



DEPARTMENT: WATER AFFAIRS AND FORESTRY  
REPUBLIC OF SOUTH AFRICA

**DANCED**

**WATER CONSERVATION AND WATER DEMAND  
MANAGEMENT PILOT PROJECT  
CEDERBERG MUNICIPALITY**

**DWAF/DANIDA IWRM PROJECT**

**VOLUME 1: PROJECT REPORT**

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Prepared for:

Directorate: Water Use Efficiency

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## **1. INTERGRATED WATER RESOURCES MANAGEMENT (IWRM) PROJECT – DWAF/DANCED PROJECT**

The concept of Integrated Water Resources Management (IWRM) has been enshrined in the South African National Water Act (Act 36 of 1998). It is envisaged that this concept will act as a vehicle towards achieving equitable access to and sustainable use of water resources by all stakeholders at catchment, regional and national level, while on the other hand maintaining characteristics and the integrity of water resources at the catchment scale. The implementation of IWRM requires participation of all stakeholders at various levels of water resources management.

In order to assist the South African Department of Water Affairs and Forestry in establishing the principles of IWRM, the Danish government aid agency, Danish Cooperation for Environment and Development (DANCED) has funded the provision of technical assistance project led by an international professional services provider with the support of local professional services providers. The technical assistance project comprised of the following components:

- Water conservation and water demand management (WC/WDM)
- Groundwater
- Institutional development and support
- Capacity building, and
- Communication

This report focuses on water conservation and water demand management component of the technical assistance project. In Work Package 2, water conservation and water demand management planning framework and guidelines targeting future catchment management agencies (CMAs), water users and water services providers were developed. In addition to the guidelines a situation assessment was undertaken for the Olifants-Doring WMA which led to the development of the WC/WDM business plan. The primary objectives for developing the business plan are discussed in the Section 2 below.

## 2. WATER CONSERVATION AND WATER DEMAND MANAGEMENT (WC/WDM) BUSINESS PLAN FOR CEDERBERG MUNICIPALITY

In Work Package 2 WC/WDM situation assessment was undertaken to:

- a. Gain better understanding of the broad picture with regard to water resources availability, water use by various sectors of the Olifants-Doring WMA, and conditions of water supply infrastructure in the Cederberg Municipality.
- b. Develop WC/WDM business plan for the Cederberg Municipality. It was envisaged that in the Business Plan key elements of the scope of work for the pilot project in the four towns of Cederberg Municipality would be covered.

These key elements of the BP in each of the four towns were:-

▪ **Clanwilliam:**

- Update asset records and establish Geographic Information System (GIS)
- Install additional bulk meters (over and above the replacement and new meters already planned)
- Build validated hydraulic model of the reticulation network, use to design sectorisation of the network and pressure management scheme
- Sectorise the network – check and replace any faulty boundary valves, install zone meters (2 in number)
- Install Pressure Reducing Valve(s)
- Implement full passive leakage control
- Consumer demand management – general measures

▪ **Citrusdal:**

- Replace obsolete bulk flow meters
- Sectorise the high level network – check and replace any faulty boundary valves, install new and replacement zone meters (3 no)
- Implement full passive leakage control
- Implement active leakage control (zone establishment) within 3 high level zones
- Consumer demand management – general measures

- **Lamberts Bay:**
  - Initiate consumer meter management programme, including testing of selected meters to assess competence of existing meter stock
  - Implement full passive leakage control
  - Consumer demand management – general measures
  
- **Elands Bay:**
  - Check and if necessary install replacement meter suitable for active leakage control purposes
  - Implement active leakage control (zone establishment) within 3 high level zones
  - Implement full passive leakage control
  - Consumer demand management – general measures

The abovementioned key elements of the business plan provided basis for the scope of work for the Pilot Project.

