The Emfuleni Water Loss Project – A major challenge

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Synopsys

The Emfuleni Local Municipality is situated in southern Gauteng and supplies water to a population of 757 555 with a daily consumption of approximately 200Ml / day. The area is characterised by high water losses and limited cost recovery.

The Sebokeng / Evaton Performance Based Pressure Management Project, commissioned in June 2005, has been the most significant WC/WDM project in the area and has saved the municipality an average of 10million m^3/annum of water for the past three and a half years and is still fully operational. The municipality and Department of Water Affairs (DWAF) have invested in subsequent projects but unfortunately the municipality has not yet embarked on a major WC/WDM project to reduce their losses and non-revenue water mainly due to political instability and insufficient resources.

Subsequent intervention programmes have been incredibly challenging to implement due to poor operation of the system, major backlogs in maintenance, poor water use practices of water users and general lack of maintenance of the water supply infrastructure. Upon commencement of subsequent intervention programmes, the project team was tasked with resolving intermittent water supply problems and ensuring all customers are provided with a 24 hour supply prior to being able to implement WDM interventions. Adequate 24hour water supply is a prerequisite for effective metering and billing and must be attained prior to implementing certain WDM interventions such as pressure management. Achieving 24 hour pressurised water supply is often difficult in these systems due to the wastage through garden watering, inefficient water use and poor condition distribution networks. Closed valves in the system play a huge role in creating low pressure / intermittent supply in certain areas. After the intermittent supply problems were addressed, the overall water consumption increased in some areas which in turn was of concern to the various managers within the local Municipality.

Due to a combination of the reluctance by residents to pay for their water services and the inability of the municipality to implement an efficient metering and billing system, there remains no incentive for the consumer to fix internal plumbing leakage which is by far the greatest source of water wastage in the area. It is estimated that the internal plumbing leakage for Sebokeng and Evaton is in the order of 50 000 m^3/day or 18million m^3/annum.

Addressing the internal leaks can be achieved in a relatively short period but is not being tackled since council policy does not allow leaks to be repaired by council personnel on private properties. Introducing a proper metering and billing system will encourage consumers to fix internal leaks and conserve water but will take at least 10 years to implement since this will also require major reticulation upgrades, installation of meters, an operational metering and billing system, capital investment and political support. The magnitude of the problems being experienced in the area are evident from the example of one local hostel which provides very basic accommodation for individuals living in the area which has an average monthly consumption of 52 000m^3 for the 672 units. These single roomed dwelling units each use an average of 77m^3/month despite the fact that there is no garden watering and several of the units on the upper levels do not receive water.

This paper will elaborate on some of the problems encountered through the implementation of the Emfuleni water demand management strategy. The strategy focuses on technical, social, institutional, and financial aspects. These all pose challenges at political, financial, institutional capacity and customer levels. The paper will illustrate how the various interventions were implemented using labour intensive construction methods which created in excess of 350 local jobs and what benefit and saving was achieved through these interventions.

Introduction

The Emfuleni Local Municipality is situated in southern Gauteng and supplies water to a population of 757 555 with a daily consumption of approximately 200Mℓ / day. The municipality is comprised of the following towns; Vanderbijlpark, Vereeniging, Sebokeng, Evaton, Sharpville, Boiphatong and Bophelong. The municipality is characterised by high water losses and limited cost recovery. Municipal debt stood at R2.3billion in April 2008. Water losses for the system are estimated at 34% of the system input volume. If the non-payment for services are included this number goes up to 53%.

Emfuleni has often been in the news for sewage spills into the Vaal River system from their various sewage treatment plants. The reason for these spillages is the combination of issues; old malfunctioning infrastructure, lack of skilled resources and lack of treatment capacity. One of the key reasons for the lack of capacity is due to the high levels of non-payment and subsequent high levels of internal plumbing leakage. The internal plumbing leakage impacts directly on the sewage treatment plant. Despite several upgrades on all the sewage treatment plants in the past few years, the municipality is now embarking on the construction of an R 800million regional sewage treatment plant to address the capacity problems in the area.

This paper will explain the problems encountered with the implementation of the Emfuleni water demand management strategy. The strategy focuses on technical, social, institutional, and financial aspects which pose challenges at political, financial, institutional capacity and customer levels. It will illustrate how the various interventions implemented using labour intensive construction methods which created in excess of 350 local jobs and what benefit and savings were achieved through these interventions. It will also illustrate how water demand management could possibly impact on the deferment of the regional sewage treatment plant.

