ... A1.1

Select a PR ... 1

CLOSE

Item Description	Amount	Start Date	Status	PR Date	PR Subject	Est. Amount	Status
Upgrade of Access road	10,000,000		PR(s) raised	20/08/2007	Grading of Access Road to Gaba Complex	8,000,000	PO(s) Issued

Select a PO ... 1

Select an Invoice ... 75

PO Date	Supplier	PO Amount	Due Date	Status
25/08/2007	Dott Services Ltd.	7,500,000	30/09/2007	Invoice(s) received

Inv Date	Inv Number	Inv Amount	Status
25/09/2007	A12/07	7,500,000	Payment(s) processed

Payments made to date for Invoice Number 75:

PV Routing Number	PV Date	Amount	Date Paid	Status
2503	30/09/2007	7,500,000	05/10/2007	Payment effected

Edit Existing Payment

Inv Routing Number	75	Date Paid	05/10/2007
PV Routing Number	2503	Cheque Number	45627
PV Date	30/09/2007	Scala PV Number	29837
Amount	7,500,000	Remarks	

SAVE EDITS

REFLECTIONS/LESSONS LEARNT

- The study created awareness on the need to apply a more structured and rigorous approach to decision-making within the organization, replacing the hitherto prevalent “fire-fighting” approach.
- Through the four case studies, a number of insights were gained into how best to ensure successful DSS implementation in an organization.
- The establishment of an “Action Learning” forum (T-Cube) led to promotion of a culture of participatory problem-solving among the middle-management staff.

REFLECTIONS/LESSONS LEARNT

- The Action Research approach was found to be useful in bridging the gap between academic research and technological practice, promoting the development of decision support tools with a good chance of being adopted in practice.
- Application within a real-world organisation to solve real-life problems rendered the developed tools of practical benefit to the organisation rather than a mere academic pursuit.
- The reflection inherent in the Action Research process fostered an improved understanding of the problem situations within the study area, thereby enhancing organisational learning.

REFLECTIONS/LESSONS LEARNT

- Successful implementation of decision support tools requires implementing change processes within the organization, and managing this change calls for support and commitment at all management levels.
- The necessity of a holistic outlook, going beyond a focus on decision support tools as technological artifacts, was underscored.
- The challenge is to attain the right balance in emphasis between the technological tools and the processes that they support, and to recognize that the need for such tools differs at different management levels.



Thank You!

Asanteni!

MERCI!!

