

## NELSON MANDELA BAY MUNICIPALITY NON REVENUE WATER PROGRAMME – “PROVIDING SUSTAINABLE WATER SUPPLY SERVICES TO NELSON MANDELA BAY”

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### ABSTRACT

Five years ago, Nelson Mandela Bay Municipality (NMBM) was faced with the dual challenge of Non-Revenue Water (NRW) levels of over 40% and the onset of a severe drought. After receiving an ultimatum from the Department of Water Affairs (DWA) to significantly reduce NRW levels, the Municipality embarked on a programme that would radically change the way in which its water supply system was managed.

From the outset, the need for a water management system was identified and a suitable system implemented which integrates the GIS, billing and customer information, infrastructure development and asset management as well as operations and maintenance.

A Master Plan for the provision of water services in the short, medium and long term was then developed. Following this, and as a result of a Water Research Commission Study on water loss in municipalities (commissioned by DWA), an Integrated Water Resource Management Strategy was developed. This strategy provided the necessary impetus for the Municipality to begin implementing a comprehensive water demand management and water conservation initiative.

In order to significantly reduce the NRW, the Municipality then embarked upon various internal programmes (including a comprehensive meter replacement and infrastructure upgrade programme) and appointed professional service providers to implement the following: Education and Awareness Campaign; Assistance to the Poor Programme (ATTP); School Leak Repair, Asset Management Database and Infrastructure Backlog and Water Loss Programmes.

Through targeted interventions, the NRW program is reducing non-revenue water, thereby increasing the profitability of the water service provider. The utility is as a consequence been able to improve allocation of resources to the upgrade and extension of the water supply system. The NRW programme interventions have also had direct impact on service delivery by improving the reliability of supply and level of service to customers.

### BACKGROUND TO NON-REVENUE WATER

The IWA water balance and its various elements provide standard, internationally accepted terminology for water loss. By adopting a comprehensive auditing procedure to regularly update the water balance for NMBM, progress in reducing non-revenue water can be monitored and priority areas for intervention can be identified. The three components of Non-Revenue Water are apparent losses, real losses and unbilled authorised consumption.

#### Apparent Losses

Unauthorised consumption – illegal or unauthorised connections to the water supply network results in water theft. Early identification, removal and prosecution, through the application of the bylaw, should be prioritised to minimise apparent losses.

Customer meter inaccuracies – factors contributing to meter inaccuracy include age, consumption, water quality and correct installation. Quality control for new installations, meter audits and meter replacement programmes can significantly reduce apparent losses attributed to meter inaccuracies.

#### Real Losses

Leakage on transmission and distribution mains, overflows at storage tanks and on service connections up to point of the customer meter – establishing and monitoring water supply zones within the supply network, active leak detection, customers reporting leaks through a call centre combined with repairs being carried out timeously will minimise real losses.

#### Unbilled Authorised Consumption

Unbilled metered consumption and unbilled unmetered consumption – a customer meter audit and subsequent update of the billing system should ensure that all customers are being metered, the meters are being read and that meter readings are being correctly captured and consumption accurately billed.

### DEVELOPING A WATER MANAGEMENT “ROAD MAP”

Providing sustainable water supply services to Nelson Mandela Bay requires an integrated management approach that takes the various elements including source, supply and demand into consideration. A dynamic strategic approach is required as these elements are subject to change. The following key components provide direction in terms of the water management road map for Nelson Mandela Bay.

#### Water Management System

The Engineering Design and Management System for the water and sanitation services of the municipality has been in operation for a number of years. This system has successfully integrated many of the management components including, GIS, complaints database, flow networks, billing information, asset management and operations and maintenance. The system also provides management information and reports that monitor water demand trends.

#### Water Master Plan

To analyse and evaluate historical, present and estimated future water usage by the NMBM for the period 2010 to 2030, taking into account the water needs and the impacts on water supply that may follow from various reports and planning documents.

The Water Master Plan was compiled for the complete water service operating system with the following key outcomes:

- **Supply Side Analysis and Implementation Plan** – A detailed evaluation of water supply system long term yield and peak supply capacities versus future demand. This included the treatment, transfer and pump station boosting capacities.
- **Demand Side Analysis and Implementation Plan** – An evaluation at a planning level of present and future reservoir supply zones based on economic growth points and housing demands identified by NMBM 10-Year Housing Plan. New reservoir zones and proposed infrastructure were identified, sized and located to economize on present infrastructure capacities. This was performed with additional input from a team of 9 other consulting firms, appointed for the planning and design of specific supply zones identified by the municipality as immediate growth points within its area of supply.

#### Algoa Reconciliation Study

The Algoa Reconciliation Study developed operating rules for the NMBM in 2008 to assist in decision making. The operating rules examine water availability, current water use and trends, projected use and a water

balance. Different scenarios are presented. The operating rules were used as a guideline to NMBM, Gamtoos Irrigation Board (GIB) and DWA to make important decisions and the model was revised every three months or when there was a change in water availability. Regular meetings and consultation take place between the three institutions.

The study set a target for a reduction of consumption of 37.5 Ml/day by implementing WC/WDM strategies over five years.

### Integrated Water Resource Management

An Integrated Water Resource Management Strategy was prepared for the municipality in 2009 followed by a business plan. This document became the guideline for all the interventions that followed.

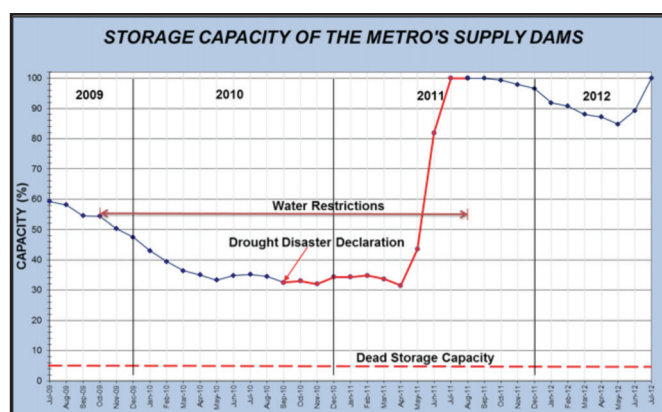
The strategy was developed into the following categories:

- Technical interventions;
- Financial measures;
- Legislative/regulatory measures;
- Social interventions;
- Institutional interventions.

