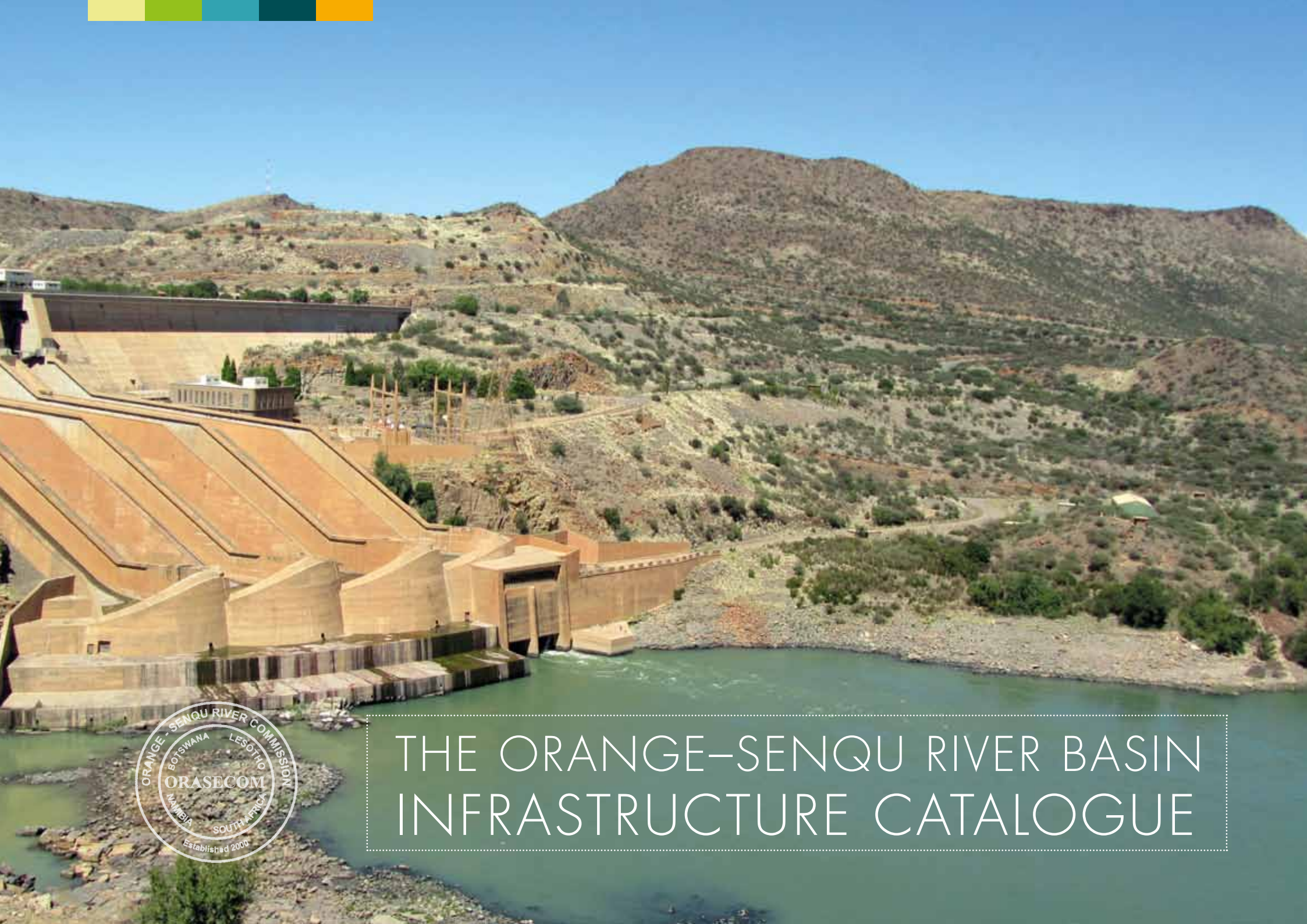

THE ORANGE–SENQU RIVER BASIN INFRASTRUCTURE CATALOGUE

The Orange–Senqu River Basin Infrastructure Catalogue
ORASECOM Report 001/2013

First edition 2012
Second edition 2013

ISBN 978-0-620-56635-6

This report was compiled by Allan Bailey of Royal Haskoning DHV (allan.bailey@rhdhv.com) from a number of existing documents and sources

The Orange–Senqu River Commission (ORASECOM) was established in 2000 by Botswana, Lesotho, Namibia and South Africa, which share the water resources of the Orange–Senqu River basin. The Commission provides a forum for consultation, sharing of information and cooperation between the countries.

An important part of ORASECOM's Programme is the Orange–Senqu Strategic Action Programme, a four-year project that aims to identify and address the threats to shared water resources in the Orange–Senqu River basin, with the ultimate goal of developing a basin-wide plan for sustainable management of its water and related natural resources. The project is funded by the Global Environment Facility through the United Nations Development Programme (UNDP) and is executed by the United Nations Office for Project Services (UNOPS).

For further information on ORASECOM, please visit www.orasecom.org.

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THE ORANGE–SENQU RIVER BASIN INFRASTRUCTURE CATALOGUE

ACKNOWLEDGEMENTS

The following people are gratefully acknowledged:

- The late Guido van Langenhove of the Department of Water Affairs and Forestry (Namibia), whose valuable comments on the first edition of this publication and assistance in gathering additional information on Namibia helped make this second edition more complete.
- Mr Stephen Mallory, for his spreadsheet on intermediate and large dams.
- Mr Lesego Raditsebe of the Botswana Water Utilities Corporation, for information on infrastructure in Botswana.
- André Mostert and Hanjörg Drews of NamWater for information on dams and purification works in Namibia.
- Rodney Amster, Water Associates, for information on wastewater treatment works in Directorate of Water Supply and Sanitation Coordination (Department of Water Affairs and Forestry).
- Lastly, but certainly not least, many thanks to Mr Peter Pyke of the Department of Water Affairs (South Africa) for valuable material on dams and transfer schemes, as well as the editorial comments he made on earlier drafts.

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PREFACE

The Orange–Senqu River basin is one of the largest river basins in southern Africa. Rising in the rain-fed highlands of Lesotho, it also covers significant areas of Botswana, Namibia and South Africa. The basin, characterised by a temperate to arid climate, variable rainfall – both temporally and spatially – and high evaporation rates, is subject to droughts and floods. Nevertheless, it provides the water required to drive the most economically active area in southern Africa, supports large-scale irrigation and meets the domestic needs of more than 14 million people. Water supply required to meet these demands has been assured through the construction of numerous dams and a series of transfer schemes. Currently, the Orange–Senqu system hosts some 300 built structures, among them 30 large dams and several large inter- and intra-basin transfers. It is regarded as the most developed river system in southern Africa.

Whilst these structures have played an important role in development of the area, extensive water abstraction for urban, industrial and agricultural purposes has significantly altered the natural flow of the river system. The frequency, size and duration of floods are also affected. These changes in flow adversely affect the health of the river, the resources and the ecosystems it supports and the services they provide. It is essential that the river system is managed effectively, efficiently and sustainably to maintain these important ecological functions and secure its resources in the long term. Such an integrated management approach is promoted by the Orange–Senqu River Commission (ORASECOM).

The Orange–Senqu River Basin Infrastructure Catalogue, produced through UNDP–GEF's Orange–Senqu Strategic Action Programme in support of ORASECOM, provides facts and figures about the structures built in the river system. Compiled from a variety of authoritative sources, it provides information, photographs, diagrams and other pertinent information on transfer schemes, reservoirs, gauges, water purification works and wastewater treatment works. The information has also been made accessible electronically as downloadable fact sheets on the Orange–Senqu Water Information System (WIS; accessible at wisp.orasecom.org), which also provides links to scanned historic documents on some of the dams and transfer schemes.

This comprehensive work provides an excellent reference to the infrastructure on the Orange–Senqu and how those built structures are used to manage the surface waters of the river system to meet the substantial human demands placed on them.

Lenka Thamae
Executive Secretary
ORASECOM

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

AUTHOR'S NOTES AND DEFINITION OF TERMS

Area–capacity relationship

At a specific elevation above mean sea level, a reservoir has a certain storage capacity and surface area. The relationship between elevation (metres above mean sea level, or mamsl), storage capacity (million m^3) and surface area (km^2) is tabulated for each reservoir.

Catchment area

The area (measured in km^2) over which water is drained to a common point is known as the catchment area.

DWA code

The Department of Water Affairs (South Africa) has assigned a unique code to each reservoir in South Africa. Some of the larger dams in Lesotho have also been given a DWA code.

Elevation

Throughout this publication, elevation refers to the level in metres above mean sea level (mamsl), denoted in metres (m).

Full supply area (FSA) of reservoirs

The surface area of a reservoir varies depending on how much water is in it. When the reservoir is at full supply capacity (FSC), the surface area is then referred to as full supply area (FSA), being full supply area at full supply capacity. Surface area is measured in square kilometres (km^2).

Full supply capacity (FSC) of reservoirs

Due to raising, siltation, re-surveying and other factors, the full supply capacity (FSC) of some reservoirs have had numerous changes over the years. For this reason, only the latest available figures have been given in the tables. Such a current figure for a reservoir is known as the 'live full supply capacity' and is the usable capacity when the dam is full. It does not include dead storage capacity, which is unusable due to outlets or other factors. Full supply capacity is measured in million cubic metres (Mm^3).

Maximum spillway capacity

The spillway releases water from the reservoir so that it does not overtop and damage or even destroy the dam. The maximum volume of water that can be released through the spillway is known as the maximum spillway capacity and is measured in cubic metres per second (m^3/s)

Mean annual runoff

Annual runoff is the total volume of water that is discharged past a certain point each year. Annual runoff is averaged over a number of years (end record – start record) to give a mean annual runoff for that period; it is measured in units of million m^3 per annum (Mm^3/a).

Quaternary catchment

South Africa is divided into a number of primary catchments which are further subdivided into secondary, tertiary and quaternary catchments based on the drainage of river systems. A group of quaternary catchments form a tertiary, a group of tertiary catchments form a secondary, and the a group of secondary catchments form the a primary. This system has also been applied in Lesotho and, due to historical reasons, quaternary catchments are also defined for Namibia.

Water management areas

The schematics presented (pages 9–17) are based on sub-divisions – or sub-basins – of the Orange–Senqu River basin, as illustrated in the map on page 7.

The sub-basins in South Africa are based on the 19 water management areas (WMAs) delineated by the Department of Water Affairs (DWA). In the Orange–Senqu basin these include the Upper Vaal, Middle Vaal, Lower Vaal, Upper Orange and Lower

Orange WMAs. The Senqu sub-basin comprises the whole of Lesotho. The part of Botswana in the Orange–Senqu basin has been defined as the Molopo–Nossob and the part of Namibia in the basin has been defined as the Lower Orange (Namibia).

Through reform of the water sector in Namibia, 11 basin management areas have been delimited. Two of these comprise the Orange–Senqu River basin in Namibia – the Orange–Fish and the Nossob–Auob basin management areas – and are shown in the map on page 7. The 19 WMAs in South Africa are to be reduced to nine, although at the time of writing, this change is not final. The change will see the Upper Vaal, Middle Vaal and Lower Vaal being combined and the Upper Orange and Lower Orange being combined. These proposed water management areas in South Africa are also shown in the map on page 7.

1:50 yield

The minimum yield of a reservoir that can be obtained in 98 out of 100 years, is known as the 1:50 yield. It is the abstracted volume that can be obtained at a 1:50 assurance and is measured in million cubic metres per annum (Mm^3/a).

ABBREVIATIONS, ACRONYMS AND SYMBOLS

∅	diameter
BH	borehole
D	design
DWA	Department of Water Affairs (South Africa)
DWAF	Department of Water Affairs and Forestry (Namibia)
FSA	full supply area
FSC	full storage capacity
GWCA	government water control area
GWS	government water scheme
IB	irrigation board
LHWP	Lesotho Highlands Water Project
mamsl	metres above mean sea level
MB	management board
NamWater	Namibia Water Corporation
ORASECOM	Orange–Senqu River Commission
ORP	Orange River Project
RSL	relative to sea level
SA	South Africa
SA	surface area
SANCOLD	South African National Committee on Large Dams
STW	sewage treatment works
UNOPS	United Nations Operational Support
VRESSAP	Vaal River Eastern Sub-system Augmentation Project
WCW	water care works
WMA	water management area
WRC	Water Research Commission
WSAM	water situation assessment model

WATER MANAGEMENT AREAS

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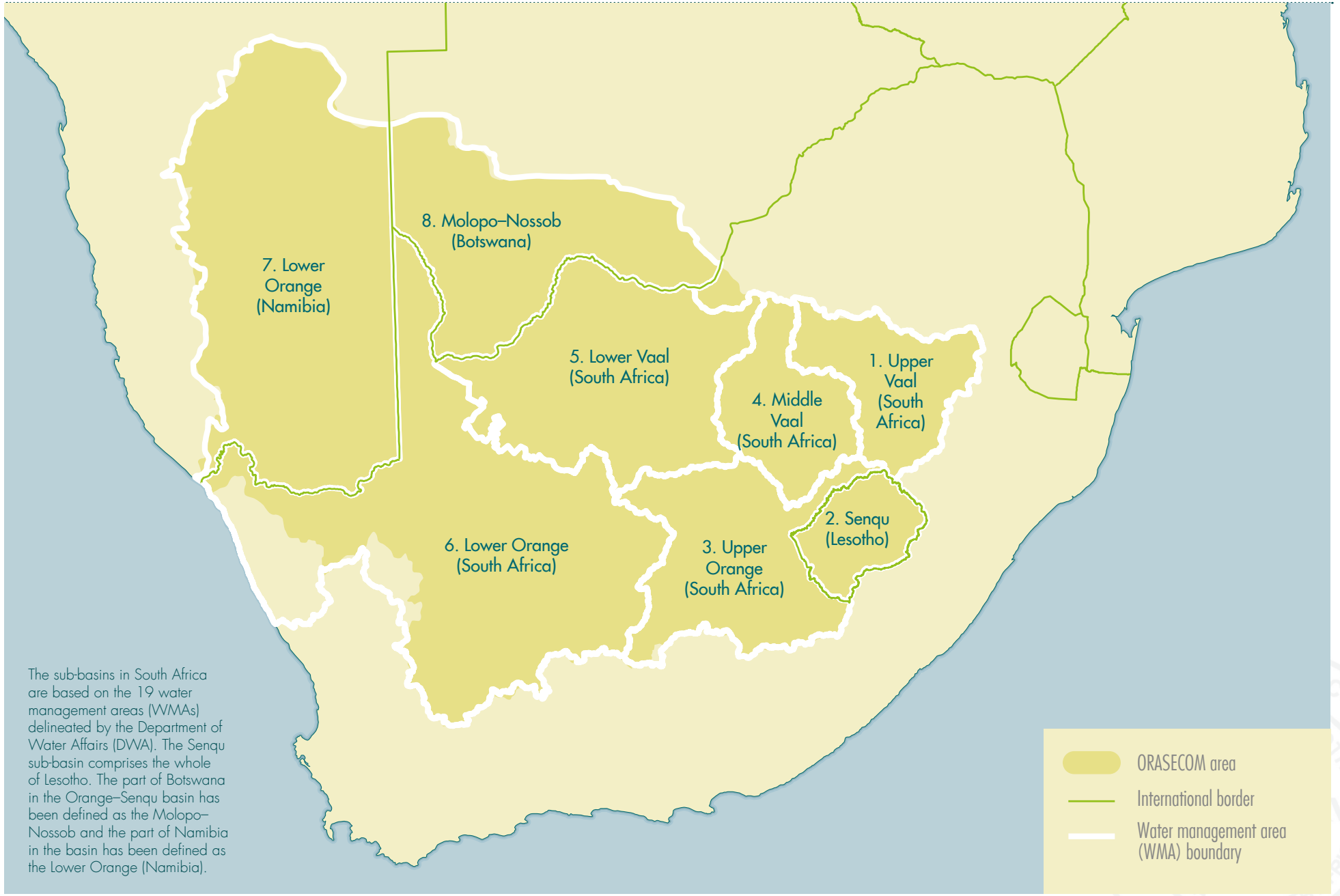
From: The Orange–Senqu River Basin Infrastructure Catalogue, ORASECOM Report 001/2013

WATER MANAGEMENT AREAS OF THE ORANGE–SENQU BASIN AS AT JUNE 2013



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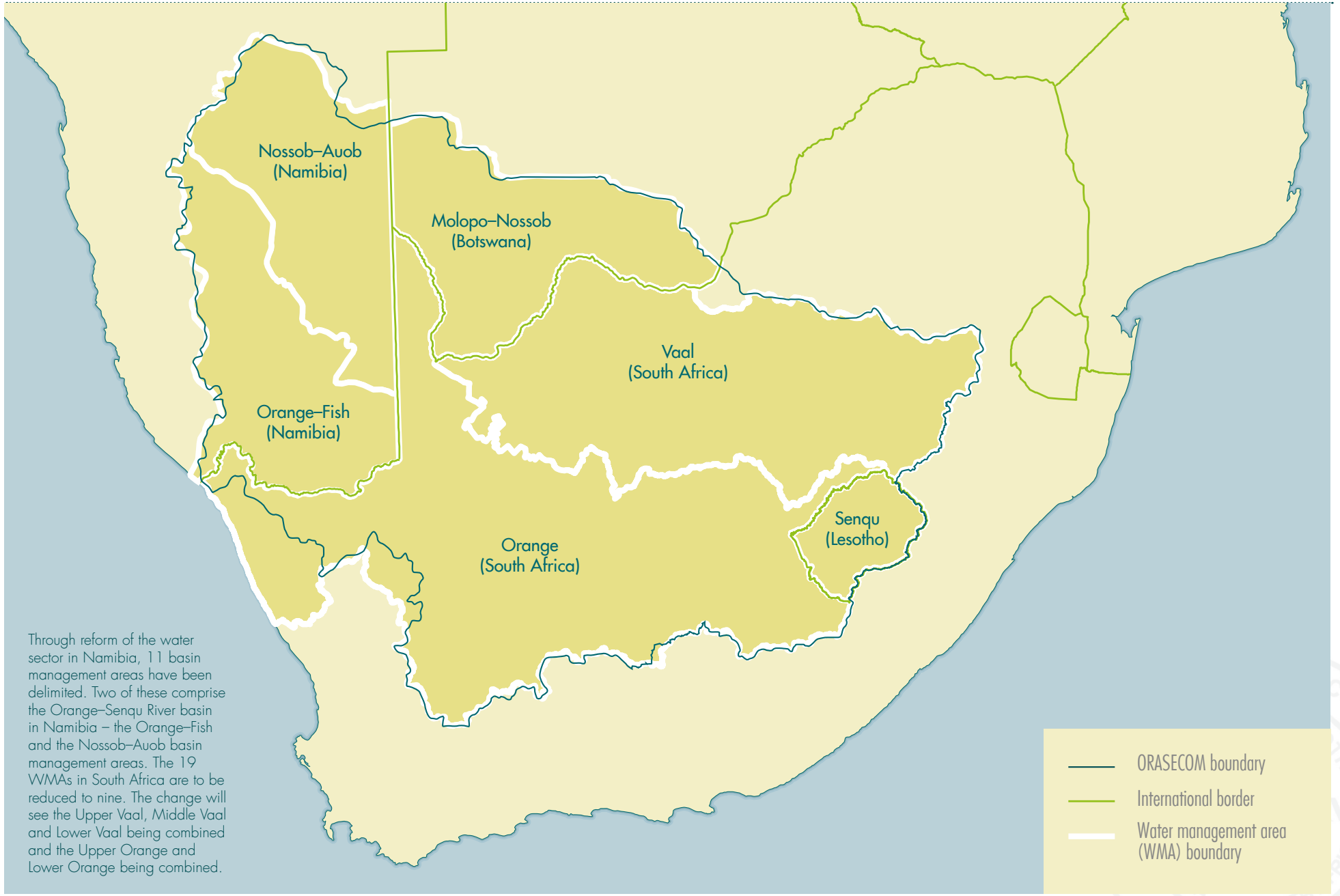
PROPOSED WATER MANAGEMENT AREAS FOR THE ORANGE–SENQU BASIN



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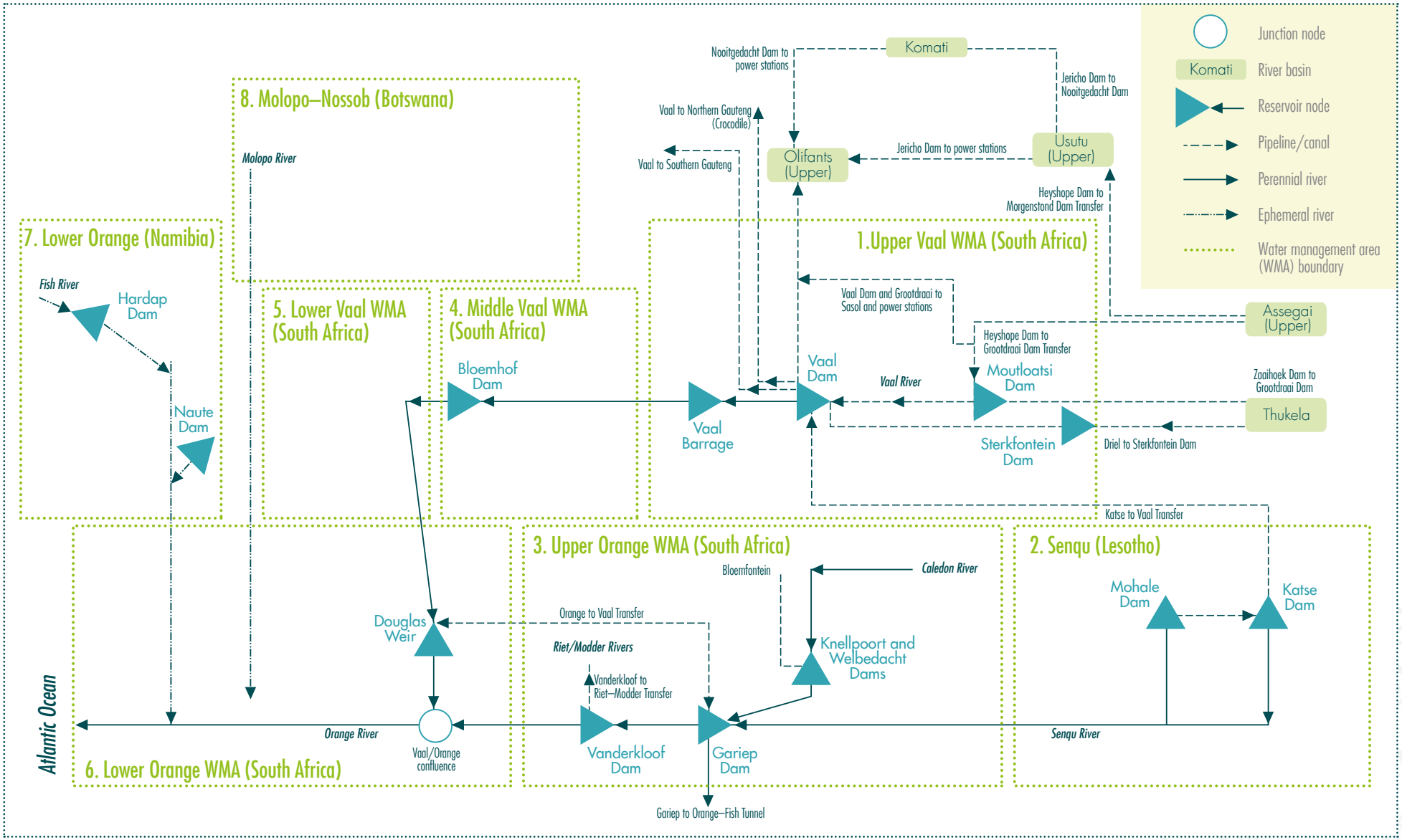
INTEGRATED SCHEMATIC



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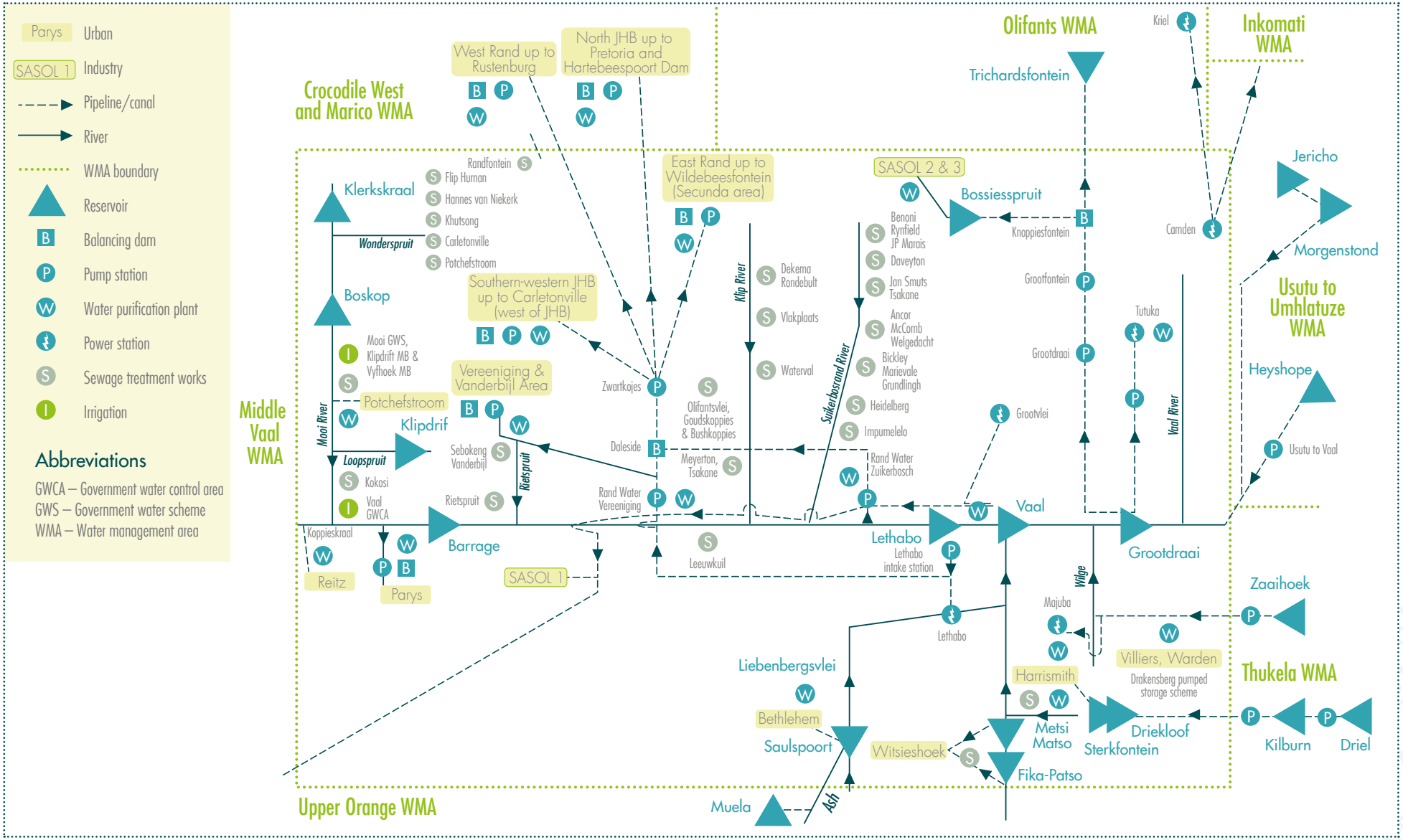
South Africa

1. UPPER VAAL



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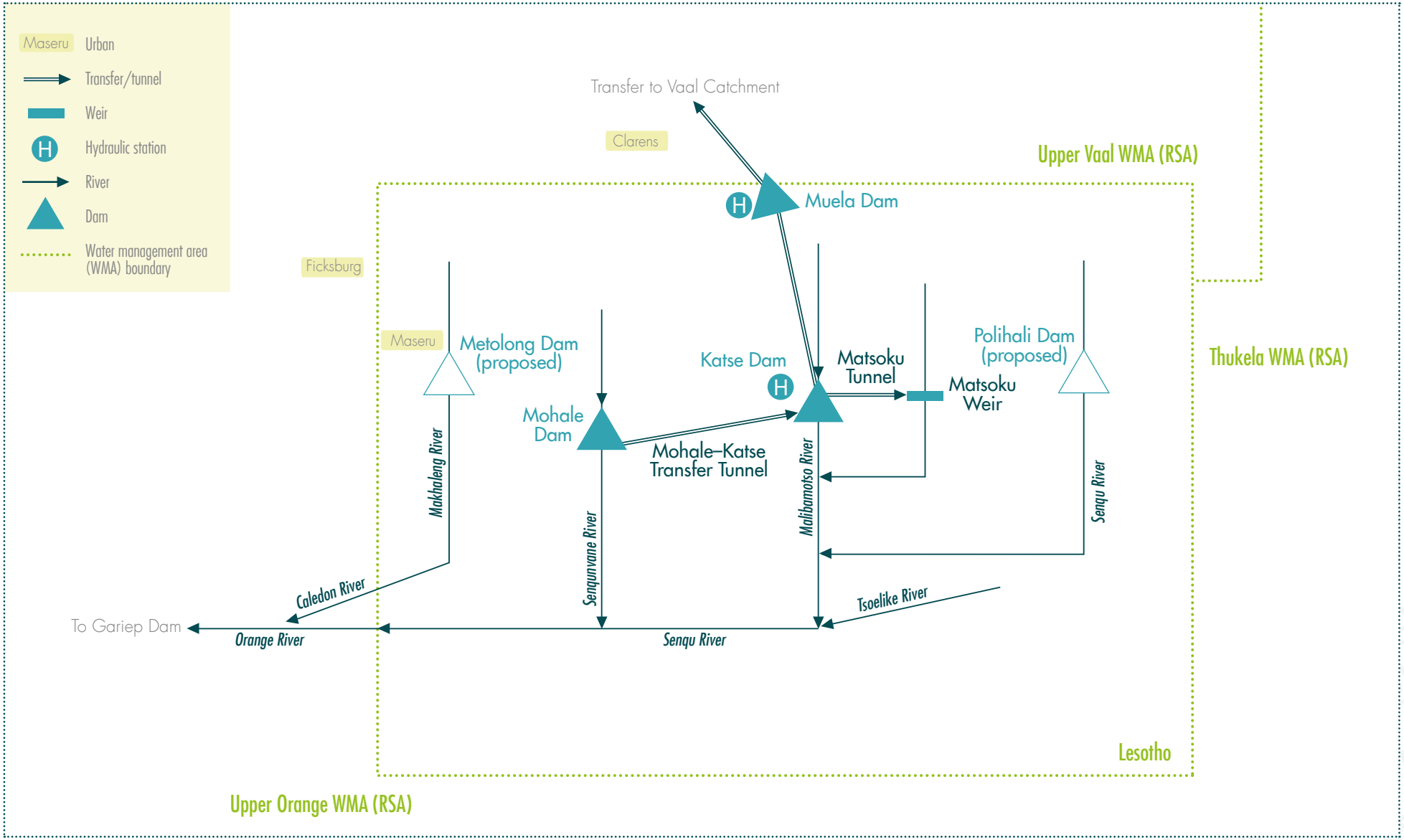
Lesotho

2. SENQU



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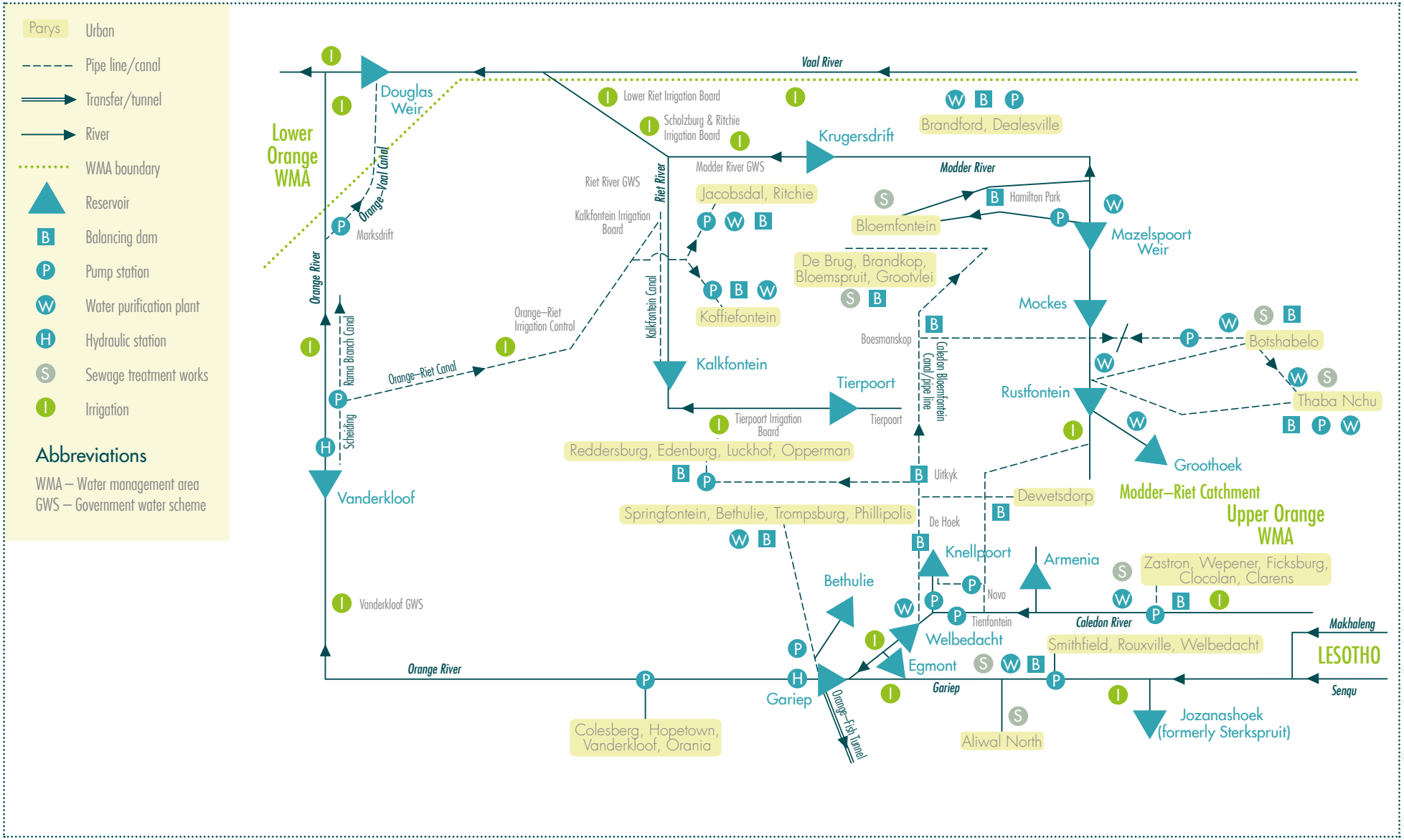
South Africa

3. UPPER ORANGE



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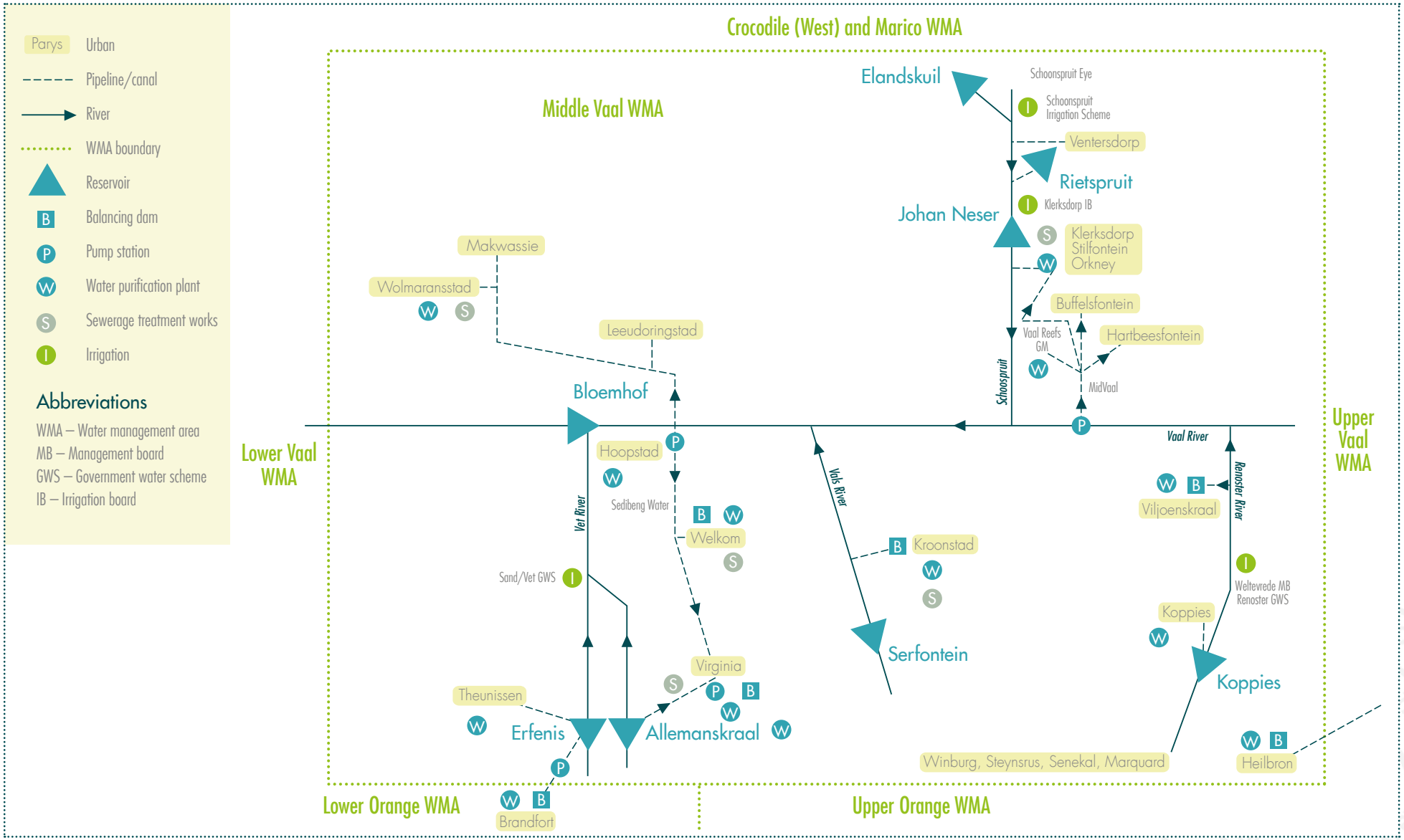
South Africa

