Pressure Management and System Stabilisation
Case Study in eSikhaleni, South Africa

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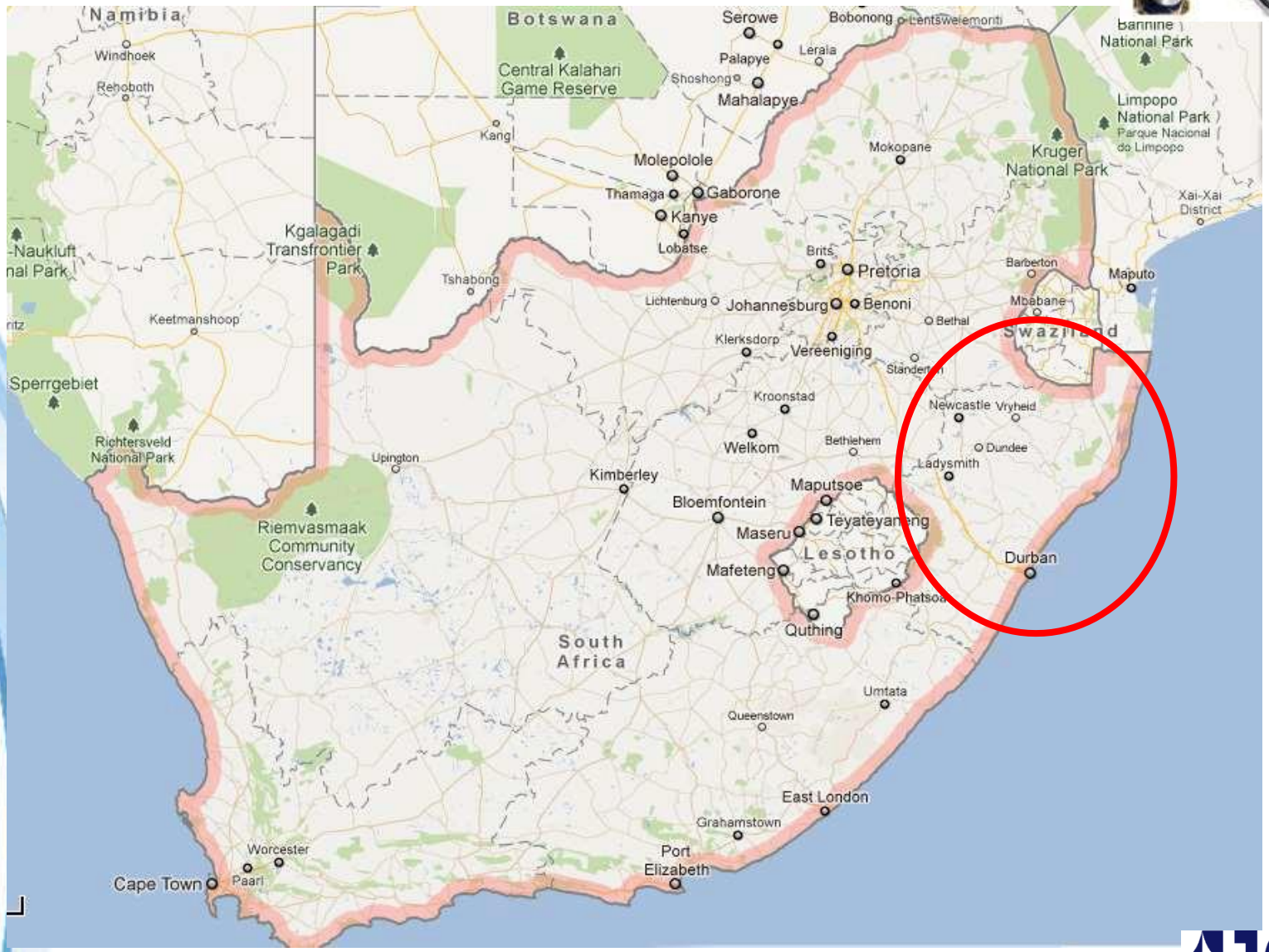
Location


Namibia
Windhoek
Rehoboth
Botswana
Central Kalahari Game Reserve
Kang
Serowe
Bobonong
Lentswelemoriti
Palapye
Lerala
Shoshong
Mahalapye
Molepolole
Thamaga
Gaborone
Kanye
Lobatse
Tshabong
Kgalagadi Transfrontier Park
Naukluft
nal Park
Keetmanshoop
Sperrgebiet
Richtersveld National Park
Upington
Riemvasmaak Community Conservancy
Kimberley
Bloemfontein
Welkom
Kroonstad
Klerksdorp
Vereeniging
Lichtenburg
Johannesburg
Benoni
Brits
Pretoria
Mokopane
Kruger National Park
Limpopo National Park
Parque Nacional do Limpopo
Xai-Xai District
Barberton
Maputo
Mbabane
Bethal
Standerton
Swaziland
Newcastle
Vryheid
Dundee
Ladysmith
Bethlehem
Maputsoe
Teyateyaneng
Maseru
Lesotho
Mafeteng
Khomo-Phatsoa
Quthing
Durban
South Africa
Umtata
Queenstown
East London
Grahamstown
Port Elizabeth
Worcester
Paarl
Cape Town