### Drought Strategy

Owing to the declining levels in the water storage dams in 2009 and the subsequent two year severe drought (see Fig 1 below), a drought strategy was included in the IWRM Strategy. The strategy included:

- Establishment of a Water Monitoring Committee;
- Regular meetings with DWA, Lower Sundays River Water User Association and GIB to consider the operating rules of the Algoa Water Supply System;
- Vigorous awareness campaign through publicity and marketing, including media and print;
- Applying three sets of stepped tariffs for different phases of the drought;
- Engaging industry, such as wet industries, nurseries, swimming pool and hotel industries;
- Engaging the Department of Education on water wastage at schools;
- Preparation of an Emergency Plan;
- Implementation of Water Services Bylaws.



**Figure 1: Graph of NMBM storage capacity (July 2009 – July 2012)**  
**Emergency Plan**

The Emergency Plan was prepared by the municipality in conjunction with DWA and included:

- Drought Campaign for the reduction of water consumption;
- Maximisation of supply of water from Gariep Dam (Orange Fish Transfer Scheme);
- Desalination of Sea Water from the Swartkops River;
- Investigating local groundwater schemes;
- Water Conservation and Water Demand Management;

- Schools Water Loss Programme;
- Low Income Housing Water Loss Programme;
- Water loss detection;
- Fast track of the Nootgedagt/Coega Low Level Scheme;
- Accessing low level storage in Impofu Dam;
- Promoting the use of rainwater tanks.

The main schemes are the Nootgedagt/Coega Low Level Scheme and the Swartkops Desalination Scheme. Government funding was required prior to contracts being awarded. Although the NMBM prepared a business plan and made presentation to National Treasury for R1.6 billion, only R450 million was approved. It was decided to spend all of these funds on the Nootgedagt/Coega Low Level Scheme pipeline, with phasing of certain elements. Two pipeline contracts were awarded in April 2011 and construction commenced in July 2011 and completed in early 2013. The NMBM have been liaising with the National Treasury for further funding to complete the scheme.

### Water Conservation and Water Demand Management

To implement WC/WDM interventions requires participation of many role-players such as different municipal directorates and sub-directorates, certain state departments, service providers and professional service providers which all needs to be managed collectively. The Non-Revenue Regular meetings are held to coordinate activities, monitor progress and deal with issues that hinder progress.

### THE NON-REVENUE WATER PROGRAMME

#### Identifying and prioritising interventions

The priority areas identified for intervention as part of the Non-Revenue Water Programme (previously known as the Water Loss Programme) are as follows:

- Marketing and Publicity;
- Assistance to the poor programme;
- Water complaints and leaks;
- Zoning;
- Water loss services;
- Water meter management;
- Pressure management.

The prolonged drought and subsequent constraint on the water supply system (2009 to 2011) provided the impetus for the Municipality to implement these interventions.

#### Marketing and Publicity

The most important strategy in WC/WDM is the awareness through publicity. The publicity campaign has two components, namely publicity through the media and radio, erection of display boards, preparation and distribution of leaflets, brochures, decals and posters. This campaign was initiated in September 2009 by the Executive Mayor with a media launch.

The focal point of the campaign was the development of water drop mascot named Thontsi, that appeared in most advertisements, display boards and literature, and the theme for the campaign, "Play your part, be water smart".

#### Community Outreach

Under the lead consultant, a social consultant was appointed for each zone cluster. Ward Councillors nominated fieldworkers to be trained and to do door to door campaign in all the residential areas throughout the Municipality. The fieldworkers were provided with branded clothing, cap and slingbag. The fieldworkers educated residents about water conservation, explained the workings of the municipal account and meter readings and noted any leaks and complaints.

Training of the fieldworkers commenced in November 2009 and the door to door campaign started thereafter. By February 2010 approximately

211 400 households had been visited which represents 95% of the total. The campaign provided temporary employment to 510 persons.

### **Schools Campaign**

The schools campaign commenced in February 2010. The social consultants and their facilitators were trained over three days by an NGO. It was decided to undertake the campaign in phases of 54 schools (9 per cluster). A programme, lesson plans, water material kit, competitions were included in this intervention. The programme needs to continue until all 362 schools within the NMBM area are covered. Awareness must go hand in hand with the school leak repair programme. This is an important intervention as learners can influence the behaviour of their parents and they themselves become future water wise consumers.

### **Assistance to the Poor Programme**

Internal leaks of ATP houses are passed to a team of consultants who arranges training of unemployed persons to undertake the repairs and the Municipality to supply the material. These repairs are only undertaken at households registered as ATP (Assistance to the Poor programme). This programme commenced in 2005 but was accelerated in 2009. Material is supplied via the municipal stores. This is most cost effective and ensures the correct standard being applied.

Leak repair projects in houses are deceptively difficult to implement in that they typically entail:

- repairing leaks in several thousand houses and properties all over the municipal area;
- managing the procurement and supply of tools, equipment, transport and thousands of material parts;
- planning and managing the daily execution of works in densely populated and often high risk areas;
- ensuring that technical quality and specifications are adhered to through conducting extensive inspections of the work;
- ensuring that stakeholder and community involvement and dynamics are properly dealt with;
- managing the recruitment, training and engagement of a typically unskilled workforce;
- monitoring and evaluating the impact of the project often with limited resources (eg water meters);
- ensuring sustainability after completion of the project through continued leak repairs and sound water demand management.

Leak repair projects require that they be tackled with a degree of trepidation, careful planning and stringent management and supervision.

### **Water Complaints and Leaks**

The campaign has resulted in thousands of water complaints being lodged through the water complaints call-free number and the water leaks e-mail address. These complaints are addressed by the Municipal artisans and inspectors, municipal contractors and through the Assistance to the Poor programme (ATPP).

The municipality have enlarged and improved their call free number at a new operations centre at the Linton Water Treatment Works. The centre is staffed 24 hours per day through an agency. The centre was being managed by a consultant during the drought with four telecallers to phone consumers with high water accounts. The operation call centre became so successful that it became the official call centre for all municipal complaints.