4. MIDDLE VAAL



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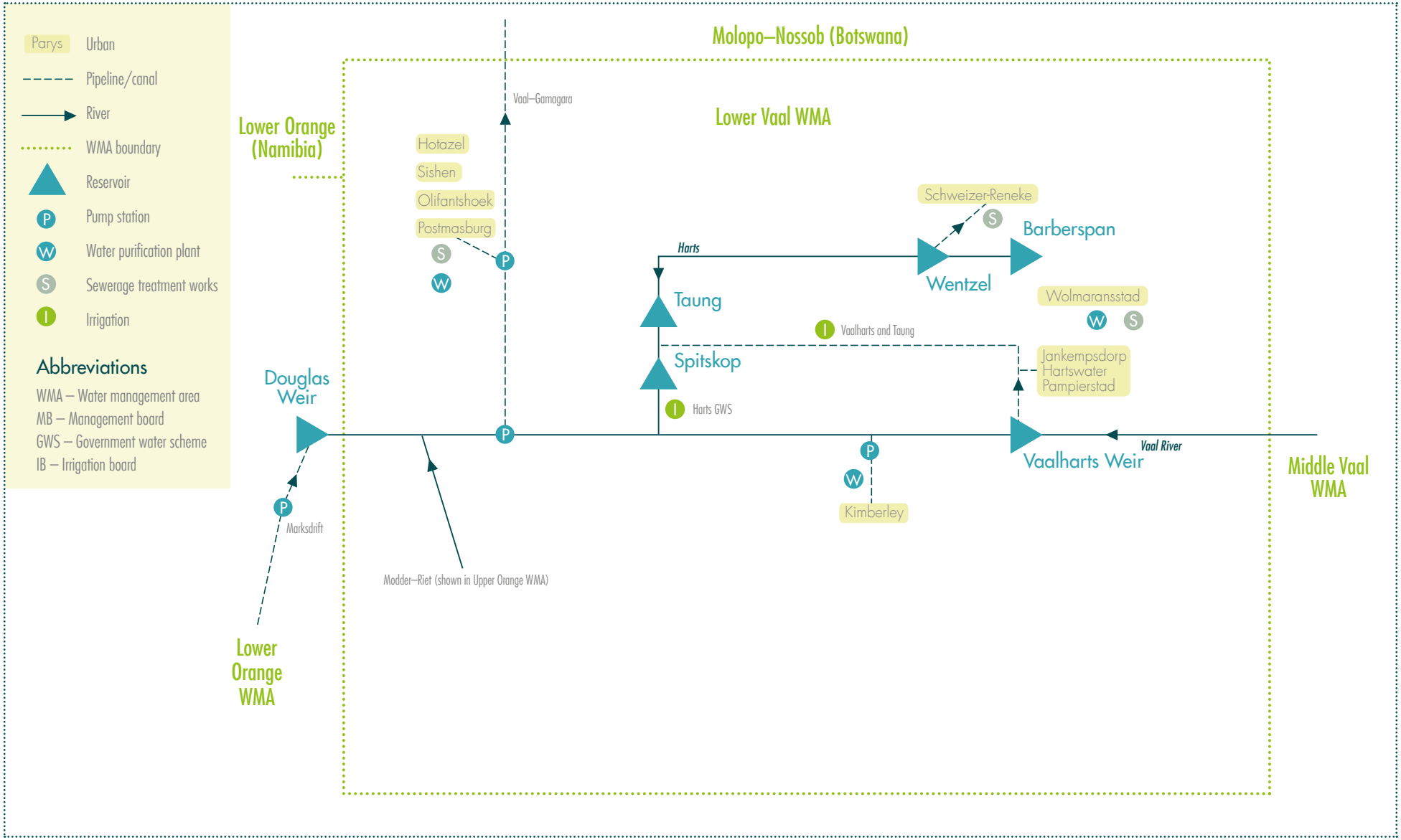
South Africa

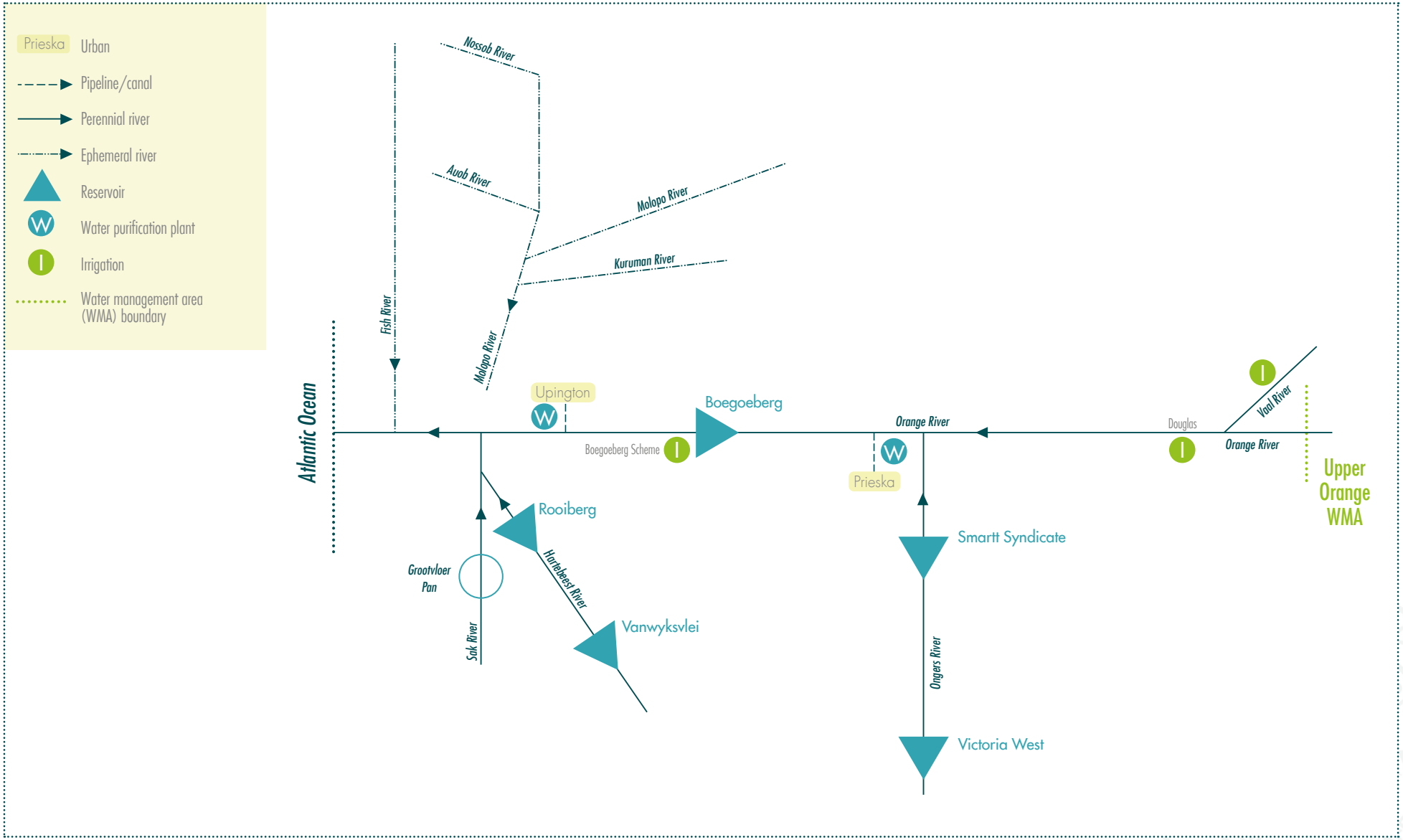
5. LOWER VAAL



From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

6. LOWER ORANGE (SOUTH AFRICA)



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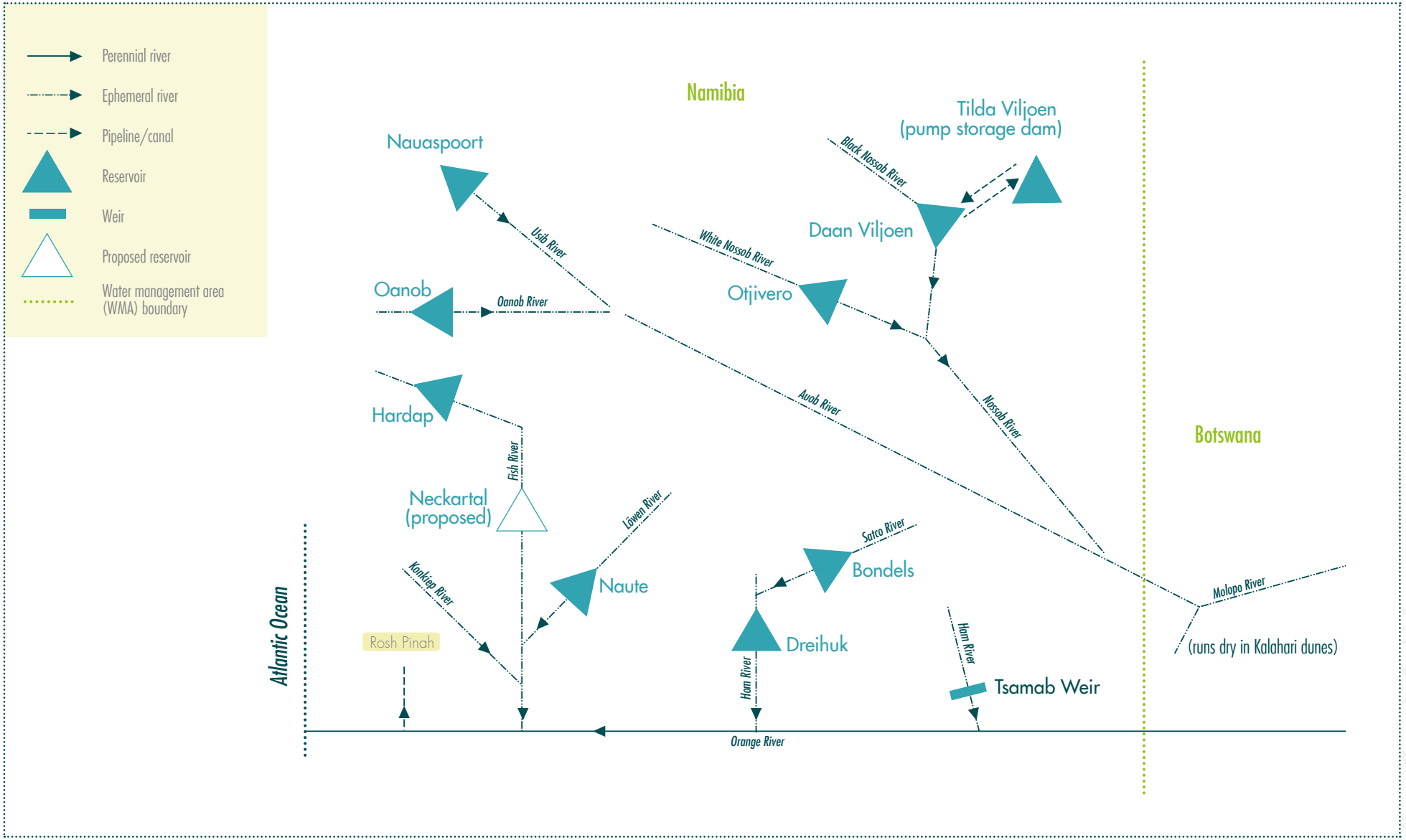
Namibia

7. LOWER ORANGE (NAMIBIA)



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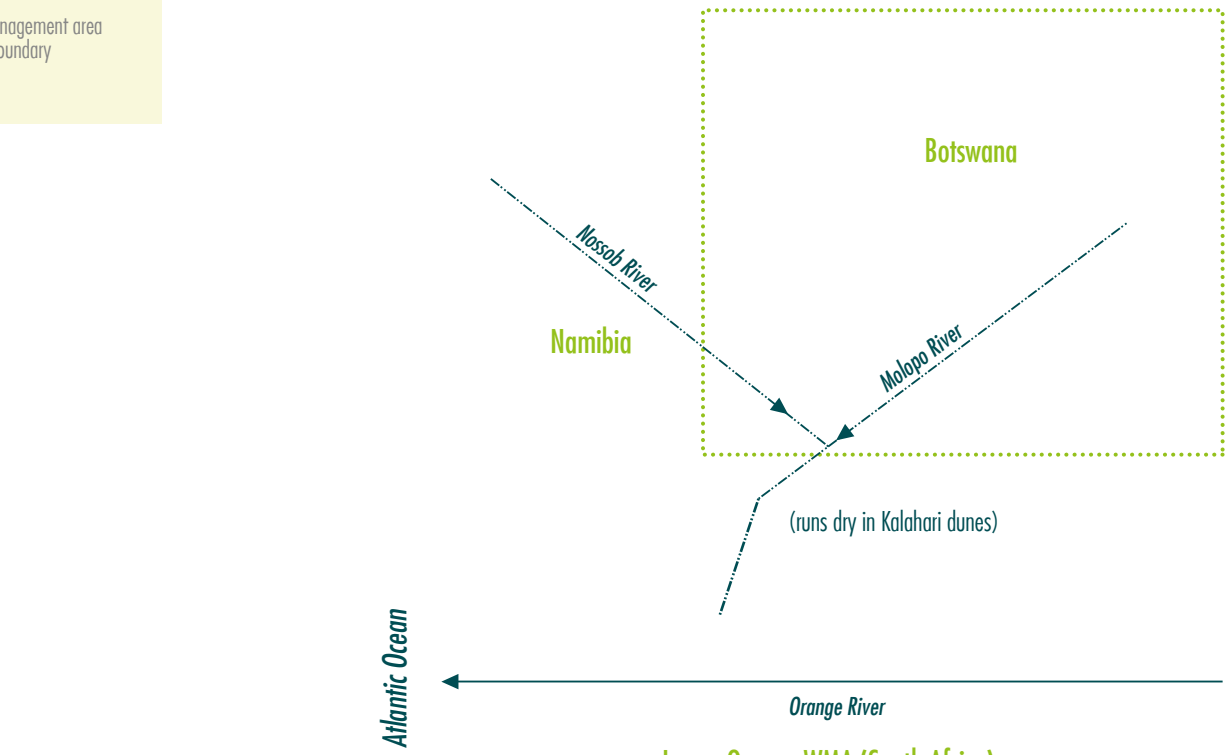
Botswana

8. MOLOPO–NOSSOB (BOTSWANA)



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TRANSFER SCHEMES

South Africa

HEYSHOPE–GROOTDRAAI TRANSFER

Grootdraai Dam (source: SA Dept of Water Affairs)

LOCATION

This transfer occurs from Heyshope Dam in the Upper Usutu catchment to the Grootdraai Dam in the Upper Vaal Water Management Area.

DESCRIPTION

The Heyshope–Grootdraai Transfer consists of the Heyshope Dam, the Geelhoutboom Balancing Dam, pumps and canals. Water is pumped from Heyshope Dam into the Heyshope Canal and on to the Geelhoutboom Balancing Dam. From there it is pumped into Morgenstond Dam via a canal and to the Balmoral Canal. From the Balmoral Canal, water is transferred into the Little Vaal River and on to Grootdraai Dam. The capacity is currently limited to 3.8 m^3/s by the pumping station and rising mains. Refer to the integrated schematic and the schematic of the Upper Vaal catchment.

PURPOSE

The main purpose of this transfer system is to support Grootdraai Dam for supply to the Sasol–Secunda complex as well as Eskom power stations in the Upper Olifants catchment.

South Africa

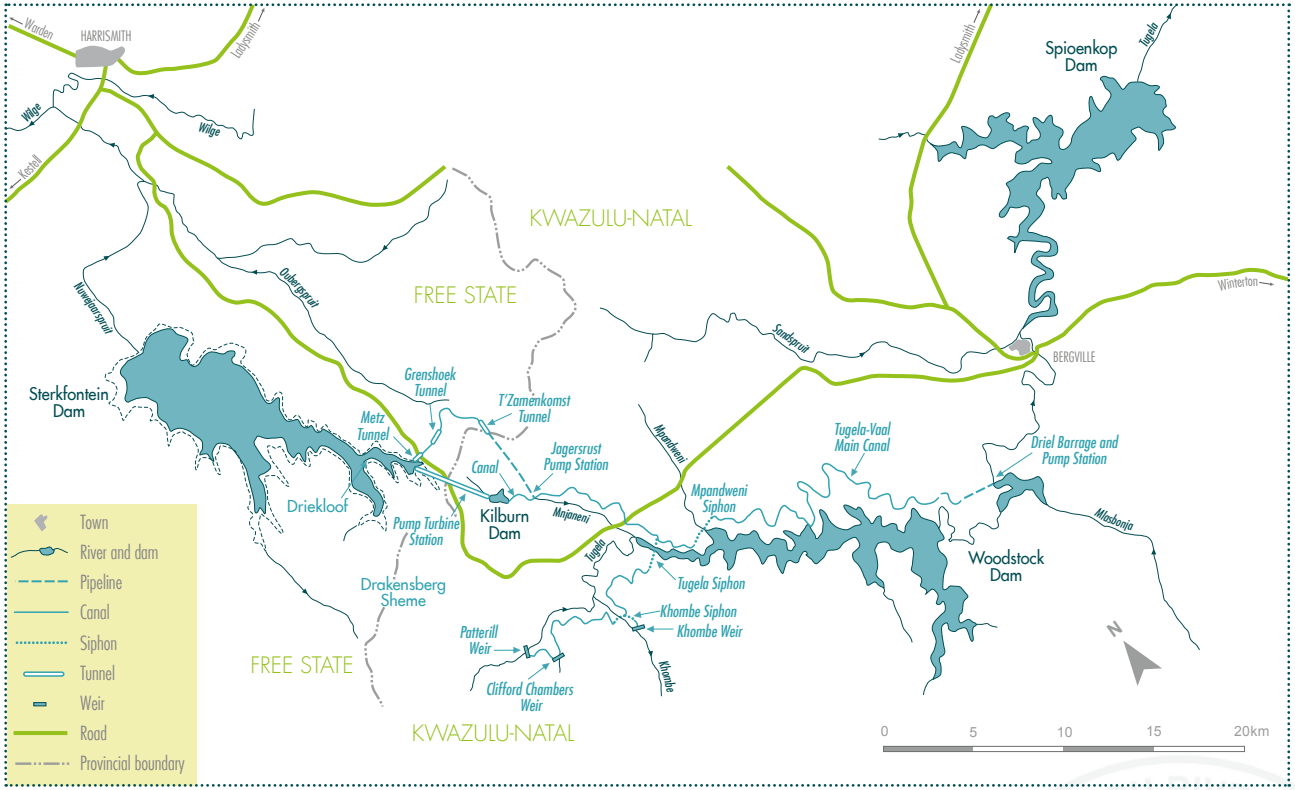
THUKELA–VAAL TRANSFER SCHEME

LOCATION

There are two schemes which transfer water from the Thukela basin to the Vaal River, namely the Thukela–Vaal Transfer Scheme, also sometimes called the Drakensberg Pumped Storage Hydro-electric Scheme, and the Zaaihoek Transfer Scheme. The larger of the two is the Thukela–Vaal Transfer Scheme, which involves Woodstock Dam, Driel Barrage, Kilburn Dam and Driekloof Dam in the Thukela Basin and Sterkfontein Dam and a number of pump stations, pipelines, canals and tunnels. The Zaaihoek Transfer Scheme is dealt with separately.

DESCRIPTION

Run of river flows in the upper Thukela tributaries are conveyed by gravity at a peak rate of 4 m^3/s to the Jagersrust pumping station. Water is also pumped from the Driel Barrage at a peak rate of 19 m^3/s to Jagersrust. Jagersrust then pumps at a peak rate of about 20 m^3/s to Kilburn Dam. From Kilburn it is pumped by Eskom to Driekloof Dam in the Upper Vaal Water Management Area from where it flows directly into Sterkfontein Dam. Woodstock Dam, upstream of the Driel Barrage, provides the storage to regulate the flow into Driel. Refer to the schematic of the Upper Vaal catchment.



General layout

PURPOSE

Eskom uses the Kilburn and Driekloof dams for their Drakensberg Pumped Storage Scheme and transfers additional water for the Thukela–Vaal Transfer Scheme.

South Africa

ZAAIHOEK TRANSFER SCHEME

Zaaihoek Dam (source: SA Dept of Water Affairs)

LOCATION

This scheme consists of a pumping station in the Slang River and the Zaaihoek Dam.

DESCRIPTION

Water for Majuba Power Station, Volksrust and the Vaal catchment is pumped from Zaaihoek Dam in the Thukela Water Management Area to the Uitkyk Reservoir. The pump station has a maximum capacity of 3 m^3/s but generally delivers at about 0.34 m^3/s when required for Majuba only. At Uitkyk, there is provision for a diversion to Mahawane Dam to supply Volksrust. From Uitkyk the water can also flow via a gravity main to Majuba Power Station and the water for the Vaal catchment is released into the Perderwaterspruit, upstream of Amersfoort Dam. This transfer has a maximum transfer capacity of 2.79 m^3/s. Refer to the schematic of the Upper Vaal catchment.

PURPOSE

The main purpose is to supply water to the Majuba Power Station. However, Majuba is running well below capacity, so surplus water is transferred to supplement Volksrust and the Ngagane River Government Water Scheme and other irrigation. Any further surplus water can be transferred from the Thukela Water Management Area to the Vaal catchment.

South Africa

VAAL–OLIFANTS TRANSFER SCHEME

LOCATION

This transfer occurs from Grootdraai Dam in the Upper Vaal catchment northwards to the Upper Olifants Water Management Area.

DESCRIPTION

The capacity is limited to a maximum of 6.5 m^3/s. Refer to the schematic of the Upper Vaal catchment.

PURPOSE

The purpose is to supply water to the Sasol–Secunda complex as well as power stations.

Grootdraai Dam (source: SA Dept of Water Affairs)

South Africa

VAAL–OLIFANTS (VAAL DAM) TRANSFER

LOCATION

This transfer occurs from Vaal Dam in the Upper Vaal catchment northwards to the Upper Olifants Water Management Area.

DESCRIPTION

The capacity is limited to a maximum of 5.1 m^3/s. Refer to the schematic of the Upper Vaal catchment. The scheme is known as VRESSAP (Vaal River Eastern Sub-system Augmentation Project).

PURPOSE

The purpose is to extend the supply of industrial water to the Sasol–Secunda complex, as well as Eskom power stations. This scheme is to work in the future in conjunction with Grootdraai Dam.

Vaal Dam (© UNOPS/C Mor)

Lesotho

LESOTHO HIGHLANDS WATER PROJECT

LOCATION

Phase I of the Lesotho Highlands Water Project (LHWP) constructed a scheme from the Kingdom of Lesotho to the Vaal River in South Africa by a treaty between the two countries.

DESCRIPTION

The original project envisaged five phases, as shown below (currently, as at 2013, Phase II is about to commence):

Phase Ia

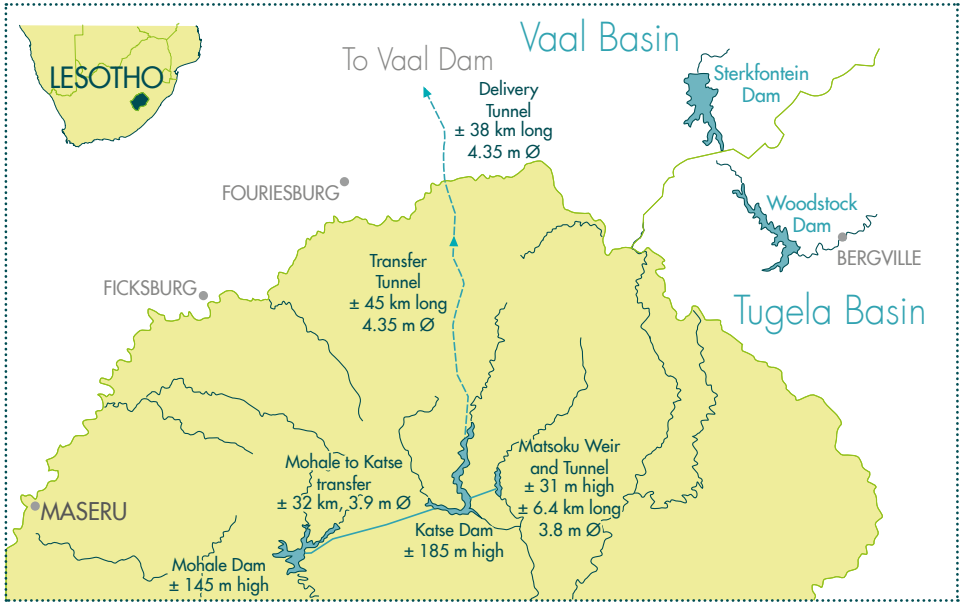
- the 185-m-high Katse Dam
- the intake structure capable of handling 70 m^3/s
- the 45-km-long transfer tunnel from Katse Dam to the Muela Dam
- the Muela Dam and hydropower station
- the 37-km-long delivery tunnel from the Muela Dam to the Vaal River basin.

Phase Ib

- the 145-m-high Mohale Dam
- the 32-km-long transfer tunnel from the Mohale Dam to upstream of Katse Dam
- the 15-m-high Matsoku Diversion Weir
- the 5.7-km-long transfer tunnel from the Matsoku Weir to Katse Dam.

Phase II

- the 163.5-m-high Polihali Dam
- the 38-km Katse–Polihali Tunnel



Phase I of the Lesotho Highlands Water Project (from locality map produced by the SA Dept of Water Affairs)

Mohale Dam, part of the Lesotho Highlands Water Project (© UNOPS/C Mor)

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- Kobong Pumped Storage Scheme
- the existing tunnels would be used as conveyance from Katse Dam.

PURPOSE

The purpose of the LHWP is to augment South Africa's water supply via a transfer to the Vaal River catchment (and it is therefore classified as part of the Vaal River System), in addition to generating electricity for Lesotho. The hydroelectric station is situated near Muela in Lesotho, approximately 45 km from Katse Dam. However, demands within Lesotho are growing, and it is envisaged that current resources, including surface water runoff, groundwater and well points, will not be sufficient. Part of the recently completed Lesotho Lowlands Study assessed options for possible storage dams for this reason.

During periods of water shortages, water is discharged from the Muela Dam into the Mohokare (Caledon) River to provide water to the capital of Lesotho, Maseru, and other towns. Releases are also made for the downstream ecological reserve. Once the whole scheme has been implemented, it will transfer the maximum flow to South Africa (long-term maximum of 877 million m^3/a).

PHYSICAL INFORMATION LHWP DAMS

Name	FSC (million m^3)	Wall height (m)
Katse	1,950	185
Mohale	947	145

PHYSICAL INFORMATION LHWP TUNNELS

Description	Length (km)
Katse Dam to Muela Dam	45
Muela Dam to the Vaal River basin	37
Mohale Dam to Katse Dam	32

Lesotho constitutes only 5% of the Orange River catchment, but provides approximately 50% of the total catchment runoff. The water quality is characterised as good, with low sediment content.

South Africa

ORANGE RIVER PROJECT: OVERVIEW

LOCATION

The Orange River Project (ORP) is the largest scheme in the Orange–Senqu River basin, and includes the two largest dams in South Africa, the Gariep and Vanderkloof. They regulate flows to the Orange River and increase assurance of supply.

DESCRIPTION

Gariep and Vanderkloof dams were constructed as part of the project, and have a combined storage of 8,500 million m^3. The ORP includes several sub-systems.

- The Orange–Riet Water Scheme.*
- The Orange–Fish Transfer Tunnel.*
- The Orange–Vaal Transfer Scheme.*
- Bloem Water: Pipeline network between Gariep Dam and the towns of Trompsburg, Springfontein and Philippolis.
- Irrigation abstractions: Between Gariep Dam and downstream of Vanderkloof Dam, up to the confluence of the Vaal and Orange rivers (near the town of Marksdrift).
- Urban and industrial abstractions: Between Gariep Dam and Marksdrift (including Hopetown and Vanderkloof towns).
- Support to the Lower Orange Water Management Area Schemes:* Support to most of the demands in the Lower Orange, including irrigation, urban use and power generation.
- Caledon–Bloemfontein Government Water Scheme.*

** Further details are given on separate pages*

PURPOSE

The purpose of this very complex scheme is to supply demands within several sub-systems, including the Upper and Lower Orange water management areas all the way down to the Orange River mouth, and the Eastern Cape Province. These demands include irrigation, urban, industrial and environmental water requirements. Power generation is also part of the system, including at Gariep and Vanderkloof dams, which contributes to the Eskom national power grid.

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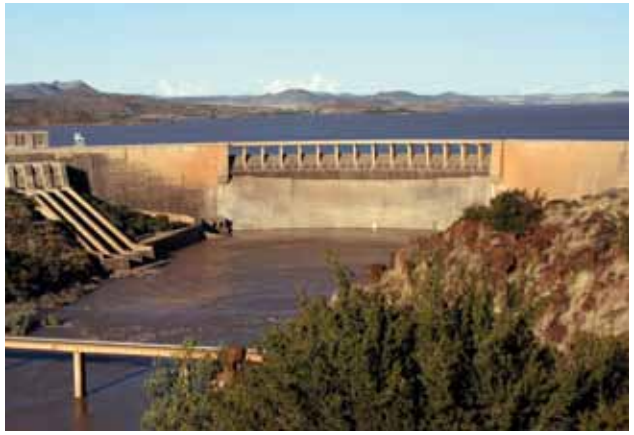


Gariep Dam (© Hendrik van den Berg/Panoramio.com)

Vanderkloof Dam (© S Crerar)

South Africa

ORANGE RIVER PROJECT

ORANGE–RIET WATER SCHEME

LOCATION

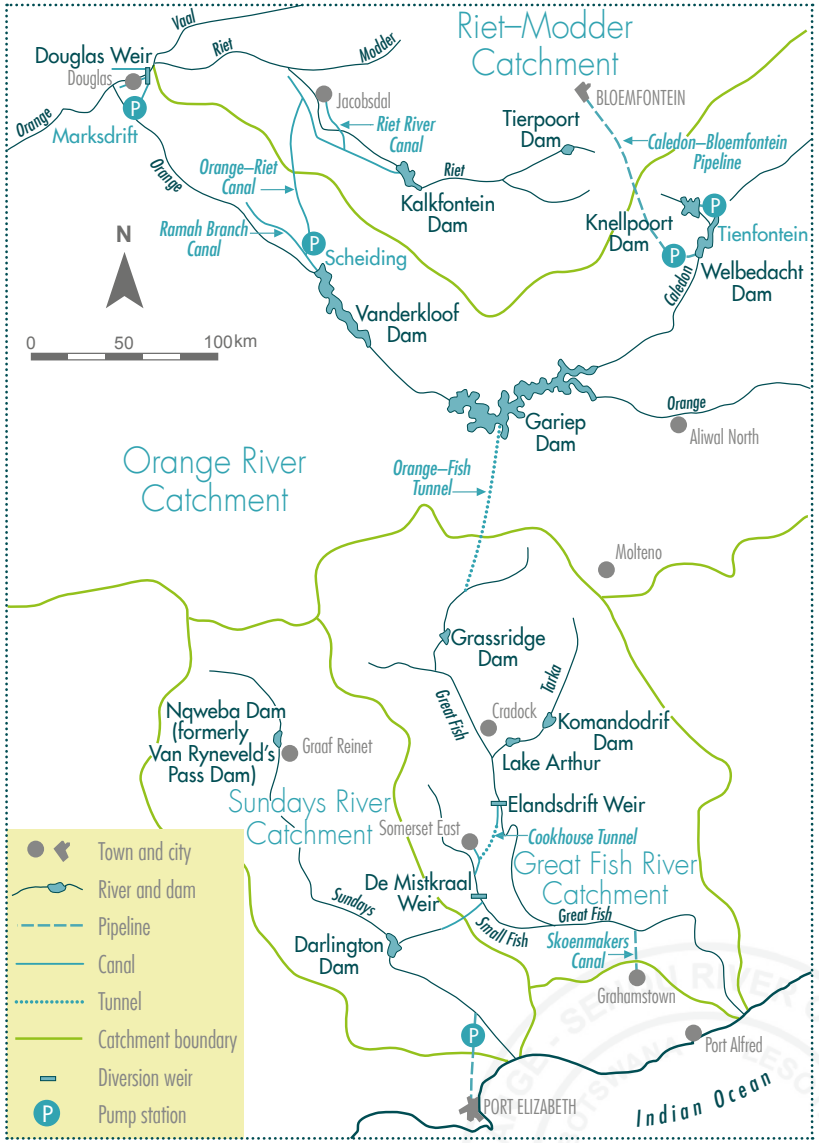
The Orange–Riet Water Scheme is a sub-system of the Orange River Project. It is located between Vanderkloof Dam and the Riet River catchment (a tributary of the Vaal River).

DESCRIPTION

The transfer scheme consists of the Orange–Riet Canal, which goes from Vanderkloof Dam to the Riet River catchment. In 1983 the construction of Kalkfontein Dam was completed. The purpose of this dam was to supply downstream users such as farmers, the Riet River Settlement, the Ritchie Irrigation District and the Scholtzburg Irrigation District, as well as assist in urban water supply to the towns of Koffiefontein and Jacobsdal. Eventually the demands grew too large to be supplied from the dam only, and the Orange–Riet Canal was constructed in 1983 to transfer water from the Orange River (Vanderkloof Dam) to the Riet River.

The water is pumped from Scheiding Pump Station into the Orange–Riet Canal, where it is transferred to a balancing dam near Jacobsdal, which is 112 km away. From the balancing dam, water is transferred via smaller canals to the Scholtzburg and Ritchie Irrigation Districts, as well as the Riet River Settlement.

Water is also supplied to the Lower Riet Irrigation Board, which is situated downstream of the Modder–Riet confluence. It supplies all the farmers along the Riet River downstream of Ritchie as far as the weir at Soutpansdrift, by direct releases of Orange River water from the canal and the balancing dam into a drainage canal, which discharges into the Riet River.



Orange–Riet Transfer Scheme (adapted from ORASECOM, 2007a)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

PURPOSE

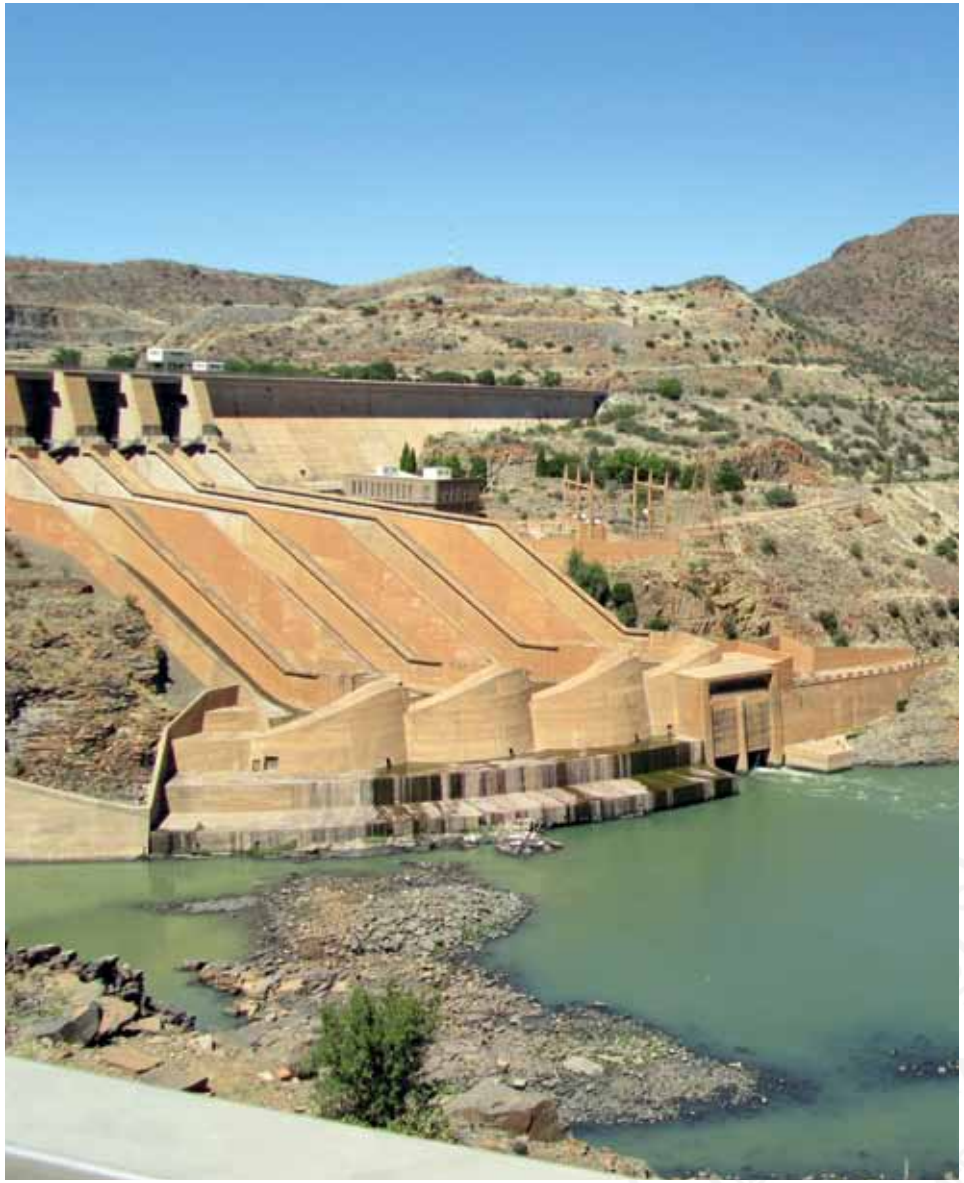
The scheme is used mainly for irrigation, but also supplies urban requirements of Koffiefontein, Ritchie and Jacobsdal.

PHYSICAL INFORMATION: CANALS

Canal name	Length (km)	Capacity (m^3/s)
Orange–Riet (1st section)	73	16
Orange–Riet (2nd section)	39	13

OPERATING RULE

Both the Orange–Riet and Douglas Weir irrigation schemes are operated to minimise pumping costs and water wastage. Inflows and spillages are kept to a minimum and under normal operating conditions these areas are dependent on imported water from the Orange River. Only sufficient water is pumped to meet the demands of these farmers, so that spills over Soutpansdrift are minimised.



Vanderkloof Dam (© Ian Cameron-Clarke)

South Africa

RIET RIVER GOVERNMENT WATER SCHEME

LOCATION

The Riet River Government Water Scheme is located downstream of Kalkfontein Dam (quaternary C51J) on the Riet River.