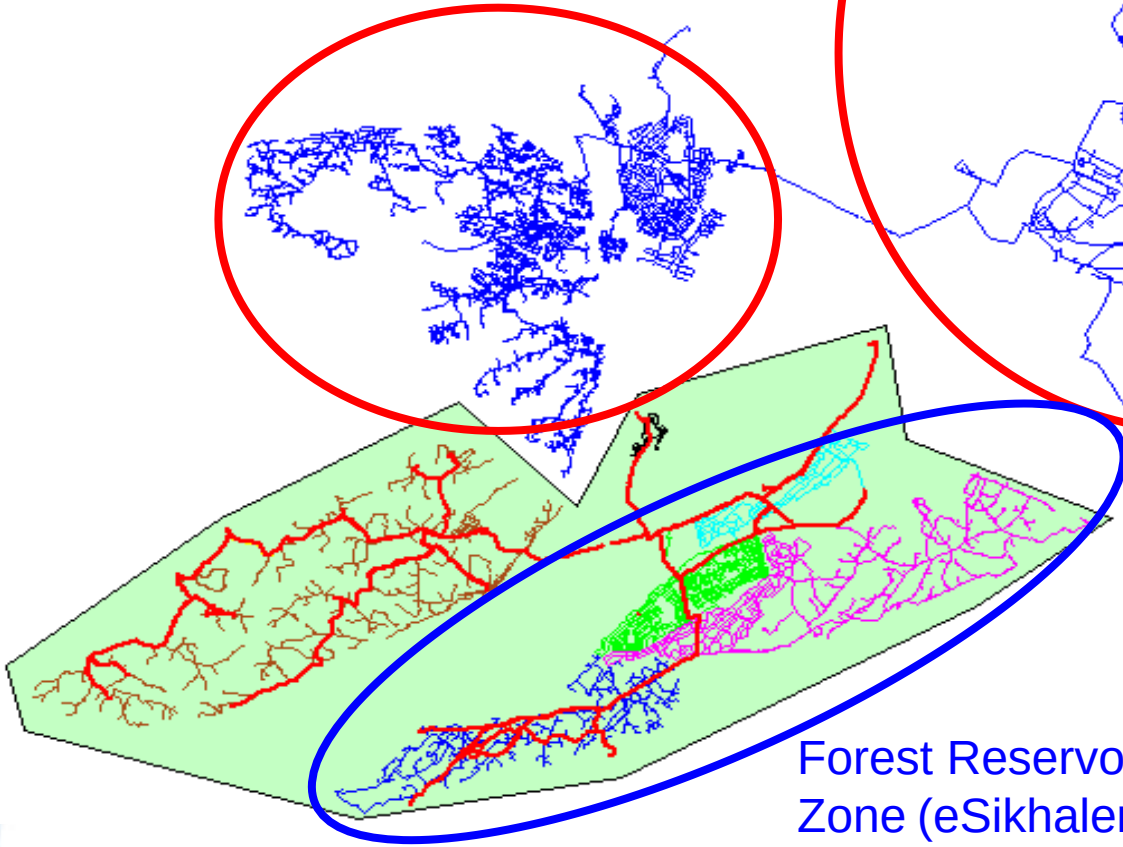
Location


Kosi
Ndumo
Paulpietersburg
Pongola
Charlestown
Ithala
Utrecht
Louwsburg
Mkuze
Newcastle
Vryheid
Hlomo Hlomo
Hluhluwe
Dannhauser
Dundee
Fort Mistake
Glencoe
Van Reenen
Ulundi
Mtubatuba
St Lucia
Isandlwana
Ladysmith
Bergville
Colenso
Empangeni
Winterton
Eshowe
Richards Bay
Estcourt
Greytown
170km
Mooirivier
Rosetta
Stanger
Zinkwazi Beach
Nottingham Road
Lion's River
Sheffield Beach
Lidgetton
Wartburg
Salt Rock
Howick
Westbrook
Port Zimbali
Pietermaritzburg
Verulam
Umdloti
La Lucia
Umhlanga
Himeville
Underberg
Durban
Isipingo
Umlazi
Amanzimtoti
Umkomaas
Scottburgh
Pennington
Kokstad
Hibberdene
Port Shepstone
Oslo Beach
Shelly Beach
St. Michaels-on-Sea
Uvongo
Margate
Southbroom
Ramsgate
Port Edward
San Lameer
INDIAN OCEAN
KWAZULU NATAL
Clickable Search Map

Location

Empangeni water supply system

Richards Bay water supply system



Forest Reservoir Zone (eSikhaleni)

