water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Water Reconciliation Strategy Study for the Algoa Water Supply Area

Algoa Reconciliation Strategy

Status Report 4

September 2016

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1 Introduction

1.1 Background

The Algoa Reconciliation Strategy Development was undertaken by the Department of Water Affairs (DWA), in cooperation with the Nelson Mandela Bay Municipality (NMBM) and other stakeholders, in order to secure a sustainable future water supply for NMBM and the other towns served by the Algoa Water Supply System (AWSS), shown in **Figure 1.2**. The purpose of the Reconciliation Strategy is to determine the current water balance situation and to develop various possible future water balance scenarios for at least a 25-year planning horizon. It further aims to describe the proposed strategy, and the associated actions, responsibilities and timing of such actions that are urgently needed to reconcile available resources and requirements, to enable additional interventions to be timeously implemented so as to prevent the risk of a water shortage becoming unacceptable. The Strategy offers a system for the continuous monitoring and updating of the Algoa Reconciliation Strategy into the future.

The Strategy was initially completed in early 2010 and was subsequently updated in April 2011 due to emergency interventions planned as a result of the drought, as well as revised Coega IDZ requirements.

The Strategy has since been reviewed and updated by the Algoa Strategy Steering Committee as shown in **Figure 1.1**. This Status Report (Status Report 4) provides an overview of the September 2016 update to the Strategy.

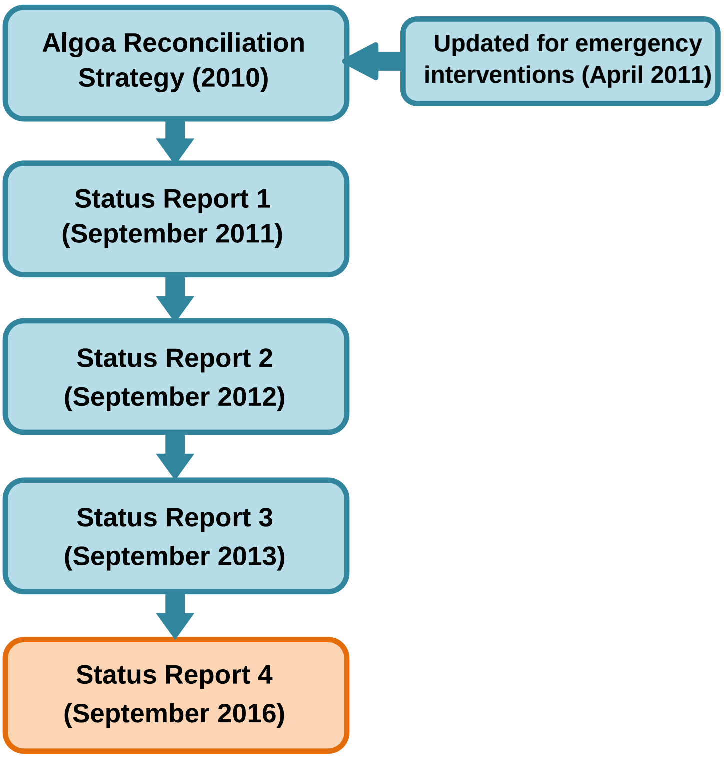


Figure 1.1: Review and updating of the Algoa Reconciliation Strategy

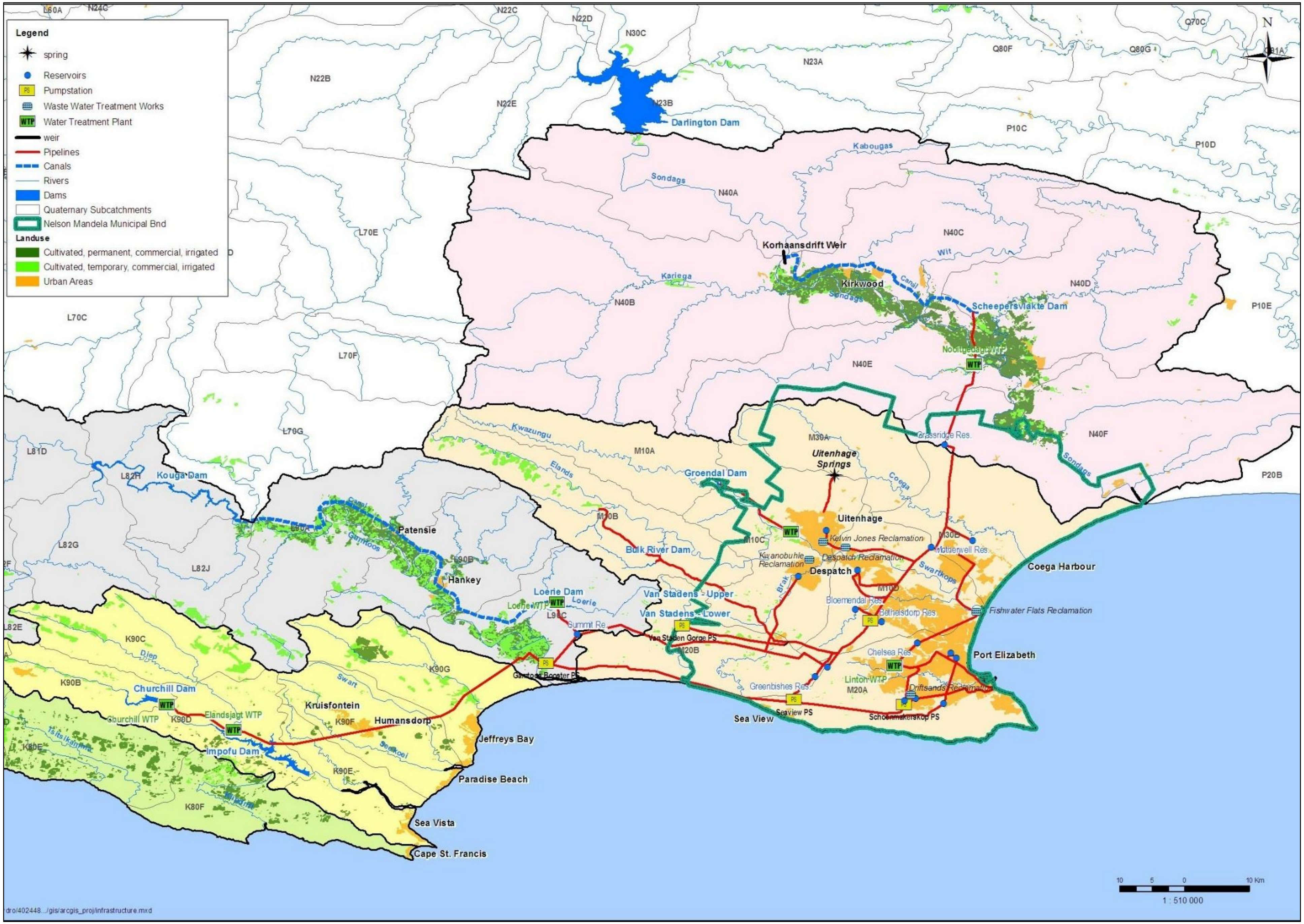


Figure 1.2: Algoa Water Supply System

1.2 Strategy Area

The Algoa Water Supply System (WSS) extends from the Kouga River system in the west to the Sundays River system in the east. The AWSS provides water to the Gamtoos Irrigation Board, the NMBM and several smaller towns within the Kouga Municipality. The AWSS currently comprises three major dams in the west, several smaller dams and a spring situated near to NMBM, as well as an inter-basin transfer scheme from the Orange River via the Fish and Sundays rivers to the east.

Western System

The Western System provides water to NMBM from the Churchill and Impofu dams on the Kromme River, from the Kouga Dam on the Kouga River and from the Loerie Balancing Dam on the Loerie Spruit, a tributary of the Gamtoos River. The bulk supply of water provided to NMBM and the coastal towns from the combined Western System at an assurance of 1 in 50 years amounts to 65 million m^3/a (178 Ml/day). The Gamtoos Irrigation Board has an allocation from Kouga Dam of 59.36 million m^3/a. There is also relatively small usage by other towns and irrigators as well as a small provision for ecological water requirements (EWR) below Impofu Dam. The growing water requirements of the Kouga Local Municipality (LM), who *inter-alia* receives water from the Kromme sub-system needs to be carefully monitored. Significant growth in their urban water requirements, coupled to the possibility of a nuclear power plant being established at Thyspunt, means that their requirements could start to influence decisions regarding the implementation of interventions for the Algoa WSS.

Eastern System

The Orange-Fish-Sundays Transfer Scheme supplies Orange River water from Gariep Dam to the Great Fish River valley and the Sundays River valley, to supplement local water supply for irrigation and some urban use by local towns. The Lower Sundays River Irrigation Scheme supplies water for irrigation as well as for two major water users, namely the Sundays River Valley Local and NMBM for domestic water supply in Port Elizabeth.

The Eastern System receives water transferred from the Gariep Dam on the Orange River via the Orange-Fish Tunnel, the Fish River, the Fish-Sundays Canal, Skoenmakers River, Darlington Dam and abstraction from the lower Sundays River at the Korhaansdrift Weir.

The Lower Sundays River Water User Association (LSRWUA) also obtains water from the Gariep Dam on the Orange River via the same transfer scheme, sharing some bulk storage and conveyance infrastructure with NMBM. The LSRWUA manages an area of 17 293 ha, with a total scheduled quota of 156 million m^3/a. Infrastructure is shared with NMBM from the abstraction in the lower Sundays River at Korhaansdrift Weir, up to the Scheepersvlakte Balancing Dam, with most of the water being used for irrigation. The capacity of the balancing dam is not sufficient to meet the dual purpose of supplying the upgraded Nooitgedagt WTW as well as the irrigators in the future.

Central System

The Central System consists of the older dams on the Sand, Bulk, Van Stadens and Kwa Zunga (a tributary of the Swartkops) rivers and the Uitenhage Springs, all of which are owned by the NMBM. Combined, the quantity of water abstracted by NMBM from these sources is about 10 million m^3/a (27 Mℓ/day) including 4 million m^3/a (11 Ml/day) from Groendal Dam. Groendal also supplies 2.4 million m^3/a to irrigators.

1.3 Interventions

Potential strategy interventions were initially identified according to the following categories, to identify a longlist of interventions to screen:

- Water conservation and water demand management (WC/WDM);

- Increased operational efficiency of the current water supply system;
- Trading of water use authorisations;
- Re-use of water;
- Groundwater schemes;
- Inter-basin transfer schemes;
- Desalination of seawater or
- Desalination of brackish river water; and
- Surface water schemes.

An intervention is a measure that could be timeously implemented, either by reducing water requirements or by increasing water availability, to prevent the risk of a water shortage becoming unacceptable.

More than sixty potential interventions, which could contribute to meeting the future water requirements of the AWSS, were initially identified. Preliminary screening of potential interventions were then done based on the following criteria, to identify a shortlist of interventions to consider further:

- Scheme cost based on the unit reference value (URV) which provides an indication of the combined capital and operation costs,
- The time required for implementation,
- Adequate intervention yield, and certainty that the yield can be realised,
- Spreading of risk by becoming less reliant on surface water sources, and
- Ensuring that there is an adequate number of interventions to supply water to the end of the planning period of at least 25 years.

Maximising the yield of the existing Kouga/Loerie Scheme is an operational measure that was adopted after approval of the reconciliation strategy in 2011. The recommended Nooitgedagt Low Level Scheme is currently being implemented in phases. Some interventions have fallen away since the reconciliation strategy was completed, an example being the trading of water entitlements, due to a change in DWS policy. The Abstraction of lower Gamtoos River irrigation return flows was ruled out by DWS Reserve Directorate staff. The Tsitsikamma River Diversion to Impofu Dam was abandoned, following the DWS strategic decision that the Tsitsikamma River water should be reserved for local development in the Tsitsikamma River catchment.

Interventions currently being considered for the strategy is shown in **Table 1.1**.

Table 1.1: Interventions being considered

Scheme	Description
Municipal WC/WDM	Continued roll-out of a WC/WDM programme, preferably being controlled by a full-time WC/WDM manager, being the implementation of a well-formulated and funded WC/WDM strategy and programme.
Rainwater harvesting	Collection of rainwater from roofs, primarily for toilet flushing, or to supplement garden watering. This normally entails promotion by a municipality or enforcement through the promulgation of a bylaw.
Removal of invasive alien plants	Programmes to remove invasive alien plants in the catchments of the Kromme, Kouga and Baviaanskloof rivers, which is already being done on a large scale.
Re-use of water treated to industrial standards – Fish Water Flats WWTW	Re-use of treated water from the Fish Water Flats WWTW, to meet requirements for industrial quality water within the Coega IDZ.
Re-use of water treated to industrial standards – Coega WWTW	Re-use of treated water from the future Coega WWTW, to meet requirements for industrial (non-potable) quality water within the Coega IDZ.
Re-use of water treated to potable	Potable re-use of treated water from the Fish Water Flats (and possibly

Scheme	Description
standards	Uitenhage and Despatch WWTWs) through reverse osmosis treatment, storage in Loerie Dam, or in a proposed new dam at Echodale on the Elands River, and treatment at a new water treatment works.
Lower Sundays River irrigation return flows	Abstraction of irrigation return flows in the Sundays River downstream of the Sundays River WUA, desalination, and blending at Olifantskop reservoirs with treated Orange River water supplied from the Nooitgedagt WTW.
Desalination of seawater	Supply via a bulk seawater intake system and pumping of seawater via pipeline to a proposed Reverse Osmosis plant site. Such a scheme can easily be phased. Potential schemes for NMBM/Coega IDZ and Thyspunt Nuclear Power Plant has been identified. A seawater desalination plant that can be sited at the old Swartkops Power Station and will discharge brine via the existing sea outfall of the Fishwater Flats WWTW is a drought backup option.
Groundwater schemes	Implementation of the South-Eastern Coega Fault, Jeffreys Arch, Van Stadens River Mouth, Bushy Park and other new groundwater schemes. Some of these schemes could either supply NMBM or alternatively supply small coastal towns, freeing up water for NMBM. As fracking is a new technology, no fracking interventions have been identified.
ORP/Nooitgedagt Low-Level Scheme	Increased supply from the Orange River to NMBM, supplied from the Nooitgedagt WTW via a new pipeline to the Olifantskop Reservoir. This scheme would also offer significant energy savings on account of the reduced pumping heads needed. DWS issued a licence to NMBM to abstract a total of 58.3 million m^3/a of water from the Orange River with the proviso that the licence could be reduced back to 22 million m^3/a after 20 years; however NMBM have requested that the licence be made permanent on account of the high capital investment.
Guernakop Dam on the Kouga River	Construction of a new 83 m high rollcrete dam at Guernakop approximately 15 km upstream of the upper end of Kouga Dam on the Kouga River and doubling of the capacities of the Loerie WTW and the pipelines to NMBM.
Raising Kouga Dam on the Kouga River (replacement and raising)	Construction of a mass gravity rollcrete dam immediately downstream of the existing Kouga Dam and doubling of the capacities of the Loerie WTW and the pipelines to NMBM.

2 Progress with Implementation of the Strategy

2.1 Strategy Steering Committee

One of the recommendations of the Reconciliation Strategy Study was that a Strategy Steering Committee (SSC) be formed with a clearly defined mandate and scope of work.

The objectives of the SSC are:

- To ensure and monitor implementation of the recommendations of the Algoa Reconciliation Strategy,
- To ensure that the necessary studies by the responsible institutions identified in the Strategy, are started timeously to ensure continued reconciliation of water supply and requirements,
- To update the Strategy when necessary to ensure that it remains relevant, and
- To ensure that the Strategy, its recommendations and progress with its implementation are appropriately communicated to all stakeholders.

The SSC has met six times since the Strategy was completed. The Committee is functioning as it was intended and the stakeholders and water users of the Algoa Water Supply System (WSS) actively partake and provide feedback in the meetings.

An Administrative and Technical Support Group (ATSG) was formed to support the SSC. The ATSG consists of representatives from the DWS National Office, DWS Eastern Cape Regional Office, NMBM, Eastern Cape Provincial Government, agriculture and other key organisations. The ATSG meets between the SSC meetings to ensure that the recommendations of the strategy and committee are implemented. The list of SSC and ATSG members is contained in Appendix A.

2.2 Progress with other Studies and Activities

In the recommendations of the Algoa Reconciliation Strategy, a number of interventions were identified as possible future water augmentation schemes that could be implemented after completion of the Nooitgedagt Low-level Scheme. In order to ensure that these interventions are available for implementation when required, DWS and NMBM were assigned the responsibility of initiating feasibility and/or pre-feasibility level studies of these interventions, or to initiate other supporting activities.

This section of the progress report details the progress that the DWS and the NMBM have made in the implementation of the supply-side interventions.

2.2.1 DWS Studies

Verification and Validation of Water Use Study of a part of the Kromme and Kouga catchment areas

As the surface water resources of the Kromme and Kouga catchment areas could be under stress, the need for verification and validation (V&V) of water use for these areas was identified. The validation of water use of a significant part of the Kouga River catchment has been completed. The validation for the Langkloof area is complete but the verification has not yet been done. This will be done under the V&V project that has recently been awarded for the whole of the Eastern Cape. The validation process for the Eastern Cape as a whole is about 95% complete. Stakeholder engagements have commenced and are due to be completed by the end of October 2016. This will inform the verification process to follow. The PSP's contract ends in March 2017 but verification by DWS is likely to be on-going thereafter. The information gathered by the V&V studies will be used as input to the future Water Availability Assessment Study for the Kromme and Kouga catchments. This study is expected to be initiated after the verification and validation has been completed.

Kouga Dam raising in light of DWS dam safety evaluation

DWS's Directorate Dam Safety evaluated the need for rehabilitation and stabilisation of the Kouga Dam wall. Should significant construction be needed for potential rehabilitation, the dam wall could potentially also be raised at the same time. The outcome of the investigation is that no major dam safety rehabilitation work is necessary for the dam wall and the previously planned dam safety activities has been put on hold. In light of this, the potential for a larger Kouga Dam, which would consist of the construction of a new concrete gravity dam directly downstream of the existing one, is now less attractive from a cost perspective. Potential raisings by 10.5 m, 16.5 m and 19.8 m have been considered previously.

Operating capacity of Darlington Dam

There are concerns regarding the stability of the Darlington Dam, which was completed in 1921. DWS planned to undertake a dam safety investigation of the dam. The optimum operating level for Darlington Dam must be determined. This could potentially involve the removal of the dysfunctional crest gates, depending on the findings. The maximum operating capacity of the Darlington Dam is currently at 43% (78 million m^3) of its full storage capacity (181 million m^3), due to dam safety constraints.

The DWS Directorate Dam Safety planned to do investigations into the replacement of the sluice gates. This could potentially involve the removal of gates, depending on the findings. No progress has been made regarding the safety rehabilitation of Darlington Dam due to budget cuts.

The Algoa Water Resources Bridging Study reported that results from the Operational Model indicated that there is almost no benefit in the use of a larger Darlington Dam, to be able to improve the water quality and water availability of the sub-system. It was noted that, although additional water was released through the Orange/Fish tunnel, very little of that was able to reach Darlington Dam. This was mainly as result of the limited capacity of the Cookhouse tunnel. It would therefore not be possible to fill Darlington Dam during the winter period when the flows through the tunnel were at its lowest.

Additional storage in the Scheepersvlakte Balancing Dam and canal

In addition to potentially increasing the balancing capacity of the Scheepersvlakte Balancing Dam, attention must also be given to whether there is a need to increase the supply capacity of the Lower Sundays River Government Water Scheme (LSRGWS). Downtime for maintenance at the canal is currently not possible as there is not enough storage available for the required water. It is important that an operating risk assessment be urgently done.

One of the three main objectives of the ongoing Algoa Reconciliation Feasibility Study is to remove potential operating system constraints for sustainable delivery of bulk Orange River water supply to the LSRGWS and to NMBM, for water requirements up to 2040.

The objective is therefore to limit risks of shortfall in supply as well as operational risks to acceptable levels. The focus is on providing additional balancing storage, in addition to the Scheepersvlakte Balancing Dam, which includes the investigation of storage at other potential locations in the bulk transfer infrastructure.

It is essential to ensure that there are no bottlenecks regarding the transfer of additional Orange River water to NMBM with relating to the implementation of the Nooitgedagt Scheme.

2.2.2 Progress with Implementation of WC/WDM in NMBM

Water conservation and water demand management (WC/WDM) was identified in 2010 as a key action for NMBM to reduce water use and non-revenue water (NRW). The programme continued through new contracts and existing appointments. Despite limited provision for operating and capital budgets, shortage of technical staff and delays in supply chain management processes, some progress was achieved in reducing real losses, however, the NRW level remains high. The interventions to reduce NRW were restructured into 13 main workstreams.

The stated objectives of the NMBM WC/WDM Programme are:

- **Algoa Reconciliation Strategy** - recommendation of reduction in water requirements of 13 500 m^3/a within 5 years, starting with 2010/11 year.
- **The National Development Plan** - “Reduce water demand in urban areas to 15 percent below business-as-usual scenario by 2030.”
- The main objective of setting targets is to reduce the real losses from 39 000 Mℓ (as in 2013/14) to 21 500 Mℓ (as in 2011/2012).
- **Executive Director** - 1% reduction in NRW per year. The target for 2014/15 will be 41.3%.
- **Senior Director** (W & S) - 18 000 Mℓ/a after 3 years from 2014/15 to 2016/17, and ultimately 15 000 Mℓ/a in 2018/19.