DESCRIPTION

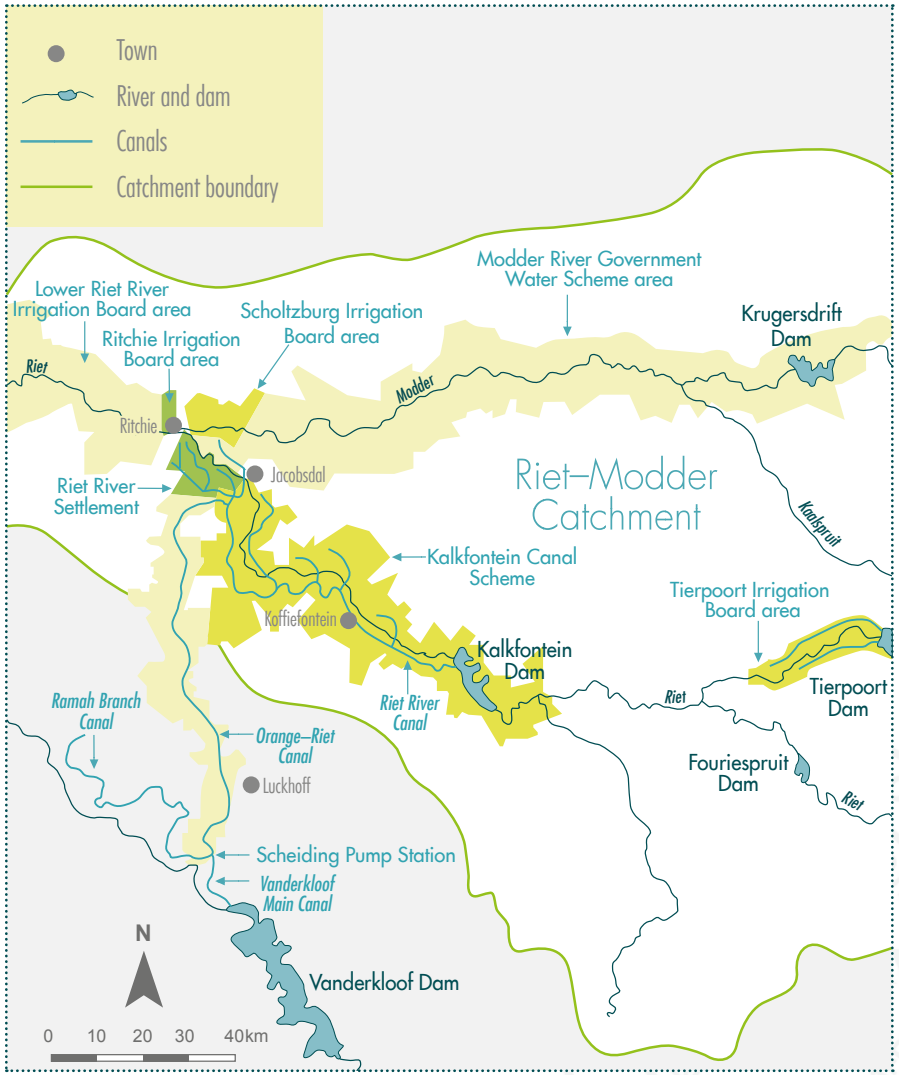
The scheme consists of Kalkfontein Dam and two canals running alongside the Riet River.

PHYSICAL INFORMATION

Kalkfontein Dam has a full supply capacity of 258 million m^3, with a wall height of 36 m and length of 317 m, and a maximum spillway capacity of 1,700 m^3/s. Refer to the schematic of the Upper Orange catchment.

PURPOSE

The scheme supplies an urban demand to the town of Jacobsdal and the mining demands of Koffiefontein. It initially supplied the additional demands of the Riet River Settlement, the Scholtzburg Irrigation Board Area, the Ritchie Irrigation Board and the town of Ritchie, but these are now supplied by the Sarel Hayward Canal (part of the Orange–Riet Water Scheme).



Riet River Government Water Scheme (adapted from ORASECOM, 2007a)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

ORANGE RIVER PROJECT

ORANGE–FISH TRANSFER TUNNEL

LOCATION

The Orange–Fish Transfer Tunnel runs from Gariep Dam on the Orange River to Grassridge Dam which is located in the upper reaches of the Great Fish River in the Eastern Cape Province.

DESCRIPTION

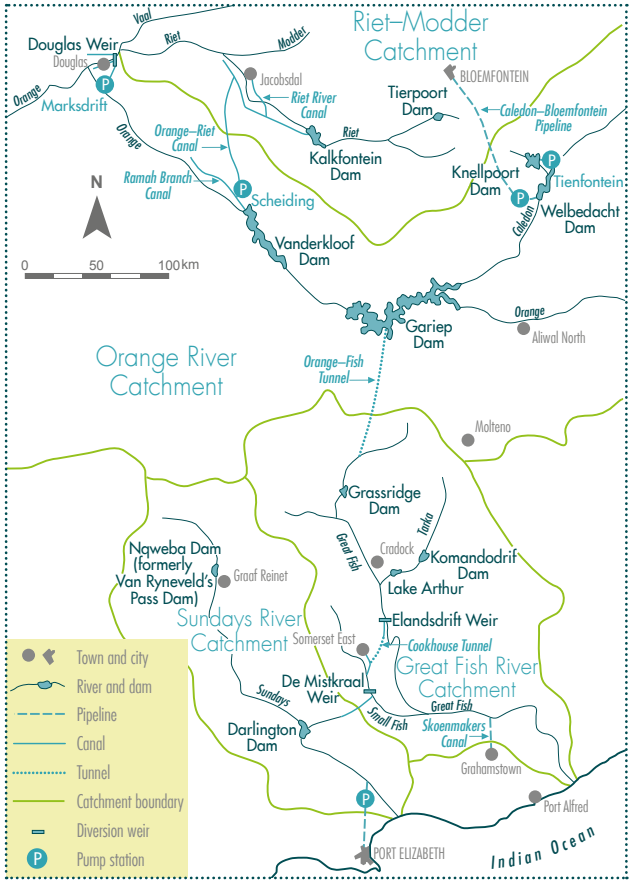
Due to severe stress the Eastern Cape underwent for many years, partly due to water shortages, and exacerbated by salinisation and siltation of the reservoirs, the Orange–Fish Transfer Tunnel was constructed, together with a network of canals, weirs and balancing dams. This restored and enabled thousands of hectares of irrigation. The Orange–Fish Transfer Tunnel was completed in 1975 and is the key structure by which water is delivered from the Gariep Dam to the Teebus Spruit and the Great Brak River, and from there to the valleys of the Great Fish and the Sundays rivers. The tunnel has a length of 82.8 km, a diameter of 5.35 m and a maximum capacity of 54 m^3/s. An intake tower in the lake some 20 km from Gariep Dam heads the tunnel through the Suurberg plateau.

PURPOSE

The purpose of the tunnel is to divert water to the Eastern Cape for irrigation, urban (including Grahamstown and Nelson Mandela Metropole) and industrial use. Due to siltation, the capacities of dams in these two river basins became greatly reduced and arable land had to be de-scheduled prior to construction of the tunnel.

PHYSICAL INFORMATION

Canal name	Length (km)	Capacity (m^3/s)
Orange–Fish Transfer Tunnel	83	54



Orange–Fish Transfer Tunnel

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

ORANGE RIVER PROJECT

ORANGE–VAAL TRANSFER SCHEME

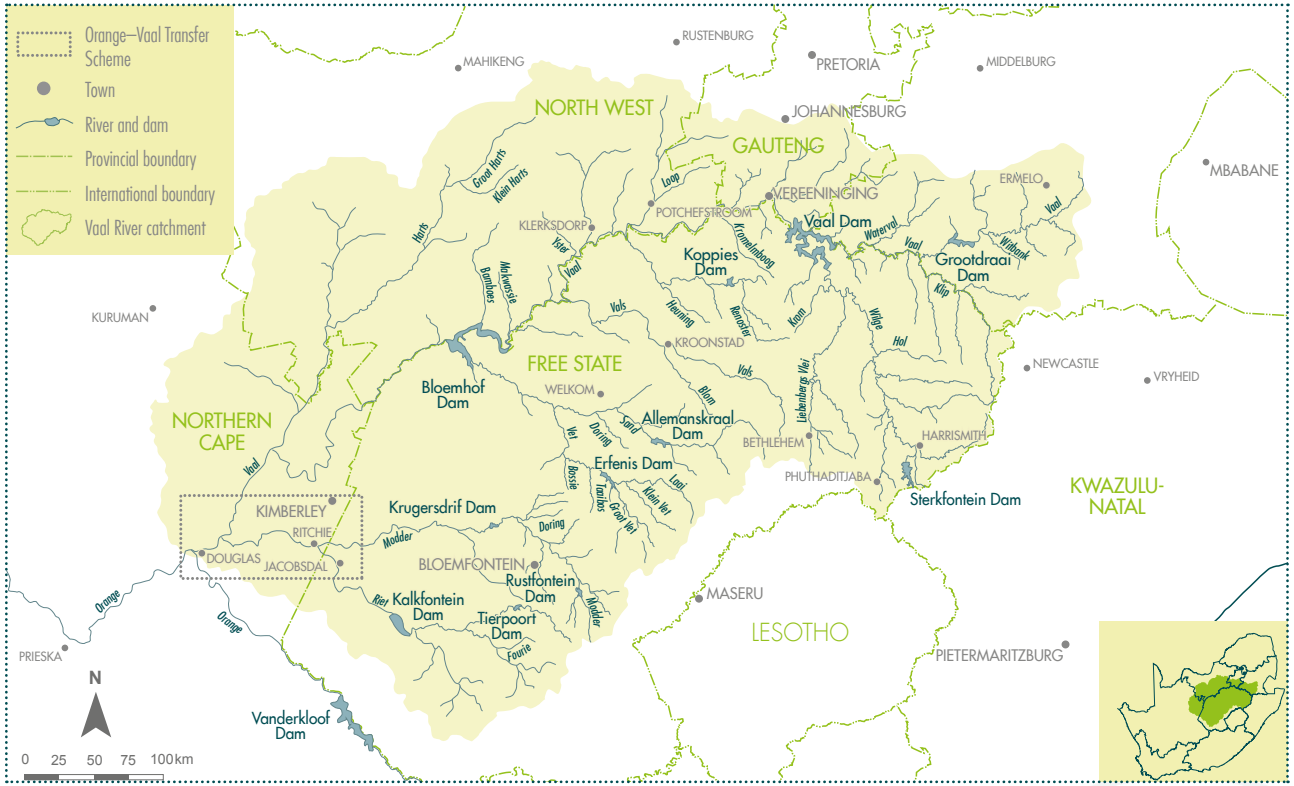
LOCATION

The Orange–Vaal Transfer Scheme (also known as the Orange–Douglas Government Water Scheme) is located on the Orange and Vaal rivers, near the confluence of the two.

DESCRIPTION

The transfer scheme consists of the Marksdrift Pump Station, located on the Orange River, and Douglas Weir (full supply capacity, 16 million m^3), located on the Vaal River, as well as three canals, namely:

- Bosman Canal (or Orange–Vaal Canal): The transfer scheme consists of a pump station at Marksdrift, with the 22-km Bosman Canal ending at Douglas Weir. Originally, the canal was unlined, but in 1994 the concrete lining of the canal began. The Bosman Canal is managed by the Douglas Irrigation Board.
- Douglas Canal: Water is released from Douglas Weir via the 24-km Douglas Canal to the confluence of the Vaal and Orange rivers, along the left bank of the Vaal River.
- Alberton Canal (or Atherton Canal): Water is released from Douglas Weir via an unlined third canal, the Alberton Canal, which runs along the right-hand side of the Vaal River to the Atherton Plots.



Upper Orange Transfer Scheme

Douglas Weir is part of the Orange–Vaal Transfer Scheme. It was initially completed in 1896 and raised in 1977. A build-up of salts occurs within the system, due to the irrigation return flows, which sometimes reach 1,400 mg/ℓ. When the system was built, it was anticipated that occasional floods would assist in washing the salts from the system. However, this has not been successful.

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

PURPOSE

Before 1984, Douglas Weir was supplied from Bloemhof Dam. However, during the 1980s a severe drought occurred which resulted in water restrictions. The Bosman Canal (or Orange–Vaal Canal) was built in 1984 as an emergency scheme to aid in the critical water shortages. In 1986 the emergency scheme was incorporated into the Orange–Douglas Government Water Scheme.

Currently the scheme is used to supply an irrigation area of 8,113 ha. It is also used to improve water quality as salinity levels have increased in recent years.

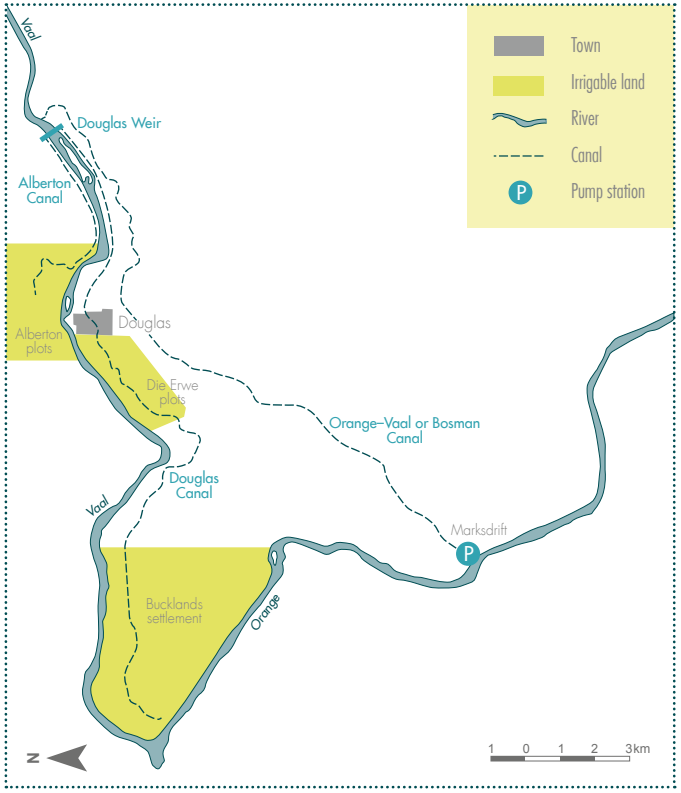
The Douglas Irrigation Board regulates the amount of water transferred to farmers along the Douglas Weir and the Riet River downstream of Soutpansdrift, as well as the areas along the Vaal River downstream of the Douglas Weir served by the Bucklands and Atherton canals.

The Atherton Canal supplies water to irrigators on the northern bank of the Vaal River, and the Bucklands Canal transports water for 24 km to irrigators on the southern bank of the Vaal River.

PHYSICAL INFORMATION

Canal name	Length (km)	Capacity (m^3/s)
Bosman (or Orange–Vaal)	22	12
Douglas	24	7
Atherton (or Alberton)	Unknown	Unknown
Bucklands	24	Unknown

Source: ORASECOM



Orange–Vaal Transfer Scheme (adapted from ORASECOM, 2007a)

OPERATING RULE

The Bloemhof Dam is operated in a manner that allows as little water as possible to enter the Douglas Weir via the Vaal River, and all water demands are met from the Orange River. To prevent supply problems along these sections of the Vaal River, the Douglas Weir must be operated at not less than 1.1 m below full supply level.

The Douglas Weir irrigation schemes are operated to minimise pumping costs and water wastage. Inflows and spillages are kept to a minimum and under normal operating conditions these areas are dependent on imported water from the Orange River.

South Africa

TIERPOORT DAM SCHEME

LOCATION

The Tierpoort Dam Scheme is located in quaternary C51G on the Tierpoort River (a tributary of the Riet River), upstream of the Kalkfontein Dam.

DESCRIPTION

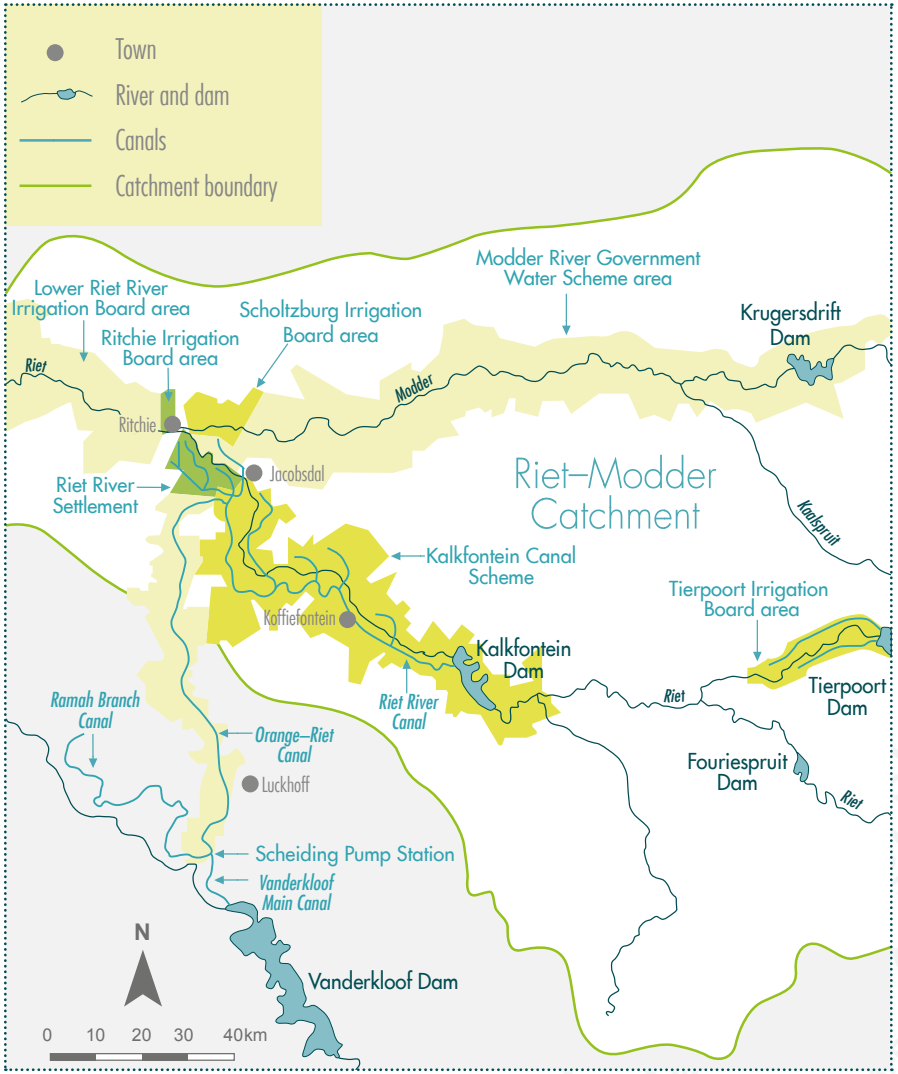
The scheme consists of the Tierpoort Dam and two canals that run alongside the river.

PHYSICAL INFORMATION

Tierpoort Dam was commissioned in 1923 but was reconstructed in 1990 after the 1988 floods washed it away. It has a full supply capacity of 34.5 million m^3, with a wall height of 20 m and length of 180 m, with a maximum spillway capacity of 4,700 m^3/s. Refer to the schematic of the Upper Orange catchment.

PURPOSE

The scheme is owned by, and supplies, the Tierpoort Irrigation Board via the two canals.



Tierpoort Dam Scheme (adapted from ORASECOM, 2007a)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

MAZELSPOORT SCHEME

LOCATION

The Mazelspoort Scheme, located on the Modder River downstream of Rustfontein Dam, supplies water from Mazelspoort Weir to Bloemfontein.

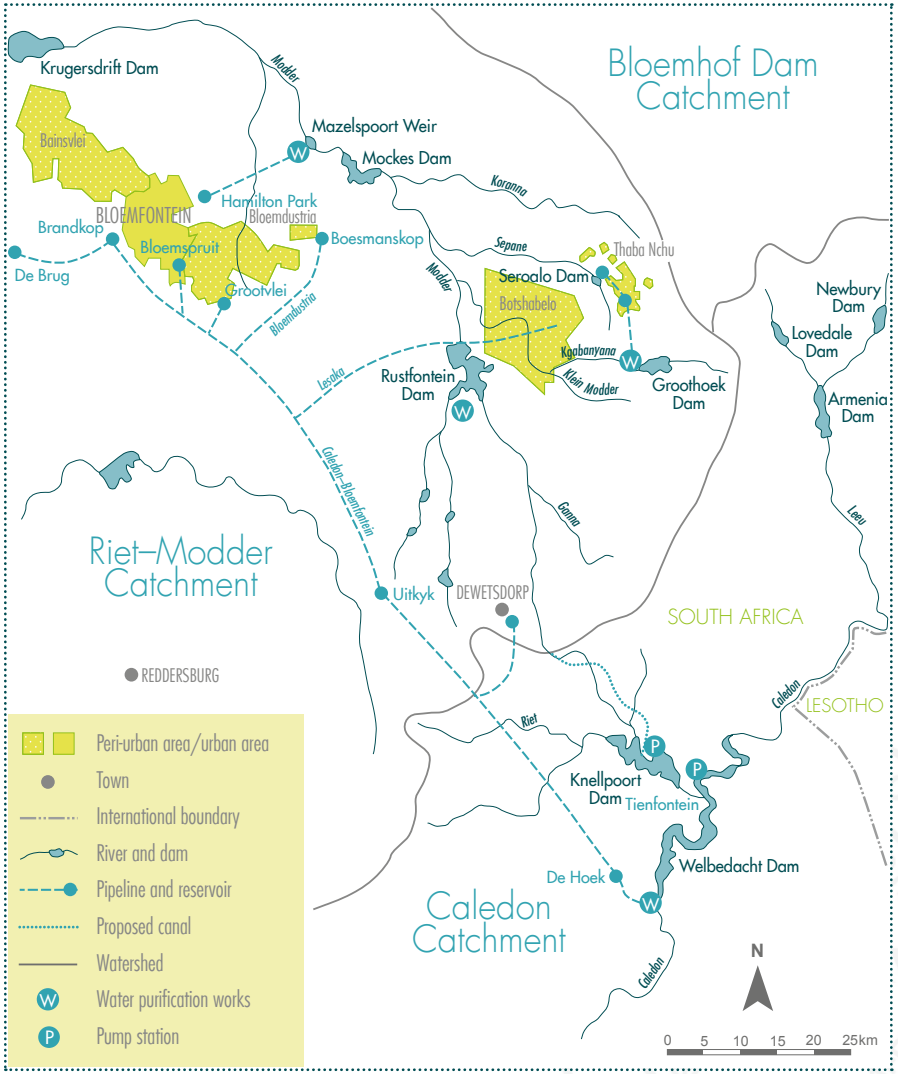
DESCRIPTION

Upstream of Mazelspoort Weir, water is released from Mockes Dam. Mockes Dam is supported by Rustfontein Dam, as well as transfers from Knellpoort Dam. At the Mazelspoort Weir, water is pumped to a reservoir at Hamilton Park where it is treated at the wastewater treatment works and used to augment domestic requirements in Bloemfontein. It is owned by the Municipality of Mangaung.

The Mazelspoort Scheme and the Caledon–Modder Transfer Scheme form one integrated supply system in the Modder River.

PURPOSE

The scheme serves to supply approximately 25% of Mangaung's water requirements, with a net demand of 38 million m^3.



Mazelspoort Scheme (adapted from ORASECOM, 2007a)

PHYSICAL INFORMATION: DAMS

Name	River	FSC (million m^3)	Wall height (m)	Wall length (m)	Maximum spillway capacity (m^3/s)
Mockes	Modder	6	18	713	991
Rustfontein	Modder	71	26	210	1,090
Knellpoort	Rietspruit	136	50	200	1,070
Mazelspoort Weir	Modder	n/a	Unknown	Unknown	Unknown

PHYSICAL INFORMATION: LOSSES

Description	Estimated losses (million m^3/a)
Knellpoort to Rustfontein losses	2.07
Rustfontein to Mockes losses	2.10
Mazelspoort losses	1.92
Total	6.09

South Africa

KRUGERSDRIFT DAM SCHEME

LOCATION

The Krugersdrift Dam Scheme is located on the Modder River downstream of Krugersdrift Dam (quaternary C52G).

DESCRIPTION

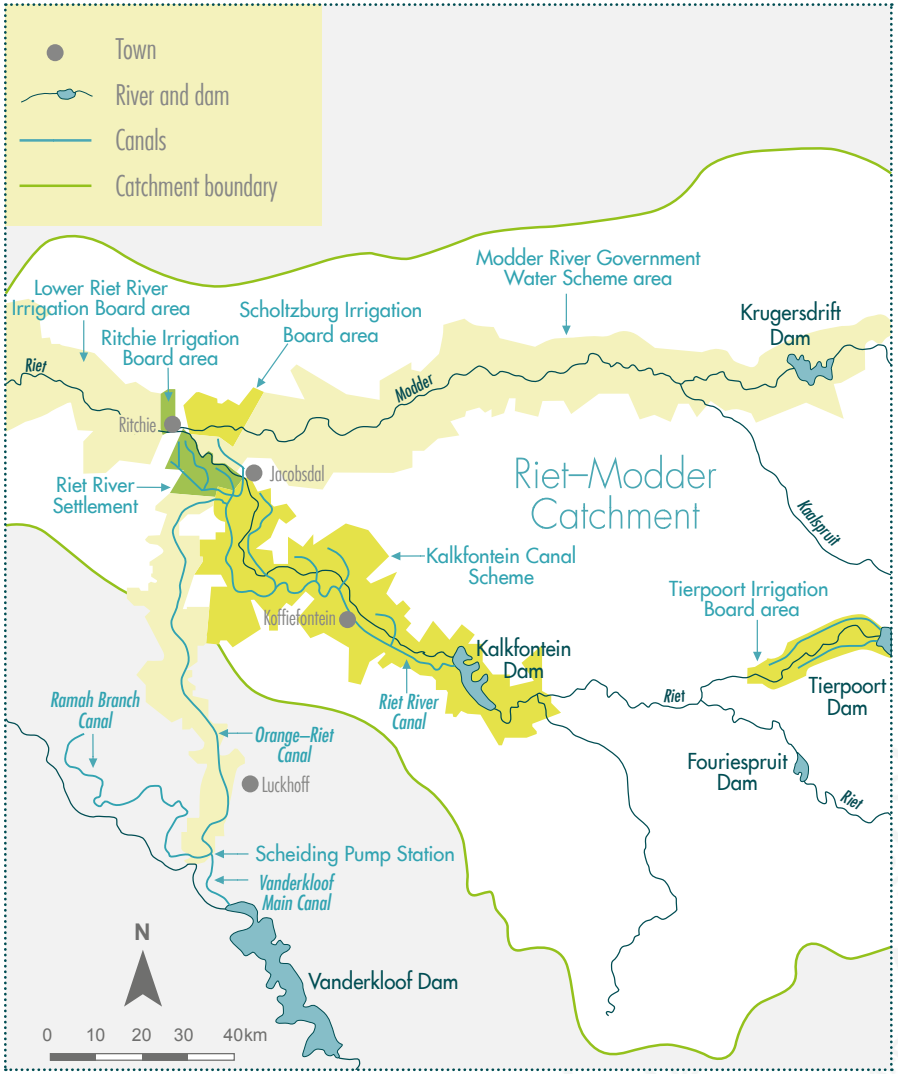
The scheme consists of Krugersdrift Dam, on the Modder River, as well as approximately 55 storage weirs along the lower Modder River.

PHYSICAL INFORMATION

The Krugersdrift Dam is the only dam in the scheme. It has a full supply capacity of 73 million m^3, a wall height of 3,114 m and length of 4,820 m. The spillway capacity of the dam is 4,820 m^3/s. (The capacities of the weirs vary in size from 5,000 m^3 to 1 million m^3.)

PURPOSE

The scheme supplies water to the Modder River Government Water Scheme, which is located further downstream of the dam, for irrigation purposes. Water is abstracted from the weirs located on the Modder River.



Krugersdrift Dam Scheme (adapted from ORASECOM, 2007a)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

ORANGE RIVER PROJECT

VANDERKLOOF CANALS SCHEME

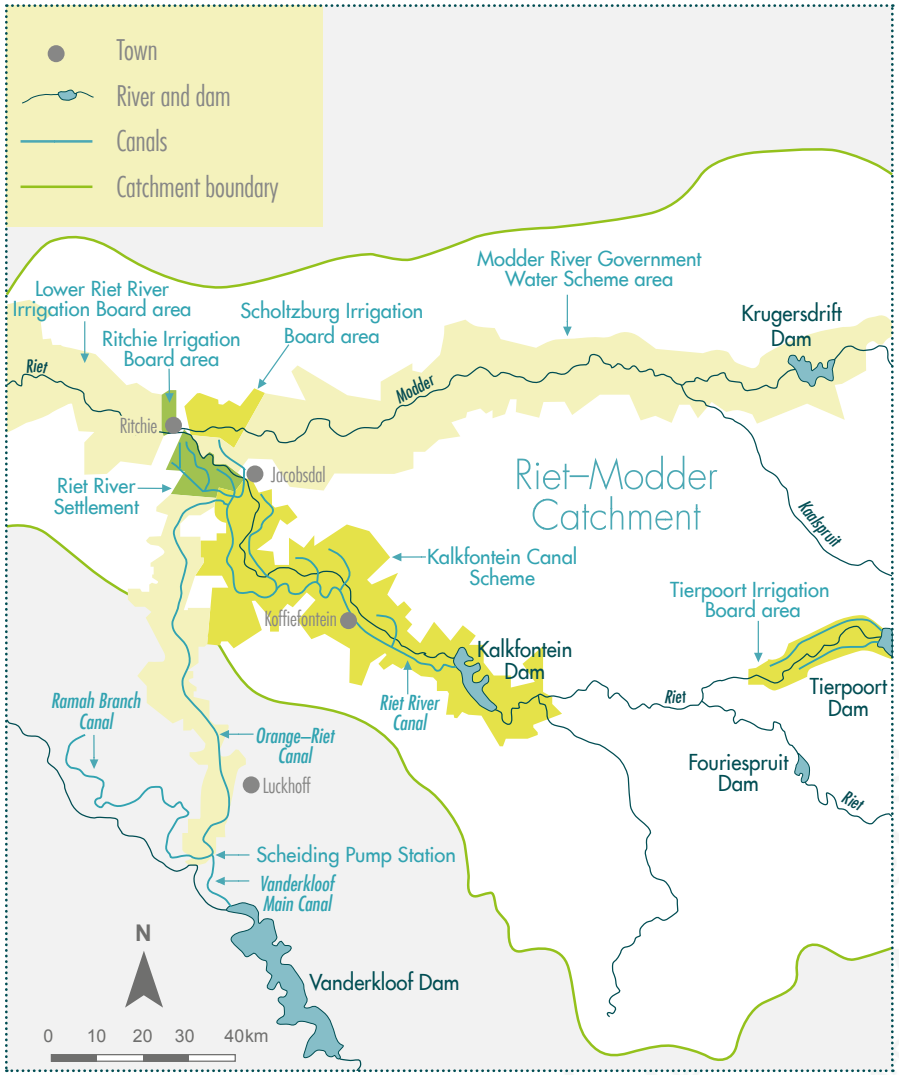
LOCATION

The Vanderkloof Canals Scheme is part of the Orange River Project (ORP) and is located downstream of the Vanderkloof Dam on the Orange River.

DESCRIPTION

The Vanderkloof Canals Scheme consists of three canals: the Vanderkloof Main Canal directly off the dam, the Orange–Riet Canal and the Ramah Branch Canal. The scheme also includes the Scheiding Pump Station, where the Vanderkloof Main Canal ends and the Orange–Riet and Ramah canals begin.

- Vanderkloof Main Canal: Water is released directly from Vanderkloof Dam into this canal until it reaches the Scheiding Pump Station, where the water is pumped into the Orange–Riet Canal and the Ramah Canal.
- Orange–Riet Canal: At the Scheiding Pump Station water is pumped into the Orange–Riet Canal, where it eventually splits into two further canals, namely the Main Canal and the S350 Canal. The Orange–Riet Canal forms part of the Orange–Riet Government Water Scheme.
- Ramah Canal: At the Scheiding Pump Station, the Vanderkloof Main Canal extends into the Ramah Canal, which lies along the right bank of the Orange River. This canal has three reaches, known as Ramah I, Ramah II and Ramah III. The canal has one balancing dam between reaches I and II, with a capacity of 340,000 m^3 and a surface area of 12.68 ha. There is a second balancing dam between reaches II and III with a capacity of 280,000 m^3 and a surface area of 9.0 ha.



Vanderkloof Canals Scheme (adapted from ORASECOM, 2007a)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

VANDERKLOOF CANALS SCHEME

Canal name	Length (km)	Capacity (m^3/s)
Vanderkloof Main Canal	14.00	57.00
Orange–Riet Canal (reach 1)	74.60	15.60
Orange–Riet Canal (reach 2)	38.00	13.20
Main Canal	Unknown	Unknown
S350 Canal	Unknown	Unknown
Ramah Canal I	17.30	9.60
Ramah Canal II	48.90	4.20
Ramah Canal III	21.20	1.48

PURPOSE

- Vanderkloof Main Canal: Vanderkloof Dam releases water via the canal to the Scheiding Pump Station to be used further downstream.
- Orange–Riet Canal: The original intention for the construction of the Orange–Riet Canal in 1983 was to regulate the supply of sufficient water for peak daily demands and the annual water demand. The Orange–Riet Water Scheme abstracts water from Vanderkloof Dam (via the Scheiding Pump Station) to be transferred to the Riet River catchment via the Orange–Riet Canal. The water is primarily used for irrigation but also supplies Koffiefontein (for urban use and mining) and the urban requirements of Ritchie and Jacobsdal towns. The Orange–Riet Canal supplies water to a 3,787 ha irrigation area next to the canal and the Lower Riet Irrigation Board (3,937 ha). The main canal supplies the Ritchie Irrigation Board (97 ha). The S350 Canal releases water into the Modder River, which is in turn abstracted (via the Scholtzburg Weir just upstream of the Riet and Modder confluence) to supply the Scholtzburg Irrigation Board (637 ha). The Riet River Settlement near Jacobsdal (7,812 ha) receives water from both the Main Canal and the S350 Canal. The settlement also receives water from the Orange River and is part of the Riet River Government Water Scheme.
- Ramah Canal: The Ramah Canal supplies water to 5,667 ha of irrigated land on the right bank of the Orange River.

South Africa

CALEDON–MODDER TRANSFER SCHEME

LOCATION

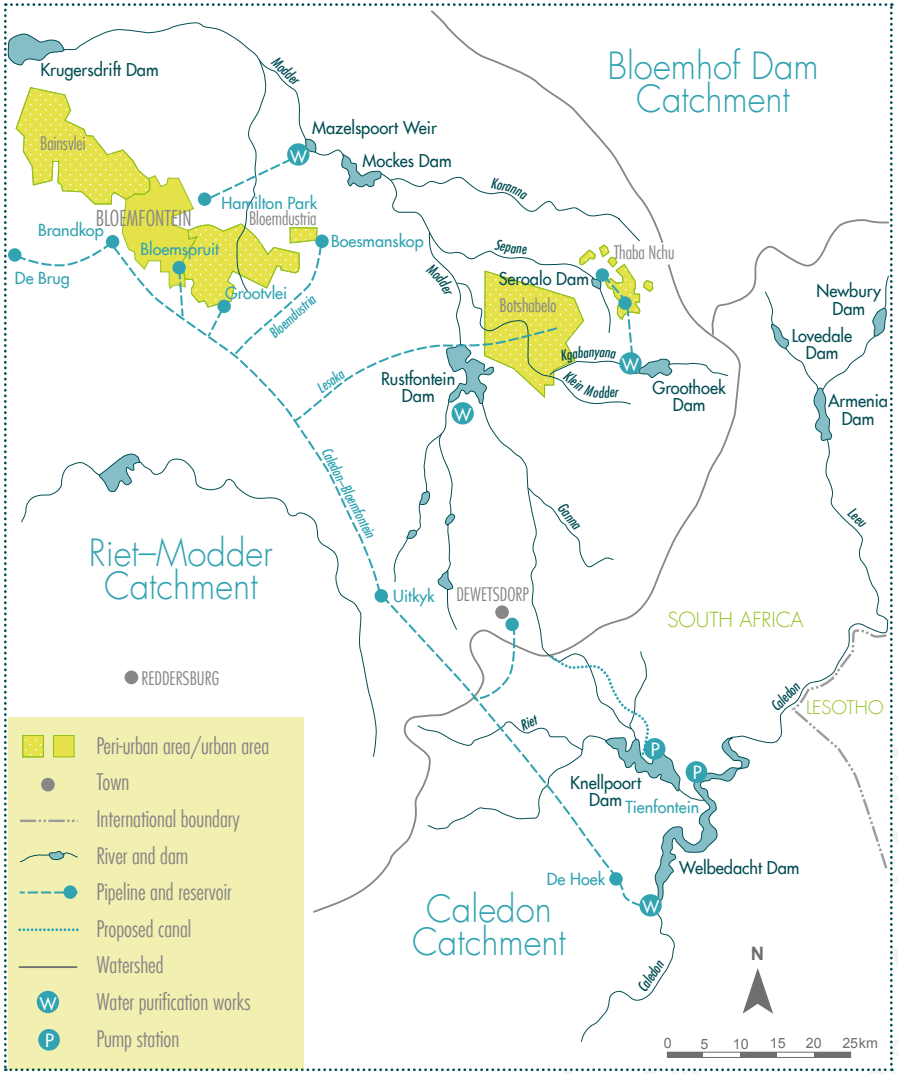
The Caledon–Modder Transfer Scheme consists of two transfer schemes, namely the original Caledon–Bloemfontein Government Water Scheme and the Novo Transfer Scheme, which are situated in the Upper Orange catchment.

DESCRIPTION

The Caledon–Bloemfontein Government Water and Novo Transfer schemes are two of the three main schemes used to supplement the Riet–Modder catchment due to the full utilisation of the water resources within the catchment, the third main scheme being the Orange–Riet. The Mazelspoort Scheme was developed by Mangaung Municipality. The Caledon–Bloemfontein Government Water Scheme and Novo Transfer Scheme, together with the Mazelspoort Scheme situated on the Modder River, form one integrated supply system serving the Mangaung area.

The Caledon–Bloemfontein Government Water Scheme is operated by Bloem Water and consists of Welbedacht, Rustfontein and Knellpoort dams, along with other service reservoirs, pump stations and water treatment works.

The storage capacity of the Welbedacht Dam reduced from 115 million m^3 to approximately 16 million m^3 in only 20 years due to siltation. This had an impact on the assurance of supply to Bloemfontein and so Knellpoort Dam was constructed (off-channel storage) to augment the supply. The Tienfontein Pump Station in the Welbedacht Reservoir pumps water to Knellpoort Dam at a capacity of 10 m^3/s. Control measures have been set up to reduce similar siltation problems in the dam. There is also a water treatment works at Welbedacht Dam. Water is pumped via the 112 km Welbedacht–Bloemfontein Pipeline (or Caledon–Bloemfontein Pipeline) to augment urban water supply at Bloemfontein.



