

## KHAYELITSHA LEAKAGE REDUCTION THROUGH ADVANCED PRESSURE CONTROL

### SUMMARY PARAGRAPH

The Khayelitsha Pressure Management Project includes the largest Advanced Pressure Control installation in the world and has been recognised as “World’s Best Practice” by numerous respected international experts. The project has been hailed as a great success by the City of Cape Town and has been acknowledged not only for its Technical Excellence but also for its contribution to Environmental Sustainability and improving the level of service to the 450 000 inhabitants it serves. The project demonstrates the role of the Civil Engineer in serving the community and providing innovative solutions to a serious problem experienced throughout South Africa and in many other parts of the developing world. The project which cost R2.5 million to construct is already saving more than R18 million per year through reduced leakage and saves approximately 10% of the water to be supplied by the new Berg River Scheme (to cost R2 billion).

Through this project it is now possible to provide lower water pressures to the Khayelitsha residents thus reducing their monthly water consumptions to levels which they can afford to service.

The following quotes bear testament to the significance and success of the project:

***This innovative water saving project is world class and the best pressure management system in existence. I have been in charge of WDM implementation systems all over the world and would class the Khayelitsha project as a major step forward in saving water. I will be advising all water supply managers and engineers in Australia to visit this impressive project.***

Mr Tim Waldron, CEO of Wide Bay Water in Australia: June 2002

***Absolutely World Class engineering project which demonstrates social, environmental and economic benefits of water use efficiency***

Mr Allan Mayne from the Queensland Government, Department of Sustainable Industries: June 2002

***I believe the Khayelitsha Pressure management Project is more than one of the most important water conservation projects to have taken place in South Africa. It is also one of the most significant projects of its type worldwide.***

David Erleigh: Head of Cape Town's Executive Committee speaking to press and TV representatives on Tuesday 4 June 2002 – page 8 Cape Argus, 5/6/2002.

## 1 INTRODUCTION AND BACKGROUND

Khayelitsha is one of the largest townships in South Africa and is located approximately 20 km from Cape Town on the Cape Flats. The area covers 24 km<sup>2</sup> and provides housing to 450 000 people. There are 43 000 serviced sites with both internal water supply and water borne sewage and a further 27 000 squatter shacks supplied from communal standpipes. The area has been expanding since the early 80's when the first settlements were established with the result that the basic water distribution infrastructure is relatively new and in good condition.

Khayelitsha is supplied with potable water from Blackheath Reservoir situated at an elevation of 110 m through two large water mains of 450mm and 1065 mm diameter. The average pressure at the supply point is approximately 80m which is excessive and has caused considerable damage to the household plumbing fittings.

In April 2000 the water supplied to Khayelitsha was in excess of 21 million m<sup>3</sup>/a with a Minimum Night Flow (MNF) of 1 600 m<sup>3</sup>/hr (sufficient to fill an Olympic sized swimming pool every hour). From the analysis of the MNF as well as the night-time sewage flows, it was established that approximately 1 200 m<sup>3</sup>/hr was leaking to the sewer system indicating that the key problem was household leakage and not burst pipes in the reticulation system.

The Khayelitsha Pressure Management Project was therefore initiated in June of 2001 by the City of Cape Town and the Project Team to improve the level of service to the Khayelitsha community by reducing the excessive water pressure in the reticulation system.

## 2 SCOPE OF THE PROJECT

Following a preliminary investigation, the Project Team decided that the most practical approach would be to cut into the two water mains and commission two pressure management installations, each with several sections of small diameter pipe and the appropriate sized PRV's. In this regard it was decided to install three 300mm diameter sections in the 1065 mm diameter main and two 200 mm diameter sections in the 450 mm diameter main as shown in **Figures 2 and 3**. It was also decided to introduce advanced pressure control which involves the commissioning of specially imported electronic controllers to manipulate the pressure into the area during off peak periods. Through the use of such controllers, it is possible to achieve larger savings than those obtained through the PRV's on their own.

## 3 PROJECT IMPLEMENTATION

Having agreed on the approach and the conceptual design for the two PRV installations, the most difficult stage of the project was the construction of the chambers and the installation of the mechanical equipment. Most of the problems encountered were anticipated to a large degree but others could not have been predicted such as the floods of July and August 2001 which were apparently two of the wettest months in the past 100 years.

Some details of the 1065 mm diameter installation are shown in **Figures 4, 5 and 6** from which the size and complexity of the project can be seen.

**Figure 4** shows the high water table and wet conditions experienced during construction. **Figure 5** shows the construction of the chamber walls and roof while **Figure 6** shows some of the pipe details inside the chamber.