Background

The Sebokeng / Evaton Performance Based Pressure Management Project, commissioned in June 2005, has been the most significant WC/WDM project in the area and has saved the municipality an average of 10million m^3/annum of water for the past three and a half years and is still fully operational. The municipality and Department of Water Affairs (DWAF) have invested in subsequent projects but unfortunately the municipality has not yet embarked on a major WC/WDM project to reduce their losses and non-revenue water mainly due to political instability and insufficient resources.

Following the pressure management project undertaken in Sebokeng and Evaton implemented to decrease the water losses, the Water Services Unit of Emfuleni Municipality Metsi-a-Lekoa in partnership with the Department of Water Affairs and Forestry launched a full scale water demand management programme to further decrease leakage and wastage in what remained one of the most concentrated pockets of leakage in the country. The programme was developed and intended to be implemented as a long term strategy to address leakage and inefficient water use over a 5-25 year period.

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During the course of the programme several pertinent problems or challenges both of a technical and social nature were identified which the programme attempted to address and were as follows:

- Very high and very low pressures in some of the areas resulting in excessive leakage or intermittent supply;
- Profuse internal plumbing leakage resulting from poor quality household fittings and poor maintenance of domestic plumbing fixtures;
- Poor maintenance of water and sanitation infrastructure;
- Infrastructure buried and inaccessible;
- Excessive unreported or unfixed leaks;
- Inadequate non domestic and domestic metering;
- Inaccurate and inconsistent billing system;
- Low levels of payment for water services;
- Excessive garden irrigation; and
- High levels of water wastage by domestic consumers.

The technical interventions implemented to address the above mentioned included the preparation of a water balance, sectorisation and bulk metering, pressure management at zone level, the purchase and installation of logging and controller equipment, leak detection and repair, reticulation refurbishment, non domestic consumer metering, retrofitting of on-site plumbing, residential consumer metering and refurbishment of reservoirs. Running parallel and providing support to the technical interventions was a social intervention programme, aimed at addressing inefficient use of water by consumers and the identification of problematic areas and critical challenges in order to direct resources to where they were most needed.

The Social programme included the appointment of 50 Water Services Assessors, preparation of educational material, a schools awareness programme, a community awareness programme, water wise gardening programme, removal of wasteful plumbing devices and stakeholder participation. More details on the social intervention programme is presented in the paper, Public Participation and Education in Water Demand Management (Siqalaba, et al, 2009).

Approach

Initially when the second phase of the project started, a list of twenty four tasks was identified in conjunction with the municipality and DWAF. These 24 tasks covered technical, financial, social, and institutional aspects. Some of these tasks were abandoned during the implementation due to budget constraints. It was also felt that the team should rather focus on completing the existing tasks than taking on too many.

Water demand management cannot be implemented without the support of the client, especially the management and operations staff. Their commitment and support are critical in the successful completion of any such project. In addition to their support their knowledge of the area must never be under estimated and was critical in identifying and resolving some of the key issues.

In addition to saving water and reducing losses the project had the following key focus areas :

- Optimal use of local labour and suppliers;
- Specification of labour intensive construction methods;
- Capacity building through the appointment of three local civil engineering students; and
- Employment of local water services assessors to promote public awareness on WC/WDM

Key Results from the WDM interventions

Although the project did not manage to address all the problems, significant progress was made on the following tasks.

Leak detection and repair

Due to the current lack of skilled human resources within the municipality, it was decided not to set-up dedicated leak detection teams. Instead, three contractors were appointed to clean water supply infrastructure and report on any visible leaks found. Their brief was as follows:

- Locate water infrastructure such as isolating valves, hydrants and meter boxes as indicated on drawings;
- Clean the inside of boxes and chambers;
- Clean the area around boxes and chambers to clearly expose it;
- Mark missing infrastructure on maps;
- Record leaks and report back to the client for repairs;
- Ascertain the condition of municipal water infrastructure;
- Generate employment; and
- Improve the level of service to each individual customer.

This approach proved very successful and has the following advantages:

- 11 248 Consumer meters, valve and hydrant boxes were located and cleaned;
- Consumer meters can now be read;
- Approximately 544 visible leaks were detected thought the process and reported to the Municipality;
- Local emerging contractors were awarded meter cleaning contracts and generated substantial employment through the exercise.

Figure 1: Dirty Meter Chamber

Figure 2 Cleaned meter box

The Water Services Assessors appointed to promote water use efficiency identified an additional 8170 leaks over a nine-month period just by visual inspection. Of the 8170 leaks reported, almost half were leaking taps and toilets inside the properties.

Pressure management

There is enormous scope for pressure management in the municipality as was shown by the Sebokeng / Evaton pressure management project. In addition to the major pressure management installation, there is additional scope in the low lying areas of Sebokeng / Evaton, the whole of Vereeniging (supplied directly from Rand Water), Ironsyde, Debonairs Park, Eatonside, Palm Springs, Stretford, Sharpville, Thepiso, Boipatong and Bophelong.