Figure 2.1 provides a comparison of the average daily water consumption for NMBM with and without WC/WDM. While this graph is indicative of success with WC/WDM, it may be necessary to consider another ways to indicate the success or not of water efficiency programmes.

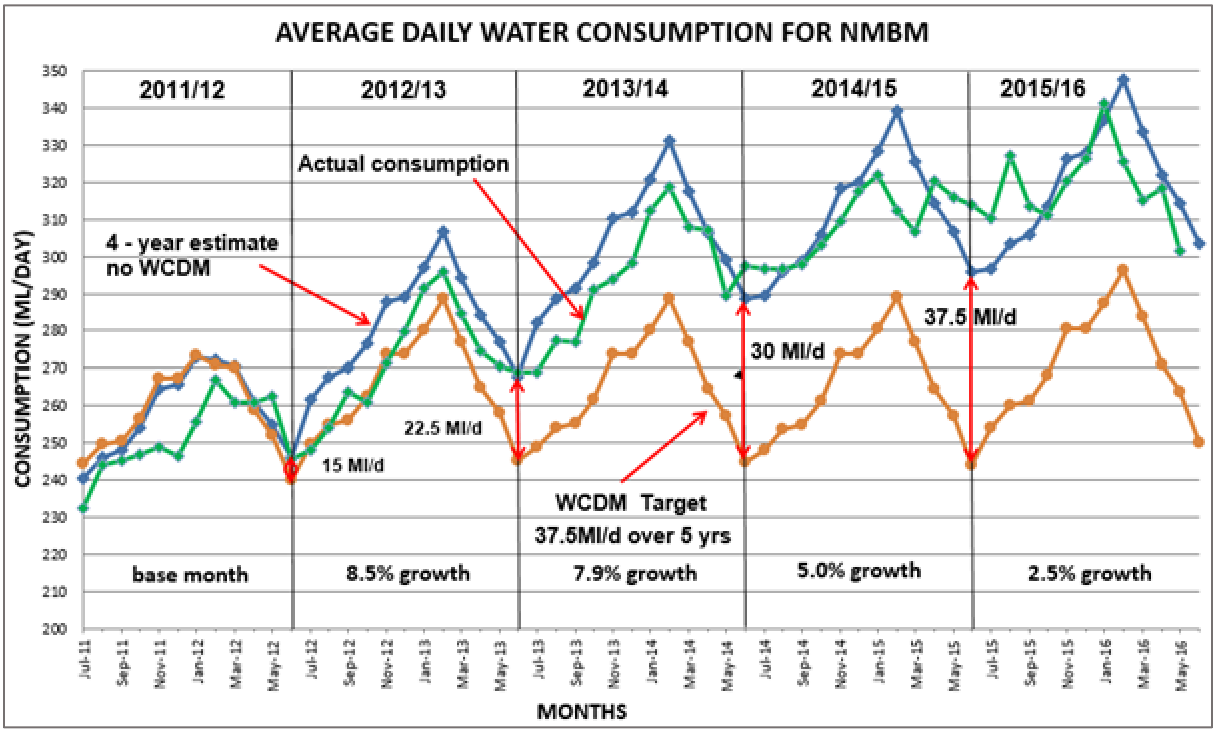


Figure 2.1: Water use for NMBM with and without WC/WDM

The progress with the implementation of the 13 WC/WDM workstreams is summarised in Table 2.1. A detailed description of the progress has been included in Appendix B.

Table 2.1: Summary of progress with implementation of WC/WDM

No.	Workstream	Progress with Implementation of WC/WDM
1	Bulk Supply Meters	A Bulk Water Task Team was set up to expedite the installation of bulk meters. By August 2016, sufficient metering was installed for the Churchill Pipeline and Loerie/Summit/Chelsea systems. The Nooitgedagt/Motherwell system will be completed in September 2016.
2	GMA and DMA Meters	There are approximately 25 Greater Metered Area (GMA) and 180 District Metered Area (DMA) meters required. A priority list was prepared and designs of the chambers undertaken. Once designs were approved by NMBM, the work was issued to R&M contractor to construct.
3	Remote Metering	Advanced Metering Infrastructure (AMI) must be introduced to enhance revenue collection. A triennial tender document has been prepared for the provision of AMI to Water Metering Systems for 1 500 meters for industrial, commercial and institutional (ICI) consumers, bulk supply meters and GMA and DMA meters. The document will go through the Supply Chain Management (SCM) process of the NMBM.
4	NRW	The non-revenue water (NRW) was 46% in 2014/2015, decreasing to 43.4% in 2015/2016. Although the NRW level has reduced from 2014/15, it remains high.
5	PRV Management	To date, some 38 Pressure Reducing Valve (PRV) stations have been audited, 22 upgraded and three new stations have been installed.
6	ICI Consumers and Billing	Some of the problem areas identified with regards to industrial, commercial and institutional (ICI) consumers include the estimation of consumers' water use for 4 months or longer, as well as issues arising from meters with flow-restrictors. Although a task team was established to address these problem areas, the attendance of Municipal Treasury officials has been poor, which has impeded progress.
7	Water Tariffs	The NMBM increased their domestic tariffs for 2016/17 by 9% and the industrial/commercial tariff by 19%.
8	Leak Repairs	Assistance to the Poor (ATTP) leak repairs are repairs to private plumbing of poor households. This program contributes to the reduction of water losses and offers work for the ward-based contractors. During 2015/16, the number of repairs increased to 20 087, and a further 38 ward-based plumbers were employed and trained to total 83. The revised target of repairs is 4 000 per month. Of the 384 schools, 107 had meters with various problems that needed replacing. The bulk of these have been replaced. The Auditor General considers leak repairs by the NMBM at schools to be unlawful expenditure. The programme will only proceed if the DoE provides the funding. The Metro's in-house leak repair teams cannot cope with the large number of leaks reported at the Call Centre. There is a backlog of 6 389 water-related complaints (reporting period March 2015 to April 2016). The NMBM is finalising the appointment of six cluster-based contractors (10 municipal wards per cluster) to carry out leak repairs within the wards of each cluster.
9	Repair and Maintenance Contractor	The R&M Contractor commenced work in January 2015, however, ceased work in November 2015 due to financial problems. The contractor only recommenced work on 14 March 2016. The delay of 4 months has had a negative impact on the NRW programme. The bulk of the work has been in the Uitenhage and Despatch areas where the water infrastructure is old.
10	Domestic Meter Audit	The report given on 12 August 2016: 3% of stop-cocks were faulty, 22% of meters were faulty, 1% of connections had leaks, 13% of internal connections had leaks and 9% of valves and hydrants were faulty.
11	Valve and Fire Hydrant Audit	Due to other priorities this intervention was not undertaken continuously. 9 391 valves and 5 692 fire hydrants have been audited.
12	Meter Replacement	Over the last eight years, 164 156 domestic meters were replaced, representing 75% of all domestic meters. 14 878 domestic meters were replaced in 2015/16. Problems were experienced with the triennial contractor appointed, however the numbers are expected to improve in 2016/17.
13	Publicity and Awareness	The municipality embarked on a Service Delivery Ambassador Programme. Ten persons per ward were selected by Ward Councillors and given leak-repair training, clothing, equipment and materials. Phase 1 of the programme included 22 wards, and covered the period from October 2015 to April 2016. For Phase 1, 20 000 complaints were received and 30 000 households visited. Phase 2 of the programme includes 29 wards, and commenced in July 2016.

2.2.3 NMBM Studies and Implementation of Schemes

Removal of distribution system limitations

It is important to take into account that the distribution system of the NMBM supply area has certain limitations of which the most important capacity limitation used to be that between the Northern and Southern parts of the NMBM supply area (between Motherwell and Chelsea reservoirs). The maximum capacity of this link was 11 million m^3/a (30 Ml/day). The capacity of this link was increased to 32.9 million m^3/a (90 Ml/day), and has been operational since March 2013.

ORP Nooitgedagt Low-Level Scheme

An additional allocation of water from the Orange River to NMBM has been approved by DWS for an initial period of 20 years, when DWS confirmed in 2009 that the NMBM water allocation from the Orange River had been increased to 58.4 million m^3/a (160 Ml/day). The EIA for the scheme has been approved by the Provincial Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), to be reviewed after 20 years. In view of the high cost of infrastructure investment, NMBM have requested DWS to consider making the additional allocation permanent.

The Metro is constructing the Nooitgedagt/Coega Low-Level Scheme (NCLLS) as an extension to the existing Nooitgedagt High-Level Scheme that will treat Orange River water, delivered through the Orange-Fish-Sundays River system, to drinking water standard for supply into the Metro's water supply system. The existing scheme capacity is 90 Mℓ/d.

NMBM is completing the outstanding works on the project in a phased approach, in line with the capacity of its capital budget. Phase 1 will ensure an average supply of 90 Ml/day (32.9 m^3/a). Phase 2 will be implemented to ensure an average supply of 125 Ml/day (45.6 m^3/a), with a peak of 160 Ml/day. Phase 3 will ensure an average supply of 160 Ml/day (58.4 m^3/a) which is the full allocation of NMBM from the OFS Scheme, making provision for a peak supply of 210 Ml/day (76.7 m^3/a).

To date, the low-level rising and gravity mains have been constructed and commissioned, including a 10 Ml balancing reservoir at Olifantskop, booster pump stations at Motherwell and Stanford Road, an emergency extension at the Nooitgedagt WTW and an additional HV/MV transformer. The scheme is currently in use through a temporary cross-connection between the high-level and low-level rising mains at the high-lift pump station.

A total of 9 separate further contracts will be implemented to complete the Nooitgedagt Low-Level Scheme and to increase the overall treatment capacity of Nooitgedagt WTW (Phases 2 and 3). These projects are currently being implemented. Implementation is however being constrained by limited availability of funds as it has to be financed by the NMBM.

Construction of Phase 2 being implemented and funded by the Metro (R128 million, excl. VAT) commenced in March 2015, with completion scheduled for March 2017. Phase 2 will provide the new low-lift pump station to complete the low-level scheme to Port Elizabeth. Once the Phase 2 extension is complete, it will supply approximately 100 Ml/d through the low-level scheme which will relieve pressure on the supply from the western system of the Algoa WSS. To date, good progress has been made on the new filter block and the low-lift pump station. The new WTW extension makes use of dual-lateral filter underdrain technology and UV light, which is more efficient than the systems used in the past. The dual-lateral underdrain system will allow for more water to be filtered over longer periods with less frequent backwashing and filter cleaning needed. This will lead to operational cost savings for the NMBM. The use of UV light as part of the disinfection process will lead to improved water quality and reduced consumption of chloride gas.

Phase 3 will be funded by the DWS, who has appointed Amatola Water as the implementing agent (R287 million incl. VAT) (single contract for additional 70 Ml/day (peak) module at Nooitgedagt WTW (civil, mechanical and electrical works), 45 Ml reservoir at Olifantskop, cathodic protection and AC mitigation measures on Nooitgedagt and Churchill pipelines, and rehabilitation of Chelsea-Motherwell pipeline). It is expected that a contractor will be appointed by October 2016, with construction to take 24 months. The project is currently stalled. Once Phase 3 has been completed, the Nooitgedagt WTW will reach its full design capacity of 160 Ml/d (210 Ml/d peak capacity).

Desalination

A Feasibility Investigation was undertaken in two phases, being a Site Selection and a Detailed Feasibility Investigation. Potential plant locations for a 60 Mℓ/d desalination plant for the NMBM have been investigated. The siting was concluded with the Schoenmakers inland site at the western side of the city recommended as the preferred site. The feasibility study got underway, with its components being a comprehensive water quality monitoring program, marine bathymetry and geophysical surveys, brine dispersion modelling, and preliminary design considerations for the marine intakes and outfall, the desalination plant, and the delivery pipeline. The preferred potential plant location would then also be subject to a full EIA. The Feasibility Investigation was stopped earlier this year, with the pre-feasibility investigations, site selections and marine bathymetry having been completed, and with the water quality monitoring evaluation done at desktop level.

NMBM advertised a "Request for Proposals from Interested Parties for the Implementation of a 60 Ml/d Sea Water Reverse Osmosis Desalination Plant in Port Elizabeth", potentially at a Coega IDZ site, which closed in June this year.

Groundwater

a. Background

Groundwater can provide an affordable and dependable water supply and can be implemented relatively rapidly once the legal requirements, especially water use licenses, have been secured. Most of the identified groundwater targets lie within a few kilometres from existing bulk supply pipelines or reservoirs which mean that construction times will generally be low, once the legal, design and tender processes have been completed.

Figure 2.2 shows the previously identified groundwater potential areas. The potential groundwater sources have been divided into those that have been investigated in detail, where drilling sites have been identified (as part of the emergency supply investigation during and after the 2010/11 drought), and those that have been investigated, but where further studies are required to locate drilling sites.

Green – areas ready to drill; yellow – areas requiring borehole siting; dark blue – bulk supply pipelines; light blue – canals (Google Earth, 2013).

Figure 2.2: Groundwater potential areas

b. Update of groundwater yields

The assumed combined yield of the identified eight groundwater interventions ranges from 23.2 to 35.6 million m^3/a, and was reported as 30.5 million m^3/a.

The assumed yield of the Coega Fault (Coega Kop and Uitenhage) Scheme was previously 8 million m^3/a. Following the drilling of 12 target areas in the Coega Kop area, the provisional yield estimate for the recommended six production sites is estimated at 8.6 – 17.3 Ml/day, or 6-8 million m^3/a. The yields of the other targeted areas remain as before.

c. Coega Kop exploration drilling

The Coega Fault System was investigated with exploration drilling in 2014 and 2015. The drilling results are summarized below (Murray, et al, 2016):

- 12 drilling targets were drilled; of these 10 targeted faults and 2 targeted weathered/jointed rock.
- 26 deep boreholes were drilled (plus several shallow boreholes to test the near-surface conditions).
- In relation to the highest yielding borehole at each site:
    - The average depth was 211 m.
    - The total drilling “blow” yield was approximately 380 l/s (1 370 m^3/hr).
    - The average “blow” yield was 32 l/s (115 m^3/hr).
- The highest yield was from an artesian-flowing borehole (GWA2B) with an initial yield of approximately 140 l/s, a depth of 198 m and a pressure of 6 bar.
- The groundwater has very low salinity (approximately 25 mS/m), but will have to be treated for iron and manganese.

Various methods have been used to estimate the sustainable yield of the aquifer (**Figure 2.3**), and the current best estimate ranges between 35 and 43 Ml/day (or could even be as high as 50 Ml/day). The estimated yields at several drilling sites are given in **Figure 2.4**.

NMBM has applied for a groundwater use license of 9.46 million m^3/a for both the Uitenhage and Coega areas, but DWS requested NMBM to revise it to just cover the Coega area. A revised application of 6.9 million m^3/a (19 Ml/day) was then submitted.

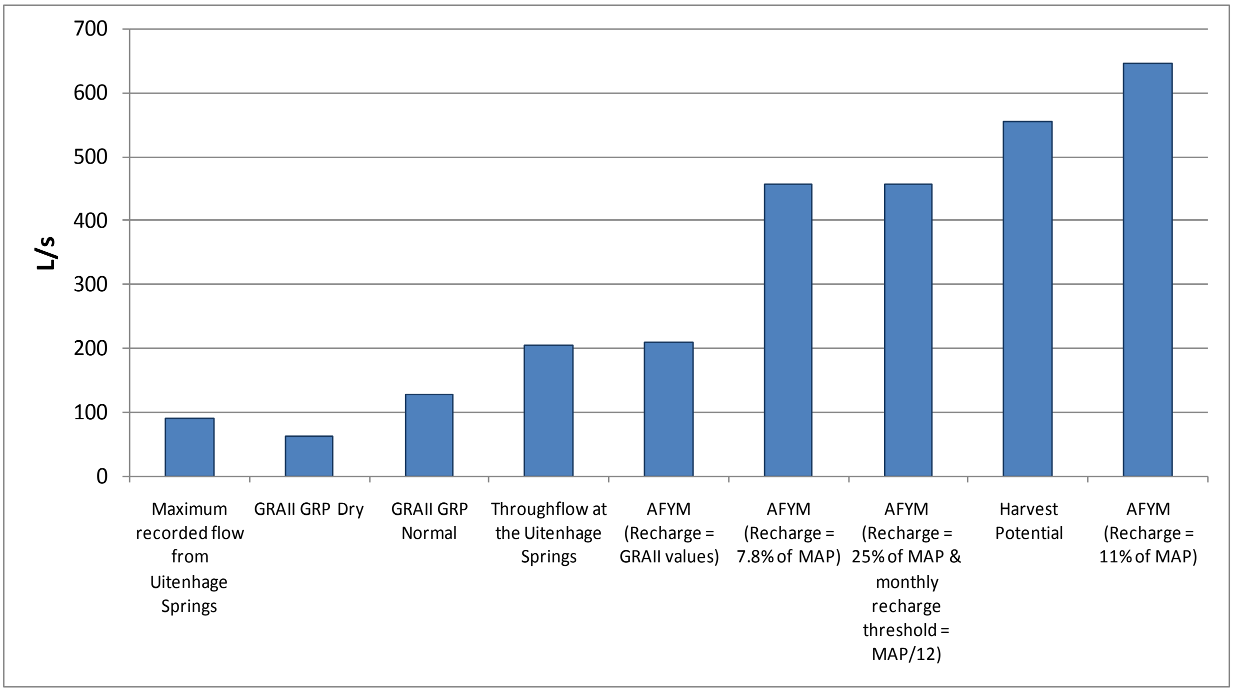


Figure 2.3: Coega Kop Fault Sustainable System Yield

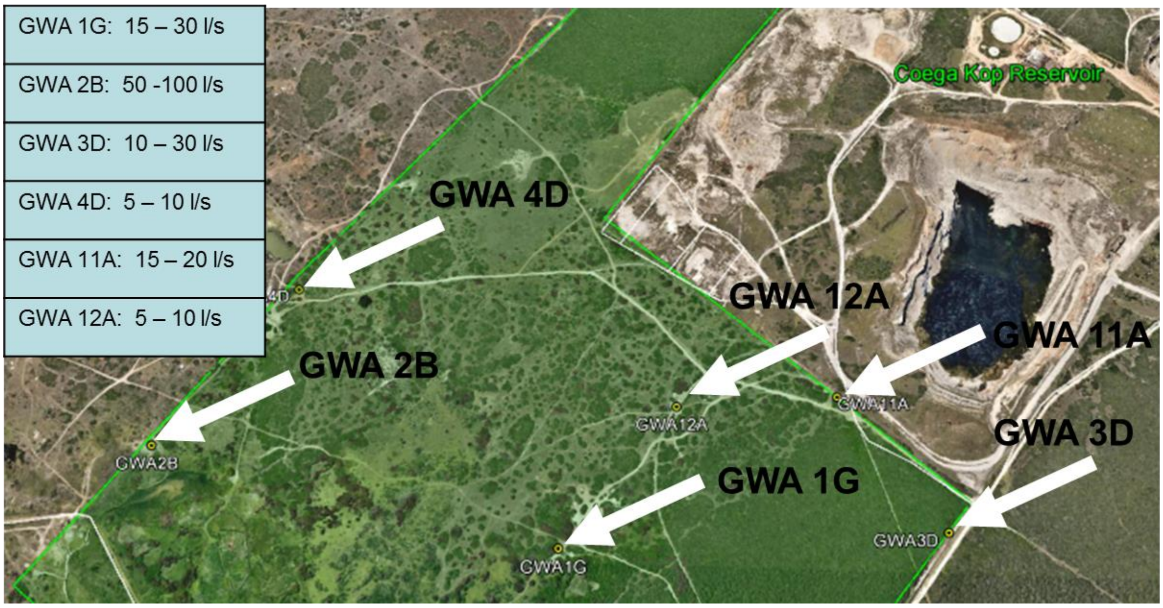


Figure 2.4: Estimated yields at drilling sites

d. Production borehole at Coega Kop

The GWA 2B borehole was selected as the first production borehole to be developed due to its large estimated yield of 50 to 100 l/s. The borehole was designed with a depth of 200 m, a flow of 5 l/s and a diameter of 267 mm. The water quality of the borehole is generally good, with the exception of high iron (Fe) and manganese (Mn) concentrations, as indicated in **Table 2.2**.