## 4 RESULTS FROM THE PROJECT

The water supply situation in April 2000 is depicted in **Figure 7** from which it can be seen that the average daily flow into the area was 2 500 m<sup>3</sup>/hr (21 million m<sup>3</sup>/a of which 75 % was wastage) with a MNF of 1 600 m<sup>3</sup>/hr.

The first phase of pressure management involved the installation of the new pipes and PRVs with the pressure reduced under fixed outlet pressure control: i.e. the pressure was reduced throughout the whole day using standard PRV pressure reduction without any additional reduction from the controllers. The impact of this can be seen in **Figure 8** which shows that the average daily flow was reduced to 1 790 m<sup>3</sup>/hr with a MNF of 1 180 m<sup>3</sup>/hr.

The second phase of the pressure control involved using the electronic controllers (Advanced Pressure Control) to provide further pressure reduction during periods of low demand. The implementation of the Advanced Pressure Control is still continuing and will be completed towards the end of 2002. The results achieved so far indicate that the MNF has been reduced by a further 430 m<sup>3</sup>/hr (to 750 m<sup>3</sup>/hr). It is too early to predict the annual savings achieved using the pressure controllers, however, the Project Team is confident that the eventual savings will be greater than the current estimate of 6 million m<sup>3</sup>/yr and possibly in excess of 10 million m<sup>3</sup>/yr .

## 5 LOCAL COMMUNITY INVOLVEMENT

The Khayelitsha community was involved at each stage of the construction and was continually informed of progress and possible water shortages through continuous liaison with an appointed RDP officer. All labour used on the project was sourced locally whenever possible and organised through the local labour forum to avoid any complaints of favoritism or nepotism. It was through such measures that the project was constructed and commissioned within the confines of a squatter area without one incidence of intimidation, vandalism or theft. The local community was used whenever possible to assist with the construction of the installations and painting of the installation as shown in **Figure 9**.

## 6 SUMMARY AND CONCLUSIONS

The Khayelitsha Pressure Management project was initiated directly as a result of various submissions made to Council by the Project Team who provided sufficient

motivation and evidence to support the investment of almost R3 million into the project.

Although there are already several advanced pressure control installations in South Africa, this project is by far the largest and most significant to be undertaken in the country. It is the first time in South Africa that an attempt has been made to reduce the pressure over such a large area from a single installation and the actual savings achieved are the highest in the world from such an installation.

The approach used in the Khayelitsha installation is simple and innovative. The savings achieved have exceeded both the Client's and the Project Teams' most optimistic expectations. The fact that the installation has been constructed and commissioned within such a short period of time and under such difficult and often dangerous conditions is of credit to both the Project Team and the Client's representatives working in Khayelitsha as well as the residents of Khayelitsha.

In conclusion, the Khayelitsha Pressure Management Project is not only one of the most important water conservation projects to have taken place in South Africa but is also one of the most significant projects of its nature worldwide. It has already attracted considerable attention from overseas specialists and is set to gain further prominence through various submissions and presentations at international conferences etc. It was completed to the full satisfaction of the Client within the available budget and time period allowed for the project and has paid for itself in the first two months of operation.

## **7 100 WORD PRESS RELEASE (NOT PART OF 1600 WORD SUBMISSION)**

The Khayelitsha Pressure Management Project is one of the largest and most successful pressure management projects in the world. It reduces and controls the water pressure into Khayelitsha which was previously very high resulting in damage to household plumbing fittings and massive household leakage. The water pressures throughout Khayelitsha have now been reduced to normal levels and the leakage levels have also dropped substantially. The water savings are in excess of R18 million per year and the consumer water bills will be reduced accordingly, leading to a situation where the residents may soon be able to pay for their water.