### **Zoning**

The Waterloss Programme focussed on zoning as an important part of the water system management. Drawings from the Water Management System had to be obtained of the planned water management zones. Continual meetings with the Metro staff were to establish current status and viability of the proposed zone plan and to verify zone status on-site (including

an audit of the zone valves and meter/s) and report on any remedial action that needs to be undertaken (including installation/ replacement of zone meter/s and installation/ repair of zone valves). It was important to isolate zone boundary valves and complete zero pressure tests for each area. This helped if there were any cross connections with neighbouring zones and also assisted in identifying and rectifying low pressure problems within the supply zones. At the end of each zoning exercise, up-to date as-built drawings of the established management zone were provided to the Metro and the Water Management System updated with the changes.

By analysing the water distribution system, 203 water districts were identified within the reticulation network of which 116 have district meters. The districts are essential to manage water losses in the reticulation system. A new database was created of existing meters and new meters including bulk meters are being installed. Thirty new district meter stations have recently been installed. District metering will result in water balances being undertaken per district and assist in prioritising areas for intervention.

### **Water Loss Services**

Water loss services assist the municipality by systematically identifying high physical and commercial losses within the water distribution system. Typical scope for water loss services has included the following in domestic areas:

- Determine zone discreteness;
- Undertake step-testing when required;
- Data logging of pressures and flows (assess minimum night flow/ consumption profile);
- Valve and fire hydrant audit;
- Meter audit;
- Meter Flow Test for on-site leakage;
- Leak detection (visual and sounding);
  - Mains
  - Valves & fire hydrants
  - House connections
  - Meters
  - On properties plumbing infrastructure
- Complete water balance/ NRW assessment per district or reservoir zone.



**Figure 2: Large leak entering storm water in Khayamnandi located through leak detection**

A similar approach to undertaking water loss services in Non-domestic areas has been undertaken with the exception of the meter flow test and on property leak detection. A shutdown of the known supply/s is however completed to verify that all water is metered. The results are submitted in the form of a report per supply zone to the lead consultant. Work instructions are then issued to various contractors appointed by NMBM to undertake remedial action/ repairs as required. The billing system and GIS/ plans are also updated accordingly.



### Data Logging

Data logging was carried out throughout the programme for the following initiatives:

- Monitoring of district/ zone inlet meters for:
  - zoning exercises/ drop tests
  - Leakage monitoring/ step testing/ MNF Analysis
- Pressure investigations (zoning, low/ high pressure complaints and pressure management investigations, PRV sizing and condition assessments);
- Consumption profile monitoring of industrial, commercial and institutional consumers (including meter sizing verification);
- Sewer flow monitoring (outfall sewers for zones).

A very important part of the Waterloss Services was data logging in order to establish pre- and post-intervention flows/pressures. Data logging was usually carried out for a minimum of seven days. This was done to ensure that a representative sample of data is obtained (including pressure or flows over weekends) for analysis purposes.

### Water Meter Management

The water service keeps its own database of over 217 000 water meters and the Water Management System is used to manage the meter information, meter maintenance and meter replacement programme. A realistic period to replace water meters is between 7 and 10 years. The accuracy and quality of water meters has improved due to advancements in technology. Planned meter replacement is however normally recommended every 10 years. Regular meter audits and sample testing to determine accuracy compliance in terms of legislation is however the preferable method of informing the meter replacement programme. Due to the negative impact on revenue and high nonrevenue water the replacement of old meters became urgent and resources were provided to eradicate the backlog. The Municipality has employed a number of contractors to replace water meters. This has resulted in a huge decrease in the backlog of maintenance and reduced billing volume losses from meter slippage.

### Pressure Management

Pressure management as a means of managing real losses forms a critical component of the NRW programme. There are currently approximately 80 pressure reducing valves in the water network.

The benefits of optimising the pressure within the water supply system through pressure management include:

- Reduce excess pressure/ pressure surges;
- A reduction in existing water loss/leakage rates (and the natural rise of leakage);
- A reduction in pipe failures/ bursts;
- Extending the lifespan of existing infrastructure.

An assessment of the potential for pressure management in domestic supply zones is carried out based on the following criteria:

- Areas were discrete supply zones could be established (supplied by one or two metered inlets) and that have excess pressure during part or all of the measured daily pressure profile;
- Discrete supply zones where the inlets to the area are/can be metered and have excess pressure during part of or all of the measured daily pressure profile;
- Discrete supply zones that have existing pressure reducing valves and inlet meters with potential to further reduce excess pressure during part or all of the daily supply regime.

NMBM implemented a pilot project to test various pressure management control technologies for supply zones with different pressure management requirements. Subsequent to this 14 zones have been targeted for pressure management. This includes the use of advanced pressure management control in Wells Estate. Advanced pressure management provides significant benefits over traditional fixed outlet, timed (two point) and even flow modulated control. Advanced pressure management is



**Figure 3: New pressure management installation for Bluewater Bay** able to adjust pressure smoothly in response to real-time changes in network conditions whilst always maintaining the minimum level of service required at the critical point (usually the consumer at the highest elevation). By reducing peak pressures, and ensuring slow and smooth changes in pressure, the burst rate on pipes can be reduced and the operating life significantly extended. Leakage due to excess pressure is also greatly reduced resulting in further savings.

### School Leaks Repairs Programme

The Municipality have been aware of high leakages at schools for a long time. Inspections of all the listed schools within the NMBM boundaries were conducted and assessments completed. Tenders were advertised for the initial 35 schools. To date 17 of these have been completed with a large reduction in water consumption.

### CASE STUDIES

#### Awareness and Education Programme – “Changing the Communities’ Attitude towards Water”

Awareness and Education requires good communication with stakeholders which includes consumers who are the municipality’s customers. A campaign needs a theme and clear messages. Initially consumers were distrustful of the municipality when the drought campaign started but changed once the media became involved. Consumers have become more aware of usage and the value of water as a resource.