Table 2.2: Water quality of the Production borehole at Coega Kop

Parameter	Units	Test results range		Guideline Value (SANS 241:2011)
		Minimum	Maximum	
Ammonia	mg/ℓ	<0.08	0.12	<1.5
Calcium	mgCa/ℓ	5.6	30	
Chlorine	mgCl/ℓ	30	50	<5
Colour	mg/ℓ Pt-Co	<1	<1	<15
Conductivity @25°C	mS/m	27	99	<170
DOC	mgC/ℓ	<1	1.22	<10
Fluoride	mg/ℓ	0.25	0.80	<1.5
Iron (Total)	mgFe/ℓ	0.41	6.48	<0.3
Magnesium (Total)	mgMg/ℓ	28	32	<30
Manganese (Total)	mgMn/ℓ	0.29	3.96	<0.1
Nitrate + Nitrite	mgN/ℓ	0.01	0.87	<20
pH	-	6.1	7.4	5 to 9.7
Sodium	mg/ℓ	25	275	<200
Sulphate	$mgSO_4/ℓ$	4.41	122	<250
Total dissolved solids	mg/ℓ	94	587	<1200
Total hardness	$mgCaCO_3/ℓ$	26	202	-
Trihalomethanes	mg/ℓ	Not Measured		<0.1
True colour	mg/ℓ Pt-Co	<1	<1	<15
Turbidity	NTU	2.3	34.1	<1
Zinc	mg/ℓ	0.02	0.08	<5
Total Coliforms	Count per 100mℓ	0	54	<10
Heterotrophic Plate Count	Count per 1mℓ	5	286	<1000

e. Re-sampling of boreholes

In order to verify the water quality concentrations at Coega Kop, 4 boreholes are currently being re-sampled, namely GWA 1G, 3D, 11A and 12A. These boreholes will be re-sampled at intervals over 2-week periods, with uninterrupted flows over the 2-week period. Borehole GWA 2B has been plugged and cannot be re-sampled, however, GWA 1G was reported to be similar to GWA 2B.

Re-use of water treated to industrial standards – Fish Water Flats WWTW

Upgrade of the Fish Water Flats Waste Water Treatment Works (WWTW) Phase 1 is underway. This upgrade involves a new inlet works (170 Ml/day), upgrading of dewatering facilities, upgrade of the existing biological reactors with fine bubble, diffused aeration, addition of 45 Ml/d membrane biological reactors (MBR) to increase capacity, bulk electrical upgrade and general upgrade and refurbishment of the entire plant. Programming for overall upgrade of the plant is currently scheduled to be completed by 2016/17 but this is dependent on the availability of funding.

The re-use scheme involves large-scale supply of treated water from the Fish Water WWTW to industries in Port Elizabeth and the Coega IDZ. The first phase of supply is based on the understanding that the Metro will supply 30 Ml/day of Category 4 industrial process water from the Fish Water Flats WWTW via a balancing storage reservoir at Coega Kop to the IDZ. The second phase of the scheme will increase the water re-use scheme to 60 Ml/day and will incorporate a new storage reservoir(s) at Olifantskop. This will be constructed at a future date and is excluded at this stage. The environmental impact assessment for the scheme to supply the IDZ has been approved by the Eastern Cape DEDEAT. The design is mostly complete and a 17 Ml reservoir at Coegakop is about 85% complete. The Coega Development Corporation needs to procure additional funds to complete the reservoir. The implementation of the remainder of the scheme is dependent on the water requirements from large water users establishing in the IDZ. The construction will take 18-24 months to complete and R600 million is needed to bring the bulk supply conveyance infrastructure to the Coega IDZ boundary.

Re-use of water treated to industrial standards – Coega WWTW

The concept design phase of the engineering component has been completed and the draft Concept Design Report has been produced.

It is currently planned to implement the scheme in a phased approach, potentially starting with one domestic stream of 20 Mℓ/d. The degree to which the first few phases will need to accommodate light industrial effluent flows is uncertain, however several options have been evaluated. The way forward on this can only be confirmed once the client has reached a decision on the options presented in the Concept Design Report. **Table 2.3** shows the projected phasing based on a conservative approach, i.e. with a projected growth rate that is higher than actual current trends.

Table 2.3: Summarised phases of the Coega WWTW

Phase	Date	Volume per Phase (Mℓ/d)		Cumulative volume (Mℓ/d)	
		Domestic	Industrial	Domestic	Industrial
1	2019	20		20	
2	2024	20	10	40	10
3	2029	20	10	60	20
4	2034		20		40
5	2038		30		70

Progress is as follows:

- The concept design report assessed several alternatives in terms of primary, secondary and tertiary treatment. Based on a Multi-Criteria Decision Analysis workshop held with the client and the project team during June 2016, the preferred option is currently a conventional activated sludge system with treatment up to general limit standards and possible additional nutrient removal, including cloth filtration and UV closed-vessel disinfection.
- The preferred brine discharge alternative is to discharge to the Coega River up to a volume of 60 Mℓ/d to 80Mℓ/d, mostly domestic effluent at general limit standards (and possible additional nutrient removal).
- The current brine discharge options for the treated heavy industrial effluent are still being investigated, with one option being discharge to the ocean via the CDC's combined marine outfall (currently also in concept phase of evaluation).
- Contribution to the NMBM's Re-use Scheme is incorporated in the WWTW's planning (water to be pumped to the Coega Kop reused effluent reservoir).
- The EIA is currently in the pre-application phase and will enter the scoping phase as soon as the client has confirmed the way forward in terms of the options presented in the concept design report.

Further Orange River Water Development Options

Studies have not yet been initiated for the following options to augment (or possibly replace) Orange River water (if and when needed) in the longer term:

- Desalination of Sundays River irrigation return flows. Monitoring at the DWS monitoring station in the Lower Sundays River confirmed that sufficient water is available to justify a feasibility study.
- Increased allocation to NMBM. The investigation (as objective 1 of the Algoa Reconciliation Strategy Support Study) to evaluate the efficiency of the Eastern Cape Province Orange River Project will *inter-alia* quantify potential water savings and examine alternative options

for reallocation of water and the related effects on system operations, taking into account the requirements of NMBM and other users depending on water from the Orange River.

Monitoring

Gauges to monitor flows and quality of WWTW flows for later possible re-use schemes are in place.

Initial data obtained from the Lower Sundays River gauging point (N4L002 – Sundays River, Poplar Grove), confirmed that the minimum volume of irrigation return flows is in the order of 43 million m^3/a (120 Ml/day). This volume excludes the flooding periods in the Sundays River system and this takes into account the possibility of leakage from Darlington Dam.

2.2.4 Other Municipalities

Progress with regards to WC/WDM implementation needs to be measured and reported. Municipalities need to plan how to reduce their water requirements and become more efficient. Within the Algoa WSS only the Kouga LM needs to be monitored.

The DWS All Towns Reconciliation Strategies recommends full implementation of a Water Conservation and Water Demand Management Strategy for implementation as first priority in all the towns within the Kouga Local Municipality. In addition, the All Towns Strategy recommended the following interventions for implementation, not specifically in this order:

- Groundwater development.
- An increased allocation from the Algoa WSS (Kromme pipeline or Gamtoos GWS)

Should further allocations be made from the WSS, especially from the Kromme sub-system, to Kouga LM, this would have the implication that NMBM would need to find alternate replacement sources, with corresponding financial implications. This could also influence municipal distribution infrastructure, considering the location of such potential new sources to the water demand centres.

Own funding was made available during the 2014/2015 financial year for various bulk water related infrastructure projects with the main aim to un-block housing projects.

The DWS allocated R6.0 million during the 2014/2015 year to Kouga Municipality through the ACIP (Accelerated Community Infrastructure Program). These funds were used to (i) develop and implement WC/WDM strategies (R 2.0 million) and (ii) to augment and provide treatment of borehole water in Wavecrest, Jeffreys Bay (R 4.0 million). Application has been made to the NMBM for an additional connection to alleviate the Wavecrest supply problem.

Borehole water quality in Wavecrest, Jeffreys Bay is also not within standards with regards to the presence of Iron and Manganese, and it remains a challenge that needs to be addressed. This has partially been address with funding from DWS through the ACIP, whereby exploration boreholes were drilled, existing boreholes refurbished and a pilot biological treatment plant was constructed at the Jeffreys Bay WTW with the purpose to remove iron and manganese.

Some water services challenges are being experienced, which include the need to develop a long-term water provision master plan, with reference to the upgrading and rehabilitation of bulk infrastructure. There are water losses due to ageing infrastructure (pipe breaks and leaks). The removal of dissolved iron and manganese in groundwater, especially in Upper Wavecrest, is a challenge.

3 2016 Update of the Strategy

3.1 Algoa WSS yield

The Algoa WSS currently comprises of three major dams in the west, several smaller dams, a spring situated near to NMBM, and an inter-basin transfer scheme from the Orange River via the Fish and Sundays rivers to the east. The main components of the Algoa WSS are shown in Figure 1.2.

The need for a water availability assessment study in the Kouga and Kromme catchments to address the significant uncertainties in water availability, once the verification and validations has been completed, has been well documented

3.1.1 Priority Classes of water supply

The agreed split of the water requirements between the different assurances of supply for each category is summarised in Table 3.1, as reported in the Algoa Water Resources Bridging Study. This priority classification was derived from a process of interaction with the main role players, as part of the study. These are however not cast in concrete and can be adjusted based on the findings from the analysis as well as experience gained during the operation of the system in future.

The water user priority classification applied included five user categories, namely domestic/industrial, Gamtoos irrigation, other irrigation, environmental and losses. The water requirements associated with each category were further divided into four priority classes, each with a specific assurance of supply criteria (or acceptable risk of non-supply).

Table 3.1: Priority classes for different category water users

Category	% of total water requirement allocated to indicated priority class and acceptable risk of non-supply (assurance of supply)			
	1: 100[(1)] year (99%)	1: 50 year (98%)	1: 10 year (90%)	1: 5 year (80%)
Irrigation Gamtoos	30	20	20	30
Irrigation Other	20	20	20	40
Domestic/Industrial	50	20	20	10
Losses	100	0	0	0
Environmental	100	0	0	0

Note (1): As a recurrence interval (RI) of failure, in years.

The Algoa Water Resources Bridging Study found that the curtailment plots for the Kouga-Loerie and Kromme sub-systems showed that the two sub-systems are slightly over-allocated, as the system is curtailed more often than it should be curtailed, based on the agreed assurance of supply. The curtailments plots for the Groendal sub-system showed that the sub-system is totally over-allocated.

3.1.2 Algoa WSS Yield

Bulk water planning is generally done at a 1 in 50 year assurance of supply, for urban water supply. The Algoa WSS urban water use is in excess of 60% of total use from the system, and is expected to increase. Future evaluation and scenario planning has therefore been based on a 1 in 50 year assurance of supply.

The updated 1 in 50 year long-term stochastic yields of the various sources of supply available for urban, industrial and agricultural use are shown in Table 3.2.

Table 3.2: Long-term stochastic yields of the Algoa Water Supply System

Sources of supply	1 in 50 year yield or existing allocation/use	
	(million m^3/a)	(Ml/d)
NMBM older dams	3.4	9.3
Groendal Dam	6.8	18.6
Uitenhage Springs and boreholes	2.8	7.7
Churchill/Impofu dams	43.0	117.8
Kouga/Loerie dams	75.5	206.8
Sundays River GWS transfer	32.9	90.1
Combined Total Yield	**164.6**	**451.0**

In recent years, almost no water had been used from the **old Dams** (Sand, Bulk and the Van Stadens dams), as a result of infrastructure requiring maintenance.

The yield of the **Kromme** River sub-system (Churchill/Impofu dams) has been marginally reduced from 46 million m^3/a to 43 million m^3/a, to align with the finding of the Algoa Water Resources Bridging Study. The ecological water requirements (EWR) for the Kromme River below Impofu Dam is therefore not included in the water balance any more, as it has been taken into account as part of the Algoa Water Resources Bridging Study yield analysis. It is important that the eradication of invasive alien plants continue in the catchments upstream of the dams, to protect their yields.

The yield of the **Kouga-Loerie** sub-system has been kept at 75.5 million m^3/a, despite the finding of the Algoa Water Resources Bridging Study that the yield of the sub-system has increased to 85 million m^3/a, given the uncertainty and indication that the sub-system is slightly over-allocated.

The capacity of the Sundays River GWS transfer at **Nooitgedagt WTW** has been updated to the current capacity of 90 Ml/d, or 32.9 million m^3/a.

3.2 Historical Water Requirements

Figure 3.1 shows the historical water requirements (excluding re-use of water) for the Algoa WSS for the past 16 years, with a trendline added. The depiction of water use is by 12-month periods starting in July until June the following year, to correspond with the NMBM and Gamtoos Irrigation Board financial years.

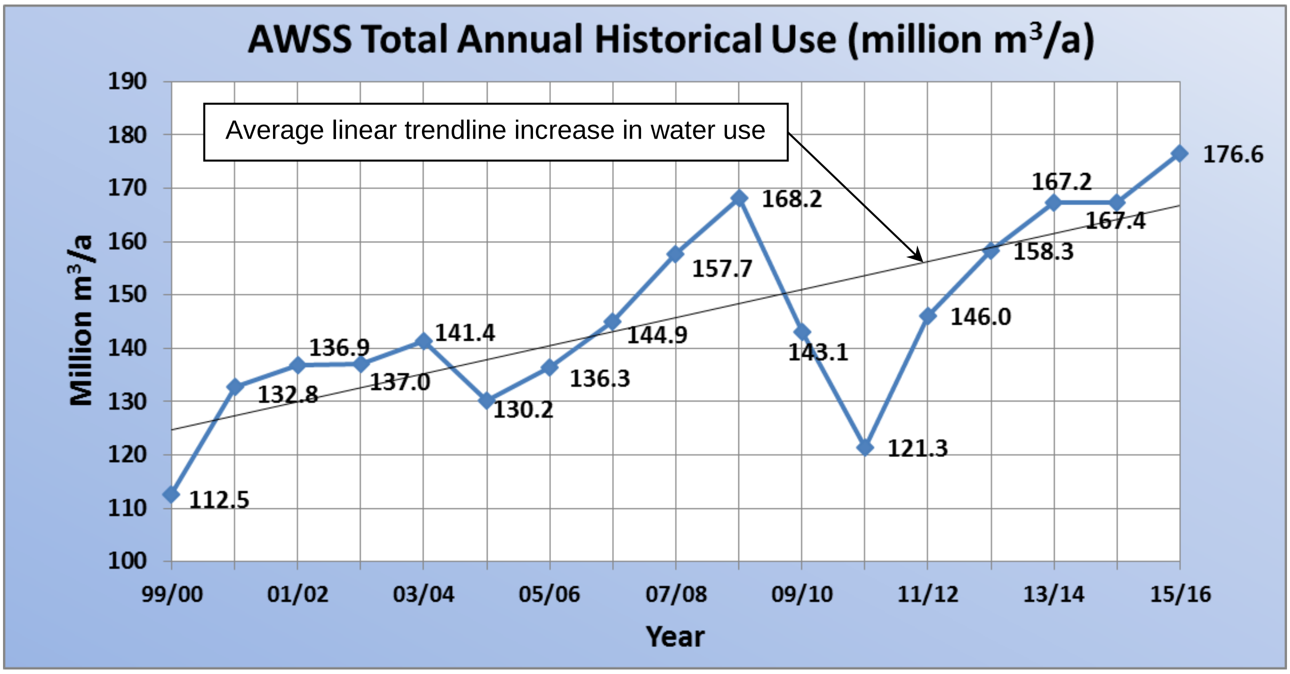


Figure 3.1: Historical Water Requirements of the Algoa WSS

The average linear increase in water use according to the trendline has been 2.6 million m^3/a, while the actual increase on average has been 4.0 million m^3/a, over this period. Linear trendline growth has been 2.1%/a, while actual growth has been 3.6%/a, expressed in terms of the starting values.

Figure 3.2 shows the composition of the historical water requirements (excluding re-use of water) for the Algoa WSS. The graph shows that, while water use is inhibited during a drought (drought restriction years shown by circles) through the implementation of water restrictions, the water requirements growth trend has continued once the droughts were broken.

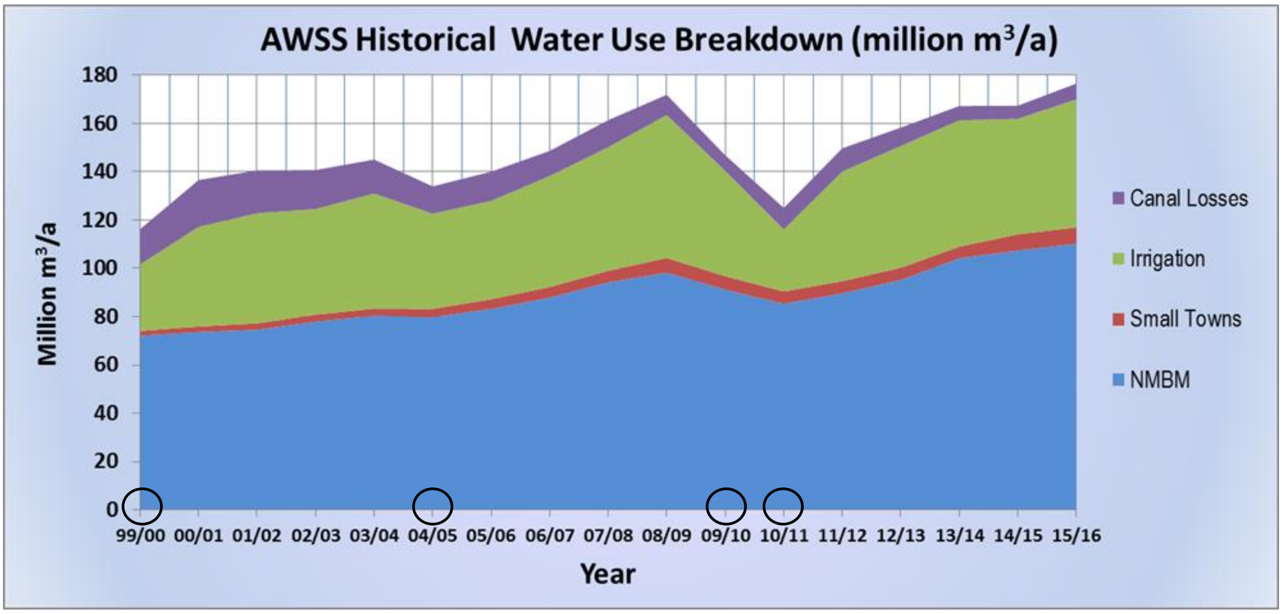


Figure 3.2: Historical Water Requirements breakdown from the Algoa WSS

Note that water use by NMBM shown in **Figure 3.1** and **Figure 3.2** includes potable water use by the Coega IDZ.

3.3 Current AWSS Water Use (2015/16)

The total usage of water from the Algoa WSS in 2015/16 was 176.6 million m^3/a (Figure 3.3). This includes urban use by NMBM and various small towns, Coega IDZ, irrigation and losses from the Kouga/Loerie canal. The sectoral water use pattern for 2015/16 was as follows:

NMBM	109.6 million m^3/a (62% of the total)
Coega IDZ Potable	0.6 million m^3/a (0.3% of the total)
Small towns	6.8 million m^3/a (4% of the total)
Irrigation	53 million m^3/a (29% of the total)
Canal losses & UAW	6.6 million m^3/a (4% of the total)
TOTAL	**176.6 million m^3/a**

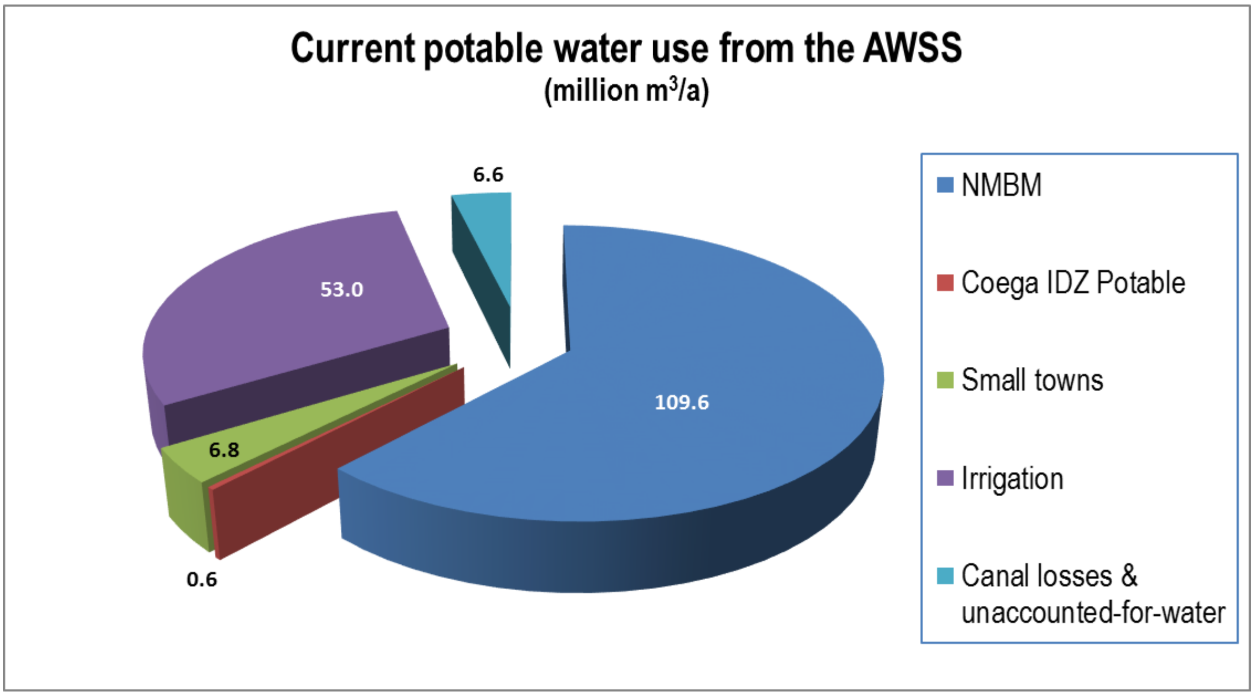


Figure 3.3: 2015/16 Algoa WSS Potable Water Use

Note that, for previous water balance calculations of the Strategy (as explained in Chapter 4 of the Water Reconciliation Strategy Study for the Algoa Water Supply Area, 2011), a converted allocation of the Gamtoos Irrigation Board was used. It was agreed at the Scenarios Workshop for this study, held in December 2009 that, as the full allocation of the GIB of 59.36 million m^3/a, from the Kouga Dam was for an assurance of supply of 91% (1 in 10 year assurance), the equivalent supply for an assurance of 98% (1 in 50 year assurance) should be determined as this is the assurance of supply for the urban sector used for the reconciliation strategy. The supply available to the GIB at 98% assurance (1 in 50 year assurance of supply) was then determined to be 44.4 million m^3/a, for purposes of scenario analysis.