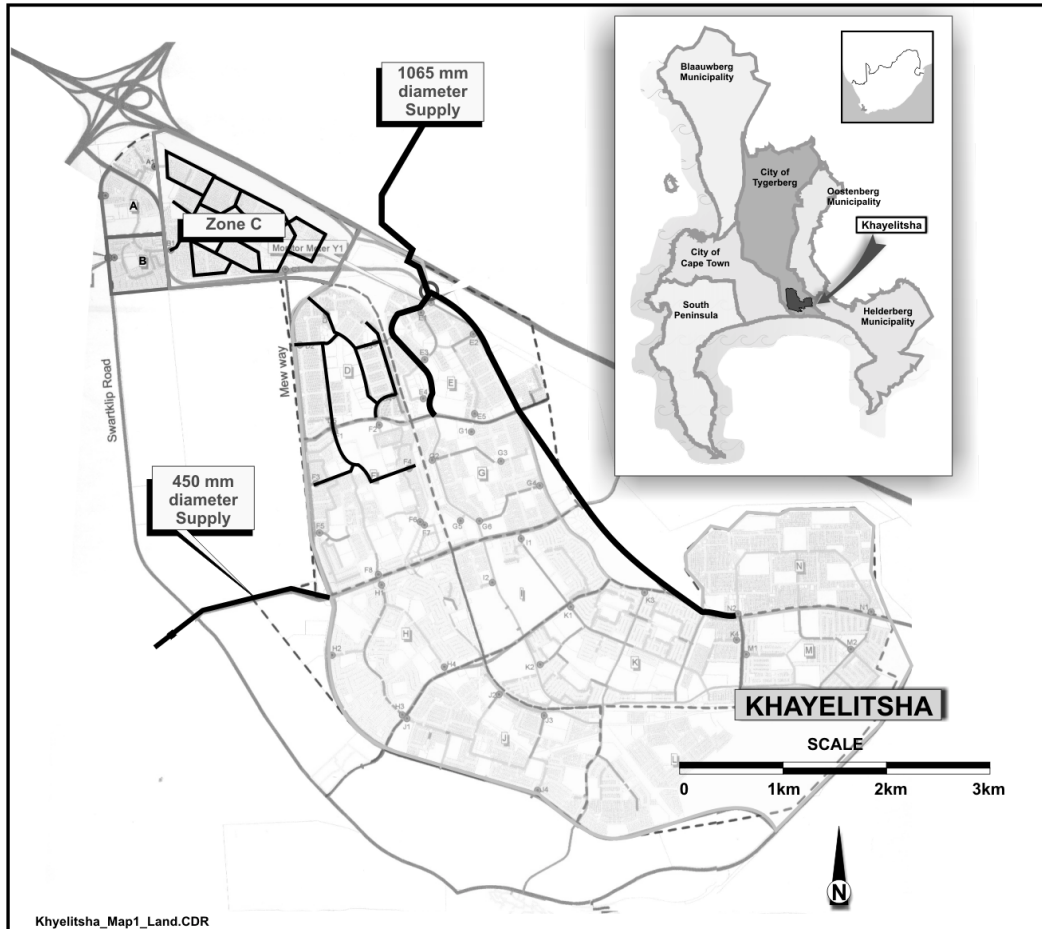


Figure 1: Location Map for Khayelitsha

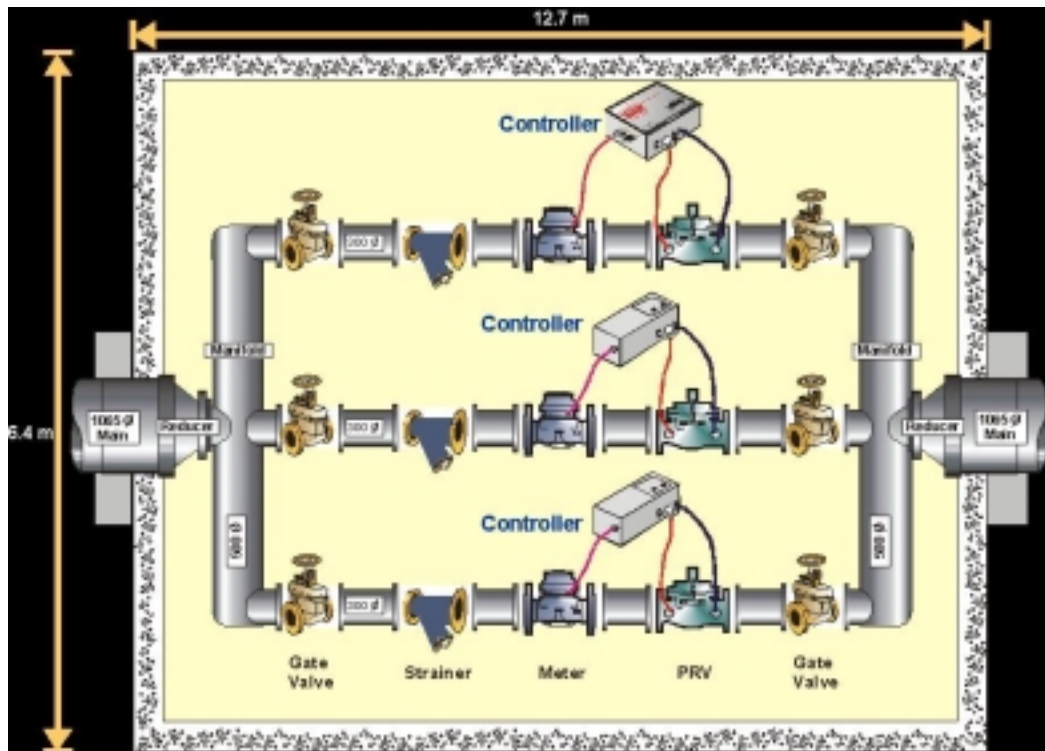


Figure 2: Schematic Layout of the 1065 mm diameter Installation

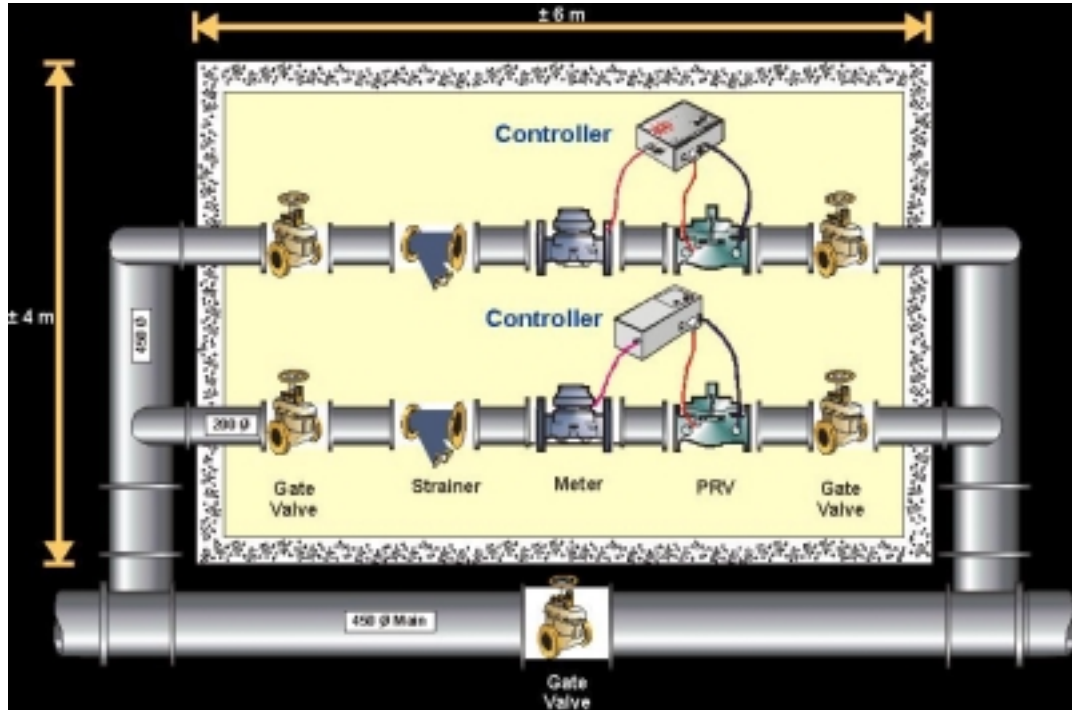


Figure 3: Schematic Layout of the 450 mm diameter Installation