#### School Leak Repair Programme

For the 17 schools where the leak repairs have been completed, pre-repairs average metered consumptions was 114.4 kl/hour. Since the repairs have been completed, the post-repair average metered consumptions for 14 of the 17 schools (3 schools consumption data was not available at time of writing) was 46.3 kl/hour. This is a saving of 68.1 kl/hr to the Department of Education or over R4.4 million in savings/annum. The cost of repairs for these 17 schools was R2.64 million. This is an indication the importance of this intervention with a return on investment of 8 months. Table 1 below provides a summary of the impact of the leak repair programme in the 17 schools.

**Table 1: School Leak Repair Project – Savings (Pre- and Post Intervention Comparison)**

| No. | School Name             | Leak Repair Status | Date School Repairs Completed | Billing History | Pre-Repairs Avg. Consumption | Post-Repair Avg. Consumption | Savings in Average Consumptions | Savings in Average Consumptions (R/annum) |
|-----|-------------------------|--------------------|-------------------------------|-----------------|------------------------------|------------------------------|---------------------------------|---|
| 1   | Enkwenkwezini PS        | Complete           | 10-Dec-12                     | Yes             | 26.2                         | 12.1                         | 14.2                            | R 925 607                                 |
| 2   | Canzibe PS              | Complete           | 19-Dec-12                     | Yes             | 2.2                          | 1.7                          | 0.4                             | R 28 100                                  |
| 3   | Joe Slovo PS            | Complete           | 17-Dec-12                     | No              | 4.5                          | 0.9                          | 3.6                             | R 238 246                                 |
| 4   | Phakamisa SS            | Complete           | 5-Dec-12                      | No              |                              |                              |                                 |   |
| 5   | Nokwezi PS              | Complete           | 30-Nov-12                     | Yes             | 17.1                         | 8.8                          | 8.3                             | R 541 188                                 |
| 6   | Republiek PS            | Complete           | 23-Jan-13                     | Yes             | 10.1                         | 0.8                          | 9.3                             | R 606 626                                 |
| 7   | Stephen Nkomo Pri. Sch. | Complete           | 23-Nov-12                     | Yes             | 3.5                          | 1.4                          | 2.1                             | R 139 895                                 |
| 8   | Ashton Gontshi PS       | Complete           | 24-Jan-13                     | Yes             | 2.9                          | 0.3                          | 2.6                             | R 171 409                                 |
| 9   | Ntlemaza PS             | Complete           | 13-Dec-12                     | Yes             | 3.2                          | 2.8                          | 0.4                             | R 26 693                                  |
| 10  | Mingcunube PS           | Complete           | 24-Jan-13                     | Yes             | 3.0                          | 2.0                          | 0.9                             | R 61 511                                  |
| 11  | Mzomomhle Special S     | Complete           | 30-Nov-12                     | No              |                              | 0.6                          |                                 |   |
| 12  | Bayview PS              | Complete           | 1-Mar-13                      | Yes             | 17.5                         | 6.3                          | 11.2                            | R 731 433                                 |
| 13  | Adolph Schauder PS      | Complete           | 20-Feb-13                     | Yes             | 0.2                          | 0.1                          | 0.1                             | R 5 881                                   |
| 14  | Strelitzia PS           | Complete           | 15-Mar-13                     | Yes             | 11.3                         | 2.7                          | 8.6                             | R 560 382                                 |
| 15  | Bertram SS              | Complete           | 4-Mar-13                      | Yes             | 6.2                          | 4.4                          | 1.8                             | R 116 326                                 |
| 16  | Jubilee Park PS         | Complete           | 30-May-13                     | Yes             | 0.7                          |                              |                                 |   |
| 17  | Phakamile PS            | Complete           | 25-Jan-13                     | Yes             | 5.7                          | 1.4                          | 4.3                             | R 281 932                                 |
|     |                         |                    |                               |                 | 114.4                        | 46.3                         | 67.87                           | R 4 435 229                               |
|     |                         |                    |                               |                 | kl/hr                        | kl/hr                        | kl/hr                           | R/annum                                   |

#### Pressure Management

Table 2 below provides a summary of the impact of pressure management on the night flows in seven zones.

**Table 2: Pressure Management Zones – Night Flow Measured Pre- and Post Intervention**

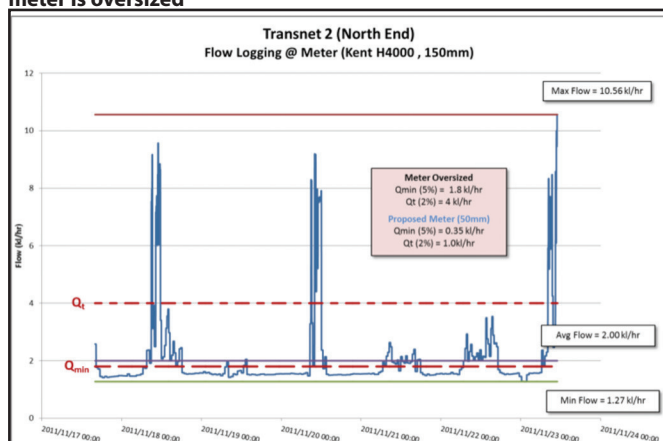
| No | Zone/ Area              | Type of Control      | MNF Before (kl/hr) | MNF After (kl/hr) | Reduction in MNF (kl/hr) | Estimated Savings Per Annum (@ R4.50/kl) |
|----|-------------------------|----------------------|--------------------|-------------------|--------------------------|--|
| 1  | Bluewater Bay           | Time (2 point)       | 57.6               | 14.1              | 43.5                     | R 1 714 770                              |
| 2  | New Brighton - Kwaford* | Fixed outlet         | 14.84              | 10.01             | 4.8                      | R 190 399                                |
| 3  | Blikkiesdorp            | Time (2 point)       | 21.43              | 17.99             | 3.4                      | R 135 605                                |
| 4  | Swartkops               | Fixed outlet         | 6.5                | 4.65              | 1.9                      | R 72 927                                 |
| 5  | Aspen Heights           | Fixed outlet         | 14.46              | 12.58             | 1.9                      | R 74 110                                 |
| 6  | Wells Estate            | Advanced (algorithm) | 63.14**            | 26.4              | 36.7                     | R 1 448 291                              |
| 7  | Scheeper-shoogte        | Time (2 point)       | 6.95               | 2.09              | 4.9                      | R 191 581                                |
|    |                         |                      | Totals             | 97.1              |                          | R 3 827 682                              |

Note:

\* Potential savings based on simulated pressure reduction

\*\*The MNF for Wells Estate has been adjusted to account for the 966 connections within the zone that are not currently under pressure management.