Location

Dube
Forest Reservoir
peri-urban
eSikhaleni
informal
informal
Nkwanazi

Quick Stats about eSikhaleni

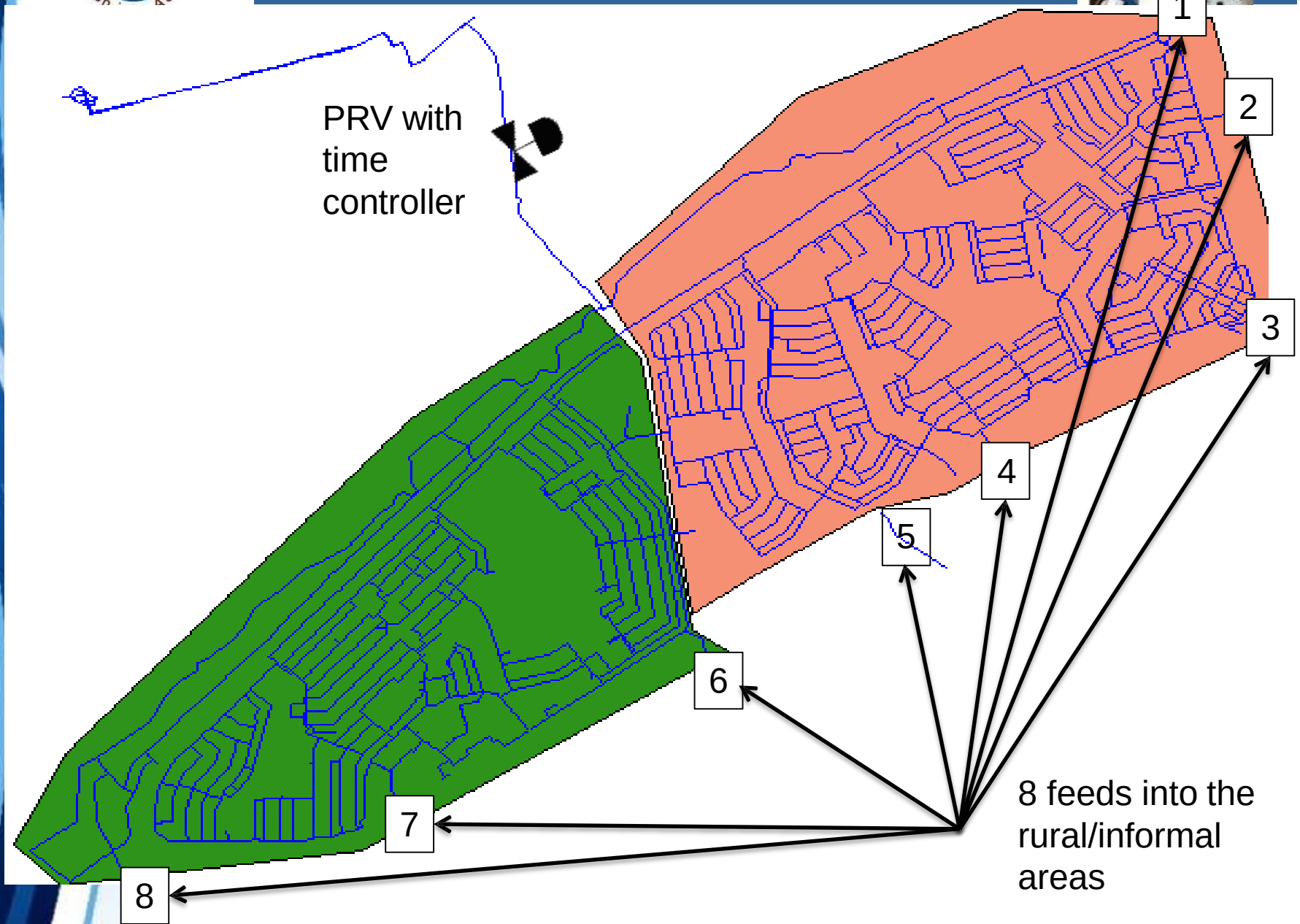
System Characteristics	Project Area – eShikhaleni	Rest of Richards Bay
No. of Connections	4,154	42,519
No. of Households	8,234	78,375
No. of PRVs	1	89
Length of Reticulation	206 km	1,802 km
Population	32,437	302,022
Average Operating Pressure	4.3 bar	5.8 bar
SIV (Ml/annum)	10.4	37.1
NRW (Ml/annum)	7.5	11.8
ILI	14.4	8.7

Approximately 10% of the population in this zone but 20% of the SIV for Richards Bay!

Description and System Operation

- eSikhaleni is a peri-urban residential zone surrounded by rural developments
- Supply originates from 3 x 20Ml reservoirs (Forest Reservoir)
- Entire zone is gravity feed via a 700mm diameter trunk main
- eSikhaleni water supply is operated by “City of Umhlathuze” (Municipality) while Forest Reservoir and the trunk mains by a private company.
- A PRV feeding eShikaleni had a timer controller installed which was set to deliver no pressure between 22h00 and 04h00 at the CP and 0.5bar between 04h00 and 22h00 daily.
- On the outskirts of eShikhaleni the water leaves to feed the rural areas via eight outlets and this was supplemented by the trunk main that ran through eShikhaleni

Description and System Operation



Description and System Operation

- The time controller was set-up by the Client as they were experiencing high burst frequency at the lower elevations of eShikhaleni and the rural areas.
- This decision was taken in 2007 and due to this consumers at the CP experienced intermittent supply and very poor to no pressure daily.
- This caused further problems, the downstream off-peak pressures setting was actually producing cavitation at the main PRV (upstream/downstream: 10bar/2bar)
- The intermittent supply was shortening the lifespan of the existing pipeline infrastructure and increasing burst frequency and water losses
- The concern of the Client were the consumers that actually PAID for the water consumed received NO or VERY LITTLE PRESSURE whereas the rural consumers always had adequate pressure 24/7 and did not pay for the service, mainly due to the topography and system operation of the zone.