Irrigation water use for 2015/16 were as follows:

Gamtoos Irrigation Board	48.6
Groendal irrigation	2.4
Irrigation from Impofu Dam	2.0
Total:	**53.0 million m^3/a**

When considering the updated assurance of supply as indicated in **Table 3.1**, now available from the Algoa Water Resources Bridging Study, it is evident that water is being supplied to irrigation at higher assurances of supply than a 1 in 10 year assurance, and that the conversion of yield for water balance calculations should no longer be done. Irrigation allocations have therefore been used in the water balance determination, instead of the previous method of using a 'converted allocation'.

The combined total allocation for irrigation in the Algoa WSS is 63.76 million m^3/a, excluding irrigation usage from the rivers upstream of the dams that form part of the Algoa WSS. This allocation is assumed to be a constant value in the evaluation of future water balance scenarios.

The breakdown of allocation for irrigation within the strategy area is as follows:

Gamtoos Irrigation Board:	59.36
Groendal Irrigation Board:	2.4
Impofu Dam: Coca Cola bottling plant	2.0
Total:	**63.76 million m^3/a**

Various future water requirement scenarios were developed, with the primary considerations being population and economic growth. Two key future water requirement scenarios are used for the Algoa Reconciliation Strategy, namely a high-growth and a low-growth scenario. These scenarios do not take account of future water conservation and water demand management (WC/WDM) measures or effluent reuse schemes, as these are included as interventions that could be selected to reduce the future water requirement. In the scenario development it has been assumed that irrigation usage do not change.

3.4 Coega IDZ water requirements

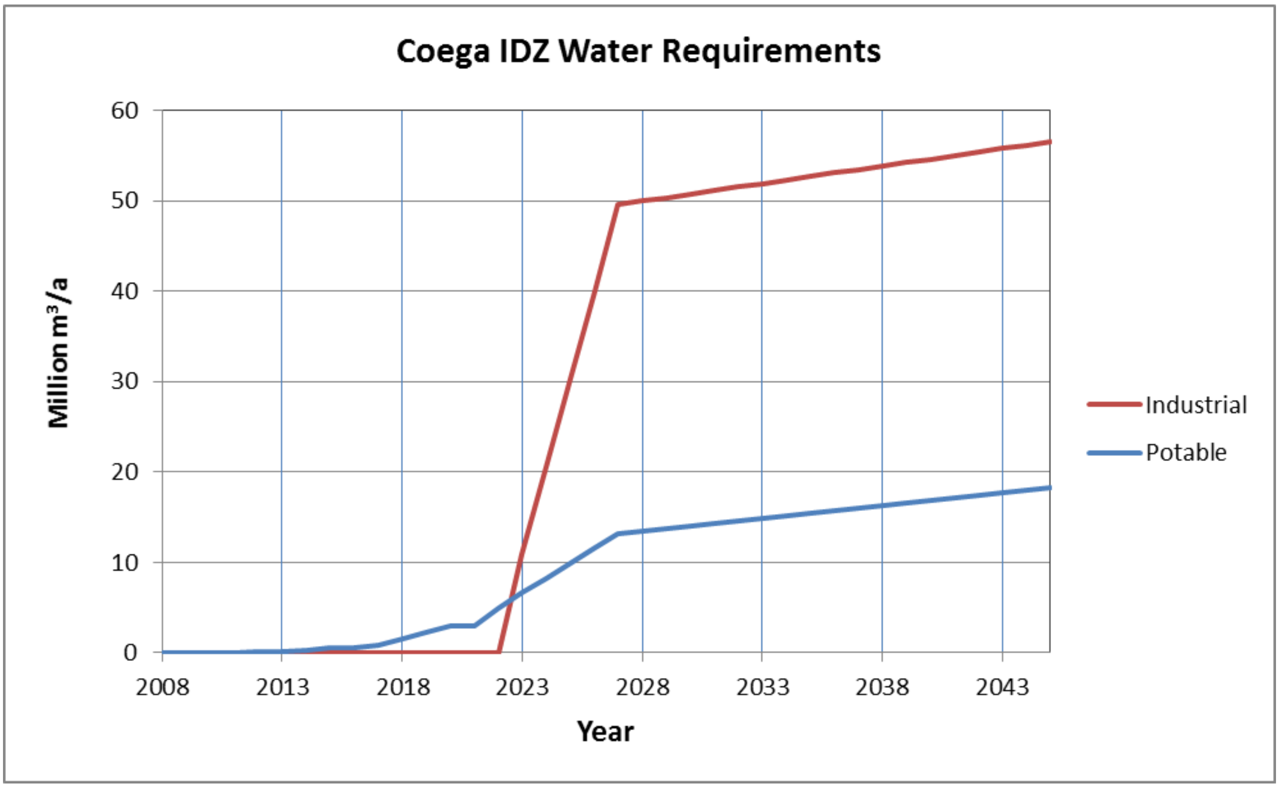
The Coega IDZ is "home to 29 operational investors" that have invested R1.2 billion, while a further R7.5 billion is at the implementation phase and further projects worth R8.1 billion are currently being negotiated. In addition, projects currently worth R116.3 billion are the subject of feasibility studies.

The estimates of the bulk water studies for the uptake of industrial water requirements have remained consistent over the past two years. However, a lack of certainty exists in respect of the new heavy industries which have previously committed and then either postponed or withdrawn their proposed developments. Future uptake of industrial water will remain uncertain until such time that the availability of industrial water supplies and power can be confirmed. The supply of industrial quality water is a requirement of the environmental authorisation for establishing large industries at the Coega IDZ. The lack of confirmed availability of industrial quality water can pose serious challenges to attracting future development to the Coega IDZ.

In terms of the future water requirements, according to projections done under this Strategy Support Study and the Water Master Plan Review document of the Metro, surplus potable water will be available from the Nooitgedagt/Coega Low-Level Scheme once completed. This potable water can be cost-effectively used as an interim industrial water supply to the Coega IDZ. The interim use of potable water in the IDZ has been accommodated through an amendment to the existing environmental authorisation for the large water user. It is however a condition of the EIA to the large water user that industrial water requirements should be met by the reuse of wastewater.

The Coega IDZ water requirement projections for potable and industrial quality water respectively, is shown in **Figure 3.4**.

Figure 3.4: Coega IDZ Projected Water Requirements from the Algoa WSS



The estimate of industrial water requirement uptake is still very uncertain as new heavy industries have previously committed and then either postponed or withdrawn their proposed developments. Future uptake of industrial water will remain uncertain until such stage that the availability of industrial water (and secure power supply) can be confirmed.

3.5 Kouga LM Water Requirements

3.5.1 Municipal water requirements

Kouga LM is responsible for the provision of water services to Cape St. Francis, St. Francis Bay, Hankey, Humansdorp, Kruisfontein, Jeffreys Bay, Oyster Bay, Patensie and Thornhill. *The Development of Reconciliation Strategies for all Towns in the Southern Planning Region (Version 2)* study (2013-2015), undertaken by the DWS, provides information on the current and estimated future water requirement for these towns, as discussed below.

Cape St. Francis is served through the bulk water supply system, which comprises of the Churchill pipeline and groundwater sources. NMBM currently supplies Kouga LM with potable water from the AWSS via the Churchill pipeline. This supply line was upgraded to 350 mm diameter, which increased its capacity to 95 l/s (2.996 million m^3/a). The Kouga LM is currently utilising 1.327 million m^3/a from the pipeline.

Humansdorp and Kruisfontein obtain surface water from the Churchill bulk water supply pipeline. The Kouga LM entered into an agreement with the NMBM which permits the Kouga LM to an annual limited abstraction volume of 0.06 million m^3.

Jeffreys Bay receives all of its surface water from the NMBM via the Churchill bulk supply pipeline. An agreement between the NMBM and the Kouga LM permits the abstraction of treated water from the Churchill bulk supply pipeline. Jeffreys Bay's agreement allows for the abstraction of 0.45 million m^3/a.

The current volume abstracted from the pipeline is approximately 2.15 million m^3/a, which is substantially more than the allocated volume.

Thornhill receives treated water from the Summit-Chelsea water pipeline, which runs from the Churchill WTW and is part of the AWSS. The Kouga LM is permitted to abstract treated water from the pipeline. A new agreement with the NMBM has to be negotiated to formalise the abstraction. Currently, Thornhill abstracts 0.08 million m^3/a from the Algoa WSS.

Oyster Bay obtains all of its bulk water from groundwater sources, and does not depend on bulk purchase of water from the NMBM.

Hankey and Patensie obtain the bulk of their water from the Gamtoos Government Water Scheme, which comprises the DWS-owned Kouga Dam, Gamtoos canals and Loerie Dam. The Gamtoos Irrigation Board operates Kouga Dam and its main canal on behalf of DWS. NMBM owns and operates Loerie Dam WTW. The Gamtoos scheme supplies water to Port Elizabeth, Hankey and Patensie for urban use, and the balance to irrigation. Water is conveyed from Kouga Dam to Loerie Dam by means of a canal from which irrigation requirements are abstracted.

A summary of the current Kouga LM population and water use per town is given in **Table 3.3**.

Table 3.3: Kouga LM population and water use

Town	2014 Population (1000)	Future Population Growth (%/a)	Annual Bulk Water Demand (million m^3/a)	NRW (%)	Available Groundwater (million m^3/a)	Available Bulk Purchase (million m^3/a)
Cape St. Francis & St. Francis Bay	6	4	1.327	46.1	1.594	0.185
Humansdorp & Kruisfontein	31	2	1.390	25.3	1.039	0.060
Jeffreys Bay	29	2	3.309	45.8	1.130	0.450
Thornhill	3	2	0.080	19.7	0.000	0.080
Oyster Bay	1	2	0.083	47.2	0.154	0.000
Hankey	12	2	0.615	53.6	0.000	0.571
Patensie	5	2	0.505	76.5	0.000	0.480
Total	**87**	**2.3**	**7.309**	**44.9**	**3.917**	**1.826**

However, according to the Kouga LM 2016/17 IDP the water use within the municipality was 10.0 million m^3/a (27.3 Mℓ/d), with an estimated bulk water requirement of 13.0 million m^3/a (35.5 Mℓ/d). Of this, 5.6 million m^3/a was supplied from the Algoa WSS in 2015/16.

It is evident that Kouga LM abstracts volumes in excess of their agreement with NMBM from the Kromme pipeline. Their current identified sources are further limited.

3.5.2 Proposed Nuclear Power Plant

Eskom Holdings Limited (Eskom) proposes to construct, operate and commission conventional nuclear power stations in South Africa, as part of a plan to meet the total demand for electricity of South Africa. The approved Integrated Resource Plan 2010, which outlines government's strategy for meeting the increasing energy needs, indicates government's commitment to the construction of 9 600 MW of nuclear power by 2030. It is Eskom's intention to investigate the feasibility of pursuing the nuclear power generating capacity required by South Africa.

The first planned nuclear power station, Nuclear-1 (4 000 MW), will have an estimated total footprint of 200 to 280 ha, and is currently in the Environmental Authorisation application phase. Nuclear-1 has three alternative proposed sites, namely Duynefontein (35 km north of Cape Town), Bantamsklip (Southern

Cape coast between Danger and Quoin Points) and Thyspunt (Eastern Cape coast between Oyster Bay and St. Francis Bay).

Water will be required on-site throughout the project life cycle, with a markedly increased water requirement during construction. It is estimated that the water requirement of the power plant will be 3.3 million m^3/a (9 Mℓ/day) during construction and 2.2 million m^3/a (6 Mℓ/day) during operation. The following options were considered to meet the additional water requirement:

- Boreholes
- Municipal water
- Desalination of seawater.

The water requirement of the proposed power station is significant relevant to existing municipal sources and the use of municipal and borehole water in the long-term will not be sustainable. This, coupled with the fact that seawater intake systems will be developed for component cooling, creates a suitable situation for the development of a desalination plant. The co-development of desalination and power generation plants is globally well documented. Prior to the desalination plant becoming operational, Eskom intends to use groundwater resources for a period of approximately one year, prior to the commissioning of a permanent desalination plant at the Thyspunt / Duynefontein sites. The required volume is 0.54 million m^3/a (17 ℓ/s) to 0.73 million m^3/a (23 ℓ/s). Planning for the use of boreholes is intended to ensure that it does has have an impact on existing boreholes used for domestic purposes adjacent to the site.

The specialist study report, *Fresh Water Supply Environmental Impact Report* (2015), prepared by SRK Consulting as part of the *Final Environmental Impact Assessment Report for the Eskom Nuclear Power Station and Associated Infrastructure* study (2006), concluded the following for the Thyspunt site:

- There is extensive use of groundwater in the surrounding area.
- There are coastal springs at the site.
- The surrounding towns are supplied with water from the Churchill and Impofu dams and from groundwater.
- There is scope for further development of local groundwater resources for construction supply, both on-site and in the surrounding area.
- Local and regional surface water resources are under stress and additional draw-off to supply a nuclear power plant would exacerbate this situation.
- The main option for surface water supply with least local and regional impact is import of water from the Orange River Scheme.
- Surface water and to a lesser extent groundwater is likely to be adversely affected by climate change.
- Desalination of seawater is the most viable option for an assured water supply with least environmental impact and would not be affected by climate change.

3.5.3 Future sources

Three different water requirement scenarios were developed as part of the All Towns Strategy Study, based on population growth rates: Low growth rate, Medium growth rate and High growth rate. The estimated future population and water requirements for Kouga LM are shown in **Figure 3.5** and **Figure 3.6** respectively.

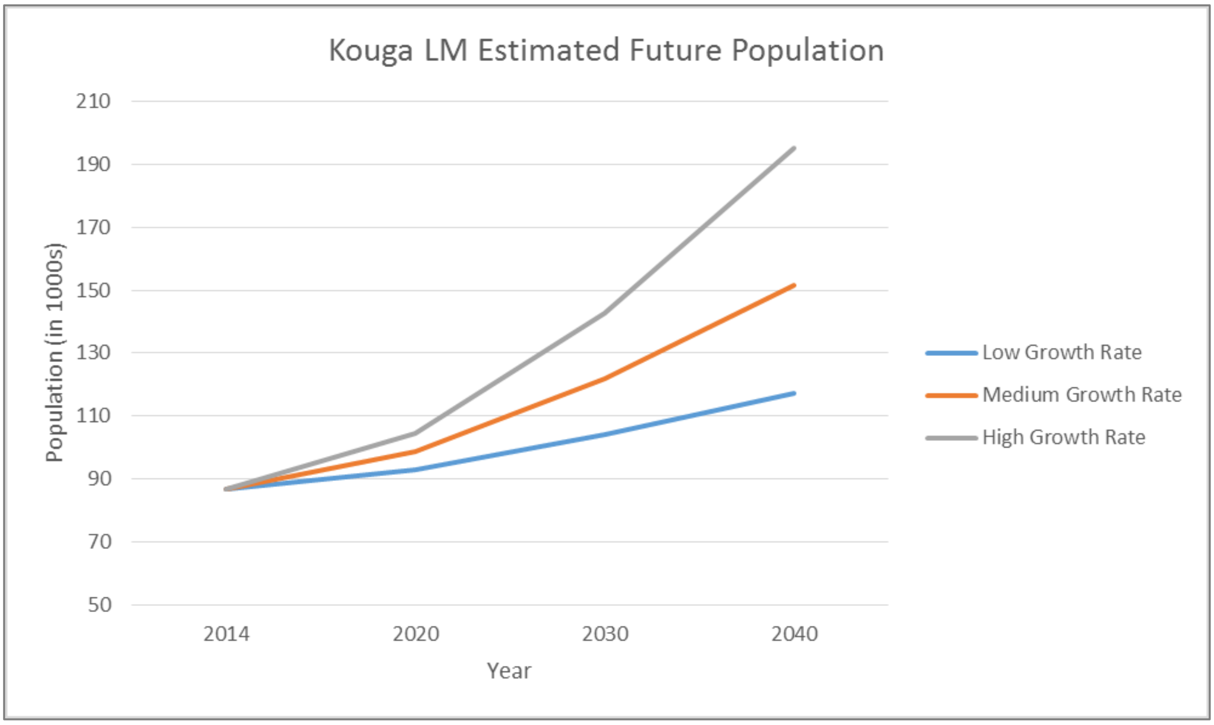


Figure 3.5: Estimated future population of Kouga LM

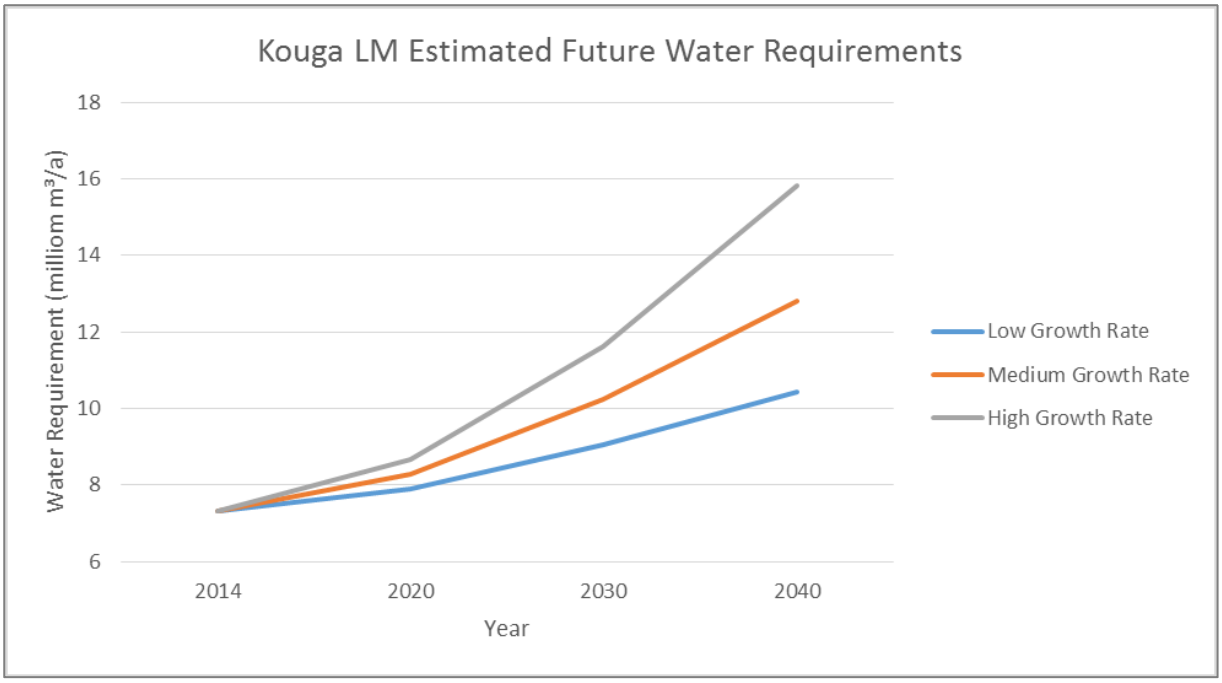


Figure 3.6: Estimated future water requirements for Kouga LM

It is evident that a very significant effort is needed to improve water efficiency, which is the most obvious source of additional water. Groundwater development options exist, including the Churchill Dam and Humansdorp groundwater schemes identified as part of this strategy. While an increased allocation from the Algoa WSS (Kromme pipeline or Gamtoos GWS) is an option, this would necessitate that NMBM find replacement sources, with corresponding financial implications. This could also influence municipal distribution infrastructure, considering the location of such potential new sources to the water demand centres.

The supply of additional Orange River water to the NMBM, in lieu of more water supplied from the Kromme River sub-system to the Kouga LM and the proposed power plant is a possibility, but is not desirable from NMBM's perspective.

It seem logical that, should a power plant be established at Thyspunt, a seawater desalination plant be implemented.