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### 3. PILOT PROJECT – CEDERBERG LOCAL MUNICIPALITY

The primary objectives of the pilot project was to:

- Test the guidelines for Water Conservation and Water Demand Management (WC/WDM) developed in Work Package 2
- Implement recommendations from the WC/WDM Business Plan (BP) developed in Work Package 2.

In order to achieve the abovementioned objectives, the following scope of work was proposed. The scope of work is outlined in Section 3.1. is the scope of work as prepared by Carl Bro.

#### 3.1. Scope of Work

The scope of work given below is the original Terms of Reference prepared by Carl Bro. Thos scope of work was stated as follows:

- a. **Project Introduction and Community Participation:** The objective of this task was to ensure that the project is undertaken with the full awareness and involvement of the communities. It was envisaged that this would commence by introducing the project through the municipality and appropriate local community organizations and representatives.
- b. **GIS/Structural Model:** The objective of this task was to ensure that background maps and records of the water mains and ancillaries for Clanwilliam town are updated and the Geographic Information System (GIS) is populated with the information, such as properties served by the water reticulation network, components of the network etc. It was also envisaged that the Professional Services Provider (PSP) in conjunction with the municipality would develop practical procedures for maintaining the GIS to ensure that new water mains and connections are recorded, information from repair incidents is captured and used to check and correct the records. The focus of this task was to provide input to the hydraulic model
- c. **Primary Component Records:** The primary goal of this task was to collect all drawings of the primary components of the water supply infrastructure, pumping stations, treatment plants, service reservoirs etc and check them against the knowledge of operations personnel to identify any known errors or omissions and lastly, prepare a schematic diagram of the water supply infrastructure. All capacities, pipe sizes, pump ratings etc. should be shown in the schematic diagram. The focus of this task was to provide input to the hydraulic model.
- d. **Primary System Metering:** The objective of the task was to obtain details of existing meter installations and advise on the specification for new and replacement meters to ensure that flow meters are measuring flow accurately. It was envisaged that primary system meters would have a continuous on-line telemetry link to the town engineer's office. This was subject to initial and running cost of the installation.

The data logger system would be provided as a minimum and the data from these loggers would be used to validate the hydraulic model after flow and pressure measurements have been taken and verified.

- e. **Consumer Register and Metering:** The primary goal of this task was to ensure establishment of a consumer meter database and the installation of a consumer meter management programme in Lamberts Bay
- f. **Validated Hydraulic Model:** The construction of a validated all mains hydraulic model of the water supply and reticulation network of Clanwilliam and the use of the model in designing leakage control zones and a pressure management regime
- g. **Sectorisation / Zone Metering** – to achieve sectorisation of the existing reticulation network, valve checking and installation of district (leakage control zone) meters in Clanwilliam, Citrusdal and Elands Bay
- h. **Pressure Reduction** - to ensure the establishment of a pressure management regime in Clanwilliam
- i. **Active Leakage Control** - to ensure the establishment of an active leakage control regime in Citrusdal and Elands Bay. This would ensure that leaks are repaired and losses reduced.
- j. **Consumer Use Reduction** – to ensure that measures to reduce consumer water use in Clanwilliam are introduced
- k. **System Performance Report:** Development of a system performance report form and initiation of its use
- l. **Capacity Building:** Contribution to capacity building for Cederberg Municipality personnel

### 3.2. Methodology

A detailed implementation programme showing tasks, beginning and end dates was developed at the Inception phase. This programme served as the baseline during the implementation.

#### 3.2.1. Workplan

Refer to **Annexure B** for the detailed workplan developed at the Inception Phase of the project.