Current Situation – Project Area

Red Reticulation – High burst frequency (lowest elevation in the zone)

Green Reticulation – Consumers complain of low pressures (highest elevation in the zone)

Current Situation – Project Area

Forest Reservoirs

Red reticulation

Green reticulation

Higher pressure

Lower pressure

Consumer complaints

High burst frequency

Highest pressure

Highest pressures experienced at surrounding rural areas increasing real losses

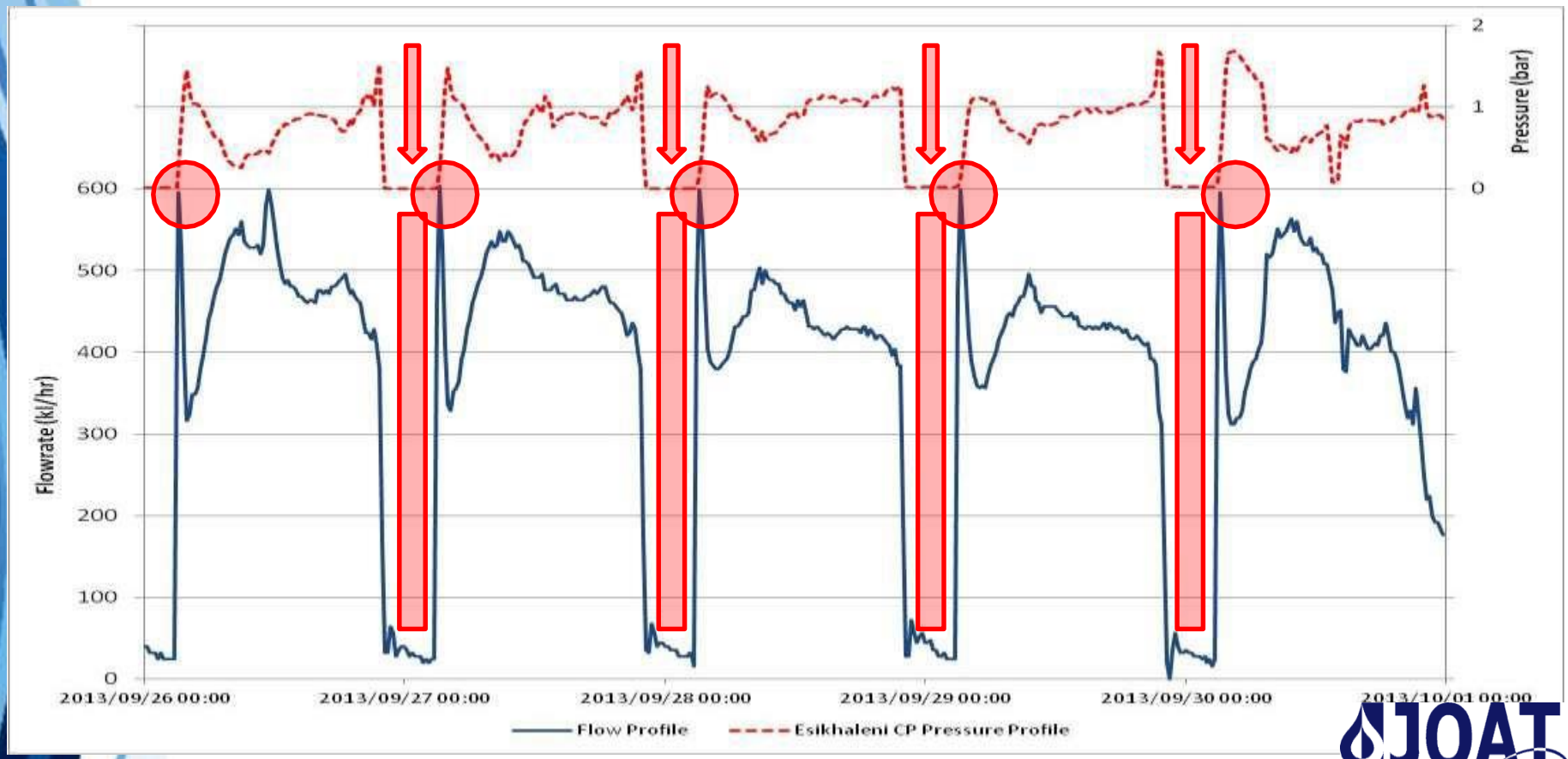
Higher burst frequency in eSikhaleni than rural areas (pipes in eSikhaleni were laid more than 50 years ago whereas rural areas 20 years old aprox)

eShikhaleni

Rural Area

Baseline Flow and Pressure Profiles

- Intermittent supply during off peak periods
- No pressure during off-peak periods and less than 1bar during peak pressures at CP
- Pressure transients caused by existing time-modulated PRV