Caledon–Bloemfontein Government Water Scheme (adapted from ORASECOM, 2007a)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

The Novo Transfer Scheme is an extension of the Caledon–Modder Transfer Scheme. It transfers water from Knellpoort Dam to Rustfontein Dam in the upper reaches of the Modder River basin. This is done via the Novo Pump Station at Knellpoort Dam (29.7 km of pipeline and 12 km of river channel). The Novo Transfer Scheme is then linked to the Mazelspoort Scheme downstream on the Modder River. The scheme will be developed in stages, according to Bloemfontein demands, which are increasing, and is expected to reach a maximum transfer capacity of 150 million m^3/a by the year 2030.

PHYSICAL INFORMATION: DAMS

Name	River	Quaternary catchment	FSC (million m^3)	Wall height (m)	Wall length (m)	Maximum spillway capacity (m^3/s)
Welbedacht	Caledon	D23J	15.50	32	192	5,310
Rustfontein	Modder	C52A	72.60	36	210	1,090
Knellpoort	Rietspruit	D23H	136.20	50	200	1,070

PHYSICAL INFORMATION: PUMP STATIONS

Pump station name	Location	Capacity (m^3/s)
Tienfontein	Welbedacht Dam	10.00
Novo	Knellpoort Dam	1.50

PHYSICAL INFORMATION: PIPELINES/CANALS

Name	Length (km)	Capacity (m^3/s)
Welbedacht–Bloemfontein Pipeline (pressure)	6.55	1.68
Welbedacht–Bloemfontein Pipeline (gravity)	105.50	1.68
Novo Pipeline	29.70	2.40

PURPOSE

Towns including Bloemfontein, Botshabelo, Thaba Nchu, Dewetsdorp, Reddersburg and Edenburg are supplied with water from Welbedacht Dam via the Caledon–Bloemfontein Canal. The Novo Transfer Scheme conveys water to supplement the Bloemfontein demands, along with Botshabelo and Thaba Nchu.

South Africa

LOWER ORANGE SYSTEM SUPPORT

ORANGE RIVER PROJECT

Smartt Syndicate Dam (source: SA Dept of Water Affairs)

LOCATION

Part of the Orange River Project (ORP) is to support the Lower Orange catchment demands, even though the Gariep and Vanderkloof dams are situated in the Upper Orange catchment.

DESCRIPTION

The transfer makes use of the Smartt Syndicate Dam and the Vanwyksvlei Dam, and a number of weirs, including the Boegoeberg and Neusberg weirs. The Lower Orange consists of several sub-systems and schemes:

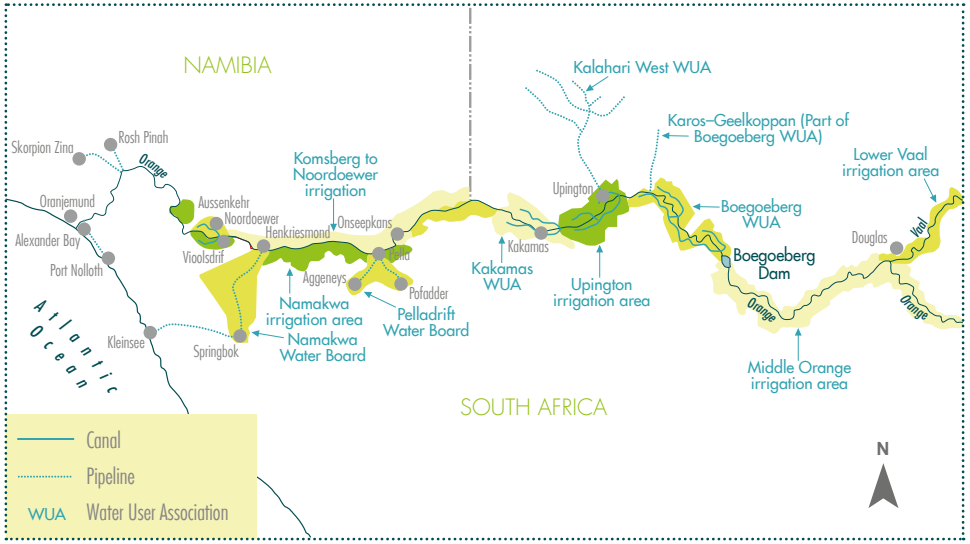
- Karos–Geelkoppen Rural Water Supply Scheme: Upstream of Upington; used for stock watering
- Kalahari West Rural Water Supply Scheme: North of Upington; uses treated water from plants for stock watering and rural domestic demands
- Pelladrift Water Supply Scheme: Supplies water to Pofadder, Pella and mines at Aggenya and Black Mountain (operated by Pella Water Board)
- Springbok Regional Water Supply Scheme: Supplies the towns of Springbok, Okiep, Carolusberg and Kleinzee, along with local mining demands, with treated water from Henkries Purification Works (Henkriesmond)
- Urban, industrial and mining: Many demands are supported along the Orange River
- Douglas Irrigation Scheme: Located at the downstream end of the Vaal River; part of the Orange–Vaal Transfer Scheme and therefore receives water from both rivers
- Boegoeberg Irrigation Scheme: The 172-km Boegoeberg Canal (capacity 9.76 m^3/s) runs along the left bank of the Orange River and supplies water to the Rouxville West Scheme (now part of the Boegoeberg GWS). The Noord-Oranje Canal, which runs along the right bank, supplies water to the Noord-Oranje Irrigation Board. Downstream, a siphon and canal convey water to the Gariep Settlement
- Middle Orange Irrigation Area: Includes irrigators along the riparian zone, from Hopetown to Boegoeberg Dam.

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

- Upington Irrigation Scheme
- Kakamas Irrigation Scheme
- Onseepkans Irrigation Scheme
- Namaqualand Irrigation Area
- Namaqualand Irrigation Scheme
- Aussenkehr Irrigation Scheme (Namibia)
- Komsberg to Noordoewer Irrigation Area (Namibia).

Other schemes

- Gifkloof Weir
- Kalahari Rural Water Supply Scheme
- Kakamas Government Water Scheme
- Neusberg Weir
- Rhenosterkop Weir
- Keimoes Canal Irrigation Area
- Onseepkans Irrigation Area
- Namaqualand Irrigation Area
- Pelladrift Water Supply Scheme
- Namakwa Water Board Supply Scheme
- Vioolsdrift and Noordoewer Irrigation Area (South Africa and Namibia)
- Alexander Bay.



Irrigation areas and controlling bodies along the Lower Orange River (adapted from ORASECOM, 2007a)

PURPOSE

The purpose of this system/scheme is to supply demands between Marksdrift and the river mouth. These demands include irrigation, urban and industrial. There is currently no hydropower generation within the Lower Orange Water Management Area.

RESERVOIRS

RESERVOIRS IN THE ORANGE–SENQU BASIN

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

ALLEMANSKRAAL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 18′ 15″ S	27° 16′ 37″ E

LOCATION

Allemanskraal Dam is located on the Sand River in quaternary catchment C42E, South Africa.

DESCRIPTION

Allemanskraal Dam has a mass gravity concrete section and an earth embankment on the right flank. It has a full supply level of 1,368.7 m, a dead storage level of 1,355.9 m and the bottom of the reservoir is at 1,353.0 m.

PURPOSE

Allemanskraal and Erfenis dams make up the Sand–Vet Sub-system. Water is released from the system into a canal approximately 115 km in length, in order to supply the Sand–Vet Government Water Scheme downstream.

PHYSICAL INFORMATION

Dam name	River	DWA code	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Allemanskraal	Sand	D4R002	C42E	179.30	26.50	DWA	38	1,338

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Allemanskraal Dam (source: www.panoramio.com)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1960	Unknown	35.60 †	Unknown	100 ‡	2,265

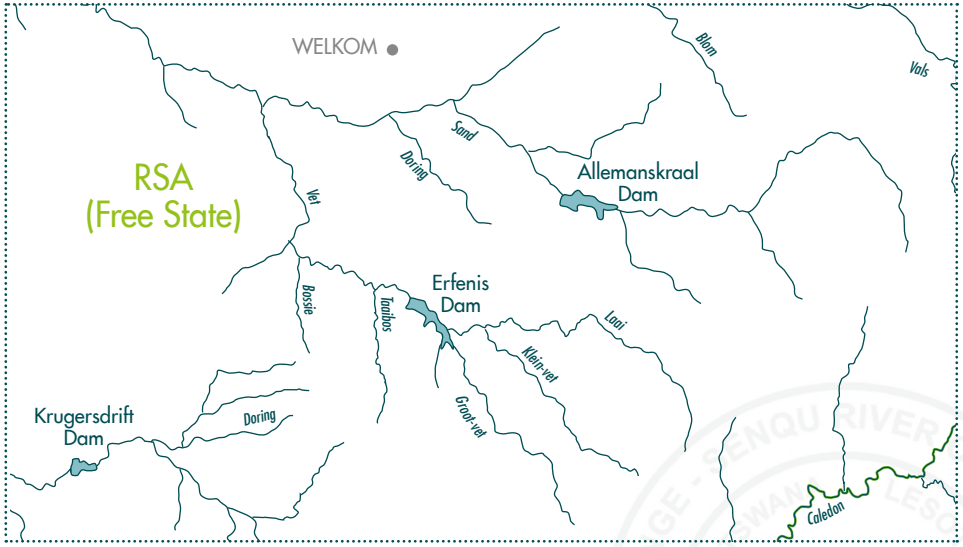
† DWA, Directorate of Hydrological Services correspondence, 2012
‡ Combined with Erfenis Dam (DWA, 2002b)

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,370	214.71	29.74
1,368	179.31	26.48
1,367	136.99	22.50
1,364	79.43	16.42
1,362	50.95	12.32
1,360	29.92	8.91
1,358	14.69	6.01
1,355	5.11	3.34
1,353	0.00	0.00

OPERATING RULE

Allemanskraal and Erfenis dams are operated as part of the Sand–Vet Sub-system. Operating rules allow for these dams to supply their demands until they reach their defined minimum operating levels. The sub-system does not support the Vaal or Bloemhof sub-systems.



Dam network

South Africa

ARMENIA DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 21′ 50″ S	27° 07′ 54″ S

LOCATION

This dam is situated on the Leeu River in quaternary catchment D23C, South Africa, upstream of Welbedacht Dam.

DESCRIPTION

Armenia Dam is a concrete arch dam, with a free overway spillway, and a catchment area of 8,581 km^2. The dam has a full supply level of 1,514.9 m. The dead storage level and bottom of the reservoir are at 1,503 m.

Armenia Dam (source: SA Dept of Water Affairs)

PURPOSE

Armenia Dam is part of the Armenia Dam Scheme, which also incorporates a canal system on the Leeu River. The purpose of the dam is to supply irrigation to the Leeu River Irrigation Scheme via a canal from the dam.

Armenia Dam supplies the Hobhouse Water Treatment Works, and its boreholes supply the Thaba Patchoa Water Treatment Works.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Armenia	Leeu	D23C	13.20	3.90	DWA	D2R002	22	110

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

ARMENIA DAM

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1954	Unknown	2.58 †	Unknown	Unknown	1,073

† WRC, 2008

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,517.2	24.59	5.24
1,514.9	13.78	3.93
1,512.5	6.00	2.60
1,510.1	1.79	0.99
1,508.9	0.92	0.48
1,507.7	0.43	0.31
1,505.4	0.06	0.07
1,503.0	0.00	0.00

South Africa

BARBERSPAN DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 34′ 03″ E	25° 35′ 56″ S

LOCATION

Barberspan Dam on the Harts River is located near the towns of Sannieshof and Delareyville in the Lower Vaal Water Management Area, South Africa.

DESCRIPTION

Barberspan is really a pan more than a dam and is about 11 km long and about 3.5 km wide. It has a full supply level of 1,492.5 m. The dead storage level and bottom of the reservoir are at 1,490 m.

PURPOSE

It is environmentally important and is a Ramsar site. The area contains up to 320 species of bird.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Barberspan	Harts	C31B	30.40	16.00	Unknown	C3R003	Unknown	Unknown

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,492.5	30.40	16.00
1,492.0	20.00	10.60
1,491.5	10.00	5.80
1,491.0	5.00	3.10
1,490.5	1.00	0.70
1,490.0	0.00	0.00

South Africa

BETHULIE DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
30° 29′ 16″ S	25° 58′ 26″ E

LOCATION

Bethulie Dam is located near the town of Bethulie on the Bethulie Spruit, which is a tributary of the Orange River flowing directly into Gariep Dam. It is located in quaternary D35A in South Africa.

DESCRIPTION

Bethulie Dam is an arch dam, with a spillway capacity of 370 m^3/s.

PURPOSE

Bethulie Dam is used for water supply to the town of Bethulie.

Bethulie Dam (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Bethulie	Bethulie Spruit	D35A	1.97	1.13	Bethulie Municipality	D3R001	23	134

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)
	Domestic	Irrigation	Other	
1921	Unknown	Unknown	Unknown	Unknown

South Africa

BLOEMHOF DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
27° 40′ 09″ S	25° 37′ 05″ E

LOCATION

Bloemhof Dam is located on the Vaal River, South Africa, in quaternary catchment C43D in the Middle Vaal Water Management Area.

DESCRIPTION

Bloemhof Dam is a mass gravity concrete overspill section supported by earth flanks. It has 20 radial crest gates for flood control. The full supply level is 1,228.5 m, the dead storage level is 1,213.6 m, and the bottom of the reservoir is at 1,210.8 m. The dam is listed as one of the top ten impoundments in South Africa in need of nutrient management, due to the high level of nutrient enrichment.

Bloemhof Dam (source: www.wikipedia.org)

PURPOSE

Bloemhof Dam is used primarily to supply the Vaalharts Irrigation Scheme (which generates considerable return flows). It also supplies the Klip Dam–Barkly Irrigation Scheme, the Vaal Gamagara Government Water Scheme, the Douglas Irrigation Board and private irrigators between Bloemhof and the Vaal–Orange confluence, as well as domestic supply to Kimberley. It is also used for flood control.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Bloemhof	Vaal	C43D	1,218	234.27	DWA	C9R002	33	4,270

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1970	Unknown	Unknown	Unknown	2,707 †	14,300

† Including Lesotho transfer (ORASECOM, 2011)

The historic firm yield of 2,707 million m³/a is the yield representing the Bloemhof total yield, excluding contributions from the Vaal system, but including the transfer from Lesotho (as operated in practice). The yield, excluding the transfer from Lesotho, is 1,927 million m³/a, and the yield after supplying the Lower Vaal demands is 1,413 million m³/a.

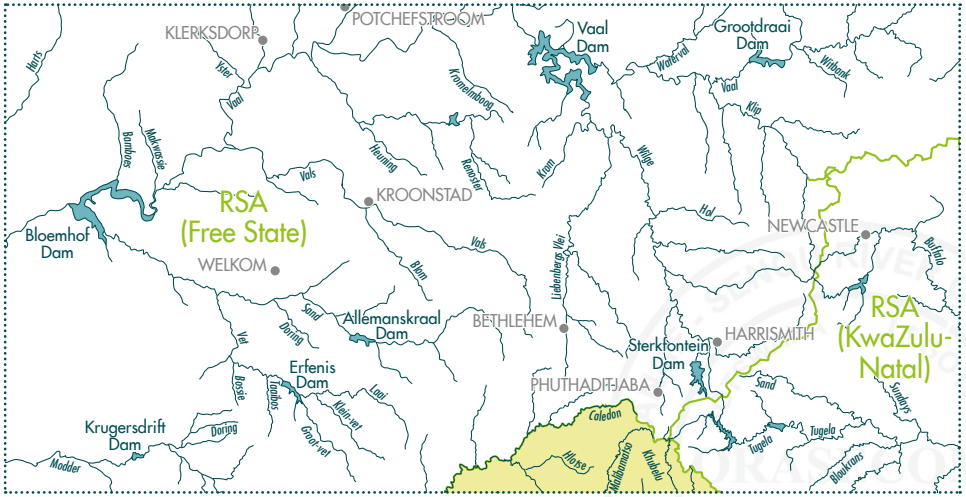
AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,229.5	1,511.73	261.63
1,228.5	1,264.42	233.54
1,226.5	848.83	183.09
1,223.5	405.68	112.71
1,221.5	217.13	77.48
1,219.5	97.14	43.76
1,217.5	41.25	16.17
1,215.5	17.03	8.70
1,213.5	5.70	3.72
1,210.8	0.21	0.66

OPERATING RULE

Bloemhof Dam, along with Vaal Dam, the Vaal Barrage and Grootdraai Dam (all on the Vaal River) and Sterkfontein Dam (on the Wilge River, a tributary of the Vaal River) form part of the Bloemhof Sub-system, which is part of the greater Integrated Vaal River System. Woodstock Dam and the Driel Barrage (situated in the Thukela River catchment), form the Thukela Transfer Scheme into the Vaal catchment.

The large scheme is operated as follows: The Thukela system supports Sterkfontein Dam until Sterkfontein Dam is full. Grootdraai Dam does not support Vaal Dam, but when the Vaal Dam is at 15% storage or less, Sterkfontein Dam will begin to support it. Abstractions at Sedibeng and Midvaal make use of local runoff and spills from upstream dams. When this is not adequate, the Vaal Dam supports the abstractions. The Vaal Dam will only begin to support Bloemhof Dam when Bloemhof Dam reaches its minimum operating level (1,213.6 m). The Vaal River System (including Bloemhof Dam) does not support any of the Orange River demands.



Dam network

South Africa

BOEGOEBERG DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 02′ 32″ S	22° 12′ 07″ E

LOCATION

The Boegoeberg Dam is situated on the Orange River, near Prieska, which is approximately 150 km upstream of Upington in the Northern Cape, South Africa, in quaternary D72C.

DESCRIPTION

Boegoeberg Dam is a gravity dam with a rock foundation. The dam has a full supply level of 884.6 m and a dead storage level of 875.3 m. The bottom of the reservoir is at 874.9 m. The dam's capacity has decreased from its original capacity of 34.7 million m^3, to the current 20.7 million m^3 due to siltation.

PURPOSE

The dam was commissioned to supply water for irrigation. It supplies the Boegoeberg Irrigation Scheme, including the 172-km-long main canal off the dam with a capacity of 9.76 m^3/s. Via the Noord-Oranje Canal along the Orange River, water is supplied to the Noord-Oranje Irrigation Board and the Gariep Settlement. Water is also supplied to the Rouxville West Scheme (now part of the Boegoeberg–Karos Government Water Scheme) via the left bank. Canal losses are estimated at 20 million m^3/a. However, return flows are 12 million m^3/a and therefore net losses are only approximately 8 million m^3/a.

Boegoeberg Dam (© S Crerar)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Boegoeberg	Orange	D72C	20.74	7.42	DWA	D7R001	12	622

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

BOEGOEBERG DAM

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1929	Unknown	102	Unknown	Unknown	18,400

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
884.6	20.74	6.90
884.3	18.93	6.53
883.6	14.70	5.55
883.2	12.59	4.98
882.8	10.71	4.46
881.7	6.50	3.22
880.9	4.26	2.40
879.7	2.02	1.40
875.3	0.01	0.00
874.9	0.00	0.00

Namibia

BONDELS DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 50′ 00″ S	18° 37′ 00″ E

LOCATION

Bondels Dam is located on the Satco River in Namibia. The Satco River flows into the Hom River. It is 7 km west of Karas.

DESCRIPTION

Bondels Dam is an earthfill embankment dam.

PURPOSE

It was built to recharge the Bondels Dam aquifer.

Bondels Dam (source: www.namwater.com)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FS* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Bondels	Satco	Unknown	1.09	0.77	NamWater	5.25	800

Year of completion	Demands/abstractions (million m³/a)			(95% assured yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1959	Unknown	0	0	0	Unknown

Source: Personal communication with Hanjörg Drews, NamWater

South Africa

BOSKOP DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 33′ 40″ S	27° 06′ 42″ E

LOCATION

Boskop Dam is located in quaternary catchment C23G in the Middle Vaal Water Management Area in South Africa.

DESCRIPTION

Boskop Dam is a gravity concrete with earthfill flanks dam. It has a full supply level of 1,386.9 m and a dead storage level of 1,374.8 m. The bottom of the reservoir is at 1,372.0 m.

PURPOSE

Boskop Dam is used for irrigation and water supply.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Boskop	Mooi	C23G	20.90	3.80	DWA	C2R001	33	823

* Live full supply capacity (SANCOLD, 2009)

Boskop Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1958	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,388	24.20	4.30
1,387	20.85	3.77
1,386	17.58	3.36
1,384	11.69	2.57
1,382	7.21	1.95
1,380	3.96	1.34
1,378	1.81	0.81
1,376	0.70	0.40
1,375	0.30	0.26
1,372	0.00	0.00

OPERATING RULE

Boskop, Klerkskraal and Lakeside dams are part of the Mooi River Sub-system, as well as Klipdrif Dam, which is located on the Loopspruit River, which is a tributary of the Mooi River. These dams are operated to allow for supply of their demands until they reach their respective minimum operating levels. The sub-system does not support the Vaal or Bloemhof sub-systems.

South Africa

BOSSIESSPRUIT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 35′ 01″ S	29° 12′ 01″ E

LOCATION

Bossiesspruit Dam is located in quaternary catchment C12D in the Upper Vaal Water Management Area in South Africa.

DESCRIPTION

Water is pumped from the Grootdraai Dam Pump Station to the Knoppiesfontein Diversion Tank where it is diverted to Bossiesspruit Dam and to Trichardsfontein Balancing Dam.

PURPOSE

Water is released from Bossiesspruit Dam to the Sasol–Secunda complex.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Bossiesspruit	Bossiesspruit	C12D	2.29	0.67	DWA	Unknown	Unknown	Unknown

* Live full supply capacity (DWA, 1990)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1978	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

No available information.

Namibia

DAAN VILJOEN DAM

COORDINATES (degrees, minutes, seconds)

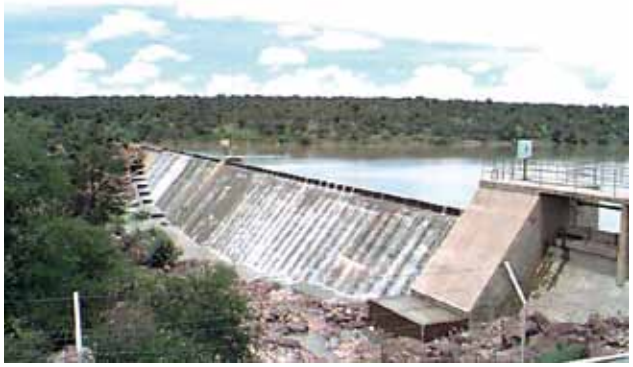
LATITUDE	LONGITUDE
22° 26′ 38.61″ S	18° 57′ 9.20″ E

LOCATION

The Daan Viljoen Dam is located in the Black Nossob River in quaternary catchment D43A in Namibia.

DESCRIPTION

The Daan Viljoen Dam is a gravity concrete structure. It has a full supply level of 1,432.2 m, a dead storage level of 1,426.0 m and the bottom of the reservoir is at 1,425.5 m.



Daan Viljoen Dam (source: www.namwater.com)

PURPOSE

Water is pumped from the Daan Viljoen Dam into the Tilda Viljoen Dam which is a pumped storage dam located next to the Daan Viljoen Dam.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Daan Viljoen	Black Nossob	D43A*	0.43	0.19	NamWater	6.60	175

* ORASECOM, 2011

Year of completion	Demands/abstractions (million m^3/a)			95% assured yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1958	0	0	0	None, augmentation of Tilda Viljoen Dam	+/-600

Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,432.2	0.43	Unknown
1,430.0	0.12	0.11
1,428.0	0.02	0.08
1,427.0	0.00	0.06
1,426.0	0.00	0.03
1,425.5	0.00	0.03

OPERATING RULE

The Otjivero, Daan Viljoen and Tilda Viljoen dams are operated as a sub-system, known as the Molopo Sub-system Namibia. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels. Water should be transferred from Otjivero silt to Otjivero main. Otjivero water should be used first for topping up Tilda Viljoen Dam.

South Africa

DISANENG DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
25° 49′ 26″ S	25° 18′ 49″ E

LOCATION

Disaneng Dam is situated near Mmabatho in the North West Province, South Africa, within quaternary D41A. It is actually in the Crocodile West and Marico Water Management Area, north-east of the Orange–Senqu River basin, but drains into the Molopo River.

DESCRIPTION

The dam is an earthfill type dam. It has a full supply level of 1,700 m. The dead storage level and bottom of the reservoir are at 1,671 m.

PURPOSE

The dam was built to supply irrigation and urban water supply.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Disaneng	Molopo	D41A	16.00	4.25	DWA	Unknown	17	780

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Disaneng Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1980	Unknown	Unknown	Unknown	Unknown	15,083

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	19.22	4.95
1,700	16.02	4.44
1,696	12.82	3.88
1,690	9.61	3.27
1,680	6.41	2.56
1,675	3.20	1.69
1,671	0.00	0.00

OPERATING RULE

The Disaneng, Setumo and Lotlamoreng dams are operated as a sub-system, known as the Molopo Sub-system South Africa. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

The border between South Africa and Botswana follows the dry bed of the Molopo River for hundreds of kilometres (© UNOPS/Greg Marinovich).

South Africa

DOUGLAS STORAGE WEIR

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 02′ 36″ S	23° 50′ 13″ E

LOCATION

Douglas Storage Weir is located in quaternary catchment C92C in the Lower Vaal Water Management Area, South Africa.

DESCRIPTION

Douglas Weir is part of the Orange–Vaal Transfer Scheme (also known as the Orange–Douglas Government Water Scheme), and was initially completed in 1896, but raised in 1977. Water is transferred via the 24-km, concrete-lined Douglas Canal, which runs alongside the left bank of the Vaal River.

Douglas Storage Weir is a labyrinth barrage, with a full supply level of 990.5 m and a dead storage level of 988.6 m. The bottom of the reservoir is at 987.8 m.

Douglas Storage Weir (source: R McKenzie)

PURPOSE

Originally the weir was constructed partly to solve water quality problems, but also to assist with water shortages. The scheme is used to supply an area of 8,113 ha of irrigation. Water quality is still a concern at the weir as the salinity levels have increased in recent years.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Douglas Weir	Vaal	C92C	17	7.99	DWA	C9R003	10	1,063

* Live full supply capacity (SANCOLD, 2009)

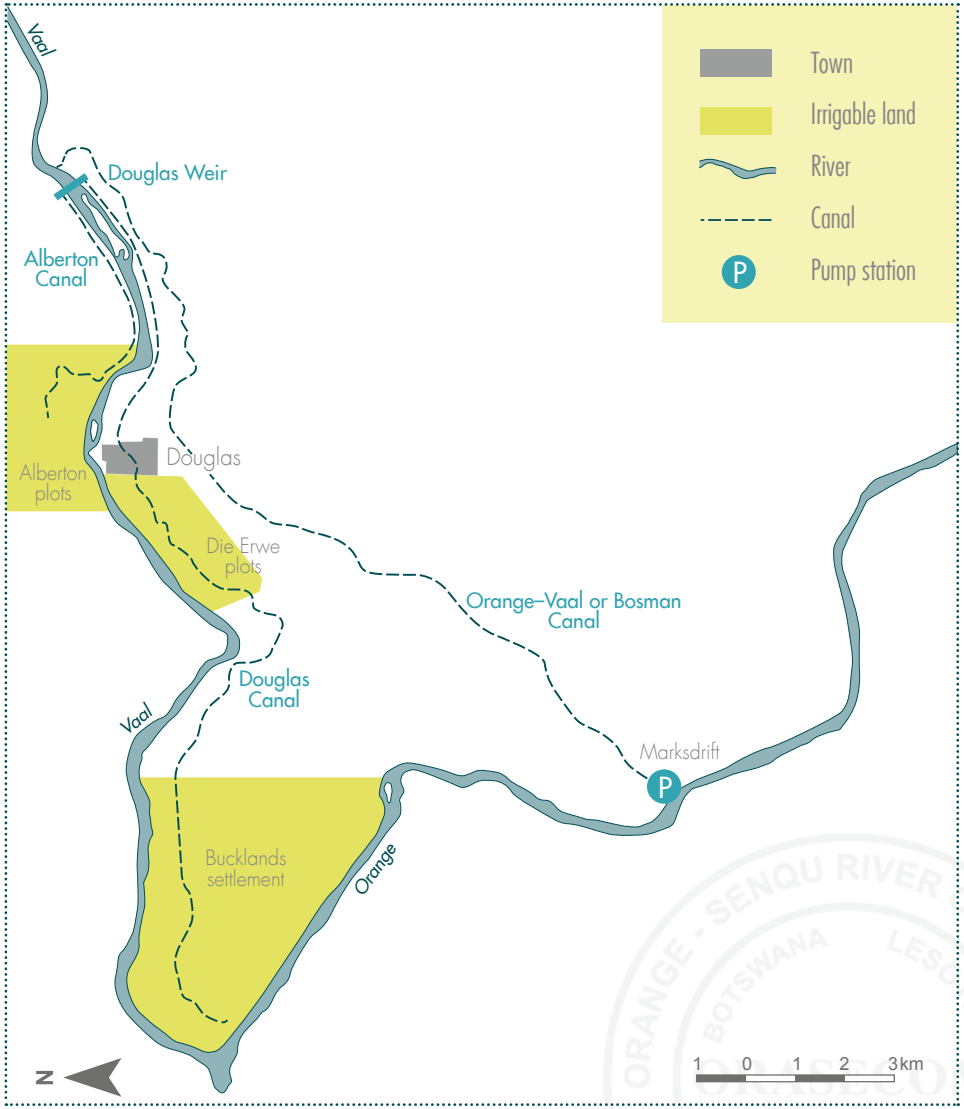
From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

DOUGLAS STORAGE WEIR

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1977	Unknown	Unknown	Unknown	Unknown	7,800

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
990.5	16.05	7.81
990.3	14.43	7.57
990.1	12.94	7.35
989.9	11.49	7.12
989.7	10.09	6.86
989.5	8.75	6.56
989.0	6.18	5.26
988.6	3.70	4.69
988.2	1.63	4.16
987.7	0.00	0.00



The Orange–Vaal Transfer Scheme

Namibia

DREIHUK DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 05′ 51″ S	18° 36′ 36″ E

LOCATION

Dreihuk Dam is located on the Hom River in quaternary catchment D82M in Namibia.

DESCRIPTION

Dreihuk Dam has a rockfill embankment on the downstream side and a vertical reinforced concrete seal on the upstream side. It has a full supply level of 895.0 m, with a dead storage level of 884.1 m and reservoir bottom at 880.2 m.

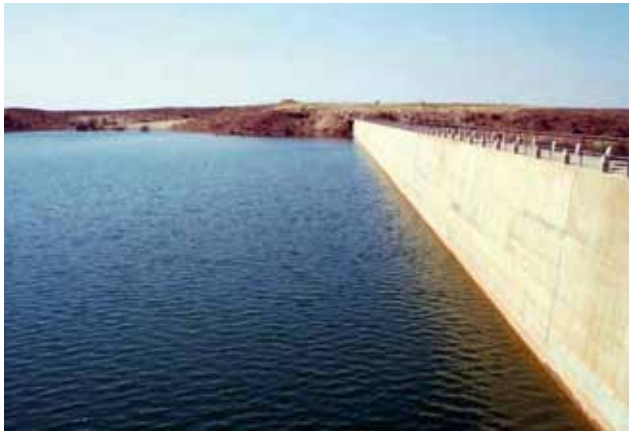
PURPOSE

Water is provided to Karasburg via a purification plant about 15 km from Dreihuk Dam.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC (million m^3)	FSA (km^2)	Owner	Wall height (m)	Wall length (m)
Dreihuk	Hom	D82M*	15.49	3.49	NamWater	21	418

* ORASECOM, 2011



Dreihuk Dam (source: www.namwater.com)

Year of completion	Demands/abstractions (million m^3/a)			95% assured yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1978	0.2	0	0	0.10 Water supply is augmented by boreholes	1,100

Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
895.0	15.49	3.49
890.0	3.87	1.38
885.0	0.36	0.22
884.5	0.26	0.17
884.1	0.21	0.13
880.2	0.00	0.00

OPERATING RULE

Dreihuk Dam transfers water to Karasburg town.

South Africa

DRIEKLOOF DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 30′ 59″ S	29° 03′ 48″ E

LOCATION

Driekloof Dam impounds a small section of the Sterkfontein Dam in the C81D quaternary catchment, South Africa.

DESCRIPTION

It is adjacent to the Sterkfontein Dam. As shown in the photo, there is a spillway between the two dams.

Weir separating Sterkfontein and Driekloof dams
(source: www.wikipedia.org)

PURPOSE

Together with the Kilburn Dam almost 500 m lower, Driekloof forms part of Eskom's Drakensberg Pumped Storage Scheme and the Tugela–Vaal Water Project, and provides for up to 27.6 GWh of electricity storage in the form of 275 million m^3 of water. The water is pumped to Driekloof during times of low national power consumption (generally over weekends) and released back into Kilburn through four 250 MW turbine generators in times of high electricity demand. The scheme is operated in such a way that there is a net pumping of up to 631 million m^3/a depending upon the water availability in the Tugela catchment (Woodstock Dam) as well as the need for augmentation in the Vaal Dam catchment.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Driekloof	Nuwejaars Spruit	C81D	32	1.90	DWA	C8R007	47	500

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1981	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

No available information.

OPERATING RULE

Operated in conjunction with Sterkfontein Dam for the Drakensberg Pumped Storage Scheme.

South Africa

EGMONT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
30° 03′ 08″ S	27° 01′ 43″ E

LOCATION

This dam is situated on a tributary of the Caledon River, the Boesmanskopspruit River, in quaternary catchment D24A, South Africa.

DESCRIPTION

This is a concrete arch dam with a free overspill spillway.

PURPOSE

Egmont Dam supplies an irrigation area of 2.89 km^2.

Egmont Dam (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Egmont	Boesmanskopspruit	D24A	8.80	2.49	DWA	D2R001	25	101

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1937	Unknown	3.18 †	Unknown	Unknown	310

† WRC, 2008

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

ELANDSKUIL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 20′ 39″ S	26° 46′ 36″ E

LOCATION

The Elandskuil Dam is located on the Swartleegte River in quaternary catchment C24D, South Africa.

DESCRIPTION

Elandskuil Dam has a full supply level of 1,438.6 m and a dead storage level of 1,432.3 m. The bottom of the reservoir is at 1,432.0 m.

PURPOSE

Unknown.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Elandskuil	Swartleegte	C24D	1.20	0.50	Unknown	C2R006	Unknown	Unknown

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Elandskuil Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1976	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

Unknown.

OPERATING RULE

Elandskuil, Rietspruit and Johan Neser dams are operated as the Schoon Spruit Sub-system. Operating rules allow for these dams to supply their demands until they reach their respective minimum operating levels. Only the spills from the Schoon Spruit Sub-system contribute to the Bloemhof Sub-system yield.

South Africa

ERFENIS DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 31′ 09″ S	26° 47′ 51″ E

LOCATION

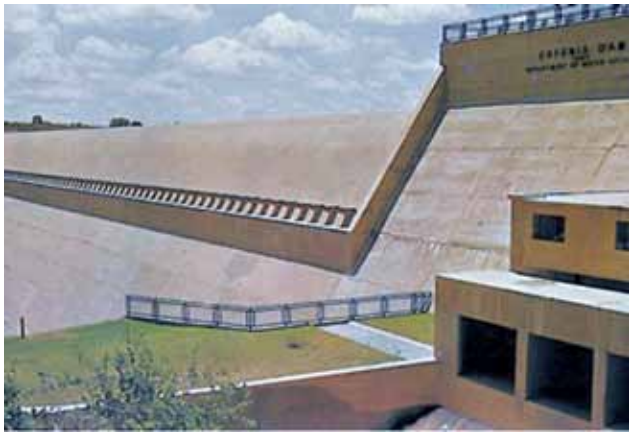
Erfenis Dam is located on the Vet River in quaternary catchment C41E, South Africa.

DESCRIPTION

Erfenis Dam is a mass gravity concrete structure with an overspill section of 183 m approximately in the middle. The main canal extends from the dam down the left flank of the Vet River. It has a full supply level of 1,331.9 m and a dead storage level of 1,318.2 m. The bottom of the reservoir is at 1,313.0 m. The dam is listed as one of the top ten impoundments in South Africa in need of nutrient management, due to the high level of nutrient enrichment.

PURPOSE

Together with Allemanskraal Dam, Erfenis Dam forms the storage for the Sand–Vet Government Water Scheme. The towns of Brandfort and Bultfontein are also augmented with water from the Vet Canal system.



Erfenis Dam (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Erfenis	Vet	C41E	212.20	32.90	DWA	C4R002	46	489

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1959	Unknown	53.60 †	Unknown	100 ‡	3,170

† DWA, Directorate of Hydrological Services correspondence, 2012
‡ Combined with Allemanskraal Dam (DWA, 2002b)

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,333	248.75	36.12
1,332	212.20	32.92
1,330	153.58	27.45
1,328	104.95	21.51
1,326	67.99	15.88
1,324	40.67	11.43
1,322	21.58	7.85
1,319	6.76	3.08
1,318	4.71	2.39
1,313	0.00	0.00

OPERATING RULE

Erfenis and Allemanskraal dams are operated as part of the Sand–Vet Sub-system. Operating rules allow for these dams to supply their demands until they reach their defined minimum operating levels. The sub-system does not support the Vaal or Bloemhof sub-systems.

South Africa

FIKA-PATSO DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 40′ 34″ S	28° 51′ 33″ E

LOCATION

Fika-Patso Dam is located in quaternary catchment C81F in the Upper Vaal near Phuthaditjaba, South Africa.

DESCRIPTION

Fika-Patso is an earthfill dam with a rock/soil foundation.

PURPOSE

The dam is used to supply domestic water requirements.

Fika-Patso Dam (source: www.panoramio.com)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Fika-Patso	Namahad	C81F	26.30	1.59	DWA	Unknown	65	300

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³)			1:50 yield (million m³)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1987	Unknown	Unknown	Unknown	Unknown	1,070

AREA–CAPACITY RELATIONSHIP

No available information.

South Africa

GARIEP DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
30° 37′ 24″ S	25° 30′ 24″ E

LOCATION

This dam, which is the largest dam in South Africa, is situated in a gorge at the entrance to Ruigte Valley on the Orange River in quaternary catchment D35KE, upstream of Vanderkloof Dam (the second largest dam in South Africa).

DESCRIPTION

It is a combined gravity and arch dam built entirely of concrete. However, only the central part of the wall is arched due to the gorge at the dam being too wide to allow a complete arch. The two concrete flank walls were needed to form artificial gravity abutments for the main arch. The dam is a double curvature structure and the wall incorporates two outlet structures on the upstream side of the wall.