3.6 LSRWUA Water Requirements

The LSRWUA is delegated to operate the LSRGWS on behalf of the DWS. The LSRGWS comprises of the Darlington Dam, the Korhaansdrift Weir, the main canal, the Scheepersvlakte Balancing Dam and a series of mostly lined distribution canals. The LSRWUA manages an area of 17 293 ha, with a total scheduled quota of 156 million m^3/a. The LSRWUA uses Orange River that is abstracted at Korhaansdrift Weir, and conveyed to Scheepersvlakte Balancing Dam, from where it is distributed further to irrigators/small towns and the NMBM. The LSRWUA also supplies the towns of Addo, Kirkwood and Paterson with water for domestic use from the Caesar's Dam at Addo, which is filled from the main canal. The bulk conveyance infrastructure that is shared with NMBM forms part of the Algoa WSS.

The capacity of the balancing dam is already not sufficient to meet the dual purpose of supplying the upgraded Nooitgedagt WTW as well as the irrigators. Increased future conveyance volumes, as a result of further phases of the Nooitgedagt WTW, and increased allocations to irrigators of the LSRWUA, will cause operating system constraints / bottlenecks for sustainable delivery of Orange River water supply to LSRGWS and to NMBM. A study is underway by DWS to evaluate the removal of such operating system constraints.

The investigation of additional balancing storage in the LSRGWS aims at removing potential operating system constraints for sustainable delivery of bulk Orange River water supply to the LSRGWS and to NMBM, for water requirements up to 2040. The objective is therefore to limit risks of shortfall in supply as well as operational risks to acceptable levels. The focus is on providing additional balancing storage, in addition to the Scheepersvlakte Balancing Dam, which includes the investigation of storage at other potential locations in the bulk transfer infrastructure. Options to increase balancing storage or alternative approaches of supply will be conceptualised. One potential approach is to separate the supply to NMBM from Korhaansdrift Weir.

The two main irrigation areas that were not completed as part of the original planned LSRGWS are the infrastructure to supply the Barkley Bridge South (1980 ha) and Penhurst Area (Addo and Milverton – 950 ha). It was originally planned to develop a further approximately 3 000 ha under irrigation in the Barkley Bridge area for resource-poor farmers. For this project to be supplied by the LSRWUA, is was planned that a 15 km canal extension as well as the future Penhurst Balancing Dam should be completed. Several allocations to resource-poor farmers have however already been made, and it will need to be established which further allocations are likely to me made and should be taken into account.

NMBM recently undertook a study termed *Design, Contract Documentation and Construction Supervision for Rehabilitation Work at the Scheepersvlakte Dam*, which *inter-alia* addressed the reliability of the scheme for domestic water supply and potential infrastructural improvements such as a new outlet tower.

3.7 Future water requirement scenarios

Due to the great variability in water requirement growth rates, the accurate prediction of long term future water requirement growth is of great importance to ensure adequate supply for the increase in requirements. A large number of factors, influencing water requirements growth rates need to be taken into account and projections are annually updated.

Factors influencing water requirement growth include:

- Population growth
- Urban and industrial development (economic growth)
- Weather (climate)
- Efficiency of water use (WC/WDM)
- Intensification of use (new water supply to existing rural areas or improved urban service delivery)
- Regulations and policies
- Seasonal variability (holiday periods)
- Water rates

High variability makes the accurate prediction of short term growth rates extremely difficult. Long term future water requirements predictions are therefore predominantly based on factors such as the long term historical growth trends, but should allow for unpredictable short term to medium-term water requirements growth periods in excess of long term historical growth trends.

It should be noted that the future water requirements projections presented below are not aimed at long term accuracy, but are instead intended as a tool to provide possible future water requirements to aid the planning of future interventions and the timing of their implementation.

Eight future water requirement scenarios have been developed, these being:

1. **Coega industrial water requirements**, showing how industrial-quality water requirements can be met from re-use schemes. The possibility of developing the Sundays River Return Flow scheme as a non-potable scheme also has potential as an alternative to meet the future industrial requirements of the IDZ.
2. **Low-Growth including Coega Potable**: 1% compounded growth, including Coega potable water and industrial standard water requirements.
3. **Reference – High-Growth Potable**: 3.5% linear growth, including Coega potable water requirements.
4. **High-Growth Potable without WC/WDM**: 3.5% linear growth, including Coega potable water requirements, excluding possible savings from WC/WDM.
5. **Increased supply to Kouga LM (new scenario)**: Similar to water requirement scenario 3, with 3.5% linear growth in WSS potable water requirements, plus additional 'All Towns' high growth of Kouga LM and water requirements from the nuclear power plant use from 2024 (assumed).
6. **High-Growth including Coega**: 3.5% linear growth, including Coega potable and industrial standard water requirements.
7. **Reserve Scenario**: 3.5% linear growth, including Coega potable water and industrial standard water requirements, with the implementation of the ecological Reserve on existing dams.
8. **Worst Case**: 3.5% linear growth, including Coega potable water and industrial standard water requirements, with climate change and the implementation of the ecological Reserve on existing dams.

The 2015/16 historical water use is the starting point for scenario planning.

3.8 Changes to Interventions and Implementation Programmes

3.8.1 NMBM WC/WDM

Allowance has been made for a NMBM WC/WDM implementation programme from 2016 to 2025, and a further WC/WDM programme thereafter, from 2026 to the end of the evaluation period (2041). In addition, these two WC/WDM programmes have been included at projected savings of 5%, 10% and 15% respectively, based on the actual or projected water use at the beginning of the programme.

3.8.2 Further allocation of Orange River water to NMBM

The concept of further phasing (post Phase 3) of the transfer scheme that will supply Orange River water to NMBM has been conceptualised. The Nooitgedagt Phase 4 Scheme has been introduced, with an initial assumed yield of 7.5 million m^3/a, in the absence of any information to base the potential yield on. It has been assumed that this phase would require increased treatment capacity at the Nooitgedagt WTW, but the best approach to convey such additional water from Korhaansdrift Weir to Nooitgedagt WTW needs further evaluation. Conveyance to NMBM could be by either of the two bulk supply (high-level and low-level) pipelines. Should the capacity of these pipelines be exceeded (assuming that supply cannot be boosted) a further bulk supply pipeline would be required.

3.8.3 Re-use of treated effluent from the future Coega WWTW

The Re-use Scheme from the future Coega WWTW (2 phases were previously allowed for, to only supply industrial quality water) has been redefined, according to the information from the ongoing study. It is currently planned to implement according to a phased approach, potentially starting with one domestic stream of 20 Mℓ/d, as Phase 1. In total five phases has been allowed for, of which Phases 1 to 3 could supply potable water at 20 Mℓ/d per phase. Industrial quality water could then be supplied from Phases 2 to 5, with Phases 2 and 3 yielding 10 Mℓ/d each, Phase 4 yielding 20 Mℓ/d, and Phase 5 yielding 30 Mℓ/d.

3.8.4 Seawater Desalination

A third potential phase of the NMBM/Coega IDZ desalination plant, yielding 11 million m^3/d has been conceptualised. A small 3.3 million m^3/d desalination plant has been conceptualised at the potential Thyspunt Nuclear Power Plant.

3.9 Adjustments to the Strategy

3.9.1 Scenario Planning Process

The scenario planning process considers a range of possible scenarios to reconcile water supply and requirements. The objective is not to select one ‘favourable scenario’ but rather to identify which interventions should be studied to allow consideration of a range of possible scenarios. This will allow the DWS, the NMBM and other stakeholders the maximum amount of flexibility in making informed decisions on which interventions to implement. The outcome of the process is a list of interventions that should be studied by specific dates, so as to meet implementation requirements of a range of reconciliation scenarios.

The selection of interventions, either to be studied further or to be implemented, to reconcile water availability of the AWSS with the requirements, is a complex task, with many diverse issues and criteria to consider. The need for` a customised planning tool, to provide support for this task to water managers, was identified. A graphical support tool, called the Reconciliation Planning Support Tool (RPST) was therefore developed to aid the process of scenario planning of interventions. This Tool has been customised for the Algoa WSS. It allows the user to compare potential interventions, or groups of interventions, with one another, and with one or more selected future water requirements scenarios. The

Tool graphically shows when decisions regarding investigations for selected interventions need to be taken to achieve a water balance.

3.9.2 Water Balance Scenarios

In order to update the scenario planning, the water balance scenarios mentioned under Section 3.5 were evaluated with the RPST, taking account of updated information. The 25-year planning window is up to 2041. The future water requirement scenarios, of which the starting point for growth estimation is 2016, are discussed below in the following sections.

The "***Coega Industrial Water Requirements***" scenario is based on forecast industrial water requirements for the Coega IDZ growing from 0 million m^3/a in 2016 to 55.0 million m^3/a in 2041. There is significant uncertainty associated with this scenario.

The "***Low-Growth including Coega***" scenario is based on low economic and population growth rates which translate to an average water requirement compound growth rate of 1% per annum. The Coega IDZ potable and industrial water requirements projected growth rates have been used. In this scenario, the total potable/industrial system water requirements grew from 180.7 million m^3/a in 2016, to 230.2 million m^3/a in 2041.

The "Reference - ***High-Growth Potable including Coega Potable***" scenario is based on high economic and high population growth rates which translate to an average water requirement linear growth rate of 3.5% per annum. The Coega IDZ potable requirements projected growth rate has been used. In this scenario, the potable system water requirements grew from 180.7 million m^3/a in 2016, to 299.1 million m^3/a in 2041.

The "***High-Growth Potable including Coega Potable without any WC/WDM***" scenario is based on high economic and high population growth rates which translate to an average water requirement linear growth rate of 3.5% per annum. In this scenario, the potable system water requirements grew from 180.7 million m^3/a in 2016, to 299.1 million m^3/a in 2041. It has been assumed that there will be no saving in water use from the water use efficiency programme or that it is absent.

The newly conceptualised "***Increased supply to Kouga LM***" scenario is based on high economic and high population growth rates which translate to an average water requirement linear growth rate of 3.5% per annum. The Coega IDZ potable requirements projected growth in requirements has been used in addition, considering the potential requirements of urban growth and a nuclear power plant, which local sources cannot meet. In this scenario, the potable system water requirements grew from 180.7 million m^3/a in 2016, to 311.4 million m^3/a in 2041.

The "***High-Growth including Coega***" scenario is based on high economic and high population growth rates which translate to an average water requirement linear growth rate of 3.5% per annum. In this scenario, the potable/industrial system water requirements grew from 180.7 million m^3/a in 2013, to 354.1 million m^3/a in 2041.

The "***Reserve***" scenario is similar to the "*High-Growth including Coega*" scenario, with the addition of the implementation of the ecological Reserve for existing system dams, from 2019 onwards.

The "***Worst-Case***" scenario is similar to the "*Reserve*" scenario, with the addition of climate change, with the reduction in yield phased in over 25 years.

Many possible scenarios exist between the 2016 "Reference" Scenario and the "Worst-case" Scenario, but if solutions could be found for these two scenarios, all others should be adequately covered. Should the water requirements follow the Low-Growth Water Requirement Curve and not the High-Growth Water Requirement Curve, the required implementation date of interventions would be delayed and therefore more options for implementation would become available to select from.

The Legend of colours used in tables 3.4 to 3.11 in the 'Status' column, for the various water balance scenarios, are the following:

Legend of colours in tables 3.4 to 3.11:	
	Study or implementation planning ongoing
	Under Construction

3.9.3 Coega Industrial Water Requirements

This Scenario water balance is shown in **Figure 3.7**.

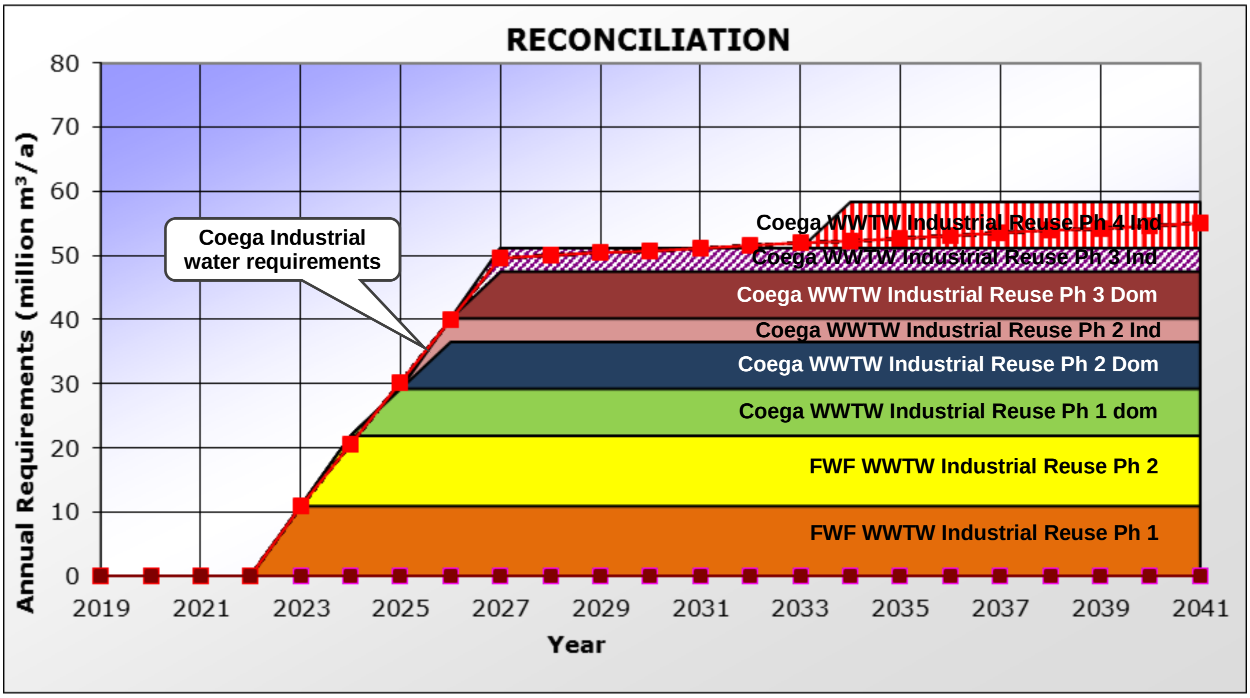


Figure 3.7: Coega Industrial Scenario

In this Scenario:

- Implementation of Phases 1 and 2 of the Fish Water Flats WWTW re-use scheme, followed by the implementation of Phases 1 to 3 domestic streams and Phases 2 to 4 industrial streams of the Coega WWTW re-use scheme, to meet growing industrial water requirements.
- Further phases of re-use schemes could be implemented.
- This illustrates that planning is on track to supply adequate volumes of industrial quality water to the Coega IDZ.

The interventions which have been used for the Scenario, as shown in **Figure 3.7,** are listed in **Table 3.4**.

Table 3.4: Interventions for the Coega Industrial Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	FWF WWTW Industrial Reuse Scheme Phase 1	2023	11.0	Implementation planning
2	FWF WWTW Industrial Reuse Scheme Phase 2	2024	11.0	Study ongoing
3	Coega WWTW Industrial Reuse Scheme Ph1 Dom	2025	7.3	Study ongoing
4	Coega WWTW Industrial Reuse Scheme Ph 2 Ind	2026	3.65	Study ongoing
5	Coega WWTW Industrial Reuse Scheme Ph 2 Dom	2026	7.3	Study ongoing
6	Coega WWTW Industrial Reuse Scheme Ph 3 Dom	2027	7.3	Study ongoing
7	Coega WWTW Industrial Reuse Scheme Ph 3 Ind	2027	3.65	Study ongoing
8	Coega WWTW Industrial Reuse Scheme Ph 4 Ind	2034	7.3	Study ongoing

For the further scenarios that include industrial water requirements, the interventions and timing of reuse schemes are silmilar to the interventions as listed in Table 3.4.

3.9.4 Low Growth including Coega Potable

The Scenario water balance is shown in **Figure 3.8.**

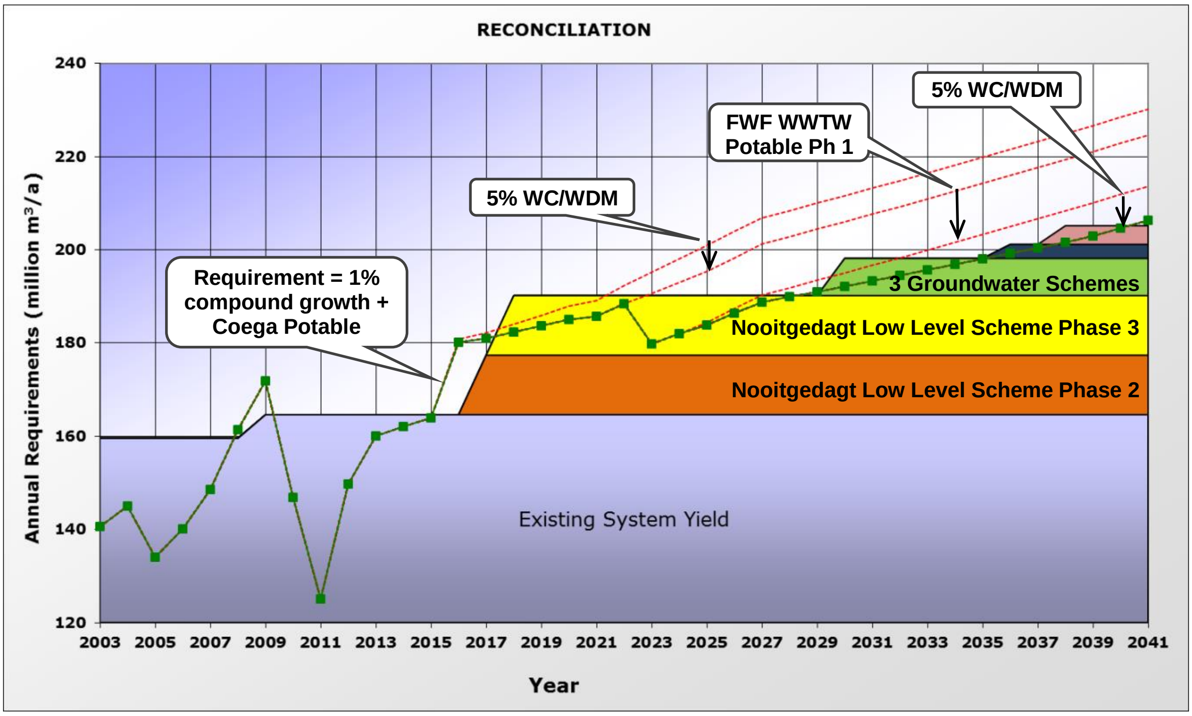


Figure 3.8: Low Growth including Coega Potable Scenario

In this Scenario:

- WC/WDM measures reduce the water requirements by 5%. This has been selected to demonstrate that for this scenario, even limited success with WC/WDM would suffice.
- The Nooitgedagt Scheme Phases 2 and 3 are implemented.
- The Coega Fault Groundwater Scheme is implemented.

The interventions which have been used for the Scenario, as shown in **Figure 3.8,** are listed in **Table 3.5**.

Table 3.5: Interventions for the Low Growth including Coega Potable Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	WC/WDM 2016 to 2025 (5% saving)	2016	5.6	ongoing
3	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
4	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
2	FWF WWTW Potable Reuse Scheme Phase 1	2023	11.0	Implementation planning
5	WC/WDM Programme from 2026 (5% saving)	2025	7.2	-
6	Groundwater - Coega Fault	2030	8	Implementation planning
7	Groundwater – Churchill Dam	2036	3	-
8	Groundwater – Bushy Park	2038	4	-

3.9.5 Reference – High Growth Potable Scenario

This scenario water balance is shown in **Figure 3.9.**

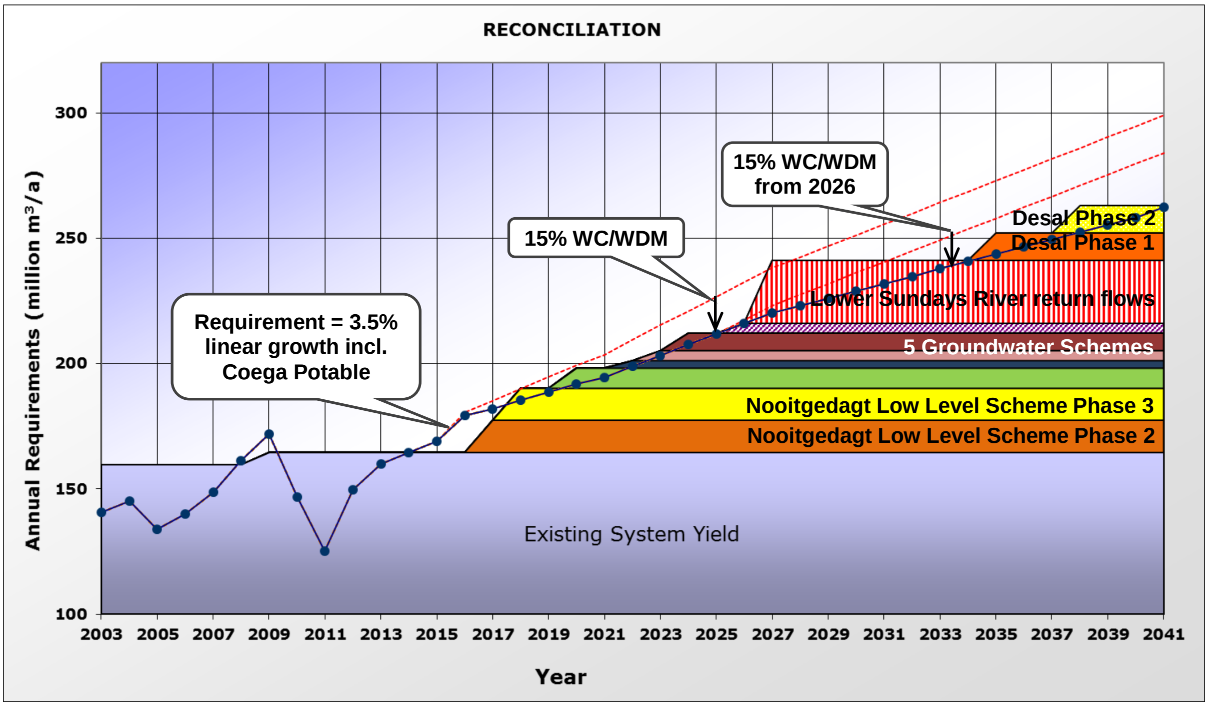


Figure 3.9: Reference - High Growth Potable Scenario

In this Scenario:

- WC/WDM measures (15% saving) reduce the water requirements.
- The Nooitgedagt Scheme is phased in.
- Groundwater interventions are undertaken at Coega Fault, Churchill, Bushy Park, Jeffreys Arch and Van Stadens.
- The Sundays River Return Flows scheme will be implemented after the groundwater interventions.
- Seawater desalination is phased in.