**Figure 4: Example of flow logging results indicating that an ICI meter is oversized**



#### Data Logging

Oversized meters – flow logging of meters suspected of being oversized was carried out where the meters were loggable. In many of these cases, a combination meter would have been a better meter option. Results from such an exercise are shown in Figure 4:

#### Domestic, Industrial, Commercial and Institutional Consumer Meter Audits

A summary of results from all the domestic meter audits is shown in Table 3:

A summary of results from all the industrial meter audits is shown in Table 4:

#### Valve and Hydrant Audits

The replacement of broken and leaking valves and hydrants, recording the correct position, finding of buried valves, the replacement of many concrete markers and manhole covers all contribute to important maintenance and improving the sustainability of the service. A repair and maintenance service provider was issued with work per specific area following on from the audits of the water loss service provider.

Over the three years 6 634 valves and hydrants were audited and 3 283 needed interventions. The service provider completed 886 of these and municipal staff the remainder.

#### Assistance to the Poor Programme

To date, 43 240 repairs have been carried out over four years and the monthly rate is approximately 400 households per month. It has been determined by the water management system, that water savings according to this programme is 22.6 Ml/day or 678 Ml/month. Over the three years billed volumes per consumer for ATTP consumers reduced by 33% from 453 to 315 litres per day.

#### Increase in Billing for Nelson Mandela Bay

Each area where domestic meter and industrial meter audits were carried out were monitored after the intervention to establish the effectiveness of the programme in terms of increased billing. An example of this is shown in Figure 5 below:

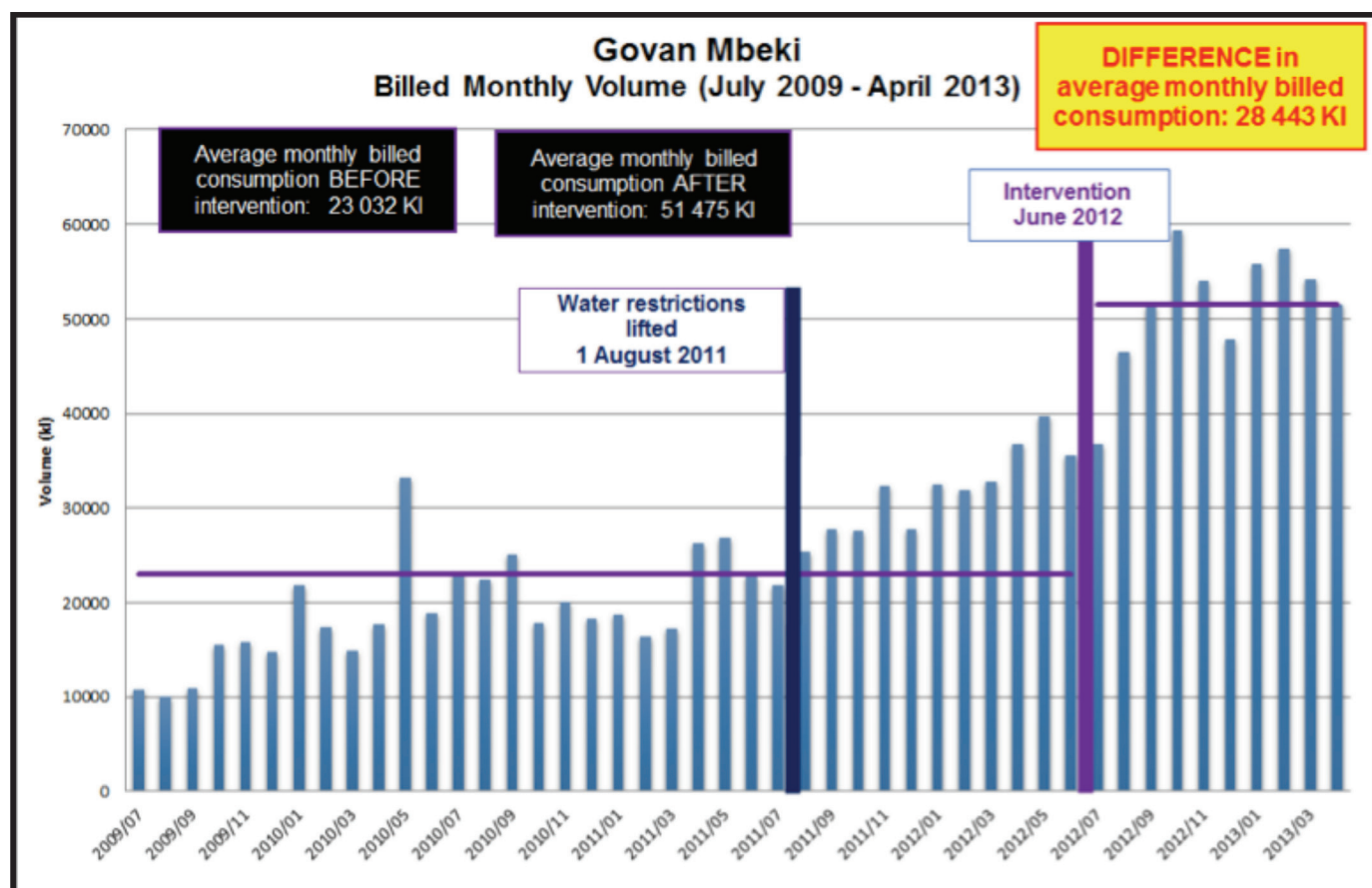
Table 3: Summary of Findings: Domestic Meter Audit