Proposed Solution

- PROBLEM - High burst frequency experienced at the lowest elevated locations due to excess pressure during off-peak periods (typically 22h00 to 04h00)
- **SOLUTION – stop intermittent supply by allowing low pressures in the system during off-peak periods thereby substantially lowering burst frequency**
- PROBLEM – Consumer complaints due to low pressures experienced during peak periods (typically 05h00 to 09h00)
- **SOLUTION 1 – Increase pressure during peak periods**
- **SOLUTION 2 – Control the volume of potable water to the surrounding rural areas**
- PROBLEM – High real losses as shown from reservoir outlet flow loggings in the order of 500 m^3/hr or 11,5 Ml/day or €1.2million/annum.
- **SOLUTION – control pressure and flow within eShikhaleni (project area) and the 8 outlet feeds to the surrounding rural areas**

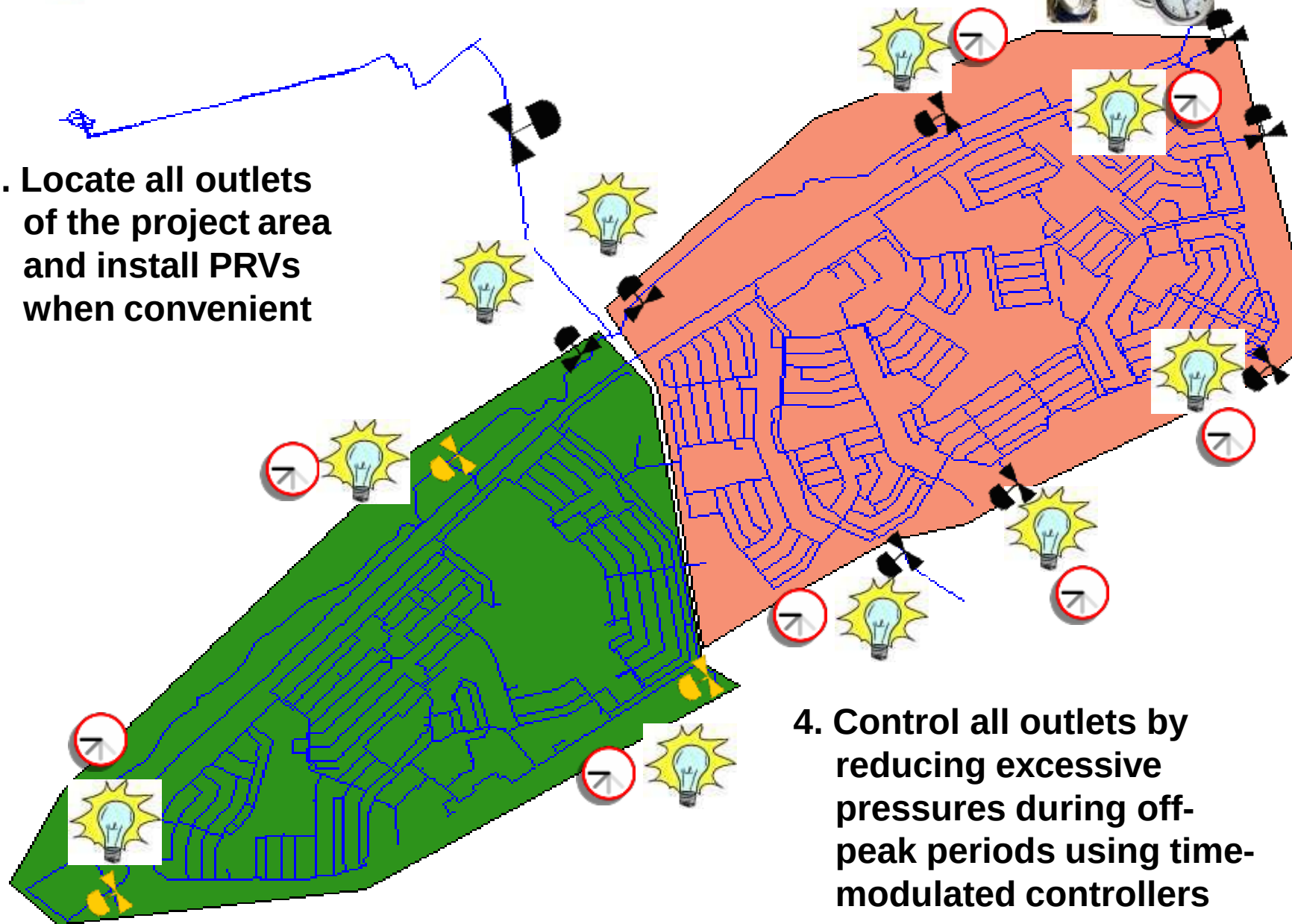
Proposed Solution

1. Separate area of supply into two separate Pressure Management Zones (PMZ)

2. Install the two PRVs with advanced flow-modulated controllers to manage pressures in each system independently

Proposed Solution

3. Locate all outlets of the project area and install PRVs when convenient



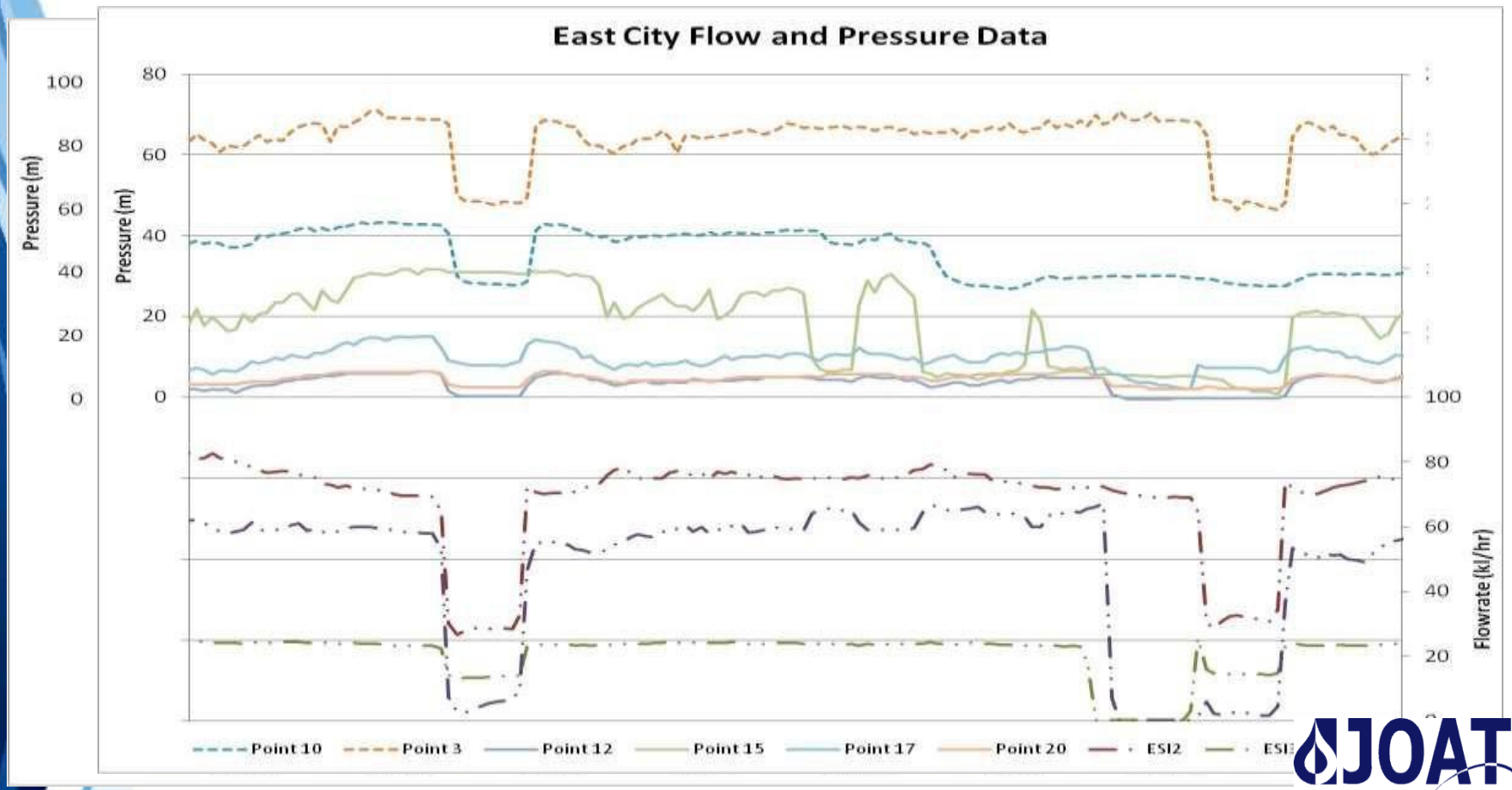
4. Control all outlets by reducing excessive pressures during off-peak periods using time-modulated controllers

Implementation

- Step Testing to separate eShikhaleni into two zones as well as make it discreet from the rural zones
- Installation of Zone Dividers
- Construction of PRVs
- Installation and Commissioning of the advanced time and flow-modulated PRV controllers
- Monitoring and Maintenance