The interventions which have been used for the Scenario, as shown in **Figure 3.9,** are listed in **Table 3.6**.

Table 3.6: Interventions for the Reference - High Growth Potable Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	WC/WDM 2016 to 2025 (15% saving)	2016	15	ongoing
2	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
3	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
4	Groundwater - Coega Fault	2020	8	Implementation planning
5	Groundwater - Churchill Dam	2022	3	-
6	Groundwater - Bushy Park	2023	4.0	-
8	Groundwater - Jeffreys Arch	2024	7	-

No	Intervention	Year of First Water or Saving	Yield	Status
9	WC/WDM Programme from 2026 (15% saving)	2026	21.6	-
10	Groundwater – Van Stadens	2026	4	-
11	Lower Sundays River return flows	2027	25.0	-
12	Seawater Desalination Phase 1	2035	11.0	Study stopped
13	Seawater Desalination Phase 2	2038	11.0	-

3.9.6 High Growth Potable without WC/WDM

This scenario water balance is shown in **Figure 3.10**.

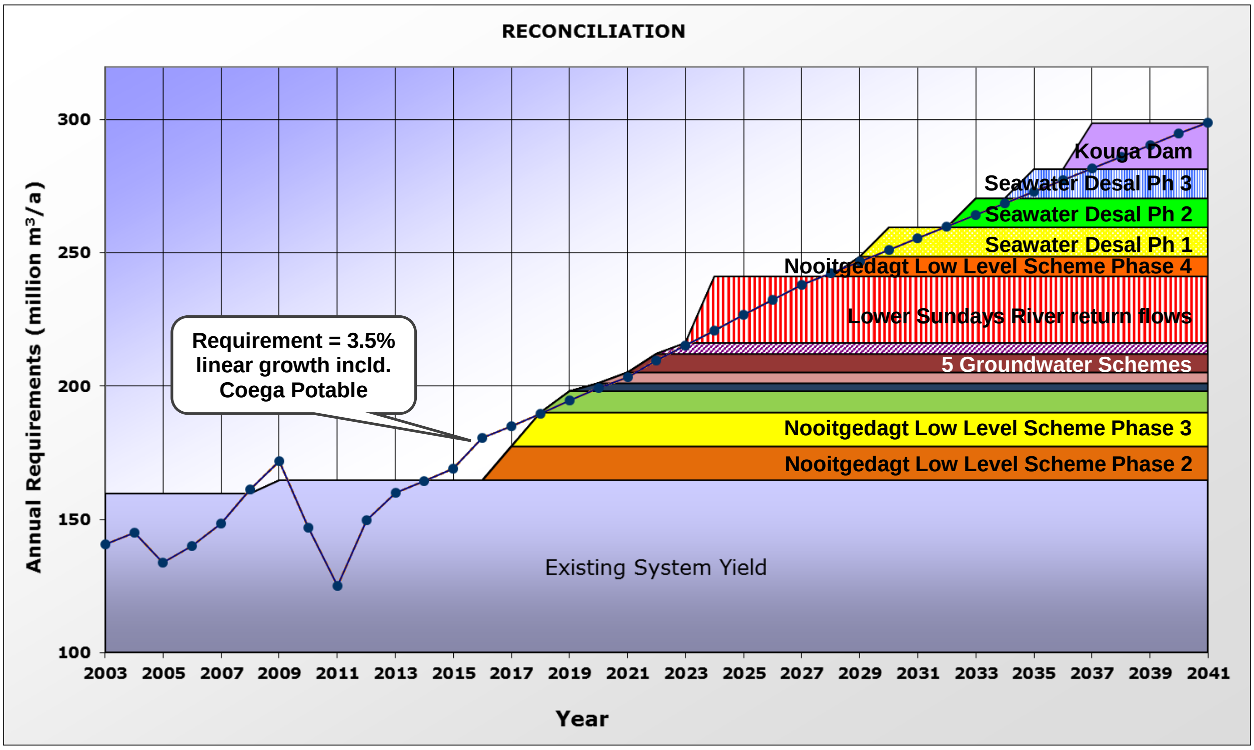


Figure 3.10: High Growth Potable without WC/WDM Scenario

In this Scenario:

- It has been assumed that WC/WDM measures are not in place or completely ineffective.
- The Nooitgedagt Scheme is phased in.
- Groundwater interventions are undertaken at Coega Fault, Churchill, Bushy Park, Jeffreys Arch and Van Stadens.
- The Sundays River Return Flows scheme will be implemented after groundwater interventions.
- A Seawater Desalination Scheme is phased in.
- Kouga Dam is raised.

The interventions which have been used for the Scenario, as shown in **Figure 3.10**, are listed in **Table 3.7**.

Table 3.7: Interventions for the High Growth Potable without WC/WDM Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
2	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
3	Groundwater - Coega Fault	2019	8	Implementation planning
4	Groundwater - Churchill Dam	2020	3	-
5	Groundwater - Bushy Park	2021	4.0	-
6	Groundwater - Jeffreys Arch	2022	7	-
7	Groundwater - Van Stadens	2023	4	-
8	Lower Sundays River return flows	2024	25.0	-
9	Nooitgedagt Low Level Scheme Phase 4	2029	7.5	
10	Seawater Desalination Phase 1	2030	11.0	Study stopped
11	Seawater Desalination Phase 2	2033	11.0	-
12	Kouga Dam replacement and raising	2037	17.3	-

3.9.7 High Growth Potable plus Kouga LM

This scenario water balance is shown in **Figure 3.11**.

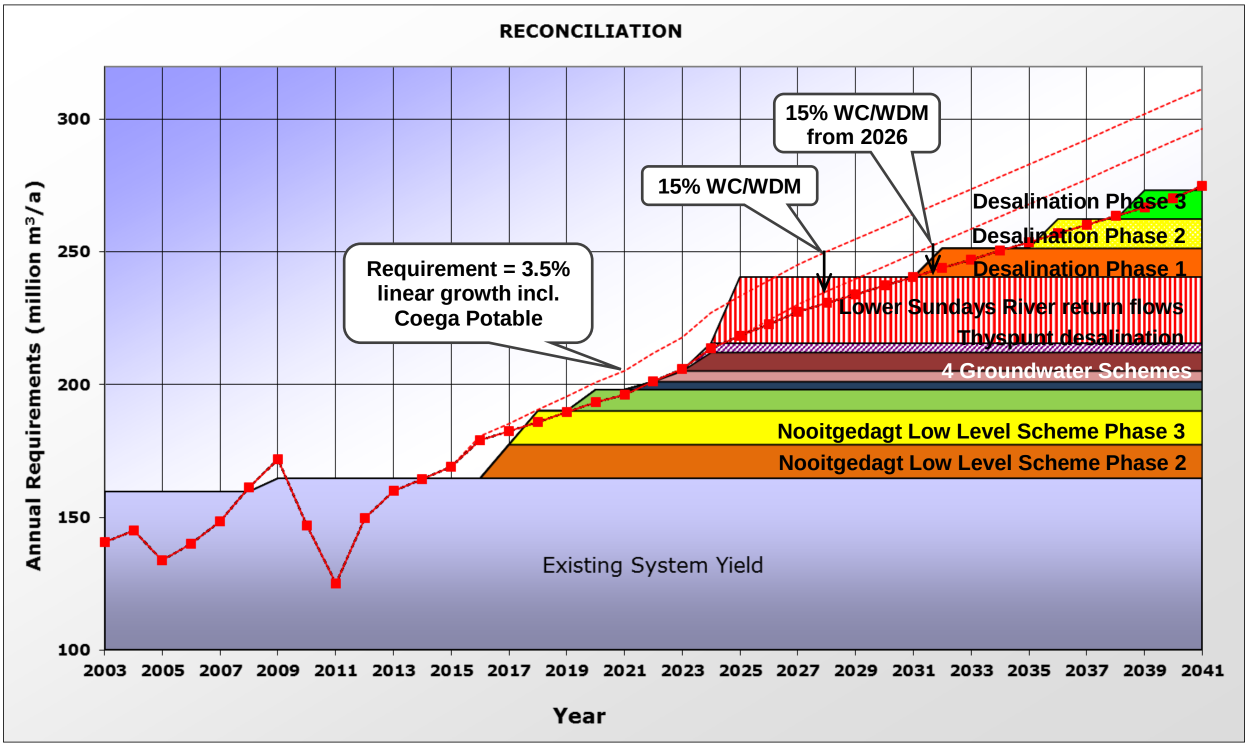


Figure 3.11: High Growth Potable plus Kouga LM

In this Scenario:

- WC/WDM measures (15% saving) reduce the water requirements.
- The Nooitgedagt Scheme is phased in.
- Groundwater interventions are undertaken at Coega Fault, Churchill, Bushy Park and Jeffreys Arch.
- The water requirements of a potential Thyspunt Nuclear Plant is met by seawater desalination,
- The Sundays River Return Flows scheme will be implemented after the groundwater interventions.
- Seawater desalination is phased in.

The interventions which have been used for the Scenario, as shown in **Figure 3.11**, are listed in **Table 3.8**.

Table 3.8: Interventions for the High Growth Potable Scenario plus Kouga LM

No	Intervention	Year of First Water or Saving	Yield	Status
1	WC/WDM 2016 to 2025 (15% saving)	2016	15	ongoing
2	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
3	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
4	Groundwater - Coega Fault	2020	8	Implementation planning
5	Groundwater - Churchill Dam	2022	3	-
6	Groundwater - Bushy Park	2023	4.0	-
	Thyspunt Desalination Scheme	2024	3.3	-
7	Groundwater - Jeffreys Arch	2024	7	-
8	Lower Sundays River return flows	2025	25.0	-
9	WC/WDM Programme from 2026 (15% saving)	2026	21.6	-
10	Seawater Desalination Phase 1	2032	11.0	Study stopped
11	Seawater Desalination Phase 2	2036	11.0	-
12	Seawater Desalination Phase 2	2039	7.5	-

Compared to the High Growth Potable (Reference) Scenario, the implication of accommodating additional future growth in water requirements of the Kouga LM, is that interventions implemented after the Nooitgedagt Scheme need to be implemented a few years earlier. One additional scheme is also required within the planning period, apart from the Thyspunt Desalination Scheme.

3.9.8 High Growth including Coega (potable and industrial)

This scenario water balance is shown in **Figure 3.12.**

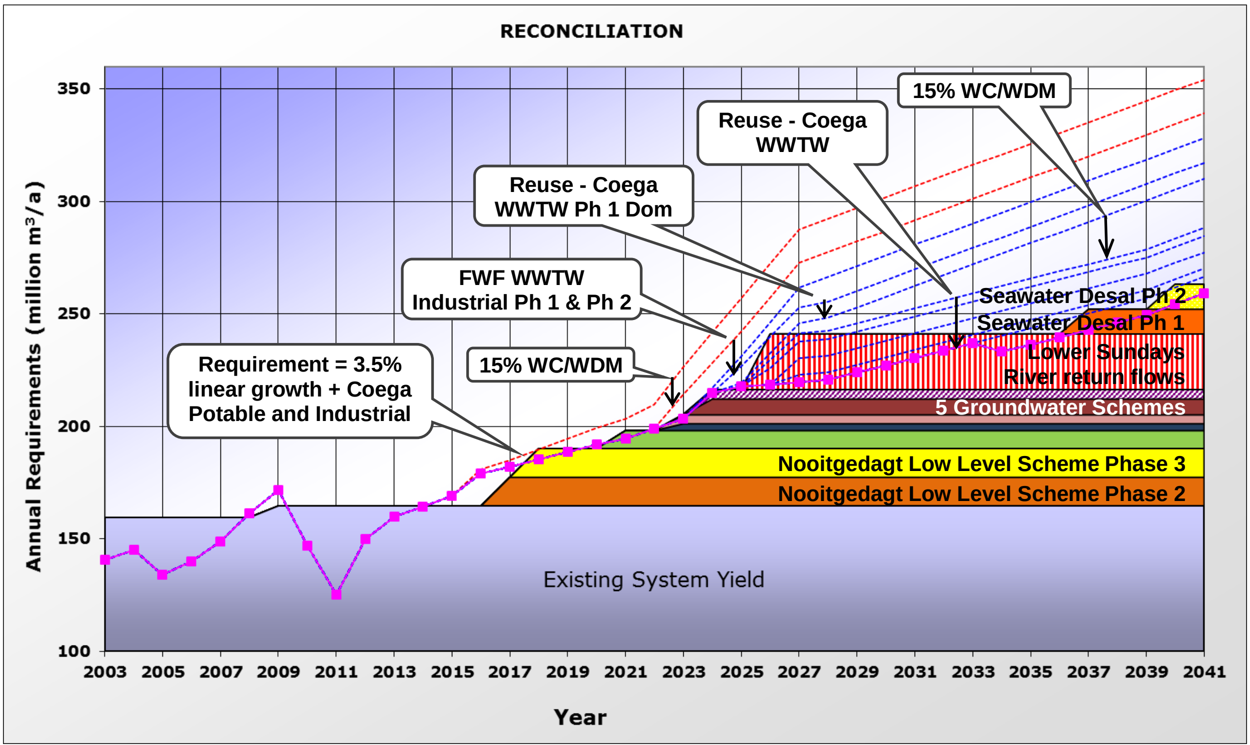


Figure 3.12: High Growth Potable including Coega Scenario

In this Scenario:

- WC/WDM measures (15% saving) reduce the water requirement.
- Phasing in of the FWF WWTW industrial re-use scheme and the Coega WWTW industrial re-use scheme.
- The Nooitgedagt Scheme is phased in.
- Groundwater interventions are undertaken at Coega Fault, Churchill, Bushy Park, Jeffreys Arch and Van Stadens.
- The Sundays River Return Flows scheme will be implemented after groundwater interventions.
- Phase 1 and 2 of a Seawater Desalination Scheme is undertaken.

The interventions which have been used for the Scenario, as shown in **Figure 3.12** are listed in **Table 3.9**.

Table 3.9: Interventions for the High Growth including Coega Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	WC/WDM 2016 to 2025 (15% saving)	2016	15	ongoing
2	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
3	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
4	Groundwater - Coega Fault	2021	8	Implementation planning
5	FWF WWTW Industrial Reuse Scheme Phase 1	2023	11.0	Implementation planning

No	Intervention	Year of First Water or Saving	Yield	Status
6	Groundwater - Churchill Dam	2023	3	-
7	Groundwater - Bushy Park	2023	4.0	-
8	Groundwater - Van Stadens	2024	4	-
9	Groundwater - Jeffreys Arch	2024	7	-
10	FWF WWTW Industrial Reuse Scheme Phase 2	2024	11.0	-
11	Coega WWTW Industrial Reuse Scheme Phase 1 (Dom)	2025	7.3	Study ongoing
12	WC/WDM Programme from 2026 (15% saving)	2025	21.6	-
13	Coega WWTW Industrial Reuse Scheme Phase 2 (Dom)	2026	7.3	-
14	Coega WWTW Industrial Reuse Scheme Phase 2 (Ind)	2026	3.65	-
15	Coega WWTW Industrial Reuse Scheme Phase 3 (Ind)	2027	3.65	-
16	Coega WWTW Industrial Reuse Scheme Phase 3 (Dom)	2027	7.3	-
17	Lower Sundays River return flows	2030	25.0	-
18	Coega WWTW Industrial Reuse Scheme Phase 4 (Ind)	2034	7.3	-
19	Seawater Desalination Phase 1	2037	11.0	Study stopped
20	Seawater Desalination Phase 2	2040	11.0	-

3.9.9 Reserve Scenario

This scenario water balance is shown in **Figure 3.13**.

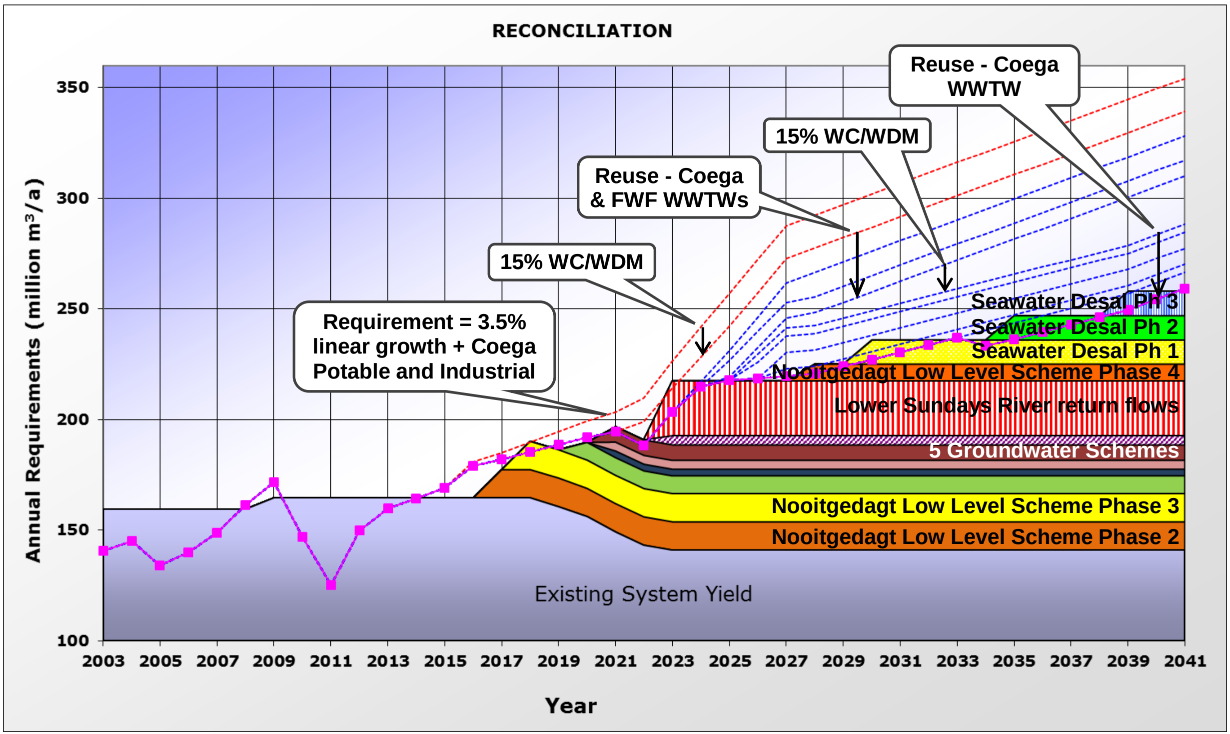


Figure 3.13: Reserve Scenario

In this Scenario:

- WC/WDM measures (15% saving) reduce water requirements.
- Phasing in of the FWF WWTW industrial re-use scheme and the Coega WWTW industrial re-use scheme.
- The Nooitgedagt Scheme is phased in.
- Groundwater interventions are undertaken at Coega Fault, Churchill, Bushy Park, Jeffreys Arch and Van Stadens. The evaluation and implementation of the interventions would need to be fast-tracked.
- The Sundays River Return Flows scheme will be implemented after groundwater interventions.
- A Seawater Desalination scheme is phased in.
- Existing system yield decreases due to implementation of the Reserve.