| Area Domestic   |         | Audit       |                   | Faults |                  |                |                               | On-site Leakage (kl/hr)  |                             |
|---|---------|-------------|-------------------|--------|------------------|----------------|-------------------------------|--------------------------|-----------------------------|
|   |         | Connections | Valves & Hydrants | Meters | Connection Leaks | Internal Leaks | Valve, Hydrant & Reticulation | Meter Flow Test (Actual) | Meter Flow Test (Potential) |
| Motherwell  | No. off | 30 864      | 1 015             | 6 174  | 116              | 7 189          | 579                           | 443                      | 2 964                       |
|   | %       |             |                   | 20%    | 0.4%             | 23%            | 57%                           |                          |                             |
| Wells Estate  | No. off | 3 956       | 244               | 857    | 19               | 1 052          | 175                           | 71                       | 420                         |
|   | %       |             |                   | 22%    | 0.5%             | 27%            | 72%                           |                          |                             |
| Khayamandi  | No. off | 2 257       | 96                | 841    | 12               | 547            | 87                            | 31                       | 185                         |
|   | %       |             |                   | 37%    | 0.5%             | 24%            | 91%                           |                          |                             |
| iBhayi  | No. off | 37 492      | 1 754             | 7 005  | 30               | 9 662          | 978                           | 492                      | 805                         |
|   | %       |             |                   | 19%    | 0.1%             | 26%            | 56%                           |                          |                             |
| Aspen Heights   | No. off | 408         | 31                | 103    | 0                | 17             | 3                             | 1                        | 0                           |
|   | %       |             |                   | 25%    | 0%               | 4%             | 10%                           |                          |                             |
| Bluewater Bay   | No. off | 1 336       | 245               | 282    | 1                | 20             | 82                            | 2                        | 3                           |
|   | %       |             |                   | 21%    | 0%               | 1%             | 33%                           |                          |                             |
| North End   | No. off | 755         | 280               | 11     | 0                | 2              | 132                           | 0                        | 0                           |
|   | %       |             |                   | 1%     | 0.0%             | 0%             | 47%                           |                          |                             |
| Uitenhage (Kabah/McNaughton/De Mist)  | No. off | 4 992       | 132               | 1 278  | 53               | 1 120          | 86                            | 34                       | 74                          |
|   | %       |             |                   | 26%    | 1%               | 22%            | 65%                           |                          |                             |
| Other: (Jacksonville, G Mbeki, Chatty, KwaMagxaki, Walmer, Kwadwesi, J/Slovo, KwaNobuhle etc) | No. off | 49 930      | 1 687             | 11 074 | 110              | 11 061         | 577                           | 308                      | 322                         |
|   | %       |             |                   | 22%    | 0%               | 22%            | 34%                           |                          |                             |
| Bethelsdorp   | No. off | 13 642      | 674               | 1 582  | 99               | 1 558          | 401                           | 66                       | 90                          |
|   | %       |             |                   | 12%    | 1%               | 11%            | 59%                           |                          |                             |
| TOTAL   |         | 145 632     | 6 158             | 29 207 | 440              | 32 228         | 3 100                         | 1 447                    | 4 863                       |
|   |         |             |                   | 4%     | 20%              | 0.3%           | 22%                           |                          |                             |

Table 4: Summary of Findings: Industrial Meter Audit

| Area Industrial                    |         | Audit       |                   | Faults                     |                      |                    |                               |
|------------------------------------|---------|-------------|-------------------|----------------------------|----------------------|--------------------|-------------------------------|
|                                    |         | Connections | Valves & Hydrants | Unmetered Fire Connections | Unmetered Properties | Meters not Working | Valve, Hydrant & Reticulation |
| Neave Industrial                   | No. Off | 136         | 106               | 8                          | 2                    | 9                  | 60                            |
|                                    | %       |             |                   | 6%                         | 1%                   | 7%                 | 57%                           |
| Motherwell ICI                     | No. Off | 52          | 0                 | 2                          | 0                    | 8                  | 0                             |
|                                    | %       |             |                   | 4%                         | 0%                   | 15%                | 0%                            |
| Markman Industrial                 | No. Off | 66          | 111               | 0                          | 0                    | 8                  | 43                            |
|                                    | %       |             |                   | 0%                         | 0%                   | 12%                | 39%                           |
| Perseverance Industrial            | No. Off | 50          | 43                | 2                          | 0                    | 2                  | 16                            |
|                                    | %       |             |                   | 4%                         | 0%                   | 4%                 | 37%                           |
| Struandale Industrial              | No. Off | 26          | 76                | 0                          | 1                    | 6                  | 37                            |
|                                    | %       |             |                   | 0%                         | 4%                   | 23%                | 49%                           |
| Uitenhage                          | No. Off | 284         | 0                 | 5                          | 5                    | 89                 | 27                            |
|                                    | %       |             |                   | 2%                         | 2%                   | 31%                | 0%                            |
| Deal Party                         | No. Off | 152         | 140               | 14                         | 0                    | 24                 | 0                             |
|                                    | %       |             |                   | 9%                         | 0%                   | 16%                | 0%                            |
| New Brighton ICI                   | No. Off | 217         | 0                 | 0                          | 11                   | 32                 | 0                             |
|                                    | %       |             |                   | 0%                         | 5%                   | 15%                | 0%                            |
| Bethelsdorp ICI                    | No. Off | 91          | 0                 | 0                          | 0                    | 0                  | 0                             |
|                                    | %       |             |                   | 0%                         | 0%                   | 0%                 | 0%                            |
| Gelvandale ICI                     | No. Off | 96          | 0                 | 0                          | 3                    | 16                 | 0                             |
|                                    | %       |             |                   | 0%                         | 3%                   | 17%                | 0%                            |
| Schauder ICI                       | No. Off | 39          | 0                 | 0                          | 0                    | 4                  | 0                             |
|                                    | %       |             |                   | 0%                         | 0%                   | 10%                | 0%                            |
| North End Industrial               | No. Off | 619         | 0                 | 4                          | 17                   | 60                 | 0                             |
|                                    | %       |             |                   | 1%                         | 3%                   | 10%                | 0%                            |
| KwaNobuhle ICI                     | No. Off | 109         |                   | 0                          | 4                    | 22                 | 0                             |
|                                    | %       |             |                   | 0%                         | 1%                   | 4%                 | 0%                            |
| Top 100 Consumers (excl ICI Audit) | No. Off | 193         |                   | 7                          | 8                    | 27                 |                               |
|                                    | %       |             |                   | 4%                         | 4%                   | 14%                |                               |
| TOTAL ALL INDUSTRIES               |         | 2130        | 476               | 42                         | 51                   | 307                | 183                           |
|                                    |         |             |                   | 2.0%                       | 2.4%                 | 14.4%              | 38%                           |





**Figure 5: Example of increased billing in area where domestic meter audit has taken place**

At an average of R7.46 / kI, this is an increase in billed consumption of over R212 000 per month for this area alone (3455 properties).