Figure 4: Excavating and De-watering the Site for the 1065 mm Chamber



Figure 5: Partial construction of the 1065 mm diameter Chamber



Figure 6: Internal View of a Portion of the 1065 mm diameter Chamber



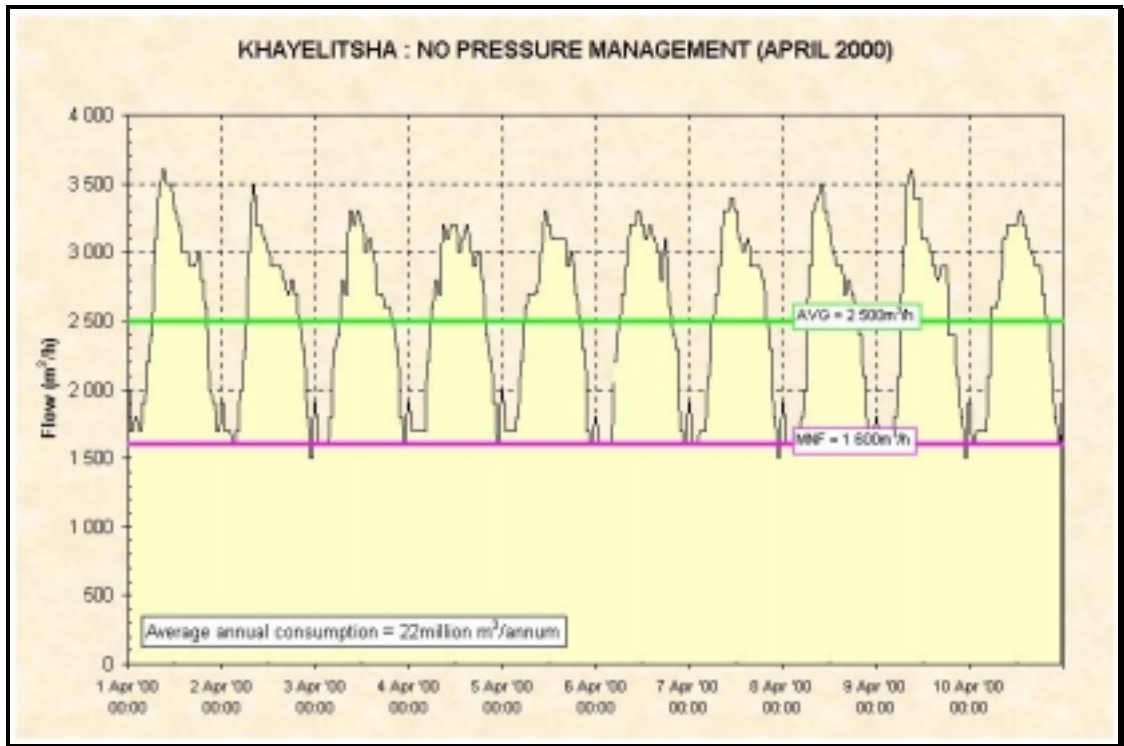