There are three rubber sealed, stainless steel-faced radial gates on each side of the wall. These are used to discharge floodwaters into six concrete chutes, which lead the water away from the base of the dam wall into the downstream flow of the river, which aids in decreasing the risk of erosion to the base of the dam wall. The radial gates' life expectancy greatly exceeds that of the dam, estimated at three centuries. There are two concrete flanks to aid in artificial gravity abutments for the main arch. The dam has a full supply level of 1,258.7 m, with a dead storage level of 1,233.1 m and reservoir bottom at 1,202.9 m.

Gariep Dam (© Hendrik van den Berg/www.panoramio.com)

PURPOSE

The dam is the central structure of the original Orange River Project (ORP) which involves the supply of water to parts of the Vaal, Fish and Sundays catchments, including the 82-km Orange–Fish Transfer Tunnel from Gariep Dam to Grassridge Dam (located on a tributary of the Great Fish River).

Gariep Dam serves to generate hydropower (Eskom), capable of providing up to 360 MW of electricity at a flow rate of 800 m^3/s (four generators, each having the capacity of 90 MW at a flow rate of approximately 200 m^3/s), served by the outlet structure on the left flank of the dam. However, both outlet structures are used for controlled releases.

The dam also supplies water for irrigation along the Orange River, as well as a wastewater treatment plant owned by Bloem Water.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Gariep	Orange	D35K	5,343	370	DWA	D3R002	88	914

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a) ‡			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1971	39.84	658	Unknown	Unknown	20,450

‡ DWA, 2008–2010

The Gariep and Vanderkloof dams are operated as the ORP. The total yield obtained for these dams is 3,318 million m^3/a. This yield is representative of the total demands imposed on the system (3,143 million m^3/a) plus the surplus yield of 175 million m^3/a as determined in 2010.

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,263.7	7,342.96	446.82
1,258.7	5,348.12	352.16
1,255.8	4,419.49	298.91
1,252.4	3,488.91	238.27
1,250.3	3,022.55	210.98
1,245.2	2,092.89	156.99
1,241.9	1,628.18	128.96
1,237.9	1,163.24	102.73
1,231.6	638.09	65.69
1,202.9	0.00	0.00

OPERATING RULES

The dam (along with Vanderkloof Dam) works on an operating rule for hydropower which utilises releases to meet downstream requirements for hydropower generation purposes. Only when surplus water is available will it be allocated for power generation purposes. Storage control curves are used to determine this rule, which utilises monthly water levels for operation. Once the level in the dam rises above a certain level, Eskom may open the hydropower turbines to utilise the water that would have otherwise spilled. This ensures minimum spillage and maximum usage of the flow.

Gariep Dam is largely dependent upon natural flows (as opposed to Vanderkloof Dam, which is dependent upon releases from Gariep and therefore highly regulated). The inflow pattern for Gariep is usually low in winter and high in summer (opposite of the regulated Vanderkloof Dam).

South Africa

GERRANDS DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 16′ 40″ S	28° 17′ 12″ E

LOCATION

Gerrands Dam is located in quaternary catchment C83B in the Upper Vaal Water Management Area near Bethlehem, South Africa.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Gerrands	Gerrandsspruit	C83B	1.395	0.57	Unknown; possibly Bethlehem Municipality	C8R006	Unknown	Unknown

* Live full supply capacity (DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1971	Unknown	Unknown	Unknown	Unknown	Unknown

Gerrands Dam (source: SA Dept of Water Affairs)

South Africa

GROOTDRAAI DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 55′ 05″ S	29° 17′ 42″ E

LOCATION

This dam is situated in the upper reaches of the Vaal River, upstream of Standerton in quaternary catchment C11L, South Africa.

DESCRIPTION

The dam is a composite structure comprising a central concrete section with two earthfill flanks. The dam has a full supply level of 1,549 m, with a dead storage level of 1,533 m and reservoir bottom at 1,514 m.

Grootdraai Dam (source: SA Dept of Water Affairs)

PURPOSE

The dam provides for the water needs of Sasol II and III petroleum from coal plant at Secunda, Eskom's Tutuka Power Station and to some extent the water requirements for the Matla and Duvha power stations.

It also serves as a flood control dam and has reduced the floods which have inundated Standerton in the past.

It is a component of the Usutu–Vaal Water Transfer Scheme. Apart from natural inflow from the Vaal River, it can store an additional 100 million m^3 of water per annum which is pumped from Heyshope Dam in the Usutu River basin across the watershed to the Vaal River. In turn, water is transferred from Grootdraai Dam to the Olifants River basin.

Grootdraai Dam supplies Tutuka Power Station. Other power stations in the Olifants catchment can also be supplied from Grootdraai Dam when the Usutu system cannot meet the full demand (although it is not desirable due to water quality issues), namely: Matla, Kriel and Kendall. Water is pumped from the Grootdraai Pump Station at Grootdraai Dam to the Knoppiesfontein Diversion Tank where the water is diverted to the Bossiesspruit Dam and to the Trichardsfontein Balancing Dam. Bossiesspruit Dam releases water to the Sasol–Secunda complex. From the Trichardsfontein Balancing Dam, water is released to Rietfontein Weir and can then be pumped to various power stations (see above) as and when required. Duvha Power Station can also be supported from water released from Rietfontein Weir to Witbank Dam.

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

It is estimated that over 45 years, the capacity of the dam could be reduced by 32 million m^3/a due to siltation.

The total irrigation demand of 19.31 million m^3/a is representative of the Grootdraai catchment. Return flows amount to 2.88 million m^3/a, leaving a net demand of 16.43 million m^3/a. The irrigation demand includes 0.336 million m^3/a which is classified as a streamflow reduction activity.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Grootdraai	Vaal	C11L	356	38.78	DWA	C1R002	42	2,249

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1978	103.48 †	19.31 ‡	42.794 †	98 ‡	11,500

† DWA, Directorate of Hydrological Services correspondence, 2012
‡ ORASECOM, 2011

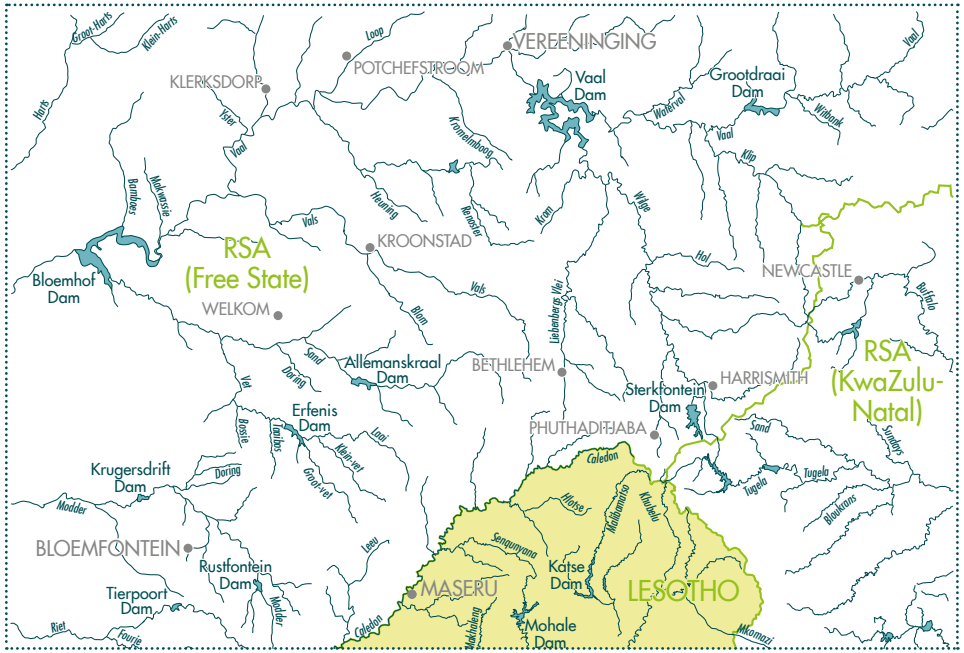
AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,550	399.52	42.49
1,549	356.02	38.82
1,546	254.37	30.37
1,542	153.63	20.62
1,540	116.39	16.86
1,536	64.12	10.34
1,533	38.01	7.15
1,529	16.07	3.98
1,525	4.83	1.80
1,522	1.32	0.65
1,514	0.00	0.00

OPERATING RULES

Grootdraai Dam, along with the Vaal Dam, the Vaal Barrage, Bloemhof Dam (all on the Vaal River) and Sterkfontein Dam (on the Wilge River, a tributary of the Vaal River) form part of the Bloemhof Sub-system, which is part of the greater Integrated Vaal River System. Woodstock Dam and the Driel Barrage (situated in the Thukela River catchment), form the Thukela Transfer Scheme into the Vaal catchment. The system is operated according to annual runs of the System Analysis Model.

The large scheme is operated as follows: The Thukela system supports Sterkfontein Dam until the dam is full. Grootdraai Dam does not support Vaal Dam, but when the Vaal Dam is at 15% storage or less, Sterkfontein will begin to support it. Abstractions at Sedibeng and Midvaal make use of local runoff and spills from upstream dams. When this is not adequate, the Vaal Dam supports the abstractions. The Vaal Dam will only begin to support Bloemhof Dam when Bloemhof Dam reaches its minimum operating level (1,213.6 m).



Dam network

Namibia

HARDAP DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
24° 29′ 58.26″ S	17° 51′ 31.02″ E

LOCATION

Hardap Dam is situated on the Fish River in quaternary catchment D46B in Namibia.

DESCRIPTION

Hardap Dam consists of a rockfill embankment with an upstream bituminous concrete blanket. It has a full supply level of 1,135.0 m, and the bottom of the reservoir is at 1,109.9 m.

PURPOSE

Water is supplied to Mariental via a purification plant downstream of the dam and then gravity fed 20 km to a reservoir at Mariental. The dam provides for a 2,000 ha irrigation scheme by means of 16 km of concrete-lined canals and pipelines. Hardap Dam is also used for flood absorption to protect the town of Mariental.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	Operational percentage‡	FSC* (million m^3)	FSA (km^2)	Owner	Wall height (m)	Wall length (m)
Hardap Dam	Fish	D46B †	100	294.60	28.70	NamWater	35.50	865
			70	206.10	23.00			

† ORASECOM, 2011
‡ Following the 2006 flood event, the Namibia cabinet has approved the Hardap Dam to be operated at 70%
* Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

Hardap Dam (©UNOPS/Leonie Marinovich)

Year of completion	Demands/abstractions (million m³/a)			Operational percentage	95% assured yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other			
1962	1	40	None	100	54.26	3,512
				70	43.60	1,892

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,138	387.36	33.15*
1,135	294.59	28.71
1,134	266.65	27.18
1,131	191.78	22.54
1,127	112.75	17.03
1,123	56.67	11.08
1,119	22.19	6.30
1,117	11.68	4.28
1,115	4.82	2.68
1,114	2.63	1.71

* Estimated

OPERATING RULE

Hardap and Naute dams are part of the Namibia Fish River Sub-system. On 1 May every year, the curtailment curve (based on short-term stochastics yield analyses) is used to determine whether there is a deficit or surplus in the system. If a deficit exists, curtailment is applied according to the following table.

User category	Low assurance (1 in 5 years)	Low assurance (1 in 10 years)	Low assurance (1 in 20 years)
Urban/industrial	0	0	100
Irrigation	83	17	0
Canal losses	50	50	0

If the water level rises to a level of 1,131.62 m (70%), water is released.

A storage projection plot is updated at the start of every month and additional actions may be required to protect the resource.

South Africa

JOHAN NESER DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 48′ 21″ S	26° 36′ 25″ E

LOCATION

Johan Neser Dam (also known as Klerksdorp Dam) is located on the Schoon Spruit near Klerksdorp in the North West Province, South Africa, in quaternary C24G in the Middle Vaal Water Management Area.

DESCRIPTION

Johan Neser Dam is an earthfill dam. It has a full supply level of 1,317.7 m, a dead storage level of 1,311.6 m and the bottom of the reservoir is at 1,311.0 m.

PURPOSE

Johan Neser Dam is used for irrigation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Johan Neser	Schoon Spruit	C24G	5.70	2.70	Klerksdorp Irrigation Board	C2R002	12	780

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Johan Neser Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1922	Unknown	Unknown	Unknown	10.40	Unknown

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,319	9.82	3.91
1,318	5.67	2.73
1,317	3.88	2.15
1,316	2.05	1.55
1,315	0.78	1.04
1,314	0.08	0.50
1,313	0.00	0.01
1,311	0.00	0.00

OPERATING RULE

Johan Neser, Elandskuil and Rietspruit dams are operated as the Schoon Spruit Sub-system. Operating rules allow for these dams to supply their demands until they reach their respective minimum operating levels. Only the spills from the Schoon Spruit Sub-system contribute to the Bloemhof Sub-system yield.

South Africa

JOZANASHOEK DAM (FORMERLY STERKSPRUIT)

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
30° 36′ 49″ S	27° 22′ 09″ E

Jozanashoek Dam (source: SA Dept of Water Affairs)

LOCATION

Jozanashoek Dam is located near the small town of Sterkspruit in the Eastern Cape (near Lesotho), in quaternary D12B in South Africa.

DESCRIPTION

Jozanashoek Dam is a gravity concrete dam with a rock foundation.

PURPOSE

The dam was built for urban water supply and supply to irrigation demands.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Jozanashoek	Sterkspruit	D12B	1.16	0.17	DWA	D1R001	47	225

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1981	Unknown	Unknown	Unknown	Unknown	1,160

South Africa

KALK DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
Unknown	Unknown

LOCATION

Kalk Dam is situated near Douglas in the Lower Orange Water Management Area, South Africa.

DESCRIPTION

Kalk Dam has a full supply level of 1,327.3 m. The dead storage level and bottom of the reservoir are at 1,325.0 m.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Kalk	Unknown	Unknown	2.20	1.00	Unknown	Unknown	Unknown	Unknown

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,327.3	2.22	0.95
1,326.9	1.85	0.79
1,326.6	1.48	0.63
1,326.2	1.11	0.47
1,325.8	0.74	0.32
1,325.4	0.37	0.16
1,325.0	0.00	0.00

South Africa

KALKFONTEIN DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 29′ 49″ S	25° 13′ 17″ E

LOCATION

This dam is situated in quaternary C51J on the Riet River near the town of Koffiefontein in the Free State, South Africa.

DESCRIPTION

Kalkfontein Dam is a concrete-faced rockfill dam, and is part of a system designed to supply irrigators with water. The dam was raised in 1977 by 2.2 m. The dam has a catchment area of 9,473 km^2, and a spillway capacity of 1,700 m^3/s. The dam has a full supply level of 1,229.0 m. The dead storage level and bottom of the reservoir are at 1,210.1 m.

Kalkfontein Dam (source: www.panoramio.com)

PURPOSE

Kalkfontein Dam originally supplied the Scholtzburg and Ritchie irrigation boards, riparian irrigators along the Riet River (Riet River Settlement), the town of Jacobsdal, and the mining centre of Koffiefontein. The dam now supplies the Riet River Government Water Scheme via a left bank canal from the dam. The dam still supplies the mining centre and Jacobsdal but the newer Sarel Hayward Canal now supplies the settlement and irrigation boards. Kalkfontein is not supported by the upstream Tierpoort Dam.

OPERATING RULE

The operating rule within the current study is that the dam supports all demands, with priority given to urban and mining demands (ORASECOM, 2007).

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Kalkfontein	Riet	C51J	319.62	45.32	DWA	C5R002	36	317

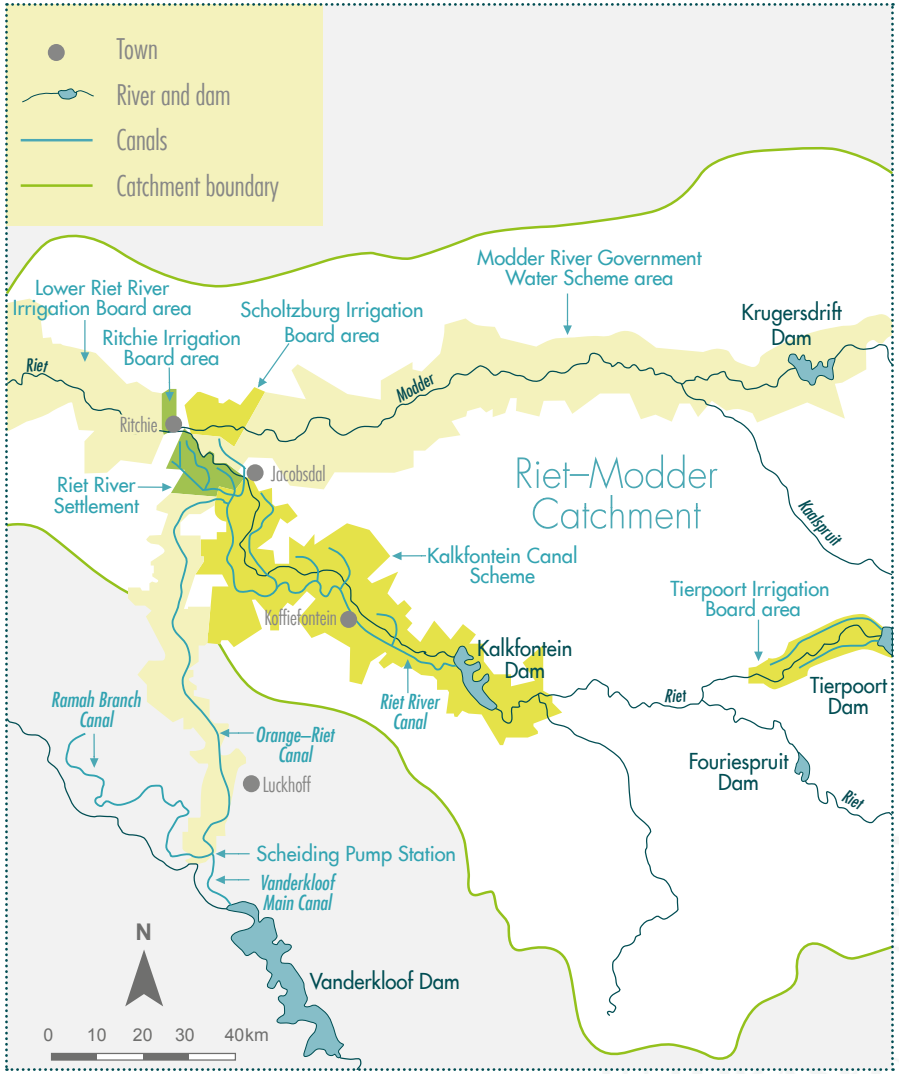
* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1938	350.64 †	Unknown	Unknown	148.50	1,700

† ORASECOM, 2007a

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,229.0	319.62	45.32
1,227.6	258.16	39.28
1,226.7	224.13	36.43
1,225.8	192.70	33.08
1,223.5	129.80	22.80
1,221.9	96.20	19.23
1,220.1	65.27	14.95
1,215.6	15.66	7.06
1,210.3	0.05	0.27
1,210.1	0.00	0.00



Riet River Government Water Scheme (adapted from ORASECOM, 2007a)

Lesotho

KATSE DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 20′ 11″ S	28° 30′ 25″ E

LOCATION

This dam is situated on the Malibamatso River, which is a tributary of the Senqu River. It is located in Lesotho (landlocked by South Africa) in quaternary catchment D11E.

DESCRIPTION

The dam is a double curvature concrete arch dam, 1,993 m above sea level. The intake tower is located approximately 18 km north of Katse Dam and has been designed to accommodate 70 m^3/s, which was the maximum transfer envisaged for full implementation of the Lesotho Highlands Water Project (LHWP). Katse Dam is connected to the Muela Dam via a 45-km tunnel (Phase I of the LHWP, which was completed in 2005). Phase I of the project also consisted of a 31-km tunnel from the Mohale Reservoir to the Katse Dam. The Mohale–Katse Transfer Tunnel has a maximum capacity of 807.56 million m^3/a. The dam has a full supply level of 2,053 m. The dead storage level is at 1,989 m and the bottom of the reservoir is at 1,895 m.

Katse Dam (source: www.jacquesleslie.com)

PURPOSE

Phase I of the LHWP, which was completed in 2005, included the construction of Katse Dam, with the intention of augmenting South Africa's water supply via a transfer to the Vaal River catchment, through an agreement between South Africa and Lesotho. The maximum long-term transfer volume is 877 million m^3/a, and will be transferred to South Africa regardless of the storage in the Vaal or Orange catchments (ORASECOM, 2007a). Currently the release from Katse Dam to the Vaal Dam is 777 million m^3/a.

Through this release, water is also used for hydropower generation, travelling through a 4-m-diameter, 45-km tunnel, existing at a hydroelectric station near Muela, approximately 45 km from Katse Dam. During periods of water shortages, water is discharged into the Mohokare (Caledon) River to provide water to the capital of Lesotho, Maseru. Releases are also made for the downstream ecological reserve of approximately 65.86 million m^3/a.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Katse	Senqu	D11E	1,950	35.8.	Lesotho	D1R002	185	710

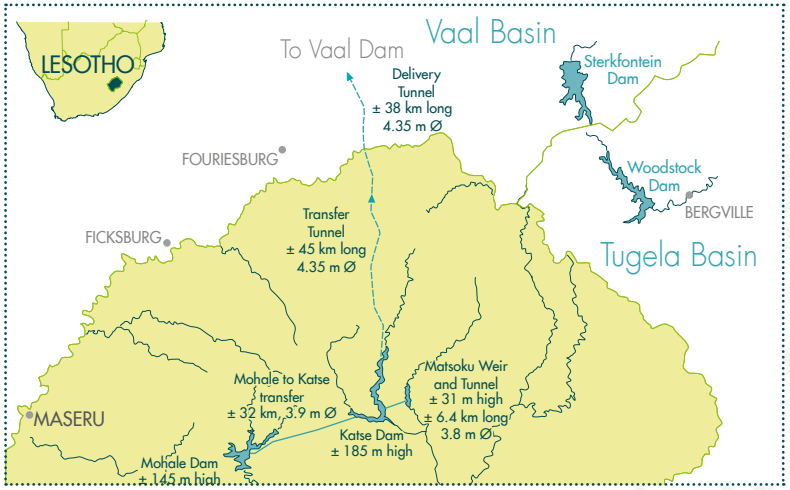
* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Transfer to Vaal Dam		
1996	Unknown	Unknown	777 †	451–586	70

† ORASECOM, 2011

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
2,053	1,950	35.80
2,050	1,845	34.60
2,040	1,520	30.50
2,030	1,234	26.70
2,020	985	23.10
2,010	773	19.60
2,000	593	16.40
1,992	472	13.90
1,985	381	12.10
1,895	0	0.00



Phase I of the Lesotho Highlands Water Project

South Africa

KLERKSKRAAL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 15′ 09″ S	27° 09′ 38″ E

LOCATION

Klerkskraal Dam is located on the Mooi River, South Africa, in quaternary catchment C23F.

DESCRIPTION

Klerkskraal Dam is a gravity concrete dam with earthfill flanks. It has a full supply level of 1,461.1 m and a dead storage level of 1,456.2 m. The bottom of the reservoir is at 1,454.5 m.

PURPOSE

Klerkskraal Dam is used to supply irrigation demands.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Klerkskraal	Mooi	C23F	8.20	3.80	DWA	C2R003	15	605

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Klerkskraal Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1969	Unknown	29.60	Unknown	24.00	354

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,462.5	14.77	5.89
1,461.1	8.25	3.84
1,460.5	6.12	3.20
1,459.5	3.47	2.30
1,458.5	1.65	1.49
1,457.5	0.58	0.78
1,456.2	0.09	0.19
1,454.5	0.00	0.00

OPERATING RULE

Klerkskraal, Boskop and Lakeside dams are part of the Mooi River Sub-system, as is Klipdrif Dam, which is located on the Loopspruit River, which is a tributary of the Mooi River. These dams are operated to allow for supply of their demands until they reach their respective minimum operating levels. The sub-system does not support the Vaal or Bloemhof sub-systems.

South Africa

KLIPDRIF DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 37′ 00″ S	27° 18′ 04″ E

LOCATION

Klipdrif Dam is located in quaternary catchment C23J near Potchefstroom in the Upper Vaal Water Management Area in South Africa. It is located on the Loopspruit River, which is a tributary of the Mooi River.

DESCRIPTION

Klipdrif Dam is an earthfill dam with a rock/soil foundation. It has a full supply level of 1,368.4 m. The dead storage level is 1,363.5 m and the bottom of the reservoir is at 1,363.5 m.

PURPOSE

Used for irrigation; 0.44 million m^3/a of the irrigation is classified as a streamflow reduction activity.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Klipdrif	Loopspruit	C23J	13.60	4.70	DWA	C2R005	12	1,721

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Klipdrif Dam Wall (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1971	Unknown	2.30 †	Unknown	5 ‡	700

† DWA, Directorate of Hydrological Services correspondence, 2012
‡ DWA 2002a to e

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,369.5	19.63	5.86
1,368.4	13.58	4.71
1,367.5	9.94	3.91
1,366.5	6.42	3.19
1,365.5	3.50	2.66
1,364.5	1.01	2.43
1,363.5	0.00	0.00

OPERATING RULE

Klipdrif Dam, along with Klerkskraal, Boskop and Lakeside dams, is part of the Mooi River Sub-system. These dams are operated to allow for supply of their demands until they reach their respective minimum operating levels. The sub-system does not support the Vaal or Bloemhof sub-systems.

South Africa

KNELLPOORT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 46′ 45″ S	26° 53′ 22″ E

LOCATION

Knellpoort Dam is situated on the Rietspruit River near Wepener in the Free State, South Africa, in quaternary D23H.

DESCRIPTION

Knellpoort Dam was the first arch gravity roller compacted concrete (RCC) dam in the world, and consists of almost 64,600 m^3 rollcrete and 14,200 m^3 concrete. It is an off-channel storage dam with a relatively small catchment area of only 798 km^2 and corresponding mean annual runoff (MAR) of approximately 20 million m^3/a. The dam has a full supply level of 1,452.1 m, with a dead storage level of 1,428.6 m and reservoir bottom at 1,412.0 m.

PURPOSE

Welbedacht Dam had been the primary source of supply for the city of Mangaung, but due to siltation, it was no longer able to meet the demands at an acceptable assurance of supply. Knellpoort Dam was therefore constructed to augment supply to Bloemfontein via the Caledon–Bloemfontein pipeline. The Tienfontein Pumping Station and Canal are equipped with a silt trap to reduce siltation in the reservoir. However, the Bloemfontein demand is ever-increasing, and the pipeline is of limited capacity. This scheme, therefore, will be further augmented by a direct transfer from Knellpoort to the Modder River (Rustfontein Dam catchment) via the Novo Transfer Scheme, which is expected to have a maximum capacity of 150 million m^3/a by the year 2030.

Water from the Caledon River is pumped to Knellpoort Dam from the Tienfontein Pumping Station via a 2-km-long canal which is equipped with a silt trap to reduce siltation in the main reservoir. The maximum capacity of this tunnel is 75.74 million m^3/a.

The Novo Transfer Scheme will be developed in stages, according to Bloemfontein's increasing demands, and is expected to reach a maximum transfer capacity of 150 million m^3/a by the year 2030.

Knellpoort Dam (© UNOPS/Leonie Marinovich)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Knellpoort	Rietspruit	D23H	136.15	9.80	DWA	D2R006	50	200

* Live full supply capacity (SANCOLD, 2009)

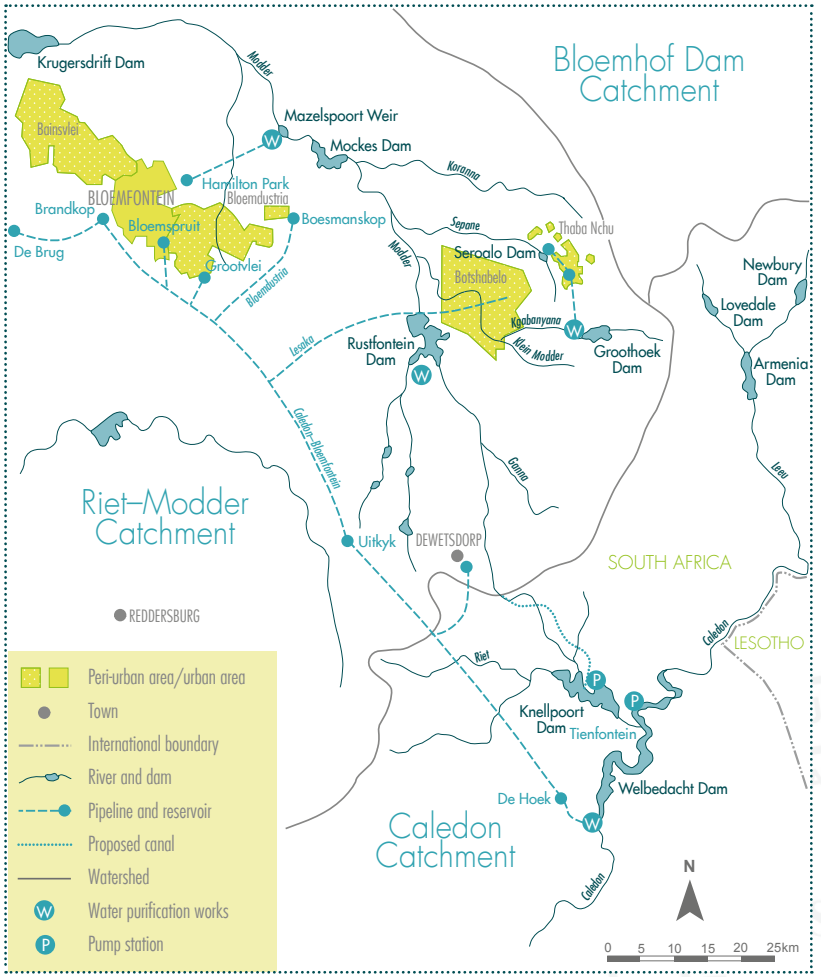
Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1988	Unknown	0.53	Unknown	Unknown	1,070

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,454.5	163.00	11.70
1,453.4	150.00	10.79
1,452.1	136.90	9.76
1,451.4	130.40	9.41
1,446.7	91.39	7.43
1,444.0	71.85	6.57
1,439.5	45.85	5.11
1,432.6	17.24	3.17
1,428.6	6.75	1.99
1,412.0	0.00	0.00

OPERATING RULE

Knellpoort Dam (along with Welbedacht Dam) supports the Modder system when there is insufficient water in the system, via the Caledon–Modder Transfer.



Caledon–Bloemfontein Government Water Scheme (adapted from ORASECOM, 2007a)

South Africa

KOPPIES DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
27° 15′ 29″ S	27° 40′ 27″ E

LOCATION

Koppies Dam is located on the Renoster River, South Africa, in quaternary catchment C70C.

DESCRIPTION

Koppies Dam has a gravity concrete wall with earthfill flanks. It has a full supply level of 1,412.4 m and a dead storage level of 1,408.0 m. The bottom of the reservoir is at 1,406.5 m.

PURPOSE

Koppies Dam is used to supply irrigation demands.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Koppies	Renoster	C70C	41.05	13.62	DWA	C7R001	25	2,309

* Live full supply capacity (SANCOLD, 2009)

Koppies Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1918	Unknown	4.60 †	Unknown	9.80 ‡	1,420

† DWA, Directorate of Hydrological Services correspondence, 2012
‡ DWA 2002a to e

OPERATING RULE

The Koppies Dam operating rule allows for the dam to supply its demands until it reaches its defined minimum operating level.

South Africa

KRUGERSDRIFT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 53′ 00″ S	25° 57′ 30″ E

LOCATION

Krugersdrift Dam is located on the Modder River in quaternary catchment C52G in the Upper Orange Water Management Area, South Africa.

DESCRIPTION

Krugersdrift Dam is a gravity concrete dam with earthfill flanks. The dam has a full supply level of 1,248.1 m. The dead storage level and the bottom of the reservoir is at 1,229.9 m.

PURPOSE

The Modder River Government Water Scheme (operational since 1971), located just downstream of Krugersdrift Dam, supports downstream irrigation, including approximately 55 weirs which abstract water for irrigation. The capacities of the weirs vary from below 5,000 m^3 to 1 million m^3.

Krugersdrift Dam (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Krugersdrift	Modder	C52G	73.19	18.53	DWA	C5R004	26	3,114

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1970	3.66 †	51.30 ‡	Unknown	Unknown	4,820

† Reservoir records for 2009 hydrological year (industry and town)
‡ WRC, 2008

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,248.5	84.48	20.11
1,248.1	76.71	18.76
1,247.7	68.97	17.23
1,247.2	61.42	15.59
1,246.7	53.76	13.96
1,246.1	45.99	12.39
1,245.5	38.37	10.73
1,243.8	23.01	7.40
1,242.5	15.36	5.07
1,229.9	0.00	0.00

OPERATING RULE

The dam is operated as part of the Krugersdrift Dam Scheme, which includes a series of approximately 55 storage weirs along the Modder River, from which water is released from the dam for the weirs to abstract water for irrigation purposes. The releases from Krugersdrift Dam are regulated so that they cascade down to fill the furthest downstream weir.

South Africa

LOCH ATHLONE DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 15′ 00″ S	28° 18′ 33″ E

Loch Athlone Dam (source: SA Dept of Water Affairs)

LOCATION

Loch Athlone Dam is located in quaternary catchment C83B in the Upper Vaal Water Management Area near Bethlehem in South Africa.

DESCRIPTION

Loch Athlone Dam is a gravity concrete dam.

PURPOSE

Loch Athlone Dam is used for recreational purposes only.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Loch Athlone	Jordaan	C83B	3.75	1.89	Bethlehem Municipality	C8R005	13	75

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1971	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

No available information.

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

LOTLAMORENG DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
25° 52′ 32″ S	25° 36′ 11″ E

LOCATION

Lotlamoreng Dam is located in quaternary catchment D41A on the Molopo River in the town of Mahikeng (within the Lotlamoreng Dam Nature Reserve) in South Africa.

DESCRIPTION

Lotlamoreng Dam has a full supply level of 1,226.3 m and a dead storage level of 1,213.4 m. The bottom of the reservoir is at 1,213.0 m. The dam is listed as one of the top ten impoundments in South Africa in need of nutrient management, due to the high level of nutrient enrichment.

Lotlamoreng Dam (source: www.tourismnorthwest.co.za)

PURPOSE

Lotlamoreng Dam is part of the Lotlamoreng Dam Nature Reserve and is used for recreational purposes.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Lotlamoreng Dam	Molopo	D41A	0.44	0.30	Unknown	Unknown	Unknown	Unknown

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	0.53	0.34
1,700	0.44	0.30
1,696	0.35	0.26
1,690	0.26	0.22
1,680	0.18	0.17
1,675	0.09	0.11
1,671	0.00	0.00

OPERATING RULE

The Lotlamoreng, Setumo and Disaneng dams are operated as a sub-system, known as the Molopo Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

South Africa

LOXTON DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
31° 28′ 37″ S	22° 22′ 05″ E

LOCATION

Loxton Dam is located in quaternary catchment D55D, on the Southpoort River in the Lower Orange Water Management Area, just east of the town of Loxton in South Africa.

DESCRIPTION

Loxton Dam is an earthfill dam, with a full supply level of 1,700 m. The dead storage level and bottom of the reservoir are at 1,671 m.

PURPOSE

Loxton Dam is used for irrigation and domestic water supply.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Loxton Dam	Southpoort	D55D	3.40	0.30	Loxton Municipality	Unknown	17	199

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1913	Unknown	Unknown	Unknown	Unknown	210

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	4.09	0.34
1,700	3.41	0.30
1,696	2.73	0.26
1,690	1.05	0.22
1,680	1.37	0.17
1,675	0.68	0.11
1,671	0.00	0.00

OPERATING RULE

The Loxton, Modderpoort, Vanwyksvlei and Rooiberg dams are operated as a sub-system, known as the Hartbees River Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

Lesotho

MATSOKU WEIR

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 13′ 55″ S	27° 46′ 36″ E

LOCATION

Matsoku Weir is situated on the Matsoku River, which is a tributary of the Senqu River. It is located in Lesotho in quaternary catchment D11E.

DESCRIPTION

The Matsoku Diversion Weir is a stone-faced concrete gravity dam, with a maximum spillway capacity of 584 m^3/s. The weir is a solid mass of concrete (21,000 m^3). Its downstream face features a series of large steps, designed to dissipate the energy of water overflowing the weir. The weir is connected to Katse Dam via a 5.7-km tunnel, 4 m in width. The tunnel is gravity fed, with a maximum capacity of 55 m^3/s.

Matsoku Weir (source: amanziflow.co.za)

PURPOSE

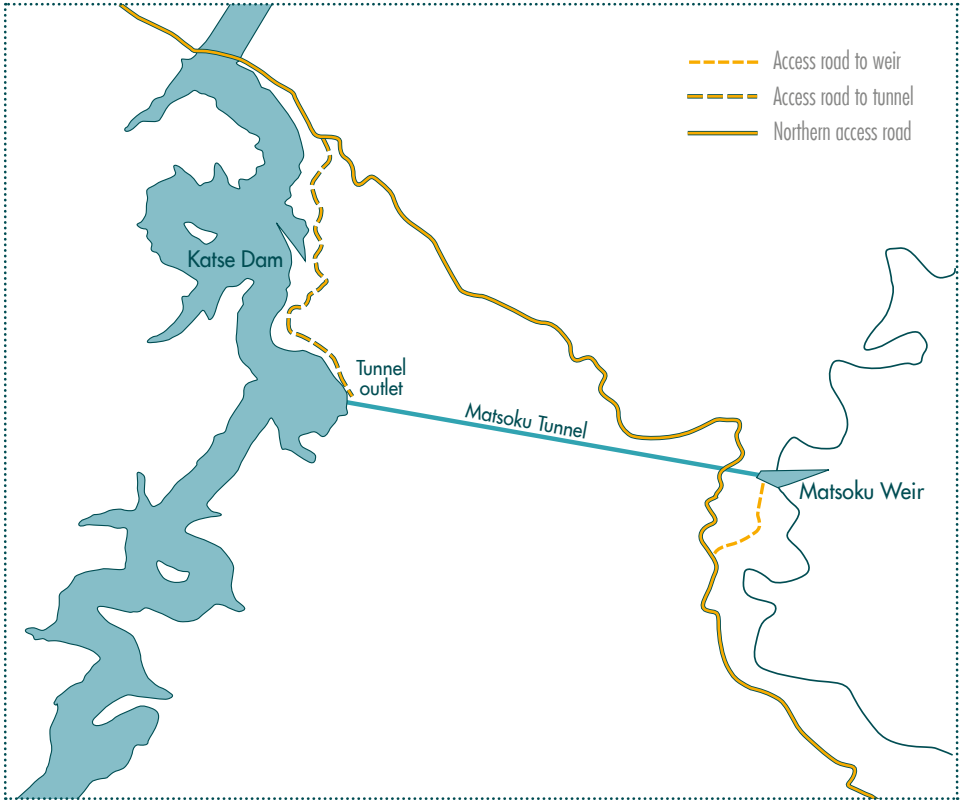
Matsoku Weir serves to transfer water via Katse Tunnel to Katse Dam to supplement Katse Dam's supply. This increases the supply of water to South Africa by 2.2 m^3/s.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC (million m^3)	FSA (km^2)	Owner	Wall height (m)	Wall length (m)
Matsoku	Matsoku	D11E	Unknown	Unknown	Lesotho	15	180

MATSOKU WEIR

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
2000	Unknown	Unknown	Unknown	Unknown	55



The Senqu River, Lesotho (© UNOPS/Greg Marinovich)

Lesotho

METOLONG DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 20′ 9″ S	27° 46′ 36″ E

LOCATION

Metolong Dam is to be constructed on the South Phuthiatsana River in Lesotho.