Implementation

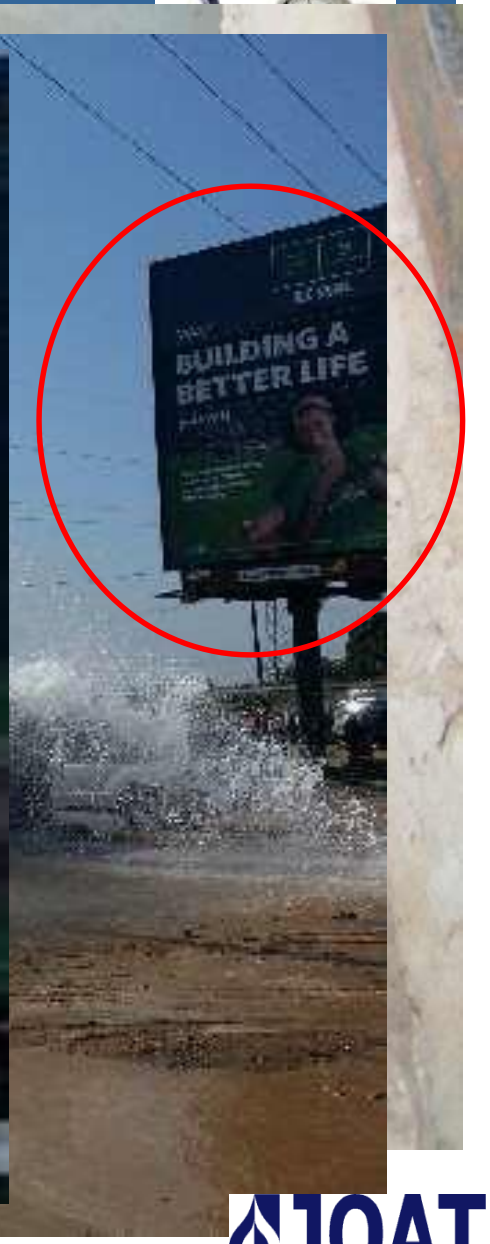
- Step Testing to separate eShikhaleni into two zones as well as make it discreet from the rural zones