The first pressure management task was to service all the existing PRV's in the system, standardise the pipework (pipe rail and pilot) and secure the chambers. In addition, 15 smart controllers were installed on key PRVs to reduce the pressures during off peak demands. Furthermore, GSM pressure loggers were installed at critical points through out the system to monitor pressures at these points. Approximately 45 pressure-reducing valves were refurbished and are currently in the process of being commissioned.

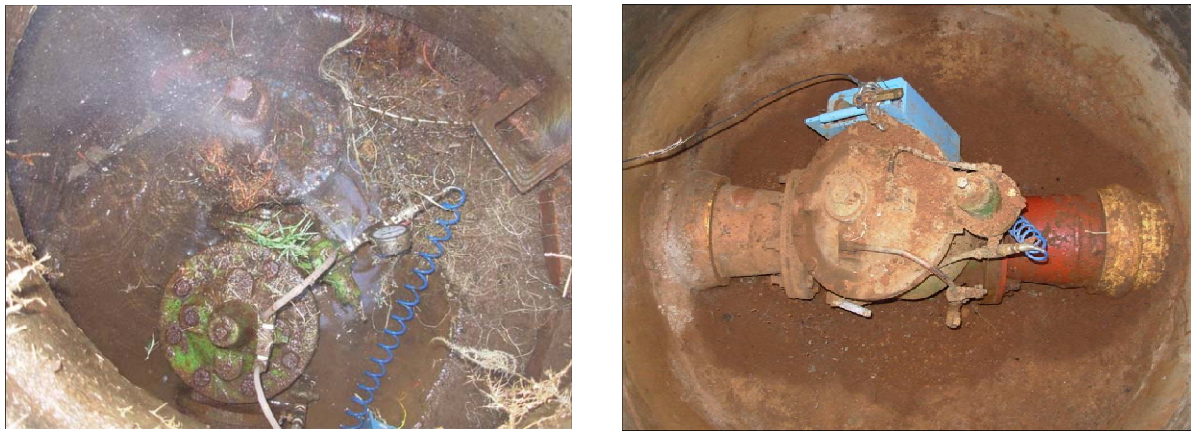

Figure 3: Pressure reducing valve installations prior to refurbishment

Training was provided to selected staff members on the operation and maintenance of control valves. The initial training was followed-up by hands-on training with the selected staff members by assisting them with the refurbishment of the valves.

Reticulation upgrades

The municipality identified a 300mm river crossing in Small farms, which had been washed away on numerous occasions, as an urgent reticulation upgrade that was required. This is an example of several reticulation upgrades in the area to improve the level of service.

Figure 4: Thrust block to anchor pipeline

Figure 5: River crossing Completed

Non-domestic consumer meters

In an effort to increase revenue, it was decided to audit all non-domestic consumers in Tshepiso,

Sharpeville, Bophelong, Boipatong, Sebokeng and Evaton and ensure they are properly metered and billed. The key results from this exercise are summarised as follows :

- 350 non-domestic consumers were identified;
- schools, clinics, formal business and government buildings formed the focus of the exercise;
- 220 of the consumers do not have account numbers;
- 140 of the consumers have un-metered connections;
- 14% of the existing meters were not working; and
- Most consumers reported that they do not receive a water bill.

The municipality is in the process of updating the treasury database with the results from the audit.

Reservoir condition assessment

The Vanderbijlpark reservoir complex consists of four reservoirs and two water towers with a total storage capacity of 110.2Ml. Two of the reservoirs at this site and both the water towers are leaking. The water towers are in urgent need of repair with visible concrete spalling on the support columns.

The Sharpville reservoir complex consists of two reservoirs and one tower, with a total storage capacity of 20.76Ml, none of which are operational. All the reservoirs and the tower are leaking and the pump station is constantly submerged.

Having completed this, task this client is now fully aware of the urgency required for fixing and reinstating the reservoir sites to their original condition. The added benefit of reinstating the Sharpville reservoir site includes 48 hour storage security, eliminating the peak-flow on the bulk supply line and improved level of service.

Johandeo pilot area

Johandeo is situated in the south western corner of Sebokeng. The area has a single supply and is an isolated area with no boundary connections. It consists of approximately 2100 stands supplied by a formal water supply network. Half the stands (older area) are supplied through a mid block water mains, with no domestic meters. The remainder of the area is supplied by street side reticulation and domestic meters.