#### 3.2.2. Project Team

The project team comprised both T & M, Cederberg Municipality personnel, DWAF representative, and Carl Bro International representative. Cederberg Municipality did not appoint the GIS/Instrumentation/information management technician that was recommended in the Business Plan (BP), the key person was provided by Tlou & Matji (Pty) Ltd. List of project team members and their roles is given in the table below:

**Table 1: Summary of Project Team Members**

<b>Name</b>	<b>Task</b>
Maselaganye Petrus Matji	Project Management & Coordination of all activities including the writing of the <b>project report</b>
Toriso Tlou	Hydraulic Model and technical support in all the tasks including writing of the <b>technical report</b>
Thabo Masike	Project management on behalf of DWAF
Louis Hattingh	Consumer meter registering
Willem Wegelin	Primary system metering and active leakage control
Ciska Engelbrecht	GIS/structural model
Lynne Williams and Jeremy Cooke	Setting up hydraulic model
Johann Addendorff	Assistance with data collection and drawings
Johan Cock	Assistance with site supervision during construction of meter chambers in Clanwilliam
Dawie de Vaal	Consumer use reduction
Ronnie Mckenzie	Active leakage control, provided specialist input
Obie Mboweni	Site technician assisting with all the tasks. Played key roles in leak location, repairing of leaks and step testing in Elands Bay, uncovering of hidden consumer meters in Lamberts Bay, removal, testing and replacement of domestic consumer meters in Lamberts Bay, supervision of the contractor during the excavation and construction of chambers in Clanwilliam and Citrusdal including installation of PRV chambers in Clanwilliam, data logging, reservoir drop testing, KAP survey in Clanwilliam, assisting in coordinating awareness campaign.
Deon Wasserman	Assisted with drawings and other project related information. Ensured that the municipality personnel are available to assist the project team on request.
Francois Swartbooi	Assisted with site supervision for the excavation of chambers, installation of primary meters and PRVs in Clanwilliam. He also assisted with the site supervision for excavation of chambers and installation of meters in Clanwilliam and Citrusdal
Five (5) Local assistants	Assisted in conducting the KAP survey
Three (3) "Champions" and Nick Wuschlegger	Assisting with consumer awareness campaign
Contractor and the team (maximum of 7)	Excavation and construction of chambers for primary system meters in Citrusdal and Clanwilliam. Installation of meters and PRVs in clanwilliam. Installation of meters in Citrusdal
Municipality Personnel in Lamberts Bay (1 x 4)	Removal, testing and replacing of faulty domestic consumer meters
Municipality Personnel in Elands Bay (1 x 4)	Assisted with night flow data collection, repairing of leaks and step testing
Hugh Allan (Carl Bro International)	Technical guidance in all the tasks

The project team provided technical support, guidance and supervision to the contractor. A summary of generic tasks undertaken by the project team together with the Cederberg Municipality personnel (in some cases) are:

- Obtaining quotations for equipments
- Facilitating delivery of equipments and training by suppliers, where necessary
- Providing designs and drawings of the installations
- Construction supervision
- Checking the completed installation for correctness

### **3.2.3. Contractors**

A local contractor was appointed to carry out the construction and installation work in Clanwilliam and Citrusdal. The tasks that were undertaken by the contractor are:

- Excavation of primary system meter chambers in Clanwilliam and Citrusdal
- Installation of primary system meters in Clanwilliam and Citrusdal
- Excavation of PRV and meter chambers in Clanwilliam
- Installation of PRVs in Clanwilliam
- Commissioning of the meters and PRVs in Clanwilliam
- Commissioning of the meters in Citrusdal

The fees for the contractor were paid by the Cederberg Municipality.

### **3.2.4. Suppliers**

The procedure that was followed in procuring the equipments was:

- To first obtain three quotations (where necessary) from various suppliers
- Evaluate the quotations and recommend one supplier to the municipality, Department of Water Affairs and Forestry (DWAF), and the Lead Consultant.
- Place an order and make advance arrangements for delivery of equipments
- Where necessary make arrangements for demonstration on how the equipment works
- Upon receipt of the original invoice, facilitate payment for the equipment

More than eighty percent of the suppliers who provided equipments have offices in Cape Town.