#### **Meter Replacement Programme**

Good progress has been made with this intervention as reflected in Table 5 below. Based on these figures, an average of 21 650 meters per year over the last five financial years has been replaced. This is an average of 10% per year (of a total 218 000 connections) which is in line with best practice and

**Table 5: Replacement of Domestic Meters**

| Financial Year | No of Meters Changed | Total Cost (R)    |
|----------------|----------------------|-------------------|
| 2008/09        | 35 015               | 14 611 332        |
| 2009/10        | 16 291               | 9 361 226         |
| 2010/11        | 11 274               | 7 675 551         |
| 2011/12        | 16 197               | 13 428 784        |
| 2012/13        | 29 474               | 30 351 959        |
| <b>Total</b>   | <b>108 251</b>       | <b>75 428 852</b> |

the target of replacing meters every 7 – 10 years.

#### **PROVIDING A SUSTAINABLE WATER SUPPLY SERVICE TO NELSON MANDELA BAY**

From analysing the historical consumption of 145 632 domestic consumers in 69 different areas for 12 months prior to interventions to consumption after interventions, the billed volume has increased from an average 1.890 million kI/month to 3.065 million kI/month. Billing in the industrial areas increased from an average of 0.446 million kI/month to 1.003 million kI/month over the same period. The increase in billed volume is partially influenced by the lifting of water restrictions after the drought which resulted in a slight increase in consumption by consumers. The success of the water loss programme is that the municipality reduced its real losses from 27 560 MI in 2009/10 to 19 270 MI in 2011/12. The reduction of Non Revenue Water over the same period is from 37.8% to 36.0%. Increased metered billed consumptions as a result of all the interventions undertaken and over the next three years is calculated to be over R500 million. Overall water consumption has however increased over the last four months where demand is matching the available water resources highlighting the need for sustained intervention aimed at managing water demand.

#### **INCREASED BILLING FOR NELSON MANDELA BAY AS A RESULT OF THE WATERLOSS PROGRAMME**

The total impact of the domestic meter and industrial meter audits carried in terms of increased billing is shown in Figure 6 and Figure 7 below:

Figure 6: Total increased billing from domestic meter audits

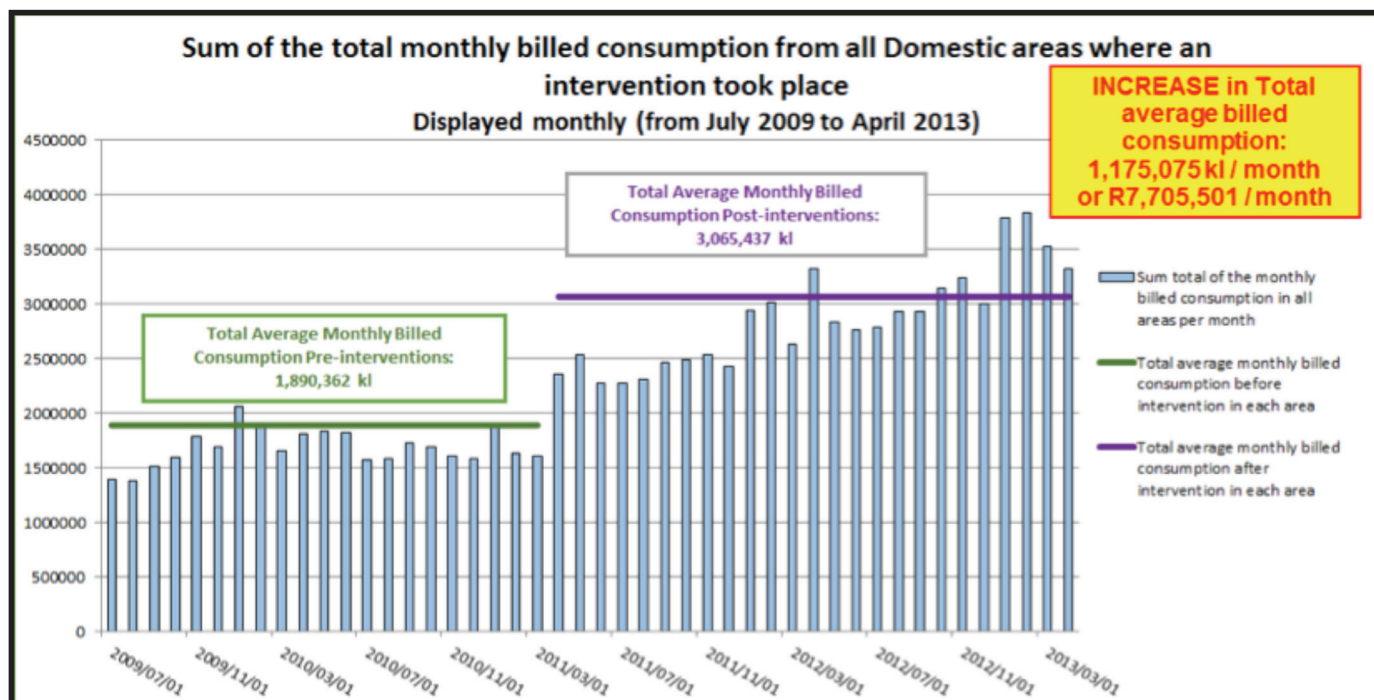
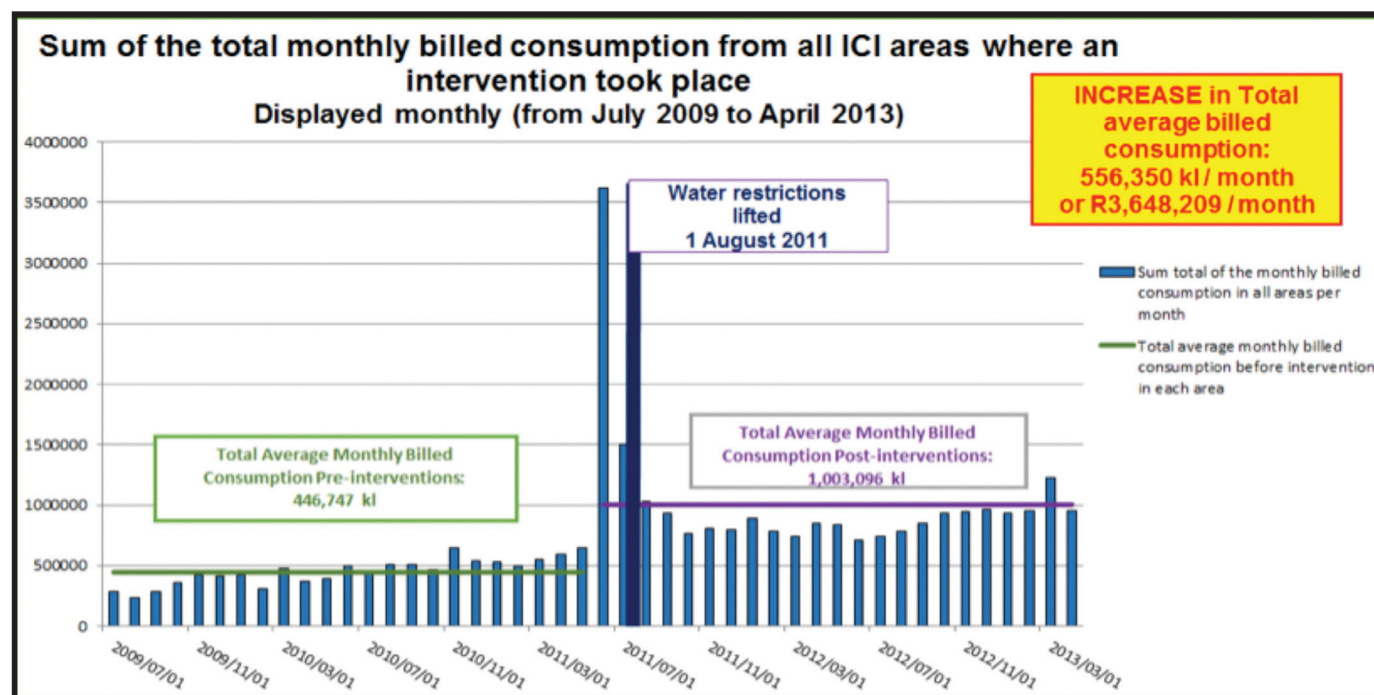