Figure 7: Flow Situation in April 2000 before any Intervention

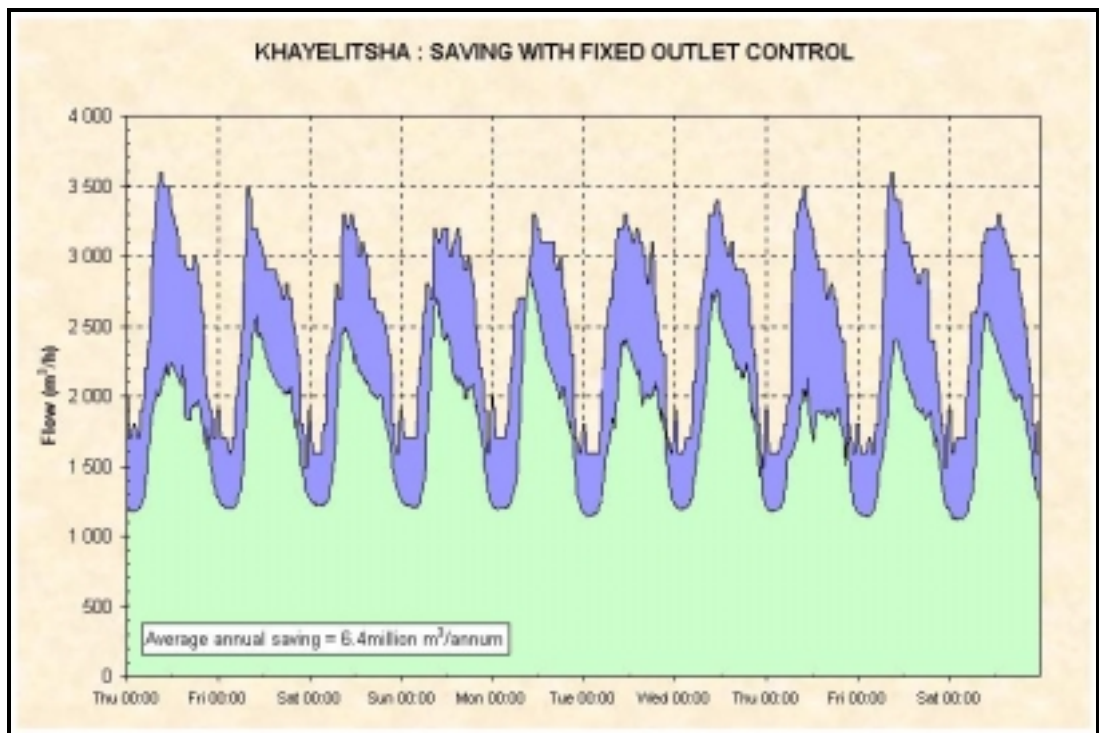


Figure 8: Inflow to Khayelitsha from Fixed Outlet Pressure Control



Figure 9: Local Community painting the 1065 mm diameter Chamber



Figure 10: Completed Chamber in Khayelitsha