The interventions which have been used for the Scenario, as shown in **Figure 3.13**, are listed in **Table 3.10.**

Table 3.10: Interventions for the Reserve Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	WC/WDM 2016 to 2025 (15% saving)	2016	15	ongoing
2	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
3	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
4	Groundwater - Coega Fault	2020	8	Implementation planning
5	Groundwater - Churchill Dam	2021	3	-
6	Groundwater - Bushy Park	2021	4.0	-
7	Groundwater - Jeffreys Arch	2021	7	-
8	FWF WWTW Industrial Reuse Scheme Phase 1	2022	11.0	Implementation planning
9	Groundwater - Van Stadens	2023	4	-
10	Lower Sundays River return flows	2023	25.0	-
11	FWF WWTW Industrial Reuse Scheme Phase 2	2024	11.0	-
12	Coega WWTW Industrial Reuse Scheme Phase 1 (dom)	2025	7.3	Study ongoing
13	WC/WDM Programme from 2026 (15% saving)	2025	21.6	-
14	Coega WWTW Industrial Reuse Scheme Phase 2 (dom)	2026	7.3	-
15	Coega WWTW Industrial Reuse Scheme Phase 2 (ind)	2026	3.65	-
16	Coega WWTW Industrial Reuse Scheme Phase 3 (ind)	2027	3.65	-
17	Coega WWTW Industrial Reuse Scheme Phase 3 (dom)	2027	7.3	-
18	Nooitgedagt Low Level Scheme Phase 4	2028	7.5	-
19	Seawater Desalination Phase 1	2030	11.0	Study stopped
20	Coega WWTW Industrial Reuse Scheme Phase 4 (ind)	2034	7.3	-
21	Seawater Desalination Phase 2	2035	11.0	-
22	Seawater Desalination Phase 3	2039	10.95	-

3.9.10 Worst Case Scenario

This scenario water balance is shown in **Figure 3.14**.

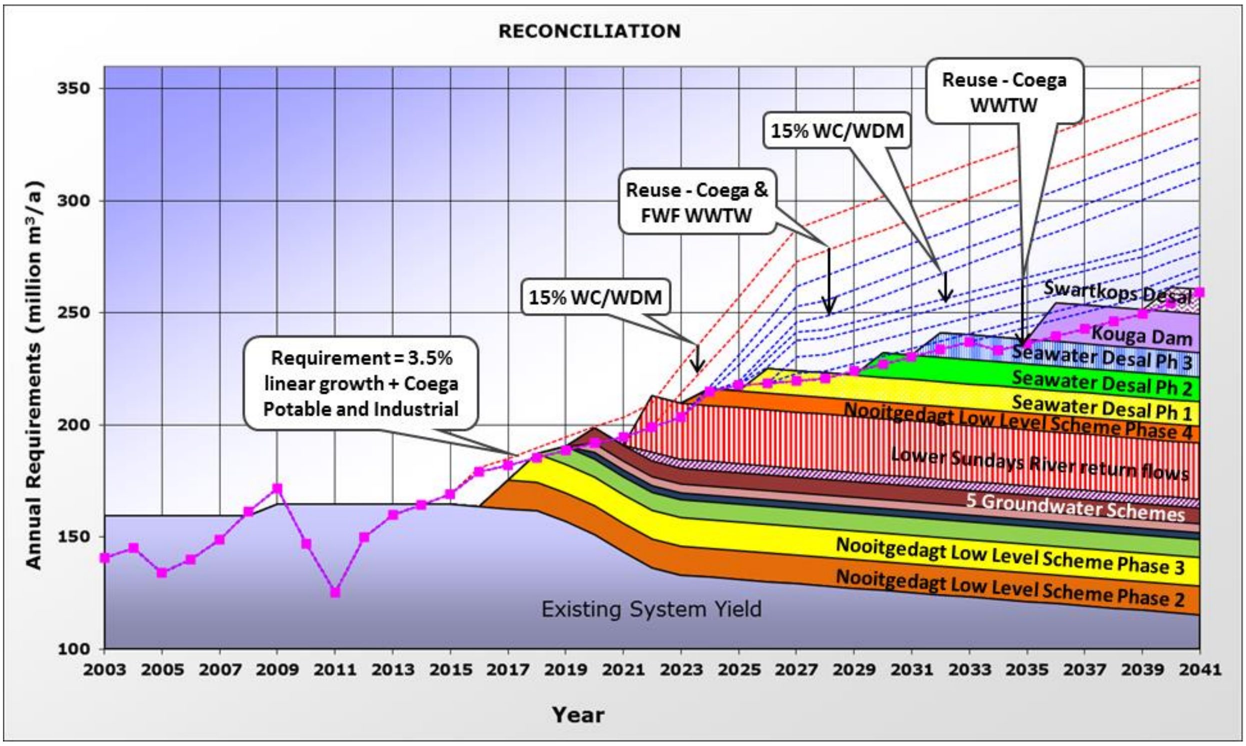


Figure 3.14: Worst Case Scenario

In the updated Scenario:

- WC/WDM measures (15% saving) reduce water requirements.
- Phasing in of the FWF WWTW industrial re-use scheme and the Coega WWTW industrial re-use scheme.
- The Nooitgedagt Scheme is phased in.
- Groundwater interventions are undertaken at Coega Fault, Churchill, Bushy Park, Jeffreys Arch and Van Stadens. The evaluation and implementation of the interventions would need to be fast-tracked.
- The Sundays River Return Flows scheme will be implemented after groundwater interventions.
- A Seawater Desalination Scheme is phased in.
- Kouga Dam is raised.

The interventions which have been used for the Scenario, as shown in **Figure 3.14,** are listed in **Table 3.11**.

Table 3.11: Interventions for the Worst Case Scenario

No	Intervention	Year of First Water or Saving	Yield	Status
1	WC/WDM 2016 to 2025 (15% saving)	2016	15	ongoing
2	Nooitgedagt Low Level Scheme Phase 2	2017	12.8	construction
3	Nooitgedagt Low Level Scheme Phase 3	2018	12.8	Implementation planning
4	Groundwater - Coega Fault	2019	8	Implementation

No	Intervention	Year of First Water or Saving	Yield	Status
				planning
5	Groundwater - Churchill Dam	2020	3	-
6	Groundwater - Bushy Park	2020	4.0	-
7	Groundwater - Jeffreys Arch	2020	7	-
8	Groundwater - Van Stadens	2022	4	-
9	Lower Sundays River return flows	2022	25.0	-
10	FWF WWTW Industrial Reuse Scheme Phase 1	2023	11.0	Implementation planning
11	FWF WWTW Industrial Reuse Scheme Phase 2	2024	11.0	-
12	Nooitgedagt Low Level Scheme Phase 4	2024	7.5	-
13	WC/WDM Programme from 2026 (15% saving)	2025	21.6	-
14	Coega WWTW Industrial Reuse Scheme Phase 1 (dom)	2025	7.3	Study ongoing
15	Seawater Desalination Phase 1	2026	11.0	Study stopped
16	Coega WWTW Industrial Reuse Scheme Phase 2 (dom)	2026	7.3	-
17	Coega WWTW Industrial Reuse Scheme Phase 2 (ind)	2026	3.65	-
18	Coega WWTW Industrial Reuse Scheme Phase 3 (ind)	2027	3.65	-
19	Coega WWTW Industrial Reuse Scheme Phase 3 (dom)	2027	7.3	-
20	Seawater Desalination Phase 2	2030	11.0	-
21	Seawater Desalination Phase 3	2032	11	-
22	Coega WWTW Industrial Reuse Scheme Phase 4 (ind)	2034	7.3	-
23	Kouga Dam replacement and raising	2036	17.3	-
24	Swartkops Desalination Phase 1	2040	10.95	-

3.10 Implications Highlighted by the updated Scenario Planning

The following implications are noted:

- The scenario planning has been done up to 2041.
- It is essential that the NMBM WC/WDM Strategy implementation should proceed as planned and receive the necessary high-level support and funding from NMBM, to ensure the necessary institutional capacity and adequate resourcing to be successful. Similarly, WC/WDM should be a very high priority for the Kouga LM.
- In the updated 2016 “Reference” Scenario for potable supply, it is evident that implementation of the Nooitgedagt Low-level Scheme (Phases 2 and 3) should urgently proceed as planned.
- Allowance has been made for groundwater interventions to be implemented thereafter. The ongoing Coegakop groundwater study should proceed and recommendations should be implemented. As groundwater implementation seems to take longer than the general perception, it would be advisable to consider getting at least the first phases of the further groundwater investigations underway very soon.

- Following that, significant potable interventions are likely the Lower Sundays River return flows scheme, or seawater desalination or a new dam in the Kouga River (Kouga Dam raising or Guernakop Dam).

4 Key Messages

The following key messages (conclusions) can be taken from the comparison of water supply and requirement and the scenario planning undertaken for the September 2016 Strategy Steering Committee meeting:

Message 1: Concern about assurance of supply of the Algoa WWS

Concerns about the accuracy of the assurance of supply values provided from the system modelling should be addressed, in light of the regular restrictions needed for the Algoa WSS, especially for the Kouga-Loerie sub-system, but also for the Kromme sub-system. The risk of planning according to system yields that are inaccurate could be significant.

Message 2: Successful implementation of WC/WDM is critical

It is essential that political and funding support for the NMBM WC/WDM implementation is stepped up, especially in terms of awareness creation. Measuring and reporting of the results obtained remains important. WC/WDM for the Kouga LM and smaller towns must also be implemented, measured and reported.

Message 3: The Nooitgedagt Low-level Scheme must be completed

The scheme has been phased with Phase 1 complete and Phase 2 under construction. It is important for Phase 3 of the scheme to be urgently implemented as planned. Outstanding funding requirements to complete the project must be met. Conditions around the Orange River water allocation to NMBM and measures if the additional allocation is regarded as 'temporary needs' should be further addressed. Potential operating bottlenecks for delivery of additional water needs to be evaluated and addressed.

Message 4: Consideration of further phasing of the Nooitgedagt Scheme

Further phasing of the Nooitgedagt Scheme (following the completion of Phase 3) and the unrestricted conveyance of such additional flow should be considered. Such a scheme could potentially include the use of transferred Orange River water that can be saved from inefficient use by irrigation, and may potentially include the use of desalinated lower Sundays River irrigation return flows as a component.

Message 5: Groundwater is both a good back-up option and a good permanent bulk supply option

While preliminary investigations into some promising groundwater schemes were done, further phases of investigation for such schemes should be initiated. The implementation of the Coegakop Scheme should proceed. It would be worthwhile to find alternative water sources for smaller towns such as Jeffrey's Bay, to limit increased water use of such towns from the Algoa WSS.

Message 6: Re-use of water is an important intervention

Reuse schemes should be implemented to provide industrial quality water to the Coega IDZ. The water requirements of the IDZ will remain uncertain until such stage that the availability of water and power to meet the needs of potential investors can be confirmed. The integration of the potential Sundays River irrigation return flows scheme as a potential source of potable or industrial quality water, or both, could be considered, along with the planned reuse schemes.

Message 7: The feasibility of seawater desalination should be investigated further

The feasibility study investigation into seawater desalination for NMBM should continue. Desalination is seen as the ultimate future augmentation solution for the area.

Message 8: A larger dam on the Kouga River remains a long-term option

Following the apparent decision that dam safety construction work at Kouga Dam will not proceed, this remains a long-term option. The Guernakop Dam should similarly still be considered.

Message 10: Choice of intervention will be dependent on growth in water requirements

If the actual growth in water requirements is lower than the high-growth water requirement curve, it will be possible to delay implementation of interventions after the Nooitgedagt Low-level Scheme is completed. If however the water requirements keep on growing at the current rate, it is important to continue with feasibility studies of the recommended range of interventions.

The specific locality of growth points within the NMBM is becoming a significant factor, to be taken into consideration in the selection of interventions.

Message 11: Monitoring is very important

It remains important to implement or maintain a system to monitor desalination intake seawater quality, potential indicators for climate change and to monitor the NMBM's success in implementing their WC/WDM Strategy measures.

5 Recommendations

The recommendations following from the assessment of the current water requirements and updated scenario planning are:

1) NMBM should submit a water use licence application to DWS for the additional water use from Loerie Dam.
2) DWS should complete the Eastern Cape Verification and Validation Study, to be followed by a Water Availability Assessment Study (WAAS), including irrigation and urban uses, to address uncertainty regarding the hydrology and assurance of supply.
3) The NMBM must improve on the implementation of their WC/WDM strategy.
4) NMBM should urgently complete the implementation of the Nooitgedagt Low-level Scheme phases 2 and 3.
5) DWS should ensure that there are no bottlenecks regarding the transfer of additional Orange River water to NMBM. DWS should complete the investigation into the balancing requirements and conveyance infrastructure in the transfer between the abstraction point in the Sundays River and the Nooitgedagt treatment works. Future expansion of irrigation must also be considered.
6) NMBM and Kouga LM should soon continue with groundwater studies, particularly those close to and easily integrated into the existing WSS infrastructure, and refine their potential yields.
7) NMBM should continue evaluating re-use alternatives for supplying the potable and industrial requirements of the Coega IDZ and be implementation-ready for water re-use and implementation from the Fish Water Flats WWTW and the future Coega WWTW.
8) NMBM should continue with the feasibility study on seawater desalination, and keep abreast of development plans at the Coega IDZ and a potential associated desalination plant.
9) Monitor progress with the decision of where the next nuclear power plant will be located, and its implementation planning, if it will be located at Thyspunt.
10) NMBM should consider starting initial phases of a Feasibility Study into the re-use of Lower Sundays River Return Flows as this could be the one of the next interventions to be considered.
11) Clearing of invasive alien plants in the catchments of Algoa WSS dams by the Gamtoos Irrigation Board should and will continue.
12) DWS should initiate a study to develop a strategy for the implementation of the Reserve for existing Algoa WSS dams.
13) DWS should initiate an impact assessment study to determine the expected regional impact of climate change on the Algoa WSS water balance.
14) NMBM and small towns should continue monitoring the success of implementation of their WC/WDM interventions. DWS is responsible for monitoring water availability and will continue to monitor the quantity and quality of the Sundays River WUA return flows. NBMM should continue with monitoring of water quality at potential desalination plant intakes.
15) The high growth water requirement scenario will still be used as basis for future scenario planning. Water requirements must be monitored and the projected water requirement curves should be updated if the current assumptions used are deemed to be no longer valid. Future water requirement curves will be projected from the latest annual water use available.

16) The Algoa Water Supply System Reconciliation Strategy should be re-assessed and updated in September 2017.

Appendix A
Representation on the Strategy Committees

REPRESENTATION ON STRATEGY COMMITTEES

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Appendix B
NBMM WC/WDM Progress Report

Water Demand and Available Storage

The annual water demand and annual average daily demand (AADD) for NMBM are presented in Table B.1, while the monthly dam storage volumes for NMBM is shown in Figure B.1. Figure B.2 and Figure B.3 show water consumption for NMBM, including current available yield and estimates of future water use with and without WC/WDM.

Table B.1: Water demands for NMBM

Year	Total Volume (Mℓ)	AADD (Mℓ)	% increase in Volume	% increase in AADD
2009/10	94521	258		
2010/11	87537	239	-7,39	-7,39
2011/12	91970	251	5,06	4,78
2012/13	99216	271	7,88	8,17
2013/14	107655	294	8,51	8,51
2014/15	112973	309	4,94	4,94
2015/16	116298	317	2,94	2,66