Figure 7: Total increased billing from industrial meter audits



### LESSONS LEARNT

Through the ongoing implementation of the NRW programme, valuable lessons learnt include:

- Ensure approved high standards in material, workmanship and quality control in new housing developments. Experience has shown that most internal leaks occur on RDP housing projects, and in particular, on toilet cisterns;
- Where roads are constructed as a later phase to services and houses, there is a big risk that services will be damaged or affected. Higher

specification and site supervision in these cases needs to be considered, such as installing road crossings in pipe ducts and increased pipe cover;

- Experience indicates that water districts need to be investigated at least three times for leak detection. As leaks are repaired pressure increases and new leaks develop, hence the necessity of a 2nd sweep of the area for leaks. Should that leakage still be unacceptably high, a 3rd sweep of the area for leaks is recommended;
- Proper awareness and education on services must be provided to recipients prior to houses being handed over and to the public as a whole. Consumers are the municipality's customers and good communication



with your customer is essential for the success of any business;

- Pressure management must go hand in hand with leak repair infrastructure replacement programmes.
- Significant effort and resources are required to establish water supply zones which form the foundation of managing NRW within the context of the water supply system. A formal procedure for the operation of zone boundary valves must be established and adopted by relevant stakeholders in the municipality in order to maintain zone integrity;
- An effective water loss programme provides an excellent return on investment.

#### **WAY FORWARD – “MAINTAINING THE MOMENTUM”**

NMBM has successfully implemented various initiatives including a Water Management System, development of the Water Master Plan and a multi-faceted Non-Revenue Water Programme. The significant improvement in the management of the water supply system cannot be attributed to one initiative alone but the comprehensive strategic approach taken by the utility. It must be emphasised that undertaking WC/WDM is not a once off project but rather a continuous programme. The programme needs to be funded through adequate budgets and requires a water management section, dedicated to best practice, maintaining momentum and moving towards attaining and ultimately overtaking benchmark standards.

While real losses has decreased appreciably over the last three years (by at least 8.3%), a number of initiatives are still in progress for which the full impact has not yet been achieved. Other initiatives (including those targeting apparent losses), through continued effort, will see on-going benefit to both NMBM and its consumers.

Existing initiatives to be prioritised going forward include:

- Education and awareness relating to water conservation and water use efficiency
- An accelerated roll-out of the zoning programme (to establish discrete district metered areas for the entire water supply system)
- Water loss surveys for all supply areas (including auditing of consumer meters and active leak detection) in conjunction with continuation of the meter and network replacement programmes
- Pressure Management programme (to include a control valve maintenance programme and review of minimum pressure service standards)
- Optimising the current meter reading and billing system (to reduce reading errors, estimates and zero consumptions)

New initiatives include:

- Implementation of flow limiters for ATTP consumers who use excessive volumes without payment. Prior to introducing this measure Council needs to approve and awareness undertaken to gain acceptance.
- Consideration of installation of rainwater tanks for new dwellings and households that have swimming pools
- An on-going maintenance programme for Schools to be established in partnership with the Department of Education

Availability of funds to maintain and operate the system while providing new services to a growing constituent is fundamental to the success of the utility in terms of service delivery. The benefit of reducing Non-Revenue Water and thereby increasing revenue remains critical to the success of the utility in providing a sustainable water supply service to Nelson Mandela Bay.