**Table 2: A Summary of Suppliers, their Location, Items Supplied and Costs**

No.	Name of Supplier	Geographic Location	Items Supplied and Quantity	Total Cost ZAR (Incl. VAT)
1.	Solid State Computers	31Bright Street, Somerset West, 7130, <b>Cape Town</b>	Arcview Software; Genuine Intel Pentium 4, Windows XP Home Edition Phillips 107.28 Digital Monitor (17 inch)	26 409.60
2	Solid State Computers	31Bright Street, Somerset West, 7130, <b>Cape Town</b>	A3 Colour Printer	5 470.00
3.	Somerset Signs	Bright street, Somerset West, 7130, <b>Cape Town</b>	Information Board	4 446.00
4	Fluid Transfer Technologies	Unit 7 Hydropark, Hydro Street, Stikland, <b>Cape Town</b>	Primary Meters and Strainers	67 972.50
5	AVK Valves	Viben Street, Brackenfell, 7661, <b>Cape Town</b>	RSV Gate Valves	27 565.38
6	Pressure Management Systems	Lincoln Road, Industrial Sites, Benoni, 1501, <b>Johannesburg</b>	Data Loggers (1 x 8 plus other accessories)	85 880.76
7	Elster Kent Metering	56 – 64 Commando Road, Maitland, <b>Cape Town</b>	Leak Detection Equipments (1 x 2)	12 933.80
8	Elster Kent Metering	56 – 64 Commando Road, Maitland, <b>Cape Town</b>	Domestic Consumer Meters (1 x 64)	14 055.01
9	Flash Fire	23 Brunel Road, Tulisa Park, <b>Johannesburg</b> , 2001	Hydrant Caps (1 x 8)	2 131.80
10	Macsteel	Steelpark, Modderdam Road, Belville South, <b>Cape Town</b>	PRVs (1 x 2); Primary Meters and Strainers (1 x 2)	40 807.44
*11	Spectrum Communications	Drill Avenue, Montague Gardens, <b>Cape Town</b> , 7441	Telemetry System	----
12	Elster Kent Metering	56 – 64 Commando Road, Maitland, <b>Cape Town</b>	Large consumer meters (1 x 4)	8 308.74
<b>Total Cost of Equipments including training provided (Incl. VAT)</b>				<b>295 981.03</b>
<b>Original Budget</b>				<b>330 000.00</b>
<b>Surplus</b>				<b>34 018.97</b>

*\*The supplier was not co-operative, hence no equipments were delivered.*

We recommend that the surplus be used for the procurement of another domestic consumer meters. This is also what the municipality would like to do with the surplus.

### 3.2.5. Project Meetings

A number of scheduled and unscheduled meetings were held to keep all stakeholders updated on the project activities. About nine project meetings were held (including the upcoming meeting on the 19<sup>th</sup> August 2003) between October 2002 and August 2003.

**Table 3: A Summary of Meetings held During the Course of the Project**

No	Date of the meeting	Venue	Purpose
<sup>s</sup> 1	18 October 2002	Clanwilliam	Project Inaugural
<sup>s</sup> 2	12 November 2002	Clanwilliam	Approval of Inception Report
3	13 December 2002	Clanwilliam	Overall progress
4	20 February 2003	Clanwilliam	Olifants-Doring Reference Group Meeting
5	6 March 2003	Belville, DWAF Offices	Overall progress
<sup>s</sup> 6	9 April 2003	Clanwilliam	Overall progress
7	8 May 2003	Clanwilliam	Project presentation to the Olifants-Doring Reference Group
8	2 June 2003	Clanwilliam	Overall progress
9	9 July 2003	Belville, DWAF Offices	Awareness campaign
10	1 August 2003	Clanwilliam	Overall progress and awareness campaign
<sup>s</sup> 11	19 August 2003	Clanwilliam	Overall Progress

s- scheduled project meetings. Other meetings were not scheduled, hence no advance budget was set aside for these meetings

### 3.2.6. Logistics

Tlou & Matji have the project office in Clanwilliam with Mr O Mboweni being the main employee. All requests related to project activities were channeled through the office. This in a way has fast-tracked the execution of most of the tasks. Even though Mr Mboweni's salary was paid by Tlou & Matji (Pty) Ltd, the costs related to the project office and accommodation for Mr Mboweni were shared by:

- The Cederberg Municipality – office furniture
- The municipality also carried the traveling costs of Mr Mboweni by providing a "Bakkie"
- DWAF carried the accommodation costs

All equipments that were supplied have been transported to Clanwilliam.