Johandeo is located at one of the lowest points in the Sebokeng supply network and has good potential for pressure management. Pressure management could not however be implemented due to bulk supply and internal network problems. The project team resolved the bulk supply to the area by locating and opening a closed valve on a 300mm uPVC pipeline constructed in 2002 to service Johandeo and future development to the South of Johandeo. This increased the minimum daytime pressure at the inlet to Johandeo from 1bar to 3.5bar while the off peak night time pressure increased from 2.5bar to 6bar.

Subsequent to resolving the bulk supply problem, the project team set about locating, and opening and upgrading internal network reticulation valves. This had a huge impact on resolving low pressure problems in the network. Low pressure problems in the network were mainly due to closed valves, reticulation pipes not being connected to the main supply line, small diameter (<50mm) pipes installed instead of the designed 110mm pipes as indicated on as-built drawings and excessive leakage.

Once the bulk supply and reticulation problems were resolved, the pressures stabilised at the expected pressures and it was possible to implement pressure management. The results from each intervention were properly recorded and shown in **Figure 8**. Each household was visited by the project team as part of the community awareness intervention programme. During this exercise, it was found that more than 80% of the households have internal leakage problems.

Figure 6:Cistern running permanently

Figure 7:Tap running permanently

Because of the interventions, the average consumption reduced from 111m^3/h to 80m^3/h resulting in a savings of 31m^3/h or 744m^3/day. The Minimum Night Flow (MNF) was reduced from 94m^3/h to 59m^3/h.

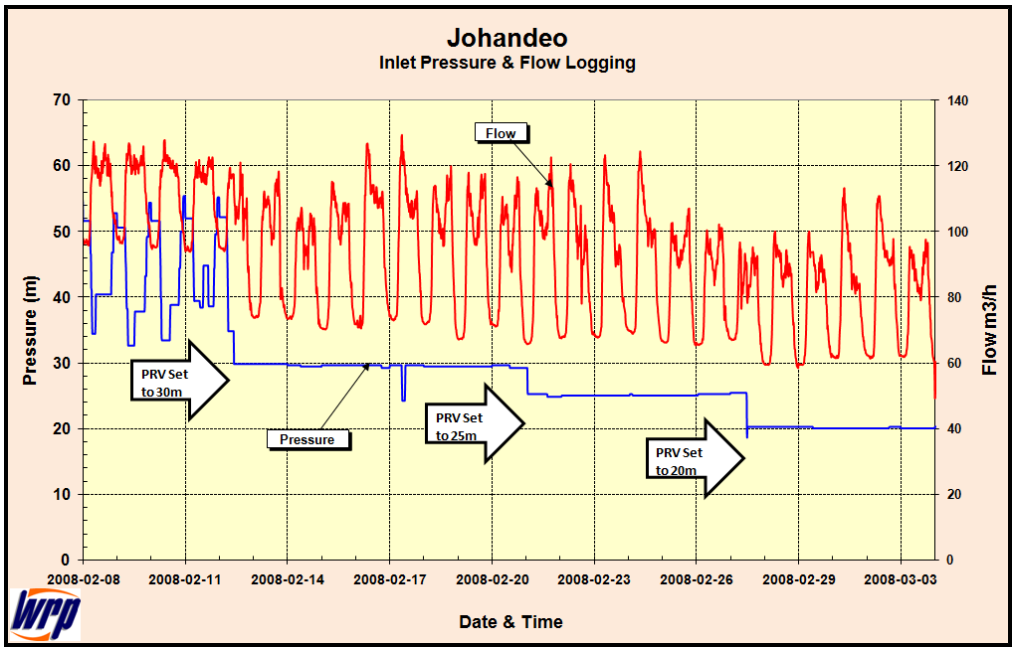

Figure 8: Johandeo flow and pressure logging at inlet point

Benefits from the programme

- Resolved intermittent supply problems to several areas through reticulation upgrades and reinstating water supply infrastructure;
- Created in excess of 400 local jobs through infrastructure cleaning, labour intensive construction methods and community awareness;
- Improved the pressure distribution in several areas through advanced pressure management;
- Identified key problem areas which must be urgently addressed;
- Improved understanding of the water loss problems in the area;
- Achievement of significant saving in several areas;
- Used unsophisticated leak detection methods to identify in excess of 9000 leaks;

Conclusion

The Emfuleni water loss project has made significant impacts on the operations, maintenance,

water losses, consumer behaviour and social upliftment in the area. Pressure management, reticulation upgrades, leak detection and repair, community awareness and all the other water conservation and demand management interventions do have a positive impact on reducing losses in the area. One of the key leakage areas is on internal plumbing in properties and current policies prohibit the fixing of leaks on private properties.

Although this policy is understandable and it is realised that proper metering and billing would resolve this problem, the municipality will not be able to resolve the metering and billing problems in the next ten years. In the mean time, major infrastructure upgrades are required to cope with the demand and the leakages.

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