DESCRIPTION

The project entails the construction of a 73-m-high roller-compacted concrete dam on the south of the river, about 35 km from Maseru, and a multi-stage raw water intake and pump station. Construction started in May 2012.

The programme is divided into five components, which include: advance infrastructure planning, the construction of the Metolong Dam and raw water pumping station, water treatment works, the construction of a downstream conveyance system, and environmental and social management.

PURPOSE

Metolong Dam will be used mainly for domestic and industrial water supply for Maseru and nearby lowland areas.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	Wall height (m)	Wall length (m)
Metolong	South Phuthiatsana	Unknown	53	Unknown	Lesotho	73	210

* Live full supply capacity (Metolong Dam Integrated Catchment Management Plan, 2010)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
To be constructed	27.40	Unknown	Unknown	Unknown	Unknown

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

South Africa

MOCKES DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 03′ 22″ E	26° 27′ 49″ S

LOCATION

Mockes Dam is located in quaternary C52D in the Upper Orange Water Management Area east of Mangaung in South Africa.

DESCRIPTION

Mockes Dam is a composite structure comprising a central concrete section with two earthfill flanks. The dam has a full supply level of 1,303.6 m, with a dead storage level of 1,301.9 m and reservoir bottom at 1,299.5 m.

Mockes Dam (source: SA Dept of Water Affairs)

PURPOSE

Mockes Dam is used for domestic water supply. It is part of the Mazelspoort Scheme which supplies Mangaung with (part of) its water supply. Mockes Dam releases water to the Mazelspoort waterworks for this purpose, and is also supported by Rustfontein Dam and transfers from Knellpoort Dam.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Mockes	Modder	C52D	4.63	3.40	Mangaung Municipality	C5R007	18	713

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

MOCKES DAM

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1956	Unknown	Unknown	Unknown	Unknown	991

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,304.0	5.50	4.50
1,303.6	4.63	3.40
1,303.3	3.97	2.90
1,302.5	2.07	1.60
1,302.0	1.42	1.10
1,301.5	0.86	0.60
1,301.0	0.54	0.40
1,300.5	0.27	0.20
1,300.0	0.20	0.10
1,299.5	0.00	0.00

South Africa

MODDERPOORT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
31° 56′ 41″ S	22° 08′ 38″ E

LOCATION

Modderpoort Dam is situated in D55A on the Rietfontein River near Beaufort West in the Western Cape, South Africa.

DESCRIPTION

Modderpoort Dam is an earth dam with a free overspill spillway (no capacity available). The full supply level is 1,700 m.

PURPOSE

The dam was designed to supply irrigation demands.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Modderpoort	Rietfontein	D55A	12.30	2.16	Unknown	Unknown	15	710

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1953	Unknown	Unknown	Unknown	Unknown	Free overspill

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	14.76	2.41
1,700	12.30	2.16
1,696	9.84	1.89
1,690	7.38	1.59
1,680	4.92	1.25
1,675	2.46	0.82
1,671	0.00	0.00

OPERATING RULE

The Modderpoort, Loxton, Vanwyksvlei and Rooiberg dams are operated as a sub-system, known as the Hartbees River Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

Lesotho

MOHALE DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 27′ 28″ S	28° 05′ 47″ E

LOCATION

The dam is situated on the Senqunyane River. It is located in Lesotho in quaternary catchment D17B.

DESCRIPTION

Mohale Dam is the second largest dam in the Lesotho Highlands Water Project (LHWP). It is a concrete-faced rockfill dam. It is connected to Katse Dam through a transfer tunnel which has a maximum capacity of 807.56 million m^3/a. The dam has a full supply level of 2,075 m and a dead storage level of 2,005 m. The bottom of the reservoir is at 1,940 m.

PURPOSE

Mohale Dam was built as part of Phase IB of the LHWP to augment South Africa's water supply and generate electricity in Lesotho. The EWR release from the dam is approximately 30.44 million m^3/a.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Mohale	Senqunyane	D17B	938	22.10	Lesotho	D1R003	145	564

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

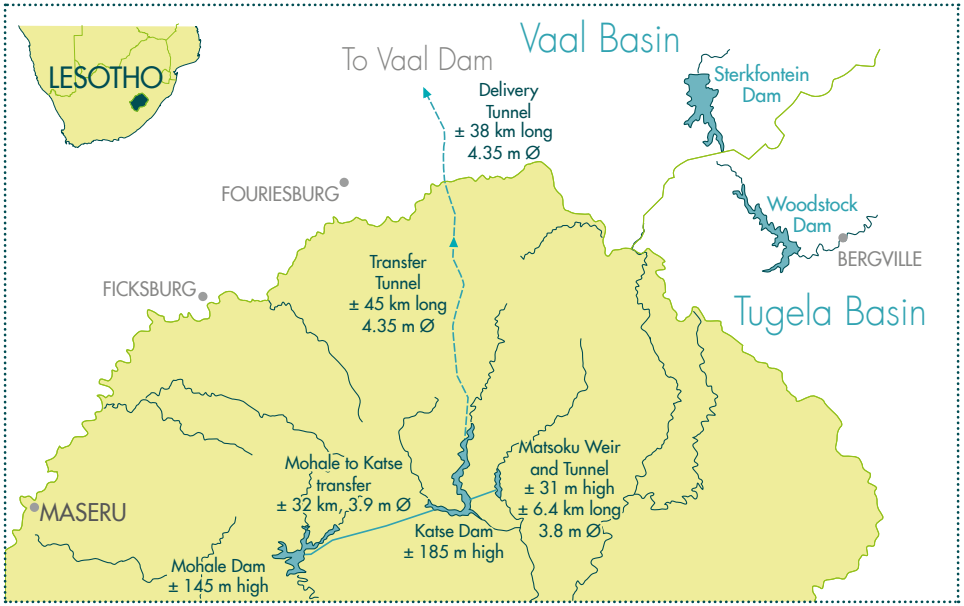
Mohale Dam (© UNOPS/C Mor)

MOHALE DAM

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
2000	Unknown	Unknown	Unknown	Unknown	2,600

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
2,075	938	22.10
2,070	828	20.50
2,060	639	17.30
2,050	481	14.30
2,040	351	11.60
2,030	248	9.10
2,020	168	6.90
2,010	108	5.00
2,000	67	3.30
1,940	0	0.00



Phase I of the Lesotho Highlands Water Project

South Africa

MOUTLOATSI DAM (FORMERLY GROOTHOEK)

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 18′ 10″ S	26° 50′ 56″ E

LOCATION

Moutloatsi Dam is situated in quaternary catchment C52B near Thaba Nchu in the Free State, South Africa.

DESCRIPTION

Moutloatsi Dam is a concrete gravity dam. The dam has a full supply level of 1,495.0 m and a dead storage level of 1,484.8 m. The bottom of the reservoir is at 1,470.0 m.

Moutloatsi Dam (source www.panoramio.com)

PURPOSE

Moutloatsi Dam provides water to domestic users.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Moutloatsi	Kgabanyane	C52B	13.20	2.58	DWA	C5R005	29	330

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1982	3.30 †	Unknown	Unknown	Unknown	1,362

† WRC, 2008

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

Lesotho

MUELA DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 45′ 41″ S	28° 27′ 20″ E

LOCATION

This dam (tailpond) is situated on the Nqoe River, which is a tributary of the Mohokare (Caledon) River. It is located in Lesotho in quaternary catchment D21A.

DESCRIPTION

Muela Dam is a double curvature concrete arch dam, built on sandstone. The dam has an ogee spillway and cascade stilling basin for energy dissipation. There is an inlet to the 38-km tunnel in the dam basin, through which water is delivered to South Africa. The tunnel begins at Muela Dam, continues into South Africa (beneath the Caledon River) and ends up in the Ash River. The tunnel is constructed through mudrocks of Karoo sediments, and is lined using precast segmental linings. The low-cover sections are steel lined to avoid rock hydrofracture.

The flow within the tunnel, in Lesotho, is measured and the quantities delivered are used to calculate royalties that South Africa pays to Lesotho. There is a magnetic flow meter to measure the flow (backed up by an ultrasonic flow meter) in an underground chamber at Ngoajane, Lesotho.

PURPOSE

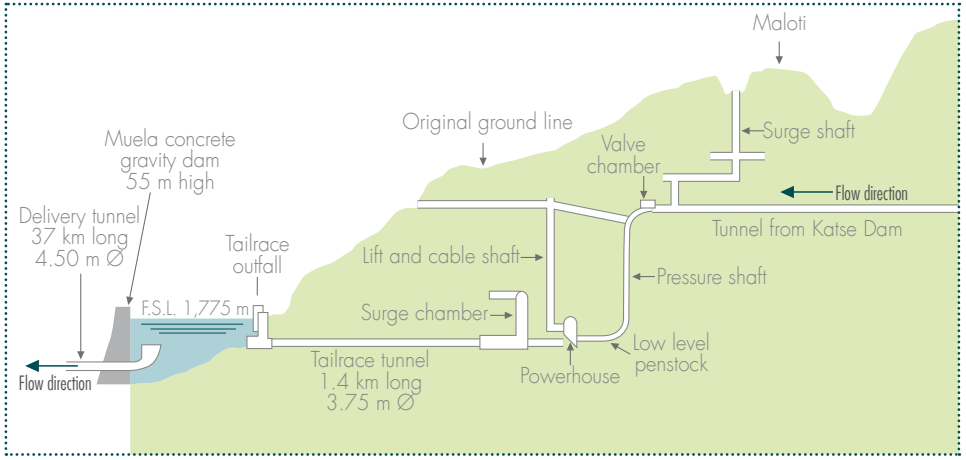
The sole purpose of the dam is to serve as a tailpond for the Muela underground hydroelectric power station that generates electricity to supply the needs of Lesotho. The plant capacity (at Phase I) is 72 MW (three Francis vertical shaft turbines at 24 MW each).

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Muela	Nqoe	D21A	6	Unknown	Lesotho	n/a	55	200

* Live full supply capacity (http://www.dwaf.gov.za/Orange/up_orange/lhwpstat.aspx)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1998	Unknown	Unknown	Unknown	Unknown	584



Cross-section of the Muela Dam (adapted from www.lhwp.org.ls/engineering/phase1a/mmuela_dam)

Namibia

NAUASPOORT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
23° 3′ 36″ S	17° 12′ 31″ E

LOCATION

Nauaspoort Dam is located on the Usib River in the Auob catchment in quaternary catchment D44F in Namibia.

DESCRIPTION

Nauaspoort Dam is an earthfill embankment dam with a clay core. It has a full supply level of 1,563.0 m and the bottom of the reservoir is at 1,554.6 m.

PURPOSE

Nauaspoort Dam originally supplied water to Oamites Mine via an 18-km pipeline to a reservoir and purification plant at Oamites. This has not happened for a long while due to the mine having ceased operations.

Nauaspoort Dam (source unknown)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment †	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Nauaspoort	Usib	D44F	3.19	0.90	NamWater	13.40	Unknown

† ORASECOM, 2011

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

NAUASPOORT DAM

Year of completion	Demands/abstractions (million m^3/a)			95% assured yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1967	0	0	0	Unknown, water supply is augmented by boreholes	Unknown

Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

AREA–CAPACITY RELATIONSHIP

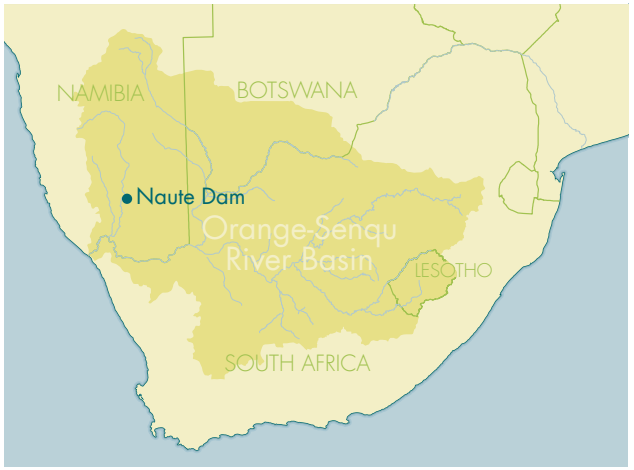
Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,563.0	3.19	0.90
1,554.6	0.00	0.00

Namibia

NAUTE DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 55′ 51″ S	17° 56′ 16″ E



LOCATION

The Naute Dam is located on the Löwen River in the Fish River catchment in quaternary catchment D46G in Namibia.

DESCRIPTION

The Naute Dam is a double curvature circular arch structure.

PURPOSE

Water is treated at the dam via a 1.9-km pipeline to the water treatment plant. Then the purified water reaches the town of Keetmanshoop via a 44-km pipeline. Water is also provided for a 270 ha irrigation scheme via a 2 km gravity pipeline.

Naute Dam (© UNOPS/Christoph Mor)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment †	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Naute Dam	Löwen	D46G	83.58	11.55	NamWater	37	470

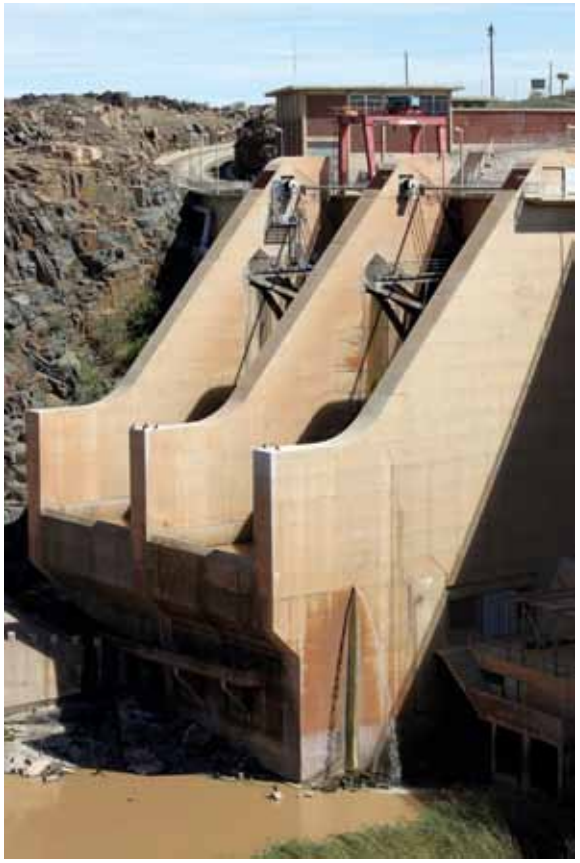
† ORASECOM, 2011
* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m³/a)			95% assured yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1971	1.80 †	2.30 †	Unknown	12	2,292

† DWA, 2005
Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
732	83.58	11.53
731	72.80	10.05
727	40.54	6.58
725	28.53	5.42
721	12.03	2.86
719	7.29	1.83
714	2.38	0.49
711	1.23	0.31
703	0.00	0.00



Naute Dam (source: www.wikipedia.org)

Namibia

NECKARTAL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 37′ 43″ S	17° 42′ 57″ E

LOCATION

The proposed Neckartal Dam is to be located on the Fish River in Namibia about 25 km north of Seeheim and 40 km west of Keetmanshoop.

DESCRIPTION

Neckartal Dam will be a roller compacted concrete gravity dam, with a spillway, spillway chute and spillway apron. Its catchment area will be 45,620 km^2. Its yield at 98% assurance will be 116 million m^3 per annum.

PURPOSE

It will provide water for 5,000 ha of irrigation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Possible future owner	Wall height (m)	Wall length (m)
Neckartal	Fish	Unknown	857*	39	NamWater	78.50	518

* Planned, personal communication G Van Langenhove, DWAF

The site of the proposed Neckartal Dam in Namibia
(© C Mor/UNOPS)

South Africa

NIGEL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 24′ 20″ S	28° 28′ 09″ E

LOCATION

Nigel Dam is an off-channel dam just west of the Blesbok River in South Africa. It is situated in quaternary C21E in the Upper Vaal Water Management Area, in the far upper reaches of the catchment.

PURPOSE

Nigel Dam supplies local urban and irrigation demands.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Nigel	Off-channel	C21E	Unknown	Unknown	DWA	C2R011	Unknown	Unknown

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
2003	Unknown	Unknown	Unknown	Unknown	Unknown

Namibia

OANOB DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
23° 19′ 31″ S	17° 1′ 24″ E

LOCATION

Oanob Dam is located on the Oanob River, a tributary of the Orange River in Namibia, in quaternary catchment D40D.

DESCRIPTION

The Oanob Dam is a concrete double-curvature arch dam. The full supply level of the dam is 1,453.0 m, with a dead storage level at 1,424.5 m and the bottom of the reservoir at 1,408.0 m.

Oanob Dam (source: www.namwater.com)

PURPOSE

It supplies Rehoboth town via a 4-km pipeline to a water treatment plant at Rehoboth.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Oanob	Oanob	D40D †	35.51	2.65	NamWater	50	560

† ORASECOM, 2011
* NamWater correspondence, 2013
Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

Year of completion	Demands/abstractions (million m³/a)			95% assured yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1990	1.60	0	0	4.30	5,000

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,453.0	34.51	3.60
1,450.0	25.22	2.64
1,445.0	14.38	1.74
1,440.0	7.53	1.00
1,424.5	0.42	0.12
1,408.0	0.00	0.01

OPERATING RULE

Water is pumped out of the dam for domestic requirements.

Namibia

OTJIVERO DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
22° 17′ 19″ S	17° 57′ 54″ E
22° 17′ 40″ S (silt)	17° 56′ 27″ E (silt)

LOCATION

The Otjivero Dam is located on the White Nossob River in the Nossob catchment in quaternary catchment in D43A in Namibia.

DESCRIPTION

The Otjivero Dam has a main dam and a silt trap dam. Water is treated at a purification plant at the dam to supply Omitara and a treatment plant at Gobabis via a 110-km pipeline. The dam has a full supply level of 1,575.5 m. The dead storage level and bottom of the reservoir are at 1,561.15 m.

PURPOSE

To supply water to Gobabis and Omitara in conjunction with the Daan Viljoen and Tilda Viljoen dams.

Otjivero Dam (source: www.sun.com.na)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment †	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Otjivero Dam	White Nossob	D43A	9.8 (main dam) 7.8 (silt trap dam)	1.50 main 3.20 silt	NamWater	16 (main) 17 (silt)	320 (main) 850 (silt)

† ORASECOM, 2011
* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)
Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

Year of completion	Demands/abstractions (million m^3/a)			95% assured yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1984 (main dam)	0.72	0	0	0.72	4,000
1982 (silt dam)	0.80	0	0	*	5,000

* 0.72 million m^3/a for both together

OPERATING RULE

The Otjivero, Daan Viljoen and Tilda Viljoen dams are operated as a sub-system, known as the Molopo Sub-system, Namibia. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels. Water is normally transferred from Otjivero silt to Otjivero main. Otjivero water is normally used first for topping up Tilda Viljoen Dam.

Lesotho

POLIHALI DAM

LOCATION

The dam is planned for construction just downstream of the confluence of the Khubelu and Senqu rivers in Lesotho.

DESCRIPTION

The Lesotho Highlands Water Project (LHWP) Phase II includes the construction of a 165 m³ capacity dam at Polihali, in the Mokhotlong District. This new dam will consist of a 145-m-high dam wall. Polihali Dam will be connected to Katse Dam via a transfer tunnel. Water transferred from Polihali to Katse will contribute to the bulk transfer of water to the Vaal River basin via the Ash River. Construction is expected to start in 2014, with water transfer estimated to begin in 2020.

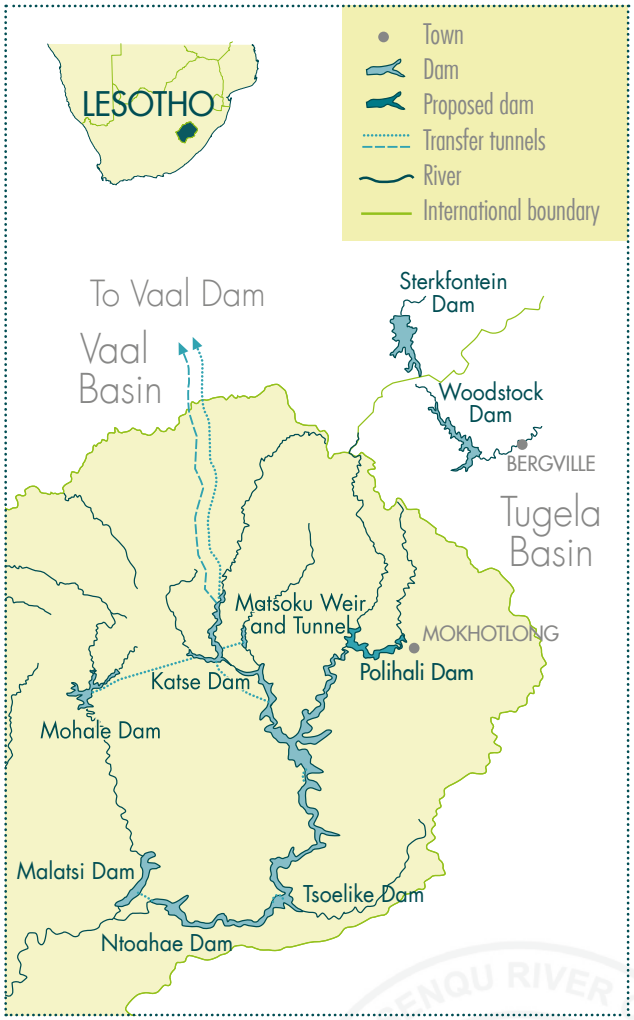
PURPOSE

The Muela Hydropower Station in Butha-Buthe may be expanded to generate more electricity for Lesotho and South Africa a well as water supply to South Africa. Muela Hydropower Station's electricity generating capacity will be increased from the current 72 MW. Polihali Dam is expected to be completed in 2020.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Polihali	Khubelu/Senqu	Unknown	2,200	Unknown	Lesotho	165	Unknown

* Live full supply capacity (www.savingwater.co.za)



The site of the proposed Polihali Dam

South Africa

POTCHEFSTROOM DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 40′ 04″ S	27° 05′ 45″ E

LOCATION

Potchefstroom Dam is located in quaternary catchment C23H in the Upper Vaal Water Management Area in South Africa.

DESCRIPTION

It has a full supply level of 1,346.1 m. The dead storage level and bottom of the reservoir are at 1,340.0 m.

PURPOSE

Irrigation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Potchefstroom Dam	Sand	C23H	2.00	0.80	DWA	C2R004	Unknown	Unknown

* Live full supply capacity (DWA, 1990)

Potchefstroom Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1968	Unknown	12.60 †	Unknown	Unknown	Unknown

† DWA, Directorate of Hydrological Services correspondence, 2012

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,346.1	2.03	0.77
1,345.8	1.82	0.73
1,345.8	1.79	0.72
1,345.4	1.52	0.67
1,345.0	1.26	0.63
1,344.6	1.03	0.56
1,343.5	0.51	0.40
1,342.8	0.26	0.32
1,340.0	0.00	0.00

South Africa

RIETSPRUIT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 24′ 34″ S	26° 48′ 38″ E

LOCATION

Rietspruit Dam is located on the Schoon Spruit in quaternary catchment C24D, near the town of Ventersdorp in the North West Province, South Africa.

DESCRIPTION

Rietspruit Dam is an earthfill dam. It has a full supply level of 1,410.3 m. The dead storage level and bottom of the reservoir are at 1,403.0 m.

Rietspruit Dam (source: SA Dept of Water Affairs)

PURPOSE

Rietspruit Dam is used for irrigation and recreation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Rietspruit	Schoon Spruit	C24D	7.30	2.30	DWA	C2R007	15	992

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1955	Unknown	7.70 †	Unknown	11.40 ‡	0

† DWA, Directorate of Hydrological Services correspondence, 2012
‡ DWA, 2002b

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,412	12.02	3.12
1,410	7.28	2.34
1,409	4.77	1.85
1,408	2.88	1.34
1,407	1.50	0.95
1,405	0.53	0.63
1,404	0.04	0.16
1,403	0.00	0.00

OPERATING RULE

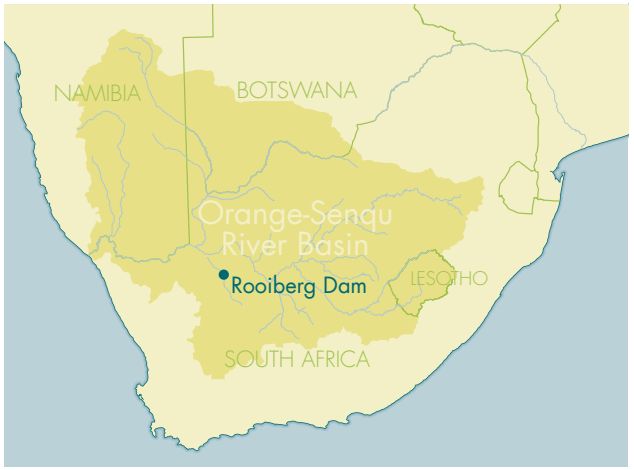
Rietspruit, Elandskuil and Johan Neser dams are operated as the Schoon Spruit Sub-system. Operating rules allow for these dams to supply their demands until they reach their respective minimum operating levels. Only the spills from the Schoon Spruit Sub-system contribute to the Bloemhof Sub-system yield.

South Africa

ROOIBERG DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 24′ 53″ S	21° 12′ 38″ E



LOCATION

Rooiberg Dam is situated on the Hartbees River near Kenhardt in the Northern Cape, South Africa, in quaternary D53A.

DESCRIPTION

Rooiberg Dam is an earth dam, with a full supply level of 1,700 m. The dead storage level and bottom of the reservoir are at 1,671 m.

PURPOSE

Rooiberg Dam was constructed to supply irrigation demands.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Rooiberg	Hartbees	D53A	3.65	3.13	Kenhardt Municipality	D5R001	8	1,210

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1900	Unknown	Unknown	Unknown	Unknown	Free overspill

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	4.38	3.49
1,700	3.65	3.13
1,696	2.92	2.73
1,690	2.19	2.30
1,680	1.46	1.81
1,675	0.93	1.19
1,671	0.00	0.00

OPERATING RULE

The Rooiberg, Vanwyksvlei, Loxton and Modderpoort dams are operated as a sub-system, known as the Hartbees River Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

South Africa

RUSTFONTEIN DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 16′ 15″ E	26° 37′ 00″ S

LOCATION

Rustfontein Dam is located near Thaba Nchu in the Free State, South Africa, in quaternary catchment C52A in the Upper Orange Water Management Area.

DESCRIPTION

Rustfontein Dam is a concrete gravity dam, with a full supply level of 1,373.0 m and dead storage level of 1,356.3 m. The bottom of the reservoir is at 1,354.0 m.

Rustfontein Dam (source: SA Dept of Water Affairs)

PURPOSE

Rustfontein Dam provides water for domestic, industrial and irrigation purposes.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Rustfontein	Modder	C52A	72.60	11.60	DWA	C5R003	36	210

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1954	22.25 †	Unknown	Unknown	Unknown	1,090

† DWA, Directorate of Hydrological Services correspondence, 2012

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,374.7	94.37	14.39
1,373.9	83.55	13.03
1,373.0	72.60	11.58
1,372.3	65.39	10.63
1,371.7	58.17	9.73
1,370.9	50.91	8.89
1,369.6	40.09	7.52
1,367.9	29.27	6.18
1,365.1	14.76	3.95
1,362.4	7.26	2.05
1,356.2	0.29	0.30
1,354.0	0.00	0.00

OPERATING RULE

Rustfontein Dam is connected to Knellpoort Dam via a transfer tunnel of maximum capacity of 75.74 million m^3/a. Losses of approximately 1.1 million m^3/a are experienced.

South Africa

SAULSPOORT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 13′ 22″ S	28° 22′ 44″ E

LOCATION

Saulspoort Dam is located in quaternary catchment C83A in the Upper Vaal Water Management Area in South Africa.

DESCRIPTION

Saulspoort Dam is a concrete dam. The dam has a full supply level of 1,627.3 m. The dead storage level and bottom of the reservoir are at 1,616.8 m.

Saulspoort Dam (source: SA Dept of Water Affairs)

PURPOSE

Saulspoort Dam is used for domestic water supply for Bethlehem.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Saulspoort	Liebenbergsvlei	C83A	16.87	3.99	Bethlehem Municipality	C8R004	24	133

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

SAULSPOORT DAM

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1971	Unknown	Unknown	Unknown	Unknown	1,800

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,628	19.89	4.43
1,627	16.87	3.99
1,625	9.39	2.68
1,623	4.90	1.91
1,621	1.77	1.22
1,619	0.19	0.45
1,618	0.01	0.03
1,617	0.00	0.00

South Africa

SERFONTEIN DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
27° 42′ 11″ S	27° 18′ 20″ E

LOCATION

Serfontein Dam is situated near Kroonstad in the Free State, South Africa, in quaternary C60D on the Vals River.

DESCRIPTION

Serfontein Dam is a rock foundation gravity dam. It has a full supply level of 1,303 m. The dead storage level and bottom of the reservoir are at 1,300 m.

PURPOSE

Serfontein Dam is heavily silted up. Water is released from Serfontein Dam to the Vals River, where it is pumped to Bloemhoek Dam, which supplies water for Kroonstad.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Serfontein	Vals	C60D	5.30	1.80	Kroonstad Municipality	C6R002	15	1,515

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

SERFONTEIN DAM

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1967	Unknown	Unknown	Unknown	Unknown	1,100

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,303.5	5.43	1.85
1,303.0	5.25	1.81
1,302.5	4.35	1.62
1,302.0	2.17	1.07
1,301.5	0.99	0.69
1,301.0	0.87	0.64
1,300.5	0.44	0.42
1,300.0	0.00	0.00

South Africa

SETUMO DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
25° 51′ 30″ S	25° 30′ 45″ E

LOCATION

Setumo Dam is located on the Molopo River near Mmabatho in North West Province, South Africa, in quaternary catchment D41A.

DESCRIPTION

Setumo Dam is an earth dam, with a full supply level of 1,226.3 m, and a dead storage level of 1,213.4 m. The bottom of the reservoir is at 1,213.0 m.

PURPOSE

Setumo Dam is used to irrigate oil-bearing trees to produce bio-diesel at the dam.

Setumo Dam (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Setumo Dam	Molopo	D41A	19.60	4.40	DWA	Unknown	17	1,600

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1995	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,226.3	20.74	4.47
1,226.0	19.56	4.37
1,225.0	15.48	3.80
1,223.0	9.39	2.59
1,221.0	5.16	1.65
1,220.0	3.51	1.31
1,218.0	1.46	0.74
1,217.0	0.94	0.52
1,215.0	0.23	0.19
1,213.0	0.00	0.00

OPERATING RULE

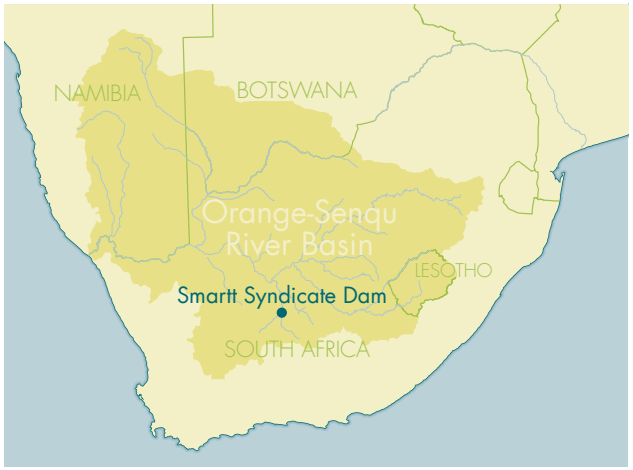
The Setumo, Disaneng and Lotlamoreng dams are operated as a sub-system, known as the Molopo Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

South Africa

SMARTT SYNDICATE DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
30° 38′ 25″ S	23° 17′ 19″ E



LOCATION

Smartt Syndicate Dam is located just west of Britstown, Northern Cape Province, South Africa, in quaternary D61M.

DESCRIPTION

Smartt Syndicate Dam is an earth dam with a rock/soil foundation. It has a full supply level of 1,700 m. The dead storage level and bottom of the reservoir are at 1,671 m.

PURPOSE

The dam is part of the Smart Syndicate Supply System, which supports 1,818 ha of irrigation. However, only approximately 16% of this area is supported, due to the low assurance of supply.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Smartt Syndicate	Ongers Brak	D61M	101	31.50	Smartt Irrigation Board	D6R002	28	2,082

* Live full supply capacity (SANCOLD, 2009)

Smartt Syndicate Dam (source: SA Dept of Water Affairs)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1912	Unknown	12.60 †	Unknown	Unknown	1,420

† WRC, 2008

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	121.32	34.10
1,700	101.10	31.37
1,696	80.88	27.44
1,690	60.66	23.09
1,680	40.44	18.10
1,675	20.22	11.94
1,671	0.00	0.00

OPERATING RULE

The Smartt Syndicate and Victoria West dams are operated as a sub-system, known as the Ongers Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

South Africa

SPITSKOP DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 07′ 24″ S	24° 30′ 07″ E

LOCATION

Spitskop Dam is located in quaternary catchment C33B in the Lower Vaal Water Management Area in South Africa.

DESCRIPTION

Spitskop Dam is a gravity concrete dam with earthfill. It has a full supply level of 1,042.6 m and a dead storage level of 1,037.1 m. The bottom of the reservoir is at 1,037.0 m.

Spitskop Dam (source: www.panoramio.com)

PURPOSE

Spitskop Dam is used for irrigation along the lower Harts River upstream of the Vaal confluence. The dam is currently underutilised due to large volumes of return flow from the Vaalharts Irrigation Scheme.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Spitskop	Harts	C33B	57.90	25.30	DWA	C3R002	18	683

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1975	Unknown	Unknown	Unknown	Unknown	878

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,043.0	69.61	28.73
1,043.6	57.89	25.31
1,042.0	44.33	23.17
1,041.0	25.15	16.90
1,040.0	11.73	11.24
1,039.0	4.09	5.77
1,038.0	0.71	2.39
1,037.1	0.06	0.19
1,037.0	0.00	0.00

OPERATING RULE

The operating rule is to be updated as part of a South African Department of Water Affairs study (in conjunction with Taung Dam).

South Africa

STERKFONTEIN DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 23′ 14″ S	29° 01′ 00″ E

LOCATION

This dam is situated in the upper reaches of the Vaal River, upstream of Standerton in quaternary catchment C11L in South Africa. It is located on the Nuwejaars Spruit, in the upper catchment area of the Vaal River.

DESCRIPTION

The dam has an earthfill wall. It receives its water via the Thukela–Vaal Transfer Scheme, which is a pumped-storage scheme involving the net transfer of up to 630 million m^3 of water from KwaZulu-Natal. This is stored in Sterkfontein Dam and released to the Vaal Dam via the Wilge River when needed. The Sterkfontein Dam is a very effective reservoir, since it is deep, with a relatively small surface area. The dam has a full supply level of 1,702 m and a dead storage level of 1,646 m. The bottom of the reservoir is at 1,617 m.

PURPOSE

The water from KwaZulu-Natal is stored in Sterkfontein Dam and released to Vaal Dam via the Wilge River when needed. Due to the favourable storage and climatic characteristics of Sterkfontein Dam, it is beneficial to store water in the deep, cool Sterkfontein Dam and only release water to the shallow Vaal Dam when needed. The evaporation losses from Sterkfontein Dam are approximately 35 million m^3/a which represents approximately 10% of the losses that would be experienced from the Vaal Dam for a similar volume. Water is pumped up from Kilburn Dam at a rate of 174 m^3/s by four 250 MW pumps/turbines into Driekloof Dam during periods of low power demand. During periods of peak demand, typically during the morning and early evening, the water is released from Driekloof Dam at a rate of 312 m^3/s to generate up to 1,000 MW of power.

Sterkfontein Dam under construction. (Source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Sterkfontein	Nuwejaars Spruit	C81D	2,616.95	67.26	DWA	C8R003	69	3,060

* Live full supply capacity (SANCOLD, 2009)

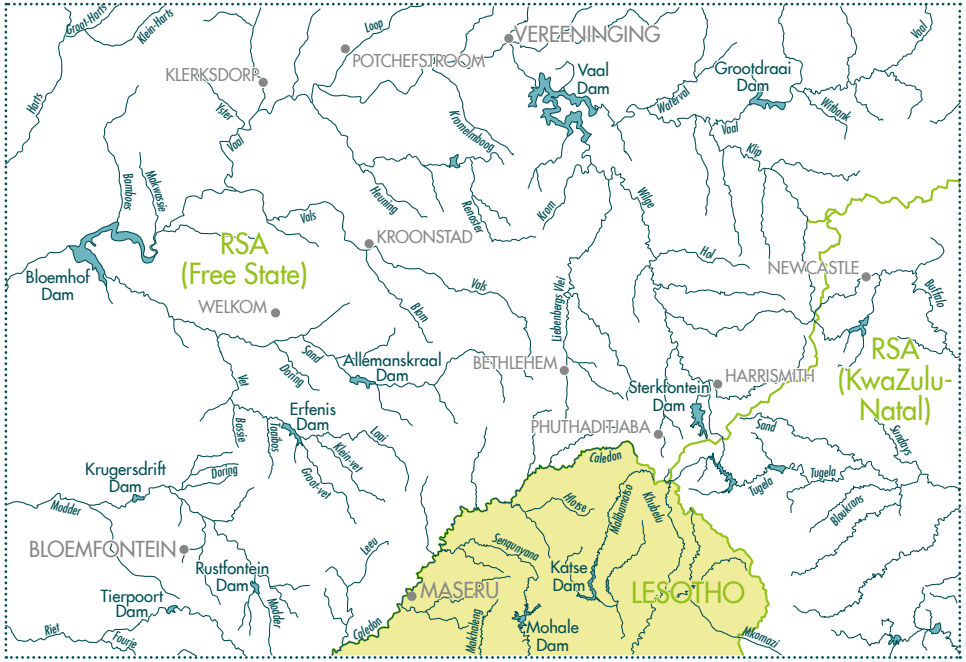
Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1974	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,702	2,616.95	67.26
1,675	1,050.95	47.13
1,664	590.24	36.53
1,656	335.16	26.68
1,651	217.40	20.49
1,644	101.52	12.72
1,634	20.61	4.38
1,630	6.88	2.56
1,621	0.05	0.04
1,617	0.00	0.00

OPERATING RULE

Sterkfontein Dam (on the Wilge River, a tributary of the Vaal River), along with Grootdraai Dam, Vaal Dam, Vaal Barrage and Bloemhof Dam (all on the Vaal River) form part of the Bloemhof Sub-system, which is part of the greater Integrated Vaal River System. Woodstock Dam and the Driel Barrage (situated in the Thukela River catchment), form the Thukela Transfer Scheme into the Vaal catchment. The large scheme is operated as follows: The Thukela system supports Sterkfontein Dam until the dam is full. The transfer limit is 606 million m³/a. When the Vaal Dam is at 15% storage or less, Sterkfontein will begin to support it. Abstractions at Sedibeng and Midvaal make use of local runoff and spills from upstream dams. When this is not adequate, the Vaal Dam supports the abstractions. The Vaal Dam will only begin to support Bloemhof Dam when Bloemhof Dam reaches its minimum operating level (1,213.6 m).