### 3.2.7. Summary of Work Progress

A summary of work progress is presented in **Annexure A**.

### 3.3. Inputs – Resources Deployed

The resources that were deployed to execute various tasks involved project team members, municipality officials in Clanwilliam, Cistrusdal, Elands Bay and Lamberts Bay, local individuals in Clanwilliam, “Champions” that were trained as part of the DWAF/DANCED IWRM project, local contractor and his team. Approximately 37 human resources (including the contractor and his team) were deployed to execute various tasks.

In addition to human resources, material resources were also procured to assist in achieving the milestones. These resources included amongst others, primary flow meters, data loggers, hydrants, pressure reducing valves, special fittings, consumer meters, listening sticks, printer, computer, GIS software and information board which provided information to the public in Clanwilliam about the project.

Tasks undertaken by various resources are presented in **Table 4**.

**Table 4: A summary of Human Resources Deployed to Undertake various Tasks**

Name	Task	Planned Days	Actual Days
M.Petrus Matji	Project Management & Coordination of all activities including the writing of the <i>project report</i>	53.375	75.125
Toriso Tlou	Hydraulic Model and technical support in all the tasks including writing of the <i>technical report</i>	26	36.125
Louis Hattingh	Consumer meter registering	20	18
Willem Wegelin	Primary system metering and active leakage control	19	30
Ciska Engelbrecht	GIS/structural model	12.75	30
Lynne Williams	Setting up hydraulic model	39.25	17.438
Jeremy Cooke	Setting up hydraulic model	5.25	5
Johann Addendorff	Assistance with data collection and drawings	24.5	7.563
Johan Cock	Assistance with site supervision during construction of meter chambers in Clanwilliam	22.5	1
Dawie de Vaal	Consumer use reduction	6.75	6.25
Ronnie Mckenzie	Active leakage control, provided specialist input	5.75	1.25

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Obie Mboweni	Site technician assisting with all the tasks. Played key roles in leak location, repairing of leaks and step testing in Elands Bay, uncovering of hidden consumer meters in Lamberts Bay, removal, testing and replacement of domestic consumer meters in Lamberts Bay, supervision of the contractor during the excavation and construction of chambers in Clanwilliam and Citrusdal including installation of PRV chambers in Clanwilliam, data logging, reservoir drop testing, KAP survey in Clanwilliam, assisting in coordinating awareness campaign.	0	97.75
Deon Wasserman	Assisted with drawings and other project related information. Ensured that the municipality personnel are available to assist the project team on request.	20	25
Francois Swartbooi	Assisted with site supervision for the excavation of chambers, installation of primary meters and PRVs in Clanwilliam. He also assisted with the site supervision for excavation of chambers and installation of meters in Clanwilliam and Citrusdal	0	30
Five (5) Local assistants	Assisted in conducting the KAP survey	2	5
Three (3) "Champions" and Nick Wulschlegger	Assisting with consumer awareness campaign	2	5
Contractor and the team (maximum of 7)	Excavation and construction of chambers for primary system meters in Citrusdal and Clanwilliam. Installation of meters and PRVs in clanwilliam. Installation of meters in Citrusdal	15	30
Municipality Personnel in Lamberts Bay (1 x 4)	Removal, testing and replacing of faulty domestic consumer meters	0	10
Municipality Personnel in Elands Bay (1 x 4)	Assisted with night flow data collection, repairing of leaks and step testing	0	5
Hugh Allan (Carl Bro International)	Technical guidance in all the tasks	16	16
<b>Total Professional Fees (incl. VAT)</b>		<b>R 649 660.00</b>	<b>R 868 110.00</b>
<b>Total Contractor Cost (Costs carried by Cederberg LM)</b>		<b>R 90 000.00</b>	<b>R 90 000.00</b>
<b>Total Procurement Cost</b>		<b>R 330 000.00</b>	<b>R 295 981.03</b>
<b>Overall Project Cost</b>		<b>R1 069 660.00</b>	<b>R1 254 091.03</b>
<b>Cost Carried by T &amp; M (man-hours converted to costs)</b>			<b>R 214 770.99</b>