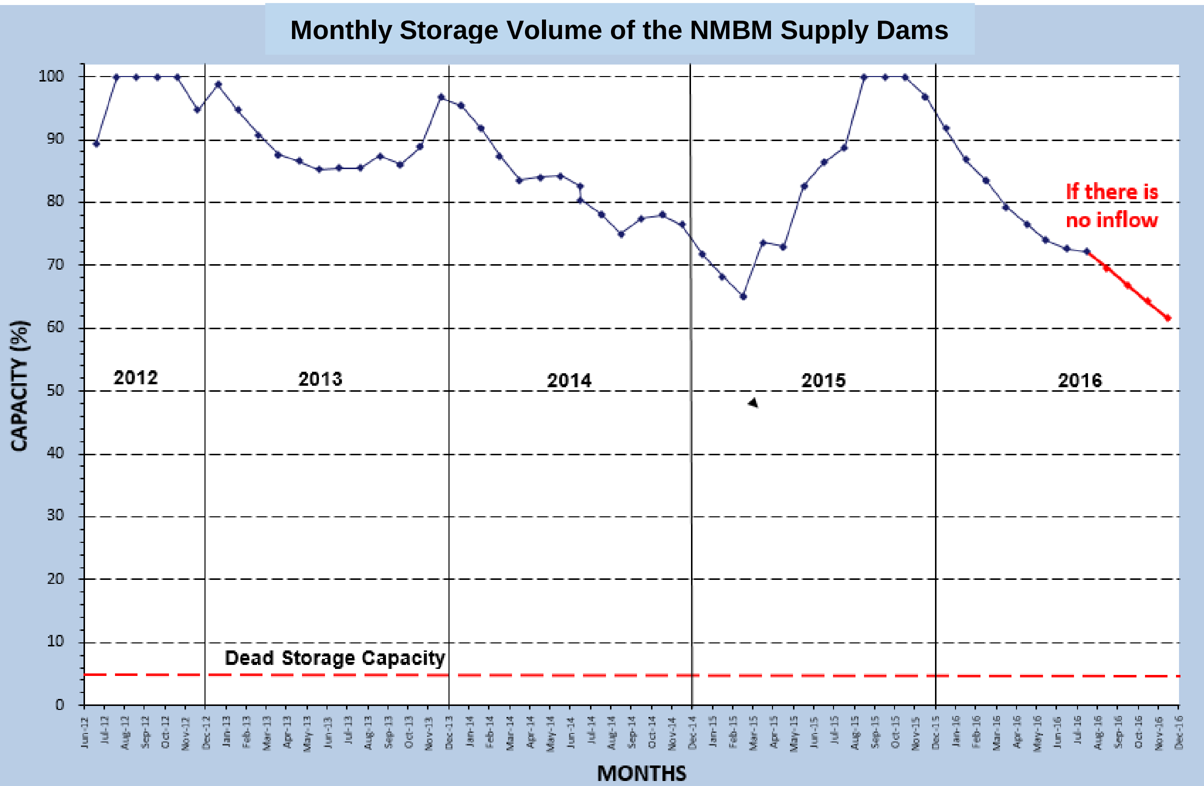

Figure B.1: Dam storage capacity for NMBM

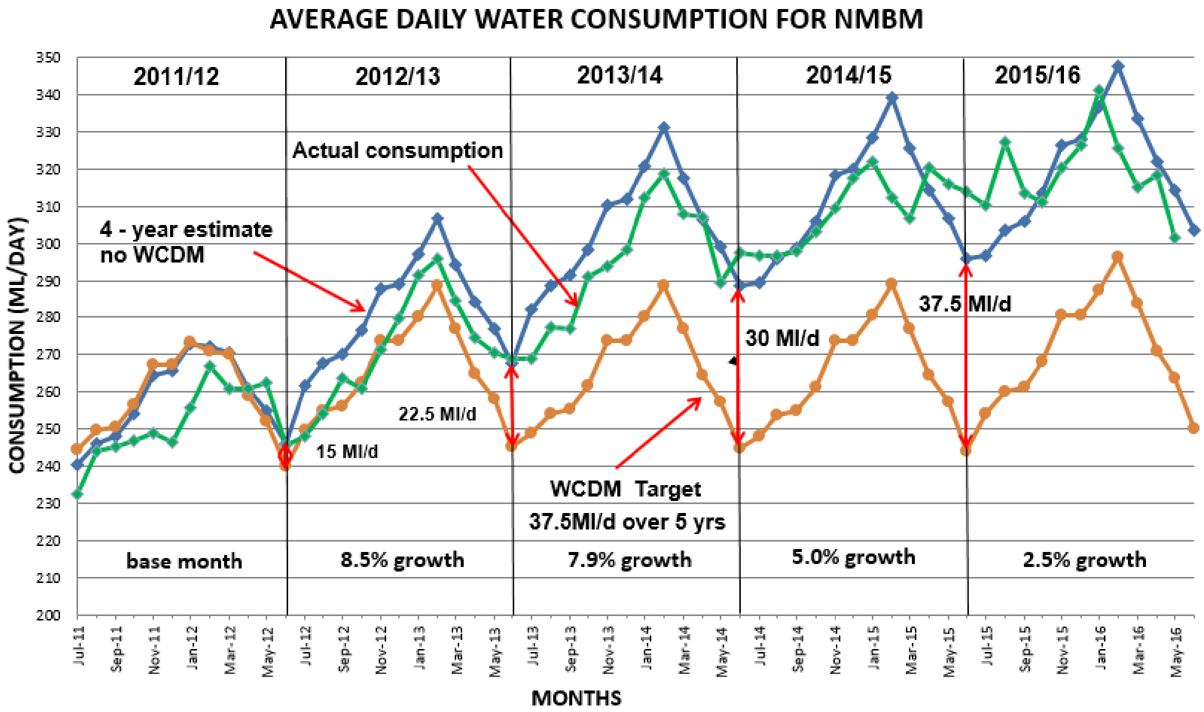

Figure B.2: Average daily water consumption for NMBM with and without WC/WDM

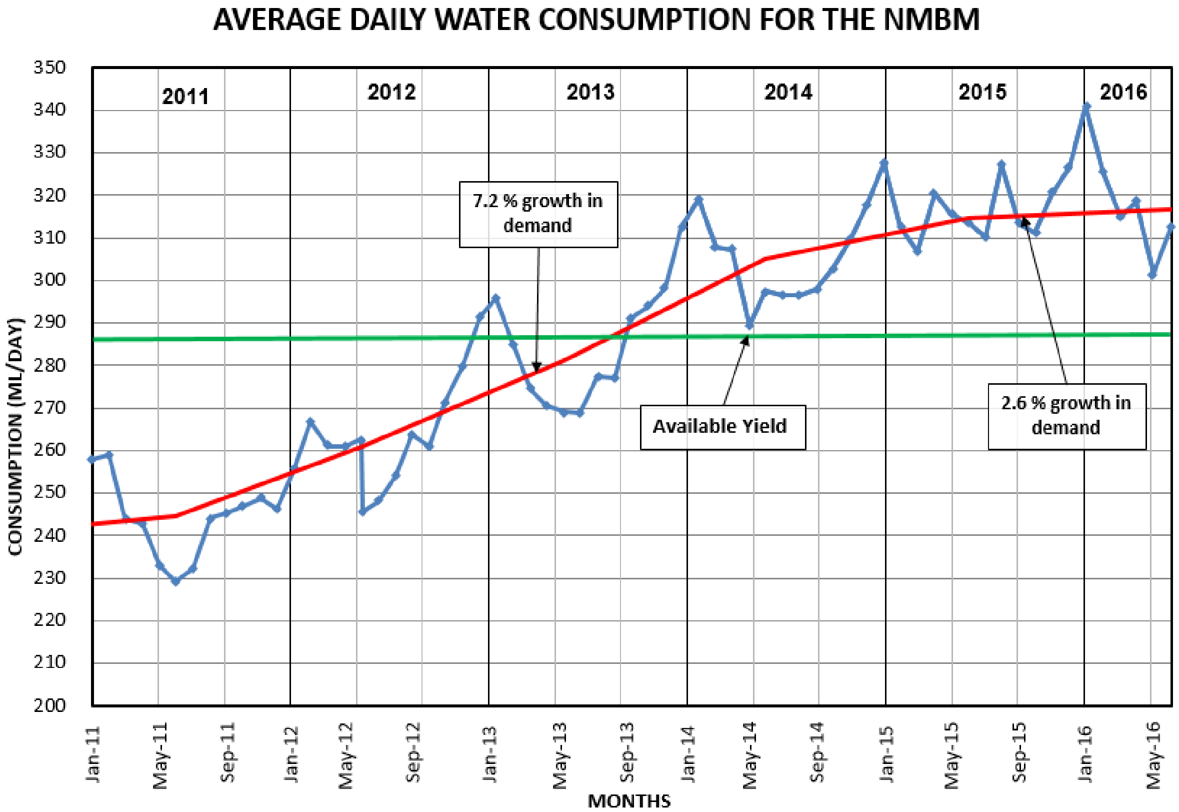

Figure B.3: Average daily water consumption for NMBM

It can be seen that the annual growth has stabilised after the high, though expected, growth after the drought period of 2009 to 2011. The use for most months in 2015 were unpredictable and outside the envelope.

Workstream 1: Bulk Supply Meters

In order to expedite the installation of bulk meters (which will establish losses on the bulk supply system for enabling the development of a water balance), a Bulk Water Task Team was set up with the relevant role-players. Each water treatment works has output meters, however there was insufficient metering on the urban edge to determine input volume to the distribution network.

The bulk pipeline system comprises the three main systems which are:

- Churchill Pipeline System
- Loerie/Summit/Chelsea System
- Nooitgedagt/Motherwell System.

As a result, the ten most critical meters that need to be replaced or newly installed were identified, and by 15 August 2016, the first two systems were able to provide the necessary data to develop water balances. The Nooitgedagt/Motherwell System is on track for completion by 30 September 2016.

There are additional meters that need to be installed, however these can only be done once there is sufficient budget available.

Workstream 2: GMA and DMA Meters

Greater Metered Area (GMA) and District Metered Area (DMA) meters are needed to determine where the most water losses occur. Meters need to be installed in constructed chambers with sophisticated fittings and equipment. DMAs need to be made discrete by auditing the boundary valves.

There are approximately 25 GMAs and 180 DMAs required. A priority list was prepared and designs of the chambers undertaken. Once designs were approved by NMBM, the work was issued to R&M contractor to construct.

Progress with the installation of GMA and DMA meters was as follows:

- 50 chamber designs completed by service provider and 21 submitted for approval
- 11 chamber designs approved and 7 issued for construction
- 2 GMA and 1 DMA meters replaced over reporting period
- There are 49 GMA zone meters and 113 DMA zone meters on the distribution network; these exclude the bulk supply systems and PRV zones meters.
- GMA zones have 15 meters in operation, 13 damaged meters and 21 new meter installations required
- DMA zones have 83 meters in operation, 23 damaged meters and 7 new meter installations required
- 48 DMAs are now discrete.

Workstream 3: Remote Metering

The Executive Director of Infrastructure and Engineering has given an instruction that Advanced Metering Infrastructure (AMI) must be introduced to enhance revenue collection.

A triennial tender document has been prepared for the provision of AMI to Water Metering Systems for 1 500 meters for industrial, commercial and institutional (ICI) consumers, bulk supply meters and GMA and DMA meters. The document will go through the Supply Chain Management (SCM) process of the NMBM.

Workstream 4: Non-Revenue Water

The non-revenue water (NRW) table for 2015/16 is presented in **Error! Reference source not found.**. Although the NRW level has reduced from 2014/15, it remains high. **Table B3** shows a summary of the NRW for 2010/11 to 2015/16.

Table B.2: Monthly NRW for 2015/16

Month	Jul 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015
Volume Treated (kℓ)	9,140,200	9,373,323	8,943,506	9,172,704	9,173,431	9,668,504
Revenue Volume (kℓ)	4,862,041	4,872,940	4,348,524	5,073,031	5,226,767	5,013,783
NRW (%)	46.8%	48.0%	51.4%	44.7%	43.0%	48.1%
Real Losses (Mℓ)	3,685,820	3,881,625	3,974,501	3,524,597	3,386,875	4,015,216
Real Losses (%)	40.3%	41.4%	44.4%	38.4%	36.9%	41.5%
Water Losses (Mℓ)	4,095,355	4,312,917	4,416,112	3,916,219	3,763,195	4,461,351
Water Losses (%)	45%	46%	49%	43%	41%	46%

Month	Jan 2016	Feb 2016	March 2016	April 2016	May 2016	June 2016
Volume Treated (kℓ)	10,100,666	8,982,106	9,309,980	8,779,181	8,847,132	8,385,021
Revenue Volume (kℓ)	5,412,696	5,653,563	5,301,833	5,656,970	5,305,151	5,412,005
NRW (%)	46.4%	37.1%	43.1%	35.6%	40.0%	35.5%
Real Losses (Mℓ)	4,037,361	2,834,010	3,439,753	2,651,964	3,028,534	2,524,784
Real Losses (%)	40.0%	31.6%	36.9%	30.2%	34.2%	30.1%
Water Losses (Mℓ)	4,485,956	3,148,900	3,821,948	2,946,627	3,365,038	2,805,316
Water Losses (%)	44%	35%	41%	34%	38%	33%

Table B.3: Annual NRW for 2010/11 to 2015/16

Financial Year	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Volume Treated (Mℓ)	87 755	91 700	99 752	107 655	109 258	109 875
Revenue Volume (Mℓ)	52 501	58 656	57 817	62 110	58 843	62 139
NRW (%)	**40.2**	**36.0**	**41.7**	**42.3**	**46.1**	**43.4**
Real Losses (Mℓ)	22 961	19 272	30 079	39 042	43 406	40 985
Real Losses (%)	26.2	21.0	33.7	40.3	39.7	37.3

Workstream 5: PRV Management

Pressure management includes revisiting the existing 60 Pressure Reducing Valve (PRV) stations, adding two-step pilot controllers, making PRV zone into sub-DMAs and investigating additional areas for PRV control.

To date some 38 PRV stations have been audited, 22 upgraded and three new stations installed. The water savings due to pressure management are presented in **Figure B5**.

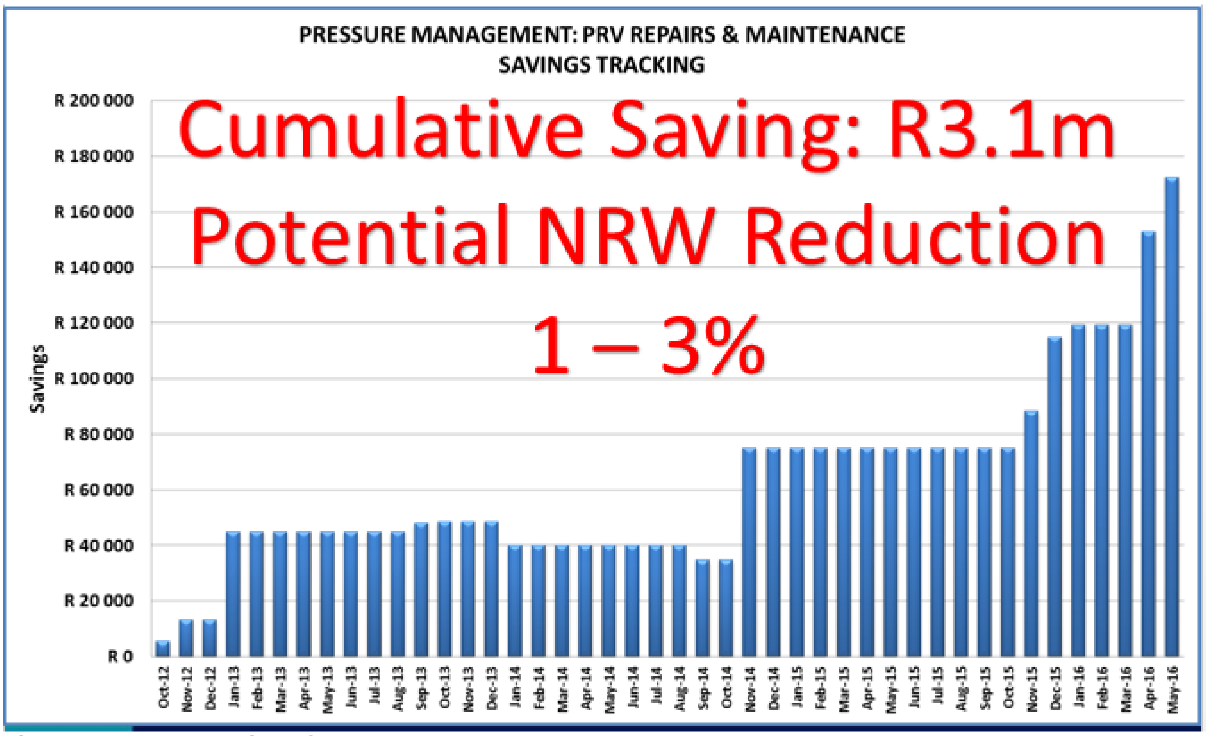

Figure B.5: Water savings from pressure management

Workstream 6: ICI Consumers and Billing Database

Industrial, commercial and institutional (ICI) consumers make up 9 500 out of 230 000 consumers (4.2%), and use 45% of the total water requirement. These consumers require additional attention. Some of the problem areas identified are:

- 27 852 consumers' water use have been estimated for 4 months or longer
- Out of a total of 9 380 ICI meters on the consolidated billing system, approximately 2 564 have been estimated for 4 months or longer (included in above total).
- 25 079 residential meters (tariff scale 05A) have been estimated for 4 months or longer – 6 351 of these consumers are ATTP registered.
- 2 893 meters with flow restrictors are using more than 8 kℓ/month.
- 209 irrigation meters have been estimated for 4 months or longer.
- 19 630 consumers have meters measuring less than 1 kℓ/month.
- Of the approximately 16 000 restricted meters, approximately 2 500 have zero readings. A restricted meter should show zero consumption as the flow rate is too low for the water meter to detect. There is therefore a high number of consumers who have removed the flow restrictors.

Although a task team was established to address these problem areas, the attendance of Municipal Treasury officials has been poor. This has impeded progress. Without the cooperation of the municipal Budget and Treasury Directorate, the high levels of NRW will not improve.

Workstream 7: Water Tariffs

An investigation was undertaken regarding the domestic water tariffs, commercial/industrial water tariffs and fixed charges of nine metropolitan municipalities.

The investigation indicated that the NMBM commercial/industrial tariff was the lowest. The NMBM increased their domestic tariffs for 2016/17 by 9% and the industrial/commercial tariff by 19%. A report on the tariff comparison investigation was submitted.

Workstream 8: Leak Repairs

ATTP leak repairs

Assistance to the Poor (ATTP) leak repairs are repairs to private plumbing of poor households. In March 2011, 2 803 ATTP water users used an average of more than 30 kℓ/month. During the financial year 2010/11, 12 472 ATTP leaks were repaired, while 17 500 ATTP leaks were repaired during the financial year 2011/12 and 12 387 during the financial year 2012/13. This program contributes to the reduction of water losses and offers work for the ward-based contractors. Although water use has increased from 21 million kℓ in 2010 to
37 million kℓ in 2012/13, this is largely due to the increase in the number of connections. In 2010, the average consumption per connection was 453 ℓ/day, which has reduced to 315 ℓ/day in May 2013.

During 2016 the number of repairs increased, and a further 38 ward-based plumbers were employed and trained to total 83. The revised target of repairs is 4 000 per month. The number of ATTP leak repairs is shown in Table B.4.

Table B.4: ATTP leak repairs

Year	No of Repairs
2010/11	13 353
2011/12	17 500
2012/13	12 387
2013/14	1 755
2014/15	7 153
2015/16	20 087
Total	**72 235**

Schools leak repairs

No further leak repairs have been undertaken besides audits, and a new triennial tender document is being prepared. The Auditor General considers leak repairs by the NMBM at schools to be unlawful expenditure. The programme will only proceed if the DoE provides the funding.

Of the 384 schools, 107 had meters with various problems that needed replacing. The bulk of these have been replaced.

Ward cluster repairs

The Metro's in-house leak repair teams cannot cope with the large number of leaks reported at the Call Centre. The turnaround time is unsatisfactory and results in a negative public perception, especially during times of water shortage. There is a backlog of 6 389 water-related complaints (reporting period March 2015 to April 2016). The Call Centre deals with an average of 181 complaints per day, of which 88 are water related.

The NMBM is finalising the appointment of six cluster-based contractors (10 municipal wards per cluster) to carry out leak repairs within the wards of each cluster. Each contractor will appoint and provide basic skills training for five community plumbers per ward to perform minor leak repairs in the ward. Work will be scheduled to the contractors using job cards with geo tags generated by the Call Centre Operating and Maintenance system. The job cards will form the basis for job verification, completion and payment.

Leak-repair complaints should be dealt with as follows:

- Before the meter – to be fixed by Cluster contractor (up to 100 mm diameter)
- Internal leaks – to be fixed by ATTP leak-repair team
- Large leaks – to be fixed by NMBM officials
- Straight connections – to be fixed by Cluster contractors

- Semi-skilled ward-based workers to be deployed in selected areas for 4 months per area on a rotational basis.

Workstream 9: Repair and Maintenance Contractor

The Repair & Maintenance (R&M) Contractor undertakes repairs as a result of problems found from audits undertaken by the water-loss service provider. This includes major and minor leak repairs and minor works. The contract was used to include construction of DMA chambers and PRV stations, as well as meter replacements.

The R&M Contractor commenced work in January 2015, however, ceased work in November 2015 due to financial problems. The contractor only recommenced work on 14 March 2016. The delay of 4 months has had a negative impact on the NRW programme. A summary of the R&M work done is provided in Table B.5. The bulk of the work has been in the Uitenhage and Despatch areas where the water infrastructure is old.

Table B.5: Summary of work done by the Repair & Maintenance Contractor

Work Item	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	April 2016	May 2016	June 2016	Total
Install standpipes	0	0	0	0	0	69	0	0	69
Leaks repaired - domestic	20	163	78	163	39	9	0	3	475
Leaks repaired - reticulation	19	5	1	2	5	2	4	160	198
Leaks repaired - trunk mains	5	3	2	1	1	2	3	0	17
Hydrants repaired	7	3	15	3	2	0	18	22	70
Hydrants replaced	8	2	12	12	1	2	1	0	38
Valves repaired	7	10	0	15	45	0	19	23	119
Valves replaced	12	10	0	2	10	0	3	2	39
Install new valves	5	1	0	3		5	2	0	16
Minor extensions	3	1	1	4		6	3	2	20
Install domestic connections	0	0	0	0	0	9	8	0	17
Total	**86**	**198**	**109**	**205**	**103**	**104**	**61**	**212**	**377**

Workstream 10: Domestic Meter Audit and On-property Leak Investigations

The domestic meter audit is undertaken due to the following reasons:

1. Many existing consumer meters are being estimated for various reasons:
   a. Buried meters
   b. Meters that are unreadable
   c. Stuck meters
   d. Broken meters.
2. Many consumer meters are not on the billing system:
   a. Incorrect serial numbers so unable to link meter to consumer
   b. Unable to link meter with erf
   c. Meters installed but missing paperwork to add to billing system
   d. No meter found at consumer’s property (straight connections).
3. Many consumers have internal leaks on their fittings (cisterns, taps, pipes etc.) which cause unnecessary wastage which is often not billed due to meter problems.

Table B.6: Progress of Domestic Audit to date

Date of Report:				12 August 2016	
No.	**Description**	**Details**		**Total**	**% Faults**
1	Audit	Connections		110973	
2		Valves & Hydrants		15083	
3		No Access		13935	13%
4					
5	Faults	Stop-cocks		3441	3%
6		Meters		24212	22%
7		Connection Leaks		701	0.6%
8		Internal Leaks		14681	13%
9		Valve, Hydrant & Reticulation		10466	69%
10	On-site Leakage	Meter Flow Test Results	Actual (kl/hr)	235.14	
			Potential (kl/hr)	432.52	

Workstream 11: Valve and Fire Hydrant Audit

The valve and hydrant audit is undertaken due to the following reasons:

1. Numerous valves and fire hydrants have faults (leaking, inoperable or missing covers and/or missing markers).
2. Many valves and fire hydrants that are on the system and recorded on as-built plans could not be located.

Due to other priorities this intervention was not undertaken continuously.

Table B.7: Summary of Valve and Hydrant Audit

No. of Valves Audited	FAULTY VALVES								
	Leak	No Marker	Not Found	Not on Map	Not Working	Replace Cover	Too Tight	Head Covered	Total Faulty Valves
9 391	291	3 684	2 646	1 174	87	143	779	968	9 772
	3.10%	39.23%	28.18%	12.50%	0.93%	1.52%	8.30%	10.31%	

No. of Fire Hydrants Audited	FAULTY FIRE HYDRANTS								
	Leak	No Marker	Not Found	Not on Map	Not Working	Replace Cover	Too Tight	Valve Head Covered	Total Faulty Fire Hydrants
5 692	54	453	1 211	709	11	44	344	75	2 901
	0.95%	7.96%	21.28%	12.46%	0.19%	0.77%	6.04%	1.32%	

Workstream 12: Meter Replacement Programme

Table B.8 shows the number of replaced domestic meters. Over the last eight years, 164 156 domestic meters were replaced, representing 75% of all domestic meters. Problems were experienced with the triennial contractor appointed, however the numbers are expected to improve in 2016/17.

Table B.8: Domestic Meters Replaced

Year	No of Domestic Meters Replaced
2008/09	35 015
2009/10	16 291
2010/11	11 274
2011/12	16 197
2012/13	29 474
2013/14	26 827
2014/15	14 200
2015/16	14 878
Total	**164 156**

Workstream 13: Publicity and Awareness Programme

In order to create more awareness of service delivery issues, challenges and successes, and to stimulate employment within wards, the municipality embarked on a Service Delivery Ambassador Programme.

The objective of this project was to:

- Repair leaks and drainage blockages on properties
- Educate households on efficient water services
- Provide awareness material to households
- Record complaints to be forwarded to the Operations Call Centre
- Create temporary employment through the EPWP programme.

Ten persons per ward were selected by Ward Councillors and given leak-repair training, clothing, equipment and materials. The programme was partly funded by the EPWP programme. It is essential that all EPWP requirements, particularly the attendance records and signatures, are complied with. The EPWP office arranged attendance registers at each of the 22 ward councillors' offices. These registers were collected on a weekly basis and processed for payment through the municipal payroll office. The EPWP office arranged formal contracts between NMBM and the Service Delivery Ambassadors.

Phase 1 of the programme included 22 wards, and covered the period from October 2015 to April 2016. For Phase 1, 20 000 complaints were received and 30 000 households visited. Phase 2 of the programme includes 29 wards, and commenced in July 2016.

A new mascot for sanitation was developed, called Ngasese, as shown in Figure B.5, to join the water mascot, Thontsi.

Figure B.6: Ngasese and Thontsi mascots with ward-based cluster plumber

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