Dam network in the upper areas of the Orange–Senqu basin

South Africa

TAUNG DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
27° 30′ 36″ S	24° 51′ 47″ E

LOCATION

Taung Dam is located in quaternary catchment C31F on the Harts River near Taung in the Lower Vaal Water Management Area in South Africa.

DESCRIPTION

Taung Dam is a rollcrete mass gravity dam with a free overspill spillway. It has a full supply level of 1,155 m and a dead storage level of 1,129 m. The bottom of the reservoir is at 1,120 m.

PURPOSE

Taung Dam was built to augment the irrigation area of Taung and possibly Pudimoe. The dam is not currently used for irrigation but has potential for abstraction from two outlet works. It is to be used for domestic water supply.

Taung Dam (© UNOPS/Greg Marinovich)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Taung	Harts	C31F	65.21	4.60	DWA	C3R006	44	255

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			Historic Firm yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1993	Unknown	Unknown	Unknown	7.85 †	0

† ORASECOM, 2011

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,155	65.21	4.62
1,151	47.61	3.83
1,147	34.00	3.12
1,142	22.96	2.45
1,139	12.31	1.84
1,135	8.03	1.36
1,133	5.96	1.13
1,131	3.86	0.90
1,129	2.34	0.68
1,120	0.00	0.00

OPERATING RULE

The South African Department of Water Affairs has instigated a feasibility study on the utilisation of Taung Dam which will include development of operating rules for a sub-system including Spitskop Dam.

An incomplete bridge or causeway over a stream leading to the Taung Dam. The former apartheid homeland of Bophuthatswana built the dam, and it was completed shortly before the bantustans were dissolved prior to the 1994 democratic elections in South Africa. It is unused for any economic purpose, despite a need for irrigation in the arid and drought-prone north-western parts of South Africa (© UNOPS/Greg Marinovich).

South Africa

TIERPOORT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 24′ 38″ E	26° 08′ 52″ S

LOCATION

Tierpoort Dam is located near Bloemfontein in the Free State, South Africa, in quaternary catchment C51D in the Upper Orange Water Management Area in South Africa.

DESCRIPTION

Tierpoort Dam is an earthfill dam. The dam has a full supply level of 1,382.8 m. The dead storage level and bottom of the reservoir are at 1,374.5 m. The dam was commissioned in 1923 but was reconstructed in 1990 after the 1988 floods washed the dam away.

PURPOSE

The Tierpoort Dam Scheme is used to supply irrigation demands downstream of the dams, through a canal system. The right and left bank canals supply an average of 3.9 million m^3/a and 3.7 million m^3/a, respectively, with an additional 3.77 million m^3/a directly off the dam.

Tierpoort Dam (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Tierpoort	Tierpoort	C51D	34.50	9.10	Tierpoort Irrigation Board	C5R001	20	180

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

TIERPOORT DAM

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1990	Unknown	11.37 †	Unknown	Unknown	4,700

† WR2005, WRC

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,383.5	41.64	10.17
1,382.8	34.50	9.10
1,382.4	31.32	8.55
1,382.0	28.02	7.93
1,380.5	17.67	6.00
1,379.1	10.37	4.34
1,377.2	3.67	2.70
1,376.4	1.82	1.92
1,374.7	0.05	0.25
1,374.4	0.00	0.00

Namibia

TILDA VILJOEN DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
22° 26′ 47″ S	18° 57′ 23″ E

LOCATION

The Tilda Viljoen Dam is located next to (off-channel) the Black Nossob River in quaternary catchment D43A in Namibia.

DESCRIPTION

The Tilda Viljoen Dam is a rockfill dam with a concrete outlet.

PURPOSE

Domestic water supply to Gobabis.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	Wall height (m)	Wall length (m)
Tilda Viljoen	Black Nossob	D43A	1.25	0.19	NamWater	14	630

* NamWater correspondence, 2013

Sources: Personal communication with Hanjörg Drews, NamWater; ORASECOM, 2007

Year of completion	Demands/abstractions (million m³/a)			95% assured yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1964	Unknown	Unknown	Unknown	Unknown	+/-10

Tilda Viljoen Dam (source: www.gobmun.com)

OPERATING RULE

The Tilda Viljoen, Daan Viljoen and Otjivero dams are operated as a sub-system, known as the Molopo Sub-system Namibia. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels. Tilda Viljoen Dam is not on a river. Daan Viljoen Dam's water is transferred to Tilda Viljoen Dam.

South Africa

TWEERIVIER/TWEESPRUIT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
Unknown	Unknown

The Modder River (source: SA Dept of Water Affairs)

LOCATION

Tweerivier Dam is located in quaternary catchment C52H on the Modder River in South Africa. There is some uncertainty about whether the name is not Tweespruit and also the location.

DESCRIPTION

Tweerivier Dam has a full supply level of 1,490.5 m, and the dead storage level and bottom of the reservoir are at 1,488.0 m.

PURPOSE

Tweerivier Dam is used for supplying irrigation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code
Tweerivier Dam	Modder	C52H †	12.60	7.50	Unknown	Unknown

* Live full supply capacity (SANCOLD, 2009)
† Some uncertainty about this

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,490.5	12.56	7.47
1,490.0	2.64	1.87
1,489.0	0.00	0.00
1,488.0	0.00	0.00

South Africa

VAAL BARRAGE

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 45′ 43″ S	27° 42′ 00″ E

LOCATION

The Vaal Barrage is located in quaternary catchment C22K, near Vanderbijlpark in Gauteng Province, South Africa.

DESCRIPTION

The Vaal Barrage is a gravity barrage. It has a full supply level of 1,421.1 m and a dead storage level of 1,413.5 m. The bottom of the reservoir is at 1,410.5 m.

PURPOSE

This reservoir was once used to supply water to the Witwatersrand but no longer does so, because the quality of its water is deteriorating due to pollution. It is now used for recreational activities, such as boating, skiing, fishing and swimming. Many holiday resorts have been established on its banks.

Vaal Barrage (source: SA Dept of Water Affairs)

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Vaal Barrage	Vaal	C22K	55.40	13.50	Rand Water	C2R008	10	329

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1922	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,422.5	77.50	18.20
1,421.1	55.40	13.50
1,420.5	47.90	12.10
1,418.5	28.10	8.10
1,416.5	14.50	5.70
1,415.5	9.40	4.70
1,414.5	5.10	3.90
1,413.5	2.00	2.60
1,413.5	1.90	2.50
1,410.5	0.00	0.00

Canoeists paddle along the Klip River, a tributary of the Vaal River, near Meyerton, south of Johannesburg. The Vaal River basin extends across the economic and industrial heartland of South Africa (© UNOPS/Greg Marinovich).

South Africa

VAAL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
26° 53′ 00″ S	28° 07′ 00″ E

LOCATION

Vaal Dam is located in quaternary catchment C12L and C83M in the Middle Vaal Water Management Area in South Africa.

DESCRIPTION

The Vaal Dam is a composite dam consisting of a 714-m-long concrete gravity wall and a main earth embankment on the right bank which is 1,970 m long and connects directly with the concrete wall. A secondary earth embankment of 910 m closes off a saddle on the right flank. In the early fifties the dam wall was raised by 6.1 m and in 1985 by a further 3.05 m. The dam has a full supply level of 1,484.6 m and a dead storage level of 1,462.9 m. The bottom of the reservoir is at 1,444.5 m.

PURPOSE

It is the main source of water to the Gauteng economic hub.

Rand Water Board is the major water supplier and has two major offtakes from the Vaal River at Zuikerbosch and Vereeniging downstream of the Vaal Dam. Zuikerbosch Pumping Station receives water via a canal from Vaal Dam and from the Lethabo Intake Station while Vereeniging Pumping Station receives water from the Lethabo–Vereeniging pipeline. There is an abstraction point at the Vaal Barrage but it has not been in use for about 20 years and needs to be upgraded. The Zuikerbosch Water Purification Works supplies mainly the eastern part of Johannesburg and Pretoria while the Vereeniging works supplies greater Johannesburg and the Vereeniging–Sasol area.

Vaal Dam (© UNOPS/C Mor)

The Rand Water system is very complex and extensive and has been summarised below as five main routes:

- Vereeniging Pump Station to Heilbron (pumping main) supplying areas Vanderbijlpark, Sasolburg and Heilbron.
- Vereeniging and Zuikerbosch pump stations to Zwartkoppies and Zuurbekom pump stations to Libanon and Blyvooruitzicht reservoirs to Khutsong (gravity main). Included are boreholes at Zuurbekom, which are also managed by Rand Water. Supplies areas of southern Johannesburg, Soweto, the Westonaria and Carletonville magisterial districts and Khutsong.
- Vereeniging and Zuikerbosch pump stations to Zwartkoppies Pump Station through Pretoria to the Hartebeespoort area and Mamelodi (gravity main). Supplies areas in the Alberton, Germiston, Kyalami and Pretoria metropolitan districts, Mamelodi, Atteridgeville, Soshanguve and the Hartebeespoort area.
- Vereeniging and Zuikerbosch pump stations to Zwartkoppies and Bloemendal pump stations to Wildebeesfontein (gravity main). Supplies areas in the Alberton, Germiston, Boksburg, Benoni, Brakpan, Springs, Nigel and Heidelberg metropolitan districts and to Devon, Leandra and Evander.
- Vereeniging and Zuikerbosch pump stations to Zwartkoppies to Rustenburg (gravity main). Supplies areas of Greater Johannesburg and the Randfontein, Krugersdorp and Magaliesburg metropolitan districts and Rustenburg.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Vaal	Vaal	C12L and C83M	2,609.80	322.75	DWA	C1R001	63	2,783

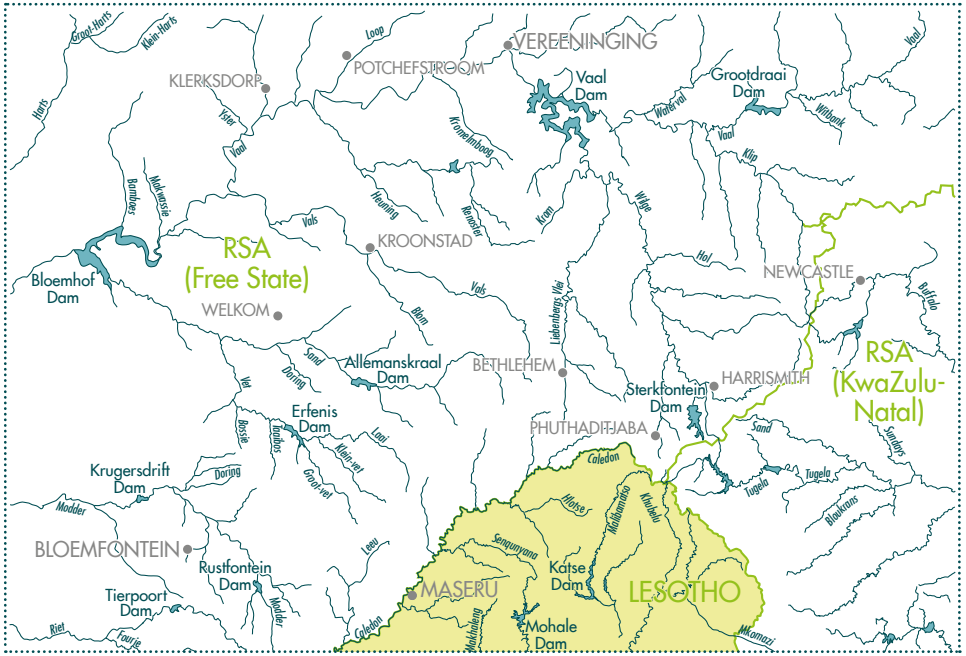
* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1936	852 †	Unknown	Unknown	831 ‡	25,000

† DWA, Directorate of Hydrological Services correspondence, 2012
‡ DWA, 2002a

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,485	2,609.80	322.75
1,484	2,280.82	298.35
1,483	1,994.65	274.71
1,482	1,733.12	249.37
1,481	1,496.83	224.41
1,480	1,284.90	200.98
1,479	1,095.93	178.62
1,475	559.66	91.50
1,471	339.27	56.38
1,456	6.38	2.61
1,445	0.00	0.00



Dam network

OPERATING RULE

The Vaal Dam, along with Grootdraai Dam, the Vaal Barrage, Bloemhof Dam (all on the Vaal River) and Sterkfontein Dam (on the Wilge River, a tributary of the Vaal River) form part of the Bloemhof Sub-system, which is part of the greater Integrated Vaal River System. Woodstock Dam and the Driel Barrage (situated in the Thukela River catchment), form the Thukela Transfer Scheme into the Vaal catchment.

The large scheme is operated as follows: The Thukela system supports Sterkfontein Dam until the dam is full. Grootdraai Dam does not support the Vaal Dam, but when the Vaal Dam is at 15% storage or less, Sterkfontein will begin to support it. Abstractions at Sedibeng and Midvaal make use of local runoff and spills from upstream dams. When this is not adequate, the Vaal Dam supports the abstractions. The Vaal Dam will only begin to support Bloemhof Dam when Bloemhof Dam reaches its minimum operating level (1,213.6 m).

The Vaal catchment also receives water from the Lesotho Highlands Water Project, in which 777 million m³/a is released from Katse Dam in Lesotho, to the Vaal Dam.

South Africa

VAALHARTS STORAGE WEIR

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
28° 06′ 55″ S	24° 55′ 33″ E

LOCATION

Vaalharts Weir is located in quaternary catchment C91B in the Lower Vaal Water Management Area in South Africa.

DESCRIPTION

Vaalharts Weir is a concrete buttress weir. It has a full supply level of 1,190.2 m, and the dead storage level and bottom of the reservoir are at 1,182.9 m.

Vaalharts Weir (source: SA Dept of Water Affairs)

PURPOSE

Vaalharts Weir provides water for irrigation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Vaalharts Storage Weir	Vaal	C91B	48.70	21.20	DWA	C9R001	12	765

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1957	Unknown	373.30 †	Unknown	Unknown	14,200

† DWA, Directorate of Hydrological Services correspondence, 2012

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,190.3	50.98	21.76
1,190.2	48.66	21.19
1,190.0	44.75	20.06
1,189.7	39.07	18.10
1,189.4	33.93	16.27
1,188.8	25.27	12.96
1,187.8	14.75	8.68
1,187.2	10.12	7.12
1,186.4	5.18	5.15
1,182.9	0.00	0.00

Vaalharts Storage Weir (© UNOPS/Leonie Marinovich)

South Africa

VANDERKLOOF DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 59′ 28″ S	24° 43′ 54″ E

LOCATION

Vanderkloof Dam is situated in the Free State on the Orange River (130 km downstream of Gariep Dam) in quaternary catchment D31E in South Africa.

DESCRIPTION

Vanderkloof Dam is a composite gravity arch dam. It has a central arch which transitions into a gravity flank on the left bank. Four sluice gates, which can in total discharge up to 20,400 m^3/s, are positioned on the left flank of the dam.

Vanderkloof Dam (© S Crerar)

PURPOSE

The dam supports requirements all the way to the mouth approximately 1,400 km away, including river-flow control, flood control, hydropower generation (Eskom) and storage of water for urban and irrigation use. The releases are primarily used for irrigation but also supply the urban requirements of Ritchie, Jacobsdal and Koffiefontein (including mining).

The dam, together with the Gariep Dam, forms an integral component of the Orange River Project and supplies water to the Riet River catchment as well as to the various users along the remaining 1,400 km of the Orange River. Water released from the Gariep Dam flows into Vanderkloof Dam where it is either transferred through the Orange–Riet Canal to the Riet River basin or released downstream. There are two hydropower generators at the dam which can collectively produce up to 240 MW of electricity at a discharge flow rate of 400 m^3/s (each generator 120 MW at 200 m^3/s). It was originally envisaged to extend the right bank canal, but due to economic factors it was decided not to proceed with the extension; it currently stops near Hopetown. All irrigation along the left bank between Vanderkloof Dam and Hopetown is supplied directly from the river using pumps.

Katse and Mohale dams do not support Vanderkloof Dam, only environmental flow releases and spills flow into Vanderkloof Dam. Vanderkloof and Gariep dams release water for the environmental flow requirements at the river mouth.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Vanderkloof	Orange	D31E	3,188.60	133.40	DWA	D3R003	108	765

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)
	Domestic*	Irrigation*	Other*	
1977	Unknown	4,848	Unknown	3,318

*The reservoir record for Vanderkloof shows three demands, namely: industry and town, power stations and mixed use. Industry and towns is relatively low and fairly constant – the 2009 hydrological year showed that 0.003 million m³ was abstracted. The power station's volume is available for downstream irrigation and varies considerably. The 2009 hydrological year gave 3,958 million m³ as having been released, but the amount varied between 2,124 million m³ (2004) and 7,004 million m³ (2005) over the last five years. The mixed use is denoted as missing throughout the reservoir record.
From 2010 AOA WRP Consulting Engineers Report (2010 demands, made up of South Africa and Namibia demands)

The yield result of 3,318 million m³/a represents a system yield of Vanderkloof and Gariep dams as they are operated as a system. This result can be broken down into the demands supplied by the dams (3,143 million m³/a) and the surplus yield obtained once those demands have been satisfied (175 million m³/a).

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,174.0	3,681.05	148.68
1,170.5	3,188.60	133.40
1,167.4	2,788.80	121.58
1,163.9	2,387.91	108.80
1,160.0	1,986.88	96.14
1,157.8	1,786.96	89.83
1,153.0	1,386.47	77.30
1,147.8	1,015.40	64.70
1,128.5	205.50	21.37
1,109.8	0.00	0.00

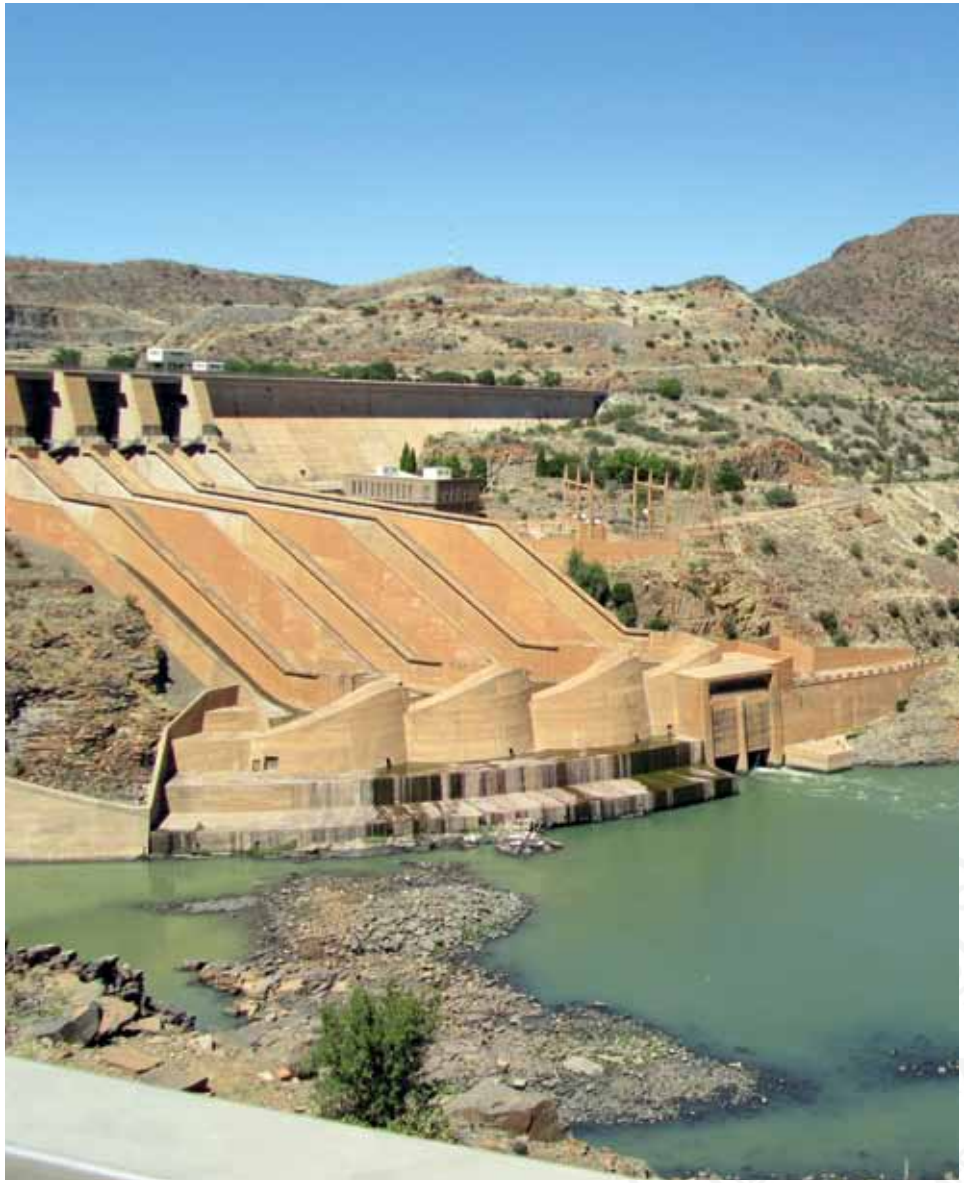
OPERATING RULE

The dam (along with Gariep Dam) works on an operating rule for hydropower which utilises releases to meet downstream requirements, for hydropower generation purposes. Eskom generates power according to downstream water requirements. Storage control curves are used to determine this rule, which utilises monthly water levels for operation. Once the level in the dam goes above a certain level, Eskom may open the hydropower turbines to utilise the water that would have otherwise spilled. This ensures minimum spillage and maximum usage of the flow.

Vanderkloof Dam is not supported at all by the Vaal River System, even the spills from the Vaal are not utilised downstream as the total demand for the Lower Orange is released from the Vanderkloof Dam (without taking the inflows/spills into account when releasing the flow). Katse and Mohale dams do also not support Vanderkloof Dam, only environmental flow releases and spills flow into Vanderkloof Dam. Due to the distance between Vanderkloof Dam and the location of abstraction points, water needs to be released two to six weeks in advance. The distance between Vanderkloof Dam and the river mouth is approximately 1,400 km and the flow takes roughly a month to reach the river mouth from the dam.

The Vanderkloof Dam inflow is highly regulated due to the upstream Gariep Dam, which is more dependent upon natural flows as it is far less regulated upstream. The inflow pattern for Vanderkloof is usually high in winter and low in summer.

Although the Fish River flows into the Orange River from Namibia, the confluence of the two rivers is too near the river mouth for the water to be usefully stored or even utilised along the lower Orange River. These demands are therefore satisfied by the Vanderkloof Dam.



Vanderkloof Dam (© Ian Cameron-Clarke)

South Africa

VANWYKSVLEI DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
30° 22′ 45″ S	21° 48′ 41″ E

LOCATION

Vanwyksvlei Dam is situated near the town of Vanwyksvlei in the Northern Cape Province, South Africa, and lies within quaternary D54C.

DESCRIPTION

Vanwyksvlei Dam was commissioned in 1882, and is an earth dam with a soil foundation. It has a full supply level of 1,700 m, and the dead storage level and bottom of the reservoir are at 1,671 m.

Vanwyksvlei Dam (source: SA Dept of Water Affairs)

PURPOSE

The dam was built to supply irrigation.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Vanwyksvlei	Vanwyksvlei	D54C	143.10	49.60	Vanwyksvlei Irrigation Board	D5R002	15	311

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1884	Unknown	Unknown	Unknown	Unknown	Unknown

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	171.72	55.34
1,700	143.10	49.61
1,696	114.48	43.39
1,690	85.86	36.51
1,680	57.24	28.62
1,675	28.62	18.88
1,671	0.00	0.00

OPERATING RULE

The Vanwyksvlei, Loxton, Modderpoort and Rooiberg dams are operated as a sub-system, known as the Hartbees River Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

South Africa

VICTORIA WEST DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
31° 24′ 08″ E	23° 05′ 58″ S

LOCATION

Victoria West Dam is located near the town of Victoria West, in quaternary catchment D61E in the Lower Orange Water Management Area in South Africa.

DESCRIPTION

Victoria West Dam is a concrete arch dam with a full supply level of 1,700 m, and the dead storage level and bottom of the reservoir are at 1,671 m.

Victoria West Dam (source: Hendri/www.panoramio.com)

PURPOSE

Victoria West Dam supplies a wastewater treatment works (domestic water supply).

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Victoria West	Dorpspruit	D61E	3.66	2.12	DWA	D6R001	25	133

* Live full supply capacity (SANCOLD, 2009)

Year of completion	Demands/abstractions (million m^3/a)			1:50 yield (million m^3/a)	Maximum spillway capacity (m^3/s)
	Domestic	Irrigation	Other		
1923	Unknown	Unknown	Unknown	Unknown	103

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,705	4.49	2.45
1,700	3.74	2.20
1,696	2.99	1.92
1,690	2.24	1.62
1,680	1.50	1.27
1,675	0.75	0.84
1,671	0.00	0.00

OPERATING RULE

The Victoria West and Smartt Syndicate dams are operated as a sub-system, known as the Ongers Sub-system. The operating rule for this sub-system allows the dams to supply the demands imposed upon them until the dams reach their respective minimum operating levels.

South Africa

WELBEDACHT DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
29° 54′ 32″ S	26° 51′ 38″ E

LOCATION

This dam is situated on the Caledon River near Wepener in the Free State in quaternary D23J, South Africa.

DESCRIPTION

The Welbedacht Dam is a concrete barrage-type dam. The dam has a full supply level of 1,402.9 m, with a dead storage level of 1,385.2 m and reservoir bottom at 1,383.2 m.

PURPOSE

Welbedacht Dam was constructed as the main storage element of the Caledon–Modder River Government Water Scheme (CMRGWS) and water is abstracted from this dam for transfer to Bloemfontein and various smaller users along the way. Its purpose was to supply water to the city of Bloemfontein via the 115-km-long Caledon–Bloemfontein pipeline which has a capacity of approximately 1.157 m^3/s. Due to the high sediment concentration in the water, the transfer from Welbedacht Dam is first purified at the Welbedacht Purification Plant which is located just downstream of the dam. The purification plant has a capacity of 1.68 m^3/s (145 Mℓ/day).

The storage capacity of the dam reduced from 115 million m^3 to approximately 16 million m^3 in only 20 years due to siltation. This impacted the assurance of supply to Bloemfontein and so Knellpoort Dam was constructed to augment the supply.

Welbedacht Dam (source: www.ewisa.co.za)

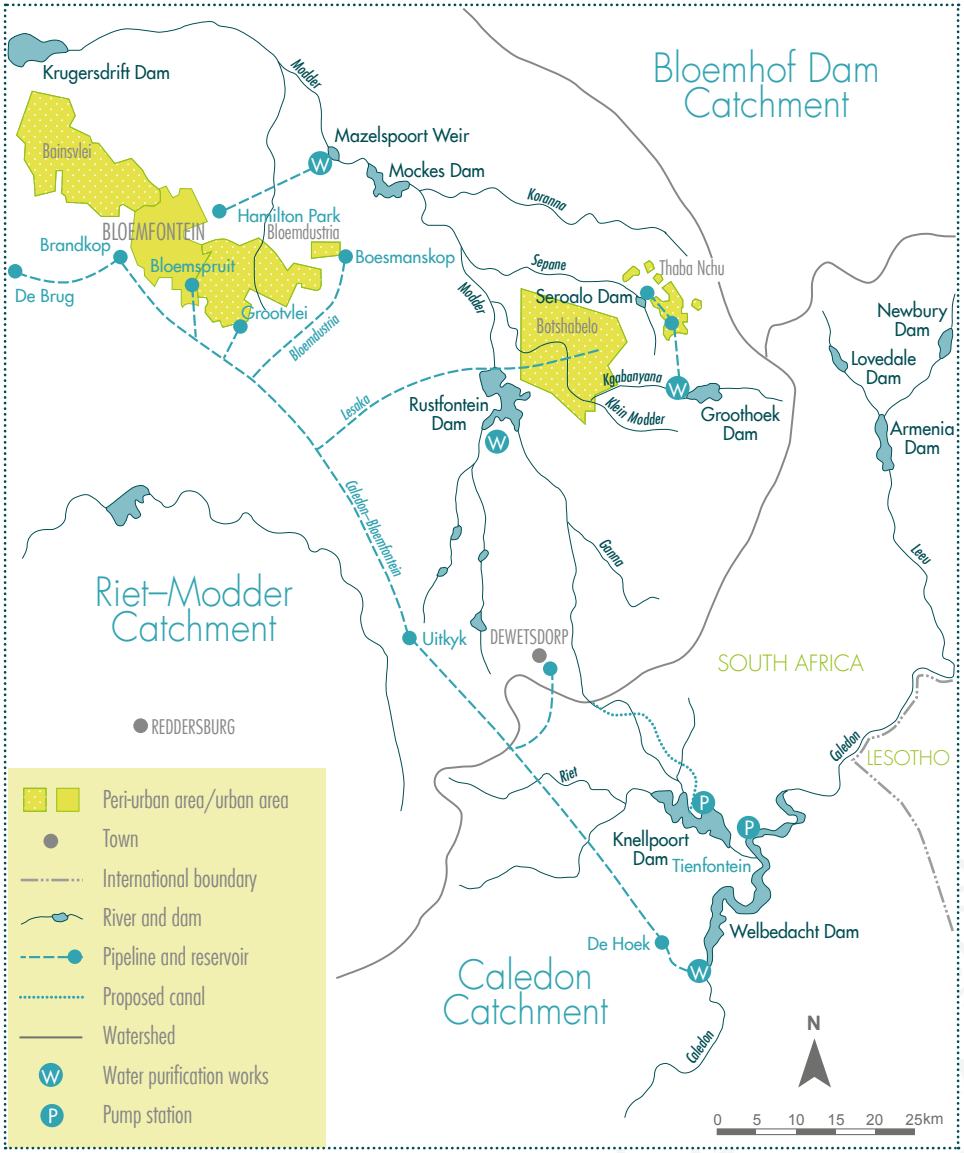
PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m³)	FSA (km²)	Owner	DWA code	Wall height (m)	Wall length (m)
Welbedacht	Caledon	D23J	15.47	11.75	DWA	D2R004	32	192

* Live full supply capacity (ORASECOM, 2007a, WRYM datasets and DWA, 1990)

Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1973	48.27 †	Unknown	1166 ‡	Unknown	5,310

† WRC, 2008
‡ Total outflow from the dam (WRC, 2008)



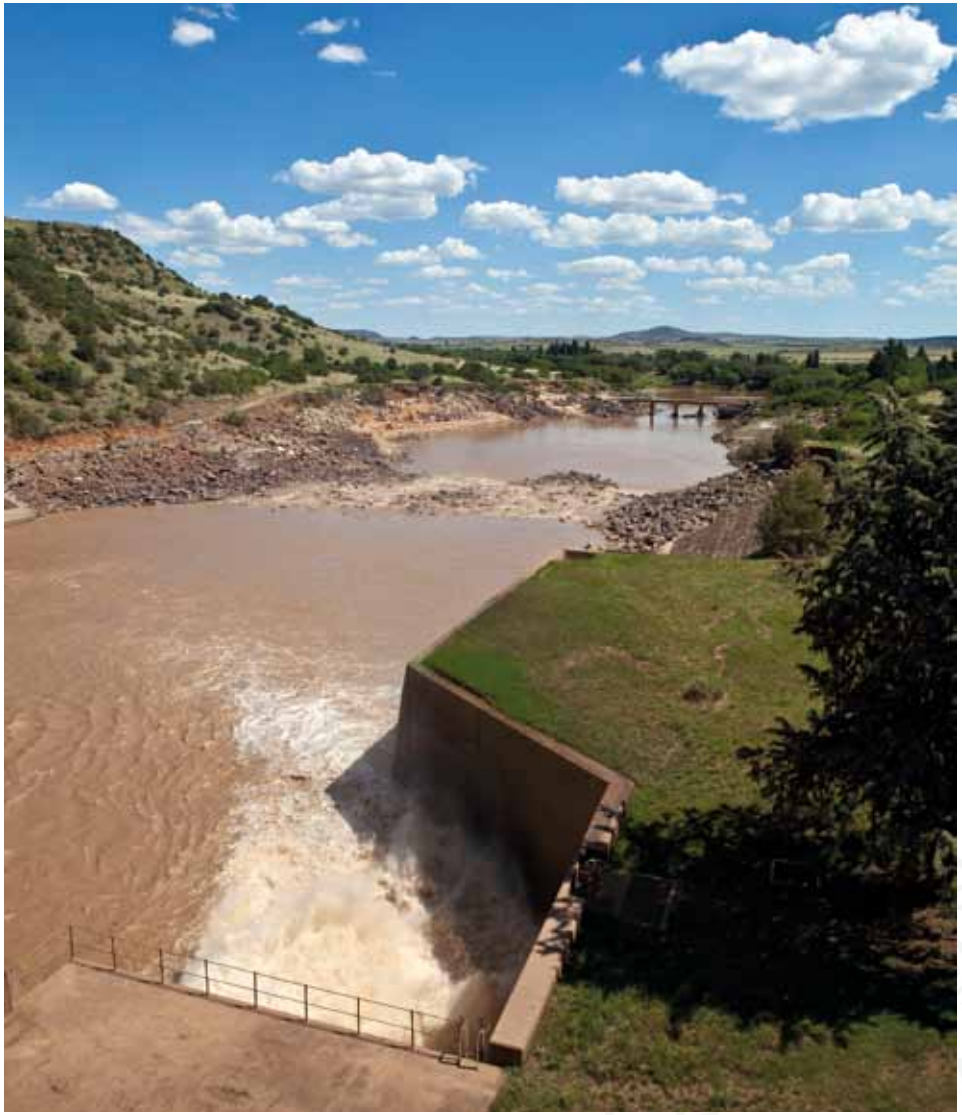
Caledon–Bloemfontein Government Water Scheme (adapted from ORASECOM, 2007a)

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m^3)	Surface area (km^2)
1,403.4	22.25	14.20
1,403.1	18.18	12.88
1,402.9	15.47	11.75
1,402.5	11.45	9.29
1,402.3	9.74	7.85
1,401.7	6.21	4.30
1,401.3	4.78	2.90
1,400.5	3.19	0.44
1,385.6	0.01	0.01
1,383.2	0.00	0.00

OPERATING RULE

Welbedacht Dam (along with Knellpoort Dam) supports the Modder system when there is insufficient water in the system, via the Caledon–Modder Transfer.



Welbedacht Dam is heavily silted (© UNOPS/Leonie Marinovich)

South Africa

WENTZEL DAM

COORDINATES (degrees, minutes, seconds)

LATITUDE	LONGITUDE
27° 10′ 24″ S	25° 20′ 10″ E

LOCATION

Wentzel Dam is located in quaternary catchment C31E in the Lower Vaal Water Management Area near Schweizer-Reneke in South Africa.

DESCRIPTION

Wentzel Dam is an earthfill dam.

PURPOSE

Wentzel Dam is used for domestic water supply for the town of Schweizer-Reneke. It has a full supply level of 1,297.7 m, and the dead storage level and bottom of the reservoir are at 1,291.3 m.

PHYSICAL INFORMATION

Dam name	River	Quaternary catchment	FSC* (million m^3)	FSA (km^2)	Owner	DWA code	Wall height (m)	Wall length (m)
Wentzel	Harts	C31E	6.56	2.99	DWA	Unknown	12	158

* Live full supply capacity (SANCOLD, 2009)

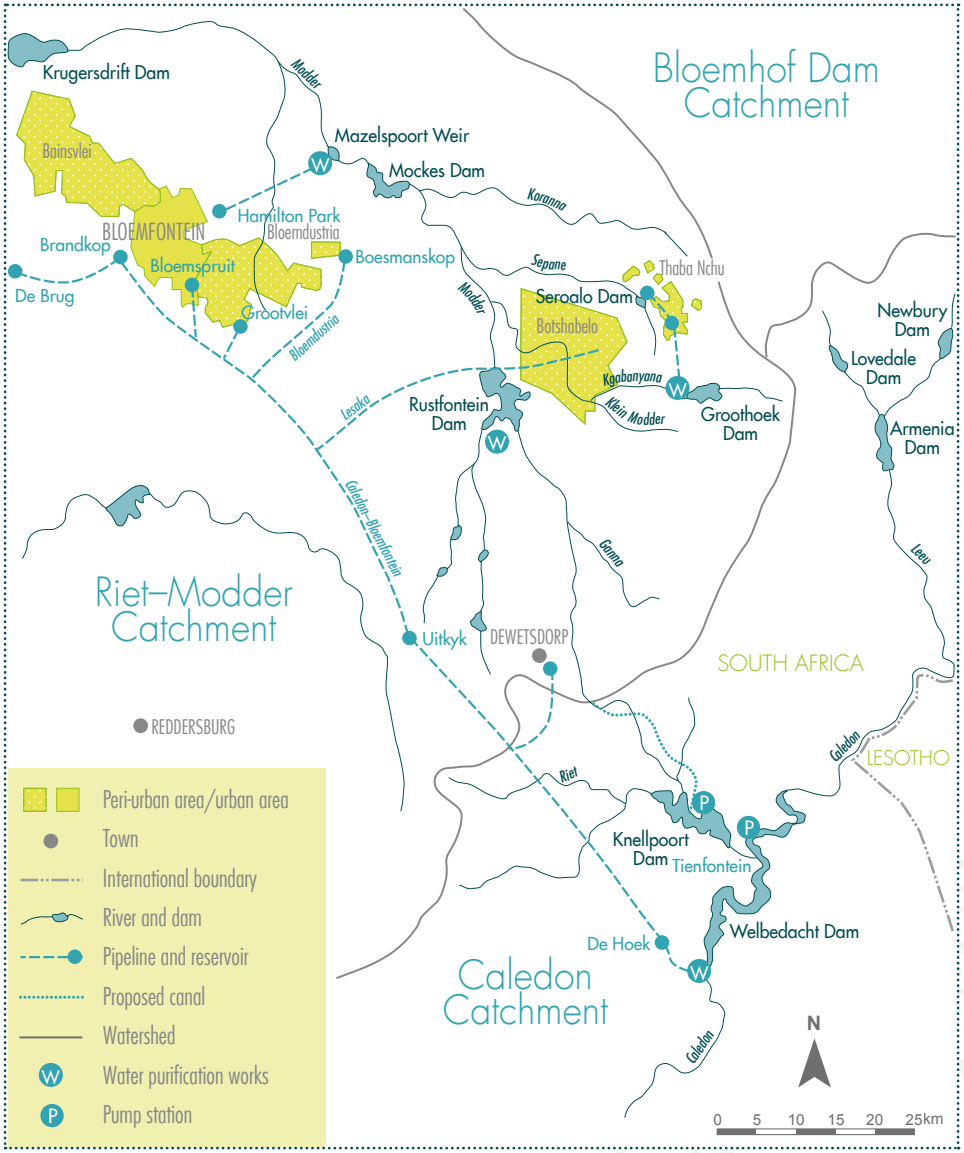
Year of completion	Demands/abstractions (million m³/a)			1:50 yield (million m³/a)	Maximum spillway capacity (m³/s)
	Domestic	Irrigation	Other		
1934	1.02	Unknown	Unknown	Unknown	895

AREA–CAPACITY RELATIONSHIP

Elevation (m)	Storage (million m³)	Surface area (km²)
1,297.9	7.10	3.12
1,297.7	6.58	2.99
1,297.4	5.62	2.75
1,297.1	4.84	2.53
1,296.5	3.46	2.08
1,296.2	2.87	1.86
1,295.7	2.04	1.51
1,295.2	1.38	1.18
1,294.5	0.69	0.81
1,291.3	0.00	0.00

OPERATING RULE

The dam is operated down to the dead storage level to supply the town.