### 3.4. Outputs – Summary of Results

This will be incorporated once all the preliminary technical reports have been consolidated into one report. A summary of project outputs are given in Table 5:

**Table 5: A Summary of Project Outputs.**

<b>Output</b>	<b>Description</b>
GIS structural model	The model was build for Clanwilliam and maintenance procedures were developed. The model was demonstrated to the municipality. The appropriate computer equipment and GIS software were procured and installed at the Cederberg Municipal offices. About 23.57km of water main records have been updated.
Primary system meters	The primary meters were procured, installed and commissioned in Citrusdal and Clanwilliam.
Consumer meter register	Domestic consumer meters were procured and faulty meters were replaced in Lamberts Bay. Only 438 of the 1183 consumer meters in Lamberts Bay were read regularly.
Hydraulic model	A hydraulic model was build, tested and verified for Clanwilliam. The model provided guidance on how sectorisation Clanwilliam system should be undertaken. It was demonstrated to the Cederberg Municipality personnel.
Sectorisation	The water network in Clanwilliam was sectorised into two sectors.
Pressure management	The system pressures were for Clanwilliam were evaluated using the hydraulic model and the PRV's were installed to reduce the pressure. Two (2) new PRVs have been installed. Eight (8) Metrolog pressure and flow loggers were purchased, eight (8) fire hydrants were also purchased.
Active leakage control	Leak detection equipment was procured and leaks were identified in Elands Bay and Citrusdal. These leaks were repaired.
Consumer use reduction	A KAP survey was successfully undertaken in Clanwilliam to understand the consumer's knowledge, attitudes and practice with regard to water conservation. Awareness campaign was also successfully undertaken.

## 4. ANALYSIS AND CONCLUSIONS

### 4.1. Milestones Achieved and those that have not been Achieved

A summary of milestones achieved and those that have not been achieved as per planned work programme are outlined in **Table 6**. Almost all the work planned, with the exception of awareness campaign, has been carried out. The only milestone that has not been achieved is the installation of all domestic consumer meters within the original planned programme. However, the delay was attributed to quite a number of issues such as payment for and delivery of the meters including availability of the municipality personnel, because no contractor was appointed.

**Table 6: A Summary of Milestones Achieved and those that have not been Achieved**

Milestones Achieved	Milestones not Achieved
Despite delays in data collection, payment for some of the equipments, and delivery of the special fittings, the team has managed to complete most of the tasks on time	-----
*Developed GIS/structural model for Clanwilliam and trained the municipality personnel on how to use it.	-----
Developed a schematic diagram for Clanwilliam showing the components of the water network	-----
Installation and commissioning of flow meters in Clanwilliam and Citrusdal	-----
Installation and commissioning of the pressure reducing valve in Clanwilliam	-----
*Build and validate hydraulic model for Clanwilliam and demonstrated to the municipality on how to use it	-----
Sectorised water network in Clanwilliam and Citrusdal	-----
Uncovered leaks in Elands Bay and Clanwilliam	-----
Developed MS Access database for the consumer meters in Lamberts Bay. Uncovered consumer meters hidden underground in Lamberts Bay. Tested and replaced faulty meters	-----
Procured budgeted equipments (e.g. primary flow meters, domestic consumer meters, PRVs, listening stick, computer, monitor, GIS software (Arcview), printer and telemetry system without exceeding the original budget	Telemetry system has not been procured. The supplier did not fulfil his promises.
Succeeded in capacity building of a student (Mr O Mboweni) who successfully assisted in completing most of the tasks with less supervision and also capacitating of the staff in Lamberts Bay, with special reference to the testing of domestic consumer meters	-----
Water conservation and water demand management awareness campaign in Clanwilliam.	-----