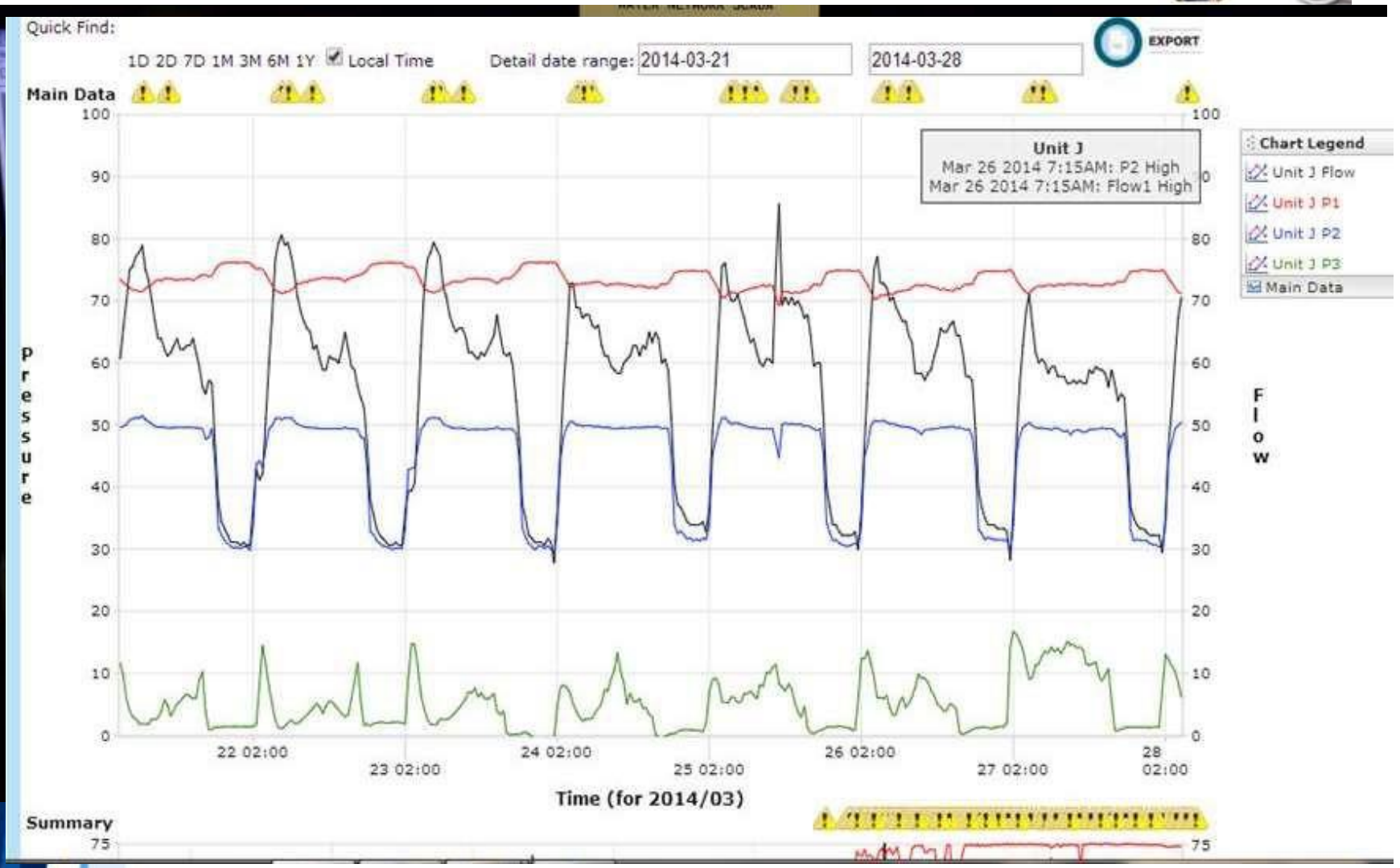
Implementation


Mfanenkosi
20/08/2013

Implementation



Implementation



- Monitoring and Maintenance

Outcomes

Forest Reservoirs

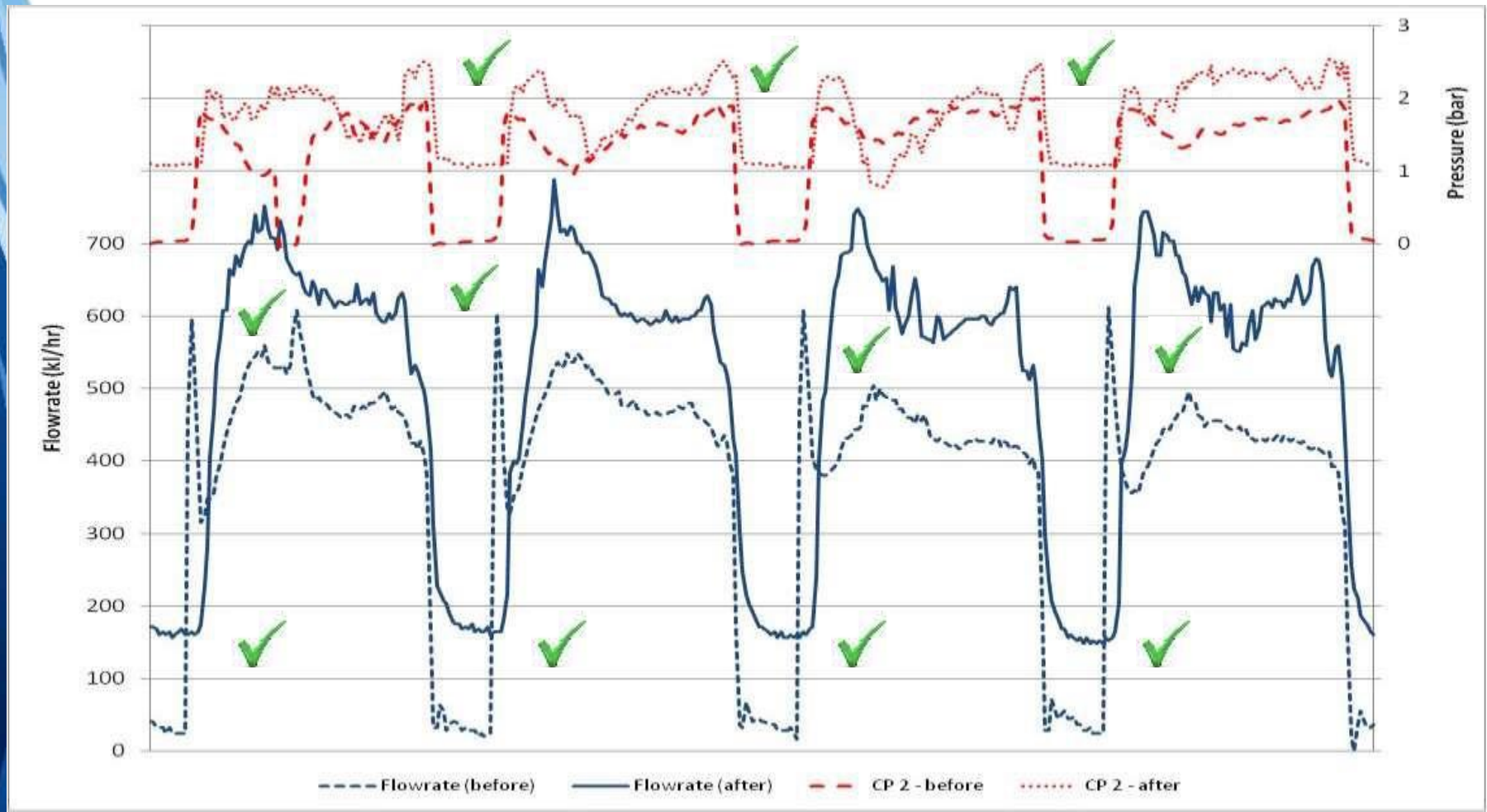
No complaints regarding low pressures

Lower burst frequency

Pressures controlled by advanced timer controllers

Final Flow and Pressure Profiles

- No more intermittent supply
- Adequate pressure 24/7 and more than 1bar during off-peak periods and more than 2 bar pressure during peak periods at CP
- No Pressure transients from new flow-modulated PRV controller



Results and Going Forward

- Burst frequency was lowered from **34 to 3 mainline bursts/100km/annum (91%)**
- **Reduction in Consumer complaints** as all the consumers that remunerated the Municipality for water are now receiving uninterrupted supply
- The abolishment of intermittent supply has resulted in all consumers now have an **adequate level of service** 24 hours/day all year round
- **Pressure Transients has been eliminated** which was caused by the quick opening and closing of the supply trunk main into the system
- **Choosing the correct and appropriate advanced flow-modulated PRV controller** was crucial to the success of this project
- As intermittent supply has been discontinued the **MNF has inevitably increased** and the going forward step testing and leak detection methods shall be used to reduce RL further

Thank you for your attention

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