The telemetry system linking the PRVs in Clanwilliam with the Engineer's office was scheduled for delivery, installation and commissioning on the 29<sup>th</sup> August 2003. However, this has never materialised and no apologies were made. A follow-up was made and another promise was made for the week of the 1<sup>st</sup> December 2003. This did not materialise as well. In January 2004, Deon Wasserman made a follow-up with Deon of Spectrum who promised that the installation and commissioning would be in February 2004. It also did not materialise. In brief the telemetry system was neither procured nor installed.

The technical team of Cederberg Municipality (i.e. Deon Wasserman, Francois Swartbooi, and other staff members) have gained, amongst others, the following in terms of awareness, knowledge and understanding:

- The importance for replacement of consumer meters and also testing consumer meters for accuracy
- Improved understanding of the water network in Clanwilliam
- The need for ensuring that the municipality keep records of all as-built drawings of both water and sanitation infrastructure.
- The importance of raising water conservation awareness amongst consumers
- Awareness about leaks in other areas of the municipality, etc.

#### 4.2. Problems Encountered and Corrective Actions

**Table 7: Some of the Problems Encountered and Solutions**

<b>Problem</b>	<b>Corrective Action</b>	<b>By Whom</b>
Data availability and collection	Undertook a site visit and also appointed of a full-time technician on site	Tlou & Matji (Pty) Ltd
Delay in the payment of some of the equipments (e.g. Data loggers, PRVs and domestic consumer meters)	Payment made	Carl Bro International
Delay in the appointment of a contractor	Contractor appointed	Cederberg Municipality
Delay in the delivery of manufacturing of special fittings	Liaised directly with the supplier	Project Manager

### **4.3 Lessons Learned**

Water conservation and water demand management guidelines developed as part of Work package 2 are generic and cannot easily be used by the municipality. Some of the critical questions not addressed by the guidelines are:

- Drawings of the as-built plans may not always be available at the municipal offices. Sometimes they are kept with various consultants who have done the work and it is not easy to obtain such drawings from the consultants. In the case of Cederberg LM as-built drawings were not available at the municipal offices. They have to be obtained from consultants who worked in the area before.
- Sometimes there are discrepancies between “as-built drawings” and the information on the ground. We had to dig the ground to locate some of the doubtful pipelines which we found that they were not as indicated on the drawings.
- The consumer meter readings as provided by the consumer meter readers may not always reflect the situation on the ground. In Lamberts Bay it was discovered that some of the domestic consumer meters were hidden underground, hence could not be read. However monthly readings were provided to the municipality.
- Generally, the objectives of the Cederberg Municipality water conservation and water demand management business plan (BP) were achieved, however further work is required if the initiatives of the pilot project are to be sustainable.

### **4.4 Resources Deployed vs the Original Plan**

Even though the scope of work did not increase, more resources than originally planned were deployed to ensure that targets are met. These resources were mainly deployed in activities lying on the critical path. Such activities are excavation and construction of chambers in Clanwilliam, including installation of primary system meters and PRVs.

### **4.5 Carl Bro’s Comments on the Project**

### **4.6 Conclusions**

In general, the project objectives were achieved. The hydraulic modeling system developed should be utilized efficiently, more especially in any future developments in Clanwilliam. Both hydraulic model and GIS/structural model should be maintained and updated.

**ANNEXURE A: SUMMARY OF WORK PROGRESS**

**ANNEXURE B: DETAILED WORKPLAN AS PER INCEPTION  
REPORT**

These Annexures are not available in electronic format.