Caledon–Bloemfontein Government Water Scheme (adapted from ORASECOM, 2007a)

STREAMFLOW GAUGES

South Africa

UPPER VAAL WMA

PHYSICAL INFORMATION

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
C1H002	Klip	C13E	Delangesdrift	27° 10′ 10″	29° 14′ 02″	4,152	288.79	1920	2004	Average
C1H004	Waterval	C12D	Roodebank	26° 37′ 37″	29° 01′ 29″	901	73.50	1960	2004	Average
C1H005	Leeuspruit	C11K	Welbedacht	26° 51′ 13″	29° 19′ 34″	341	18.10	1964	2004	Poor
C1H006	Blesbokspruit	C11H	Rietvlei	26° 46′ 32″	29° 32′ 22″	1,094	86.20	1964	2004	Good
C1H007	Vaal	C11J	Goedgeluk	26° 50′ 28″	29° 43′ 24″	4,686	321.50	1972	2004	Poor
C1H012	Vaal	C12C	Nooitgedacht	27° 00′ 08″	28° 45′ 55″	15,500	778.70	1985	2004	Good
C1R001	Vaal	C12L and C83M	Vaaldam	26° 53′ 00″	28° 07′ 00″	38,505	1,975.00	1936	2004	Average
C1R002	Vaal	C11L	Grootdraai	26° 55′ 05″	29° 17′ 42″	7,924	464.40	1978	2004	Good
C2H003	Vaal	C22F	Elandsfontein	26° 49′ 13″	28° 03′ 48″	38,698	1,536.20	1923	1992	Average
C2H004_A	Suikerbosrand	C21G	Uitvlugt	26° 40′ 15″	28° 01′ 50″	3,474	102.30	1952	1976	Average
C2H004_B	Suikerbosrand	C21G	Uitvlugt	26° 40′ 15″	28° 0′ 50″	3,474	244.80	1995	2004	Poor
C2H014	Taaibos Spruit	C22G	Verdun	26° 49′ 28″	27° 55′ 32″	825	11.90	1952	1976	Poor
C2H018	Vaal	C23C	Schoemansdrift	26° 58′ 13″	27° 12′ 40″	49,120	1,713.30	1938	2004	Good
C2H021	Klip	C22C	Witkop	26° 27′ 13″	28° 05′ 09″	1,726	203.50	1956	1994	Average
C2H070	Suikerbosrand	C21G	Platkoppie	26° 38′ 24″	28° 13′ 49″	3,124	86.80	1977	1994	Good
C2H085	Mooi	C23L	Hoogekraal	26° 52′ 50″	26° 57′ 51″	Unknown	127.70	1986	2004	Average
C2H122	Vaal	C12L and C83M	Annie's Rust	26° 51′ 13″	28° 07′ 17″	38,523	1,178.30	1980	2004	Good
C2H141	Klip	C22C	Witkop	26° 27′ 13″	28° 05′ 09″	1,726	338.90	1977	2003	Good
C2R003	Mooi	C23F	Klerkskraal	26° 15′ 09″	27° 09′ 38″	1,335	49.90	1969	2004	Good
C8H003	Cornelius	C82B	Warden	27° 50′ 34″	28° 56′ 42″	896	36.30	1953	2004	Average
C8H004	Liebenbergsvlei	C83F	De Molen	27° 42′ 00″	28° 19′ 18″	3,527	99.00	1965	1995	Average
C8H005	Elands	C81F	Elands River Drift	28° 22′ 32″	28° 51′ 42″	696	104.40	1963	2004	Poor
C8H006	Klerkspruit	C81G	Geduld	28° 17′ 45″	28° 48′ 20″	432	16.50	1964	1984	Average

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

UPPER VAAL WMA

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
C8H007	Liebenbergsvlei	C83A	Vogelfontein	28° 11′ 26″	28° 18′ 40″	868	20.00	1964	1977	Average
C8H009	Tierrivier	C83D	Tygerhoek	28° 03′ 13″	28° 29′ 33″	465	6.80	1971	2004	Poor
C8H010	Oubergspruit	C81C	Harrismith	28° 21′ 08″	29° 05′ 24″	250	22.00	1972	2004	Poor
C8H011	Elands	C81H	Killarney	28° 09′ 39″	28° 52′ 29″	1,485	140.70	1972	1997	Average
C8H012	Vaalbankspruit	C81J	Voorspoed	28° 04′ 58″	28° 52′ 20″	386	12.20	1971	2004	Average
C8H014	Wilge	C82C	Bavaria	27° 48′ 52″	28° 47′ 00″	7,497	827.00	1973	2001	Average
C8H022	Wilge	C83J	Slabberts	27° 14′ 44″	28° 29′ 20″	15,466	919.60	1961	2002	Average
C8H026	Liebenbergsvlei	C83H	Frederiksdal	27° 25′ 51″	28° 31′ 35″	4,650	363.20	1985	2003	Average
C8H027	Wilge	C82H	Ballingtomp	27° 18′ 05″	28° 35′ 08″	10,489	884.70	1985	2004	Average

Note:

Quality

<5% patched = Good

5<% patched <20 = Average

% patched >20 = Poor

Lesotho

SENQU

PHYSICAL INFORMATION

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
LESG03	Senqu	D18J	Seaka	30° 21′ 48″	27° 34′ 30″	19,875	3,881.74	1971	1987	Average
LESG05	Senqu	D17G	Koma-Koma	29° 34′ 24″	28° 42′ 06″	7,950	1,570.61	1966	1987	Poor
LESG06	Senqu	D16H	Mokhotlong	29° 17′ 18″	28° 59′ 18″	1,660	316.91	1967	1988	Average
LESG07	Tsoelike	D17K	Tsoelike	30° 01′ 30″	28° 43′ 24″	797	149.02	1963	1987	Average
LESG08	Malibamatso	D11J	Paray	29° 31′ 18″	28° 31′ 18″	3,240	799.87	1966	1987	Average
LESG17	Senqunyane	D17B	Marakabei	29° 33′ 43″	28° 09′ 28″	1,087	295.25	1965	1987	Average
LESG25	Hlotse	D21L	Leribe	28° 54′ 07″	28° 06′ 05″	989	284.18	1965	1974	Average
LESG32	Senqunyane	D17F	Nkau	30° 01′ 58″	28° 10′ 28″	3,480	621.09	1967	1979	Poor
LESG36	Khubelu	D16C	Tlokoeng	29° 14′ 06″	28° 53′ 30″	852	170.36	1969	1987	Poor
LESG41	Bokong	D11F	Bokong	29° 19′ 36″	28° 27′ 30″	403	116.33	1971	1987	Average
LESG42	Matsoku	D11H	Seshote's	29° 16′ 54″	28° 34′ 00″	652	116.73	1970	1987	Poor
LESG45	Pelaneng	Unknown	Malibamatso	29° 16′ 54″	28° 34′ 00″	Unknown	Unknown	1972	1987	Poor

Note:

Quality

<5% patched = Good

5<% patched <20 = Average

% patched >20 = Poor

Gauges D2H012, D2H035 and D2H037 are on the Caledon River, which forms the border between Lesotho and South Africa. Information for these is shown on the Upper Orange fact sheet.

There are other gauges in Lesotho that are either of very poor quality or are closed.

South Africa

UPPER ORANGE WMA

PHYSICAL INFORMATION

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km²)	Mean annual runoff (million m³/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
C5H008	Riet	C51B	Riviera	29° 48′ 44″	26° 12′ 44″	593	12.20	1958	1984	Poor
C5H012	Riet	C51B	Kromdraai	29° 39′ 29″	25° 58′ 24″	2,372	40.90	1953	2004	Poor
C5H016	Riet	C51L	Aucampshoop	28° 57′ 36″	24° 14′ 33″	33,351	221.20	1952	1998	Average
C5H018	Modder	C51K	Tweerivier	29° 02′ 36″	24° 38′ 27″	17,315	113.80	1959	1998	Good
C5R001	Kaffer	C51D	Tierpoort	29° 25′ 18″	26° 08′ 11″	922	21.47	1924	1977	Poor
C5R002	Riet	C51J	Kalkfontein	29° 29′ 49″	25° 13′ 17″	10,268	181.97	1937	2004	Poor
C5R003	Modder	C52A	Rustfontein	29° 16′ 15″	26° 37′ 00″	940	28.50	1955	2004	Poor
C5R004	Modder	C52G	Krugersdrift	28° 53′ 00″	25° 57′ 22″	6,315	121.43	1970	2004	Average
D1H001	Wonderboomspruit	D14E	Diepkloof	31° 00′ 03″	26° 21′ 11″	2,397	37.24	1920	2004	Good
D1H003	Orange	D12F	Aliwal North	30° 40′ 47″	26° 42′ 45″	37,075	4,478.64	1920	2004	Good
D1H004	Stormbergspruit	D14B	Molteno	31° 24′ 00″	26° 22′ 17″	348	6.13	1924	1965	Good
D1H005	Orange	D17L	White Hill	30° 02′ 49″	28° 30′ 26″	10,680	1,582.27	1932	1950	Good
D1H006	Kornetspruit	D15G	Maghaleen	30° 09′ 37″	27° 24′ 06″	2,969	513.49	1948	1994	Average
D1H009	Orange	Unknown	Oranjedraai	30° 20′ 10″	27° 21′ 34″	24,550	Unknown	1960	2004	Average
D1H011	Kraai	D13L	Roodewal	30° 49′ 50″	26° 55′ 17″	8,688	703.60	1965	2004	Average
D2H012	Klein Caledon	D21E	The Poplars	28° 41′ 45″	28° 14′ 09″	518	30.67	1968	2004	Poor
D2H035	Caledon	D22C	Ficksburg	28° 53′ 02″	27° 53′ 22″	3,857	484.21	1941	1954	Average
D2H037	Caledon	D23E	Wilgedraai	29° 36′ 34″	27° 03′ 52″	12,850	727.23	1993	2004	Poor
D2R001	Witspruit	D24A	Egmont	30° 03′ 08″	27° 01′ 43″	314	8.75	1937	2004	Good
D2R002	Leeu	D23C	Bethaven	29° 21′ 50″	27° 07′ 54″	858	18.36	1954	2004	Good
D2R004	Caledon	D23J	Welbedacht	29° 54′ 32″	26° 51′ 38″	15,245	1,196.04	1976	2004	Average
D3H002	Orange	D35B	Bethulie	30° 32′ 13″	25° 59′ 09″	65,615	7,539.85	1920	1969	Good
D3H003	Orange	D33E	Doornbult Uitspan	29° 38′ 45″	24° 12′ 15″	94,765	7,586.45	1920	1946	Good

From: *The Orange–Senqu River Basin Infrastructure Catalogue*, ORASECOM Report 001/2013

UPPER ORANGE WMA

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
D3H013	Orange	D35K	Roodepoort	30° 35′ 02″	25° 25′ 11″	70,897	6,706.40	1973	2003	Average
D3H015	Seekoei	D32J	De Eerstepoort	30° 32′ 03″	24° 57′ 43″	8,266	26.65	1980	2002	Good
D3R002	Orange	D35H	Gariep	30° 37′ 23″	25° 30′ 26″	70,749	6,454.16	1971	2004	Good
D3R003	Orange	D31E	Vanderkloof	29° 59′ 28″	24° 43′ 53″	89,842	4,875.87	1977	2004	Good

Note:

Quality

<5% patched = Good

5<% patched <20 = Average

% patched >20 = Poor

South Africa

MIDDLE VAAL WMA

PHYSICAL INFORMATION

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
C2H061	Vaal	C25C	Klipplaatdrift	27° 23′ 15″	26° 27′ 45″	79,903	1,938.70	1971	2004	Good
C2H066	Makwassie Spruit	C25D	Vliegekraal	27° 29′ 29″	26° 04′ 28″	1,101	8.20	1970	2004	Average
C2H067	Sandspruit	C25B	Leegte	27° 33′ 37″	26° 14′ 00″	1,895	2.20	1971	2002	Good
C2H073	Skoon Spruit	C42H	Goedgenoeg	26° 59′ 05″	26° 37′ 56″	5,969	95.30	1986	2004	Average
C4H004	Vet	C43B	Fizantkraal	27° 56′ 06″	26° 07′ 28″	16,153	222.90	1968	2004	Average
C4R001	Sand	C42E	Allemanskraal	28° 17′ 16″	27° 08′ 45″	3,665	78.10	1958	2004	Average
C4R002	Groot Vet	C41E	Erfenis	28° 30′ 27″	26° 46′ 42″	4,750	123.20	1959	2004	Average
C6H001	Vals	C60G	Roodewal	27° 26′ 29″	26° 59′ 11″	5,674	161.50	1947	2004	Average
C6H003	Vals	C60H	Bothaville	27° 24′ 00″	26° 37′ 29″	7,765	173.80	1966	2004	Average
C7H006	Renoster	C70J	Arriesrust	27° 02′ 40″	27° 00′ 18″	5,758	108.90	1977	2004	Average
C7R001	Renoster	C70C	Koppies	27° 15′ 29″	27° 40′ 27″	2,147	64.30	1937	2004	Poor
C9R002	Vaal	C25F and C43D	Bloemhof	27° 40′ 09″	25° 37′ 05″	107,911	2,101.00	1968	2004	Good

Note:

Quality

<5% patched = Good

5<% patched <20 = Average

% patched >20 = Poor

South Africa

LOWER VAAL WMA

PHYSICAL INFORMATION

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
C3H003	Harts	C31F	Taung	27° 34′ 23″	24° 44′ 47″	10,990	46.10	1938	2004	Average
C3H007	Espagsdrif	C33A	Harts	27° 54′ 12″	24° 36′ 55″	24,097	148.30	1951	2004	Average
C3R001	Harts	C31E	Schweizer-Reneke	27° 10′ 28″	25° 20′ 12″	2,919	58.50	1935	2003	Poor
C3R002	Harts	C33B	Spitskop	28° 07′ 26″	24° 30′ 05″	26,914	107.50	1990	2004	Good
C9H009	Vaal	C91E	De Hoop 65	28° 30′ 58″	24° 36′ 03″	121,052	1,341.40	1968	2004	Average
C9R001	Vaal	C91B	Vaalharts Weir	28° 06′ 55″	24° 55′ 33″	115,055	1,880.50	1947	2004	Good
C9R003	Vaal	C92B	Douglas Storage Weir	29° 02′ 37″	23° 50′ 11″	193,842	1,730.20	1958	2004	Poor

Note:

Quality

<5% patched = Good

5<% patched <20 = Average

% patched >20 = Poor

South Africa

LOWER ORANGE WMA (SOUTH AFRICA)

PHYSICAL INFORMATION

Gauge code	River	Quaternary catchment	Gauge name	Position		Catchment area (km^2)	Mean annual runoff (million m^3/a)	Start record	End record (available)	Quality
				Latitude	Longitude					
D5H011	Renoster	D51B	Bonekraal	31° 48′ 55″	20° 34′ 43″	1,658	9.43	1979	2004	Average
D5H017	Renoster	D58A	Leeuwenkuil	31° 26′ 13″	20° 28′ 29″	8,938	17.18	1987	2004	Poor
D5R001	Hartbees	D53A	Rooiberg	29° 24′ 00″	21° 12′ 22″	72,335	75.32	1933	1973	Good
D6R002	Ongers	D61K	Huisfontein	30° 36′ 42″	23° 18′ 00″	13,394	26.75	1965	2004	Good
D7H002	Orange	D72A	Prieska	29° 39′ 05″	22° 44′ 47″	337,590	7,520.65	1971	2004	Poor
D8H003	Orange	D82E	Vioolsdrift	28° 45′ 39″	17° 43′ 49″	462,870	6,758.61	1935	2004	Average

Note:

Quality

<5% patched = Good

5<% patched <20 = Average

% patched >20 = Poor

Namibia

LOWER ORANGE (NAMIBIA)

PHYSICAL INFORMATION

Station	Station name	Position		Start record	End record (available)	Station type
		Latitude	Longitude			
Direct drainage to Orange River						
0482M01	Ham at Tsamab	28° 7′ 48″	19° 15′ 30″	1970	Unknown	Weir
0483M01	Hom at Norechab	28° 31′ 12″	18° 58′ 12″	1970	1981	Weir
0483R01	Satco at Bondels Dam	28° 4′ 12″	18° 37′ 12″	1960	Unknown	Reservoir
0483R02	Hom at Dreihuk Dam	28° 0′ 36″	18° 37′ 12″	1978	Unknown	Reservoir
Fish River and tributaries						
0491M01	Fish at Gras	24° 10′ 12″	17° 21′ 6″	1970	1997	Weir
0491M02	Kam at Draaihoek	24° 10′ 48″	17° 1′ 12″	1976	Unknown	Weir
0491M03	Fish at Dirichas	24° 16′ 12″	17° 4′ 12″	1976	Unknown	Weir
0491M05	Schlip at Schlip	24° 3′ 18″	17° 0′ 36″	1974	1997	Open section
0491M06	Kam at Klein Aub	23° 0′ 48″	16° 0′ 36″	1973	2005	Weir
0492M01	Fish at Kranzplatz	25° 4′ 12″	17° 46′ 12″	1942	1969	Open section
0492M02	Packriem at Karris	24° 21′ 6″	17° 34′ 12″	1976	Unknown	Weir
0492R02	Fish at Hardap Dam	24° 52′ 12″	17° 51′ 6″	1962	Unknown	Reservoir
0493M01	Hutup at Rietkuil	25° 7′ 12″	17° 31′ 12″	1973	Unknown	Weir
0493M02	Lewer at Gelwater	25° 28′ 12″	17° 40′ 12″	1975	1998	Open section
0493M03	Hutup at Breckhorn	24° 49′ 12″	17° 10′ 12″	1978	Unknown	Weir
0493M04	Lewer at Bo Lewer	25° 1′ 12″	17° 37′ 12″	1979	1997	Open section
0494M01	Kanibes at Kanibes	25° 46′ 12″	17° 0′ 48″	1977	1981	Open section
0495M01	Asab at Asab	25° 46′ 12″	18° 1′ 12″	1977	1998	Open section
0496M01	Fish at Seeheim	26° 0′ 48″	17° 46′ 48″	1961	Unknown	Weir
0496M02	Fish at Tses	25° 0′ 24″	17° 58′ 12″	1975	Unknown	Weir
0496R02	Aub at Merensky Dam	26° 31′ 12″	18° 4′ 12″	1987	Unknown	Reservoir
0497M01	Löwen at Naute River	26° 55′ 48″	17° 58′ 12″	1961	1970	Open section
0497M02	Löwen at Aikanes	26° 52′ 12″	18° 0′ 36″	1970	1981	Weir
0497M03	Löwen at Altdorn	26° 0′ 48″	18° 13′ 12″	1975	Unknown	Weir

LOWER ORANGE (NAMIBIA)

Station	Station name	Position		Start record	End record (available)	Station type
		Latitude	Longitude			
0497M05	Löwen at Geduld	26° 46′ 12″	18° 28′ 12″	1975	Unknown	Weir
0497R01	Löwen at Naute Dam	26° 55′ 12″	17° 55′ 48″	1971	Unknown	Reservoir
0498M01	Konkiep at Konkiep	26° 43′ 12″	17° 13′ 12″	1969	1972	Open section
0498M02	Konkiep at Bethanien	26° 25′ 48″	17° 7′ 12″	1973	Unknown	Open section
0498M03	Konkiep at Mooifontein Tower	25° 58′ 12″	16° 58′ 12″	1977	1988	Open section
0498M04	Konkiep at Mooifontein Weir	26° 15′ 36″	16° 58′ 12″	1979	Unknown	Weir
0499M02	Fish at Ai-Ais	27° 55′ 12″	17° 0′ 18″	1975	Unknown	Weir
0499M03	Gab at Holoog	27° 25′ 48″	17° 58′ 12″	1979	Unknown	Weir
Nossob River and tributaries						
3111M01	Black Nossob at Henopsrus	22° 7′ 48″	18° 49′ 12″	1970	Unknown	Weir
3111M02	Black Nossob at Mentz	23° 7′ 12″	18° 40′ 48″	1973	Unknown	Weir
3111R01	Daan Viljoen Dam	22° 25′ 12″	18° 55′ 48″	1971	Unknown	Reservoir water level
3111R02	Tilda Viljoen Dam	22° 25′ 12″	18° 55′ 48″	1971	Unknown	Reservoir water level
3112M01	White Nossob at Otjivero	22° 16′ 12″	17° 55′ 48″	1969	1982	Weir
3112M02	White Nossob at Amasib	23° 4′ 12″	18° 37′ 48″	1973	Unknown	Weir
3112R01	White Nossob at Otjivero Silt Dam	22° 0′ 48″	17° 56′ 24″	1982	Unknown	Reservoir
3112R02	White Nossob at Otjivero Main Dam	22° 16′ 48″	17° 57′ 42″	1984	Unknown	Reservoir
3113M01	Nossob at Leonardville	23° 34′ 12″	18° 46′ 12″	1975	1998	Open section
Auob River and tributaries						
3121M01	Oanob at Rehoboth	23° 0′ 18″	17° 3′ 18″	1970	1996	Weir
3121M02	Oanob at Oanob Bridge	23° 0′ 18″	17° 3′ 18″	1985	1989	Open section
3121M11	Swartmodder at Swartmodder	23° 22′ 48″	17° 0′ 36″	1990	Unknown	Open section
3121R01	Oanob at Oanob Dam	23° 19′ 48″	17° 4′ 12″	1990	Unknown	Reservoir
3122M01	Usib at Nauaspoort	23° 4′ 12″	17° 10′ 48″	1970	Unknown	Weir
3122R01	Tsumis at Tsumis Park Dam	23° 37′ 48″	17° 25′ 12″	1976	1979	Reservoir water level
3122R02	Usib at Nauaspoort Dam	23° 3′ 18″	17° 13′ 12″	1980	Unknown	Reservoir water level
3123M01	Schaf at Hatsamas	22° 52′ 48″	17° 34′ 12″	1975	1998	Open section
3124M01	Auob at Gochas	25° 1′ 12″	18° 52′ 48″	1973	Unknown	Open section
3124M02	Auob at Stampriet	24° 19′ 12″	18° 25′ 48″	1977	Unknown	Open section
3125M01	Seeis at Ondekaremba	22° 28′ 12″	17° 25′ 12″	1978	Unknown	Weir
3125M02	Johannestal at Neudamm Spillway	22° 28′ 12″	17° 19′ 12″	1973	1983	Weir
3125R01	Seeis at Ondekaremba Dam	22° 28′ 48″	17° 25′ 12″	1973	1978	Reservoir water level
3125R02	Johannestal at Neudamm	22° 0′ 18″	17° 0′ 48″	1973	Unknown	Reservoir water level
3126M01	Olifants at De Duine	22° 52′ 12″	17° 55′ 48″	1977	1998	Open section

Botswana

MOLOPO–NOSSOB (BOTSWANA)

There are no streamflow gauges in the part of Botswana which falls within the Orange–Senqu basin, i.e. the southern part of Botswana.

PURIFICATION WORKS

South Africa

UPPER VAAL WMA

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Balfour	26° 39′ 19″	28° 35′ 21″	Unknown	Unknown	Balfour Dam
Bethlehem	31° 42′ 22″	35° 12′ 09″	40.00 D	Municipality	Saulspoort Dam
Camden Power Station	36° 38′ 39″	30° 28′ 45″	Unknown	Unknown	Jericho Dam
Cornelia (Frankfort WTW)	27° 13′ 60″	28° 51′ 02″	Unknown	Municipality	Wilge River
Deneysville	26° 53′ 40″	28° 05′ 53″	Unknown	Municipality	Vaal Dam
Ermelo	26° 31′ 03″	29° 59′ 03″	Unknown	Unknown	Dams
Eskom Lethabo Power Station	Unknown	Unknown	Unknown	Unknown	Vaal Barrage
Frankfort	27° 16′ 57″	28° 31′ 01″	Unknown	Municipality	Wilge River
Grootvlei Power Station (mothballed)	26° 45′ 44″	28° 29′ 49″	Unknown	Unknown	Vaal Dam
Harrismith	28° 16′ 57″	29° 07′ 60″	10.00 D	Harrismith TLC	Sterkfontein Dam, Gibson Dam, Wilge River
Iscor Klip Works	Unknown	Unknown	Unknown	Unknown	Vaal Barrage
Iscor Vaal Works	Unknown	Unknown	Unknown	Unknown	Vaal Barrage
Iscor Vanderbijl Works	Unknown	Unknown	Unknown	Unknown	Vaal Barrage
Kestell	28° 18′ 46″	28° 42′ 31″	Unknown	Sedibeng Water	Boreholes
Majuba Power Station	27° 04′ 44″	29° 46′ 51″	Unknown	Unknown	Zaaihoek Dam
Memel	27° 40′ 57″	29° 33′ 60″	Unknown	Municipality	Boreholes
Parys	26° 53′ 50″	27° 27′ 17″	12.50 D	Municipality	Vaal River
Potchefstroom	26° 42′ 47″	27° 05′ 48″	Unknown	Municipality	Mooi River
Sasolburg	26° 49′ 07″	27° 50′ 27″	Unknown	Rand Water	Vaal Dam
Reitz	27° 48′ 02″	28° 25′ 55″	Unknown	Municipality	Geluk Dam, De Mollen, Reward Dam, Gryp Dam
Sasol I	26° 45′ 52″	27° 41′ 30″	Unknown	Unknown	Vaal Barrage
Sasol II and III	26° 54′ 15″	29° 18′ 26″	Unknown	Unknown	Grootdraai Dam
Standerton	26° 56′ 48″	29° 14′ 47″	Unknown	Unknown	Vaal River
Tutuka Power Station	26° 46′ 26″	29° 20′ 19″	Unknown	Unknown	Grootdraai Dam
Tweeling	27° 33′ 04″	28° 31′ 21″	0.96 D	Municipality	Unknown
Tubemakers Stuart and Lloyd	26° 45′ 52″	27° 41′ 30″	Unknown	Unknown	Vaal Barrage
Villiers	27° 01′ 42″	28° 36′ 53″	3.50 D	Municipality	Vaal River
Vrede	27° 25′ 46″	29° 09′ 35″	Unknown	Unknown	Vrede Dam, new dam on the Spruitsonderdrif
Warden	27° 50′ 59″	28° 57′ 60″	2.59 D	Municipality	Warden

Note:

D Design

Unknown The data was not available in the existing reports used to obtain information. Where source of water is unknown, the source is generally local rivers.

These coordinates are not exactly those of the purification works, but of the nearby town.

(Source: DWA, 2002a)

Lesotho

SENQU

Purification works name	Position		Capacity (Mℓ/d)
	Latitude	Longitude	
Butha Buthe	28° 47′ 33″	28° 31′ 55″	0.60
Leribe	28° 59′ 50″	28° 20′ 19″	2.50
Mafeteng	29° 48′ 59″	27° 15′ 02″	2.60
Mapoteng	24° 38′ 32″	29° 38′ 32″	0.20
Maseru	29° 18′ 30″	27° 29′ 32″	65.00
Mohale's Hoek	30° 04′ 52″	27° 47′ 03″	0.80
Mokhotlong	29° 17′ 19″	29° 03′ 57″	0.70
Morija	29° 37′ 46″	27° 30′ 48″	0.10
Qacha's Nek	30° 06′ 59″	28° 41′ 00″	0.20
Quthing	30° 23′ 59″	27° 42′ 02″	0.30
Roma	29° 26′ 52″	27° 43′ 22″	0.44
Teyateyaneng	29° 09′ 03″	27° 44′ 32″	1.20
Thaba-Tseka	29° 29′ 50″	28° 34′ 31″	0.40

UPPER ORANGE WMA

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Bethulie	30° 31′ 21″	26° 03′ 39″	4.00 D	Municipality	Orange River, boreholes
Botshabelo	29° 13′ 58″	26° 43′ 59″	100.00 D	Bloem Water	Rustfontein Dam
Brandford	Unknown	Unknown	Unknown	Municipality	Sand–Vet Government Water Scheme
Clarens	28° 30′ 60″	28° 24′ 60″	1.00 %	Municipality	Clarens and Gryp dams
Clocolan	28° 54′ 00″	27° 34′ 01″	3.46 D	Municipality	Moperri Dam
Fauresmith	29° 45′ 23″	25° 18′ 48″	Unknown	Municipality	Jagersfontein, boreholes
Ficksburg	28° 52′ 21″	27° 52′ 42″	Unknown	Municipality	Meulspruit Dam
Gariep Dam	30° 37′ 23″	25° 30′ 24″	Unknown	Bloem Water	Gariep Dam
Hobhouse	29° 31′ 53″	29° 09′ 37″	Unknown	Municipality	Armenia Dam
Jacobsdal	29° 07′ 42″	24° 46′ 22″	960.00 D	Municipality	Kalkfontein Dam, boreholes
Jagersfontein	29° 46′ 21″	25° 26′ 33″	Unknown	Municipality	Boreholes
Koffiefontein	29° 24′ 37″	25° 00′ 07″	Unknown	Municipality	Riet River Government Water Scheme
Ladybrand (Genoe WTW)	29° 11′ 38″	27° 27′ 38″	0.60 D	Municipality	Caledon River, Cathcart Drift Dam
Luckoff	34° 20′ 36″	19° 00′ 43″	0.44 D	Municipality	Orange–Riet Canal
Oppermans	29° 24′ 11″	24° 44′ 25″	0.03 %	Municipality	Boreholes
Reddersburg	29° 39′ 10″	26° 10′ 11″	0.47 D	Bloem Water	Welbedacht Dam
Rosendal	28° 29′ 59″	27° 54′ 61″	Unknown	Municipality	Rosendal Dam
Rouxville	30° 24′ 56″	26° 49′ 60″	Unknown	Municipality	Kalkoenkrans Dam, boreholes
Smithfield	30° 12′ 44″	26° 31′ 54″	1.40 D	Municipality	Smith Dam, boreholes
Thaba Nchu (Moutloatsi)	29° 11′ 59″	26° 49′ 60″	18.0 D	Bloem Water	Moutloatsi Dam, Rustfontein Dam, boreholes
Thaba Patchoa	29° 19′ 21″	27° 06′ 53″	Unknown	SA Dept of Water Affairs	Armenia Dam, boreholes
Trompsburg	30° 01′ 60″	25° 46′ 50″	Unknown	Bloem Water	Gariep Dam
Tweespruit	29° 11′ 15″	27° 01′ 61″	1.00 %	Municipality	Lovedale Dam
Vanstadensrus	29° 59′ 13″	27° 00′ 11″	Unknown	Municipality	Boreholes
Wepener	29° 43′ 58″	27° 02′ 31″	Unknown	Bloem Water	Welbedacht Dam, boreholes
Welbedacht	29° 51′ 56″	26° 52′ 11″	145.00 D	Municipality	Welbedacht Dam
Zastron	30° 18′ 14″	27° 05′ 37″	Unknown	Municipality	Kloof Dam, Montagu Dam

Note:

D Design

% Operational capacity

Unknown The data was not available in the existing reports used to obtain information. Where source of water is unknown, the source is generally local rivers.

These coordinates are not exactly those of the purification works, but of the nearby town.

(Source: DWA, 2002d)

South Africa

MIDDLE VAAL WMA

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Arlington	28° 01′ 60″	27° 50′ 60″	0.29 D	Municipality	Dam, boreholes
Bultfontein	28° 17′ 39″	26° 09′ 29″	Unknown	Municipality	Luipaardvlei Dam, boreholes
Edenville	27° 32′ 58″	27° 39′ 60″	Unknown	Municipality	Boreholes
Excelsior	28° 56′ 22″	27° 03′ 55″	1.00 D	Municipality	Gryp Dam, boreholes
Heilbron	27° 16′ 60″	27° 58′ 05″	2.00 D	Municipality	Lang Dam
Hoopstad	27° 49′ 58″	25° 54′ 60″	4.25 D	Municipality	Vet River
Klerksdorp	26° 51′ 57″	26° 39′ 29″	Unknown	Municipality	Vaal River
Koppies	27° 13′ 57″	27° 35′ 00″	2.80 D	Municipality	Koppies Dam
Kroonstad	27° 38′ 56″	27° 13′ 59″	60.00 D	Municipality	Vals River Dam
Leeudoringstad	27° 13′ 60″	26° 14′ 00″	Unknown	Midvaal WC	Boreholes
Lindley	27° 53′ 02″	27° 55′ 41″	3.00 D	Municipality	Piekniekdraai Dam, Vals River
Marquard	28° 39′ 59″	27° 26′ 00″	168.00 D	Municipality	Marquard Dam, Laaispruit Dam
Petrus Steyn	27° 38′ 59″	28° 07′ 60″	1.00 D	Municipality	Middelpunt Dam, boreholes
Orkney	26° 58′ 41″	26° 40′ 08″	Unknown	Midvaal WC	Vaal River
Snekal	29° 50′ 49″	26° 04′ 59″	9.00 D	Municipality	Cyferfontein Dam, De Put Dam
Steynsrus	27° 57′ 02″	27° 33′ 50″	3.00 D	Municipality	Steynsrus Dam, Catch Dam, boreholes
Stilfontein	26° 50′ 30″	26° 46′ 28″	Unknown	Midvaal WC	Vaal River
Theunissen	28° 24′ 16″	26° 42′ 36″	8.88 D	Municipality	Erfenis Dam
Verkeerdevlei	28° 49′ 58″	26° 47′ 01″	0.60 D	Municipality	Unknown
Viljoenskroon	27° 12′ 42″	26° 57′ 21″	5.00 D	Municipality	Rhenoster River
Virginia	28° 05′ 40″	26° 52′ 51″	Unknown	Municipality	Allemanskraal Dam
Vredefort	26° 59′ 46″	27° 22′ 14″	2.40 D	Municipality	Unknown
Welkom	27° 58′ 26″	26° 44′ 03″	Unknown	Sedibeng Water	Vaal River
Wesselsbron	27° 50′ 23″	26° 21′ 37″	3.40 D	Sedibeng Water	Unknown
Winburg	28° 31′ 13″	27° 01′ 24″	2.46 D	Municipality	Roetfontein Dam, Wolwas Dams 1 and 2, Laaispruit
Wolmaranstad	27° 10′ 47″	25° 57′ 29″	Unknown	Sedibeng Water	Makwassiespruit, boreholes

Note:

D Design

Unknown The data was not available in the existing reports used to obtain information. Where source of water is unknown, the source is generally local rivers.

These coordinates are not exactly those of the purification works, but of the nearby town.

(Source: DWA, 2002b)

LOWER VAAL WMA

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Hartswater	27° 45′ 15″	24° 49′ 36″	Unknown	Unknown	Vaalharts canals
Jan Kempdorp	27° 55′ 03″	24° 50′ 20″	Unknown	Pokwane Municipality	Vaalharts canals
Kimberley (Riverton)	28° 43′ 40″	24° 45′ 16″	43.20 D	Unknown	Vaal River
Pampierstad	27° 46′ 48″	24° 41′ 46″	Unknown	Unknown	Vaalharts canals
Pudimoe (for towns/settlements Taung and Naledi)	27° 23′ 29″	24° 42′ 48″	Unknown	Naledi and Greater Taung Municipalities	Vaalharts canals
Schweizer-Reneke	27° 10′ 57″	25° 19′ 60″	Unknown	Unknown	Harts River
Vaal–Gamagara Scheme for towns Postmasburg, Sishen, Hotazel, Black Rock, Olifantshoek	28° 19′ 33″	23° 04′ 15″	36.37	Unknown	Vaal River

Note:

D Design

Unknown The data was not available in the existing reports used to obtain information. Where source of water is unknown, the source is generally local rivers.

These coordinates are not exactly those of the purification works, but of the nearby town.

(Source: ORASECOM, 2007a)

LOWER ORANGE WMA (SOUTH AFRICA)

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Aggeneys	29° 12′ 26″	18° 50′ 46″	No information	No information	No information
Alexander Bay	28° 36′ 16″	16° 29′ 14″	No information	No information	No information
Askham	26° 58′ 59″	20° 46′ 10″	No information	No information	No information
Augrabies	28° 40′ 22″	20° 25′ 42″	No information	No information	No information
Black Mountain	29° 15′ 39″	18° 49′ 30″	No information	No information	No information
Brandvlei/Jonkerskop	30° 27′ 59″	20° 29′ 05″	No information	No information	No information
Britstown	30° 35′ 39″	23° 30′ 08″	No information	No information	No information
Carnarvon	30° 58′ 08″	22° 07′ 38″	No information	No information	No information
Concordia	29° 32′ 23″	17° 56′ 37″	No information	No information	No information
Copperton/Proteapark	29° 55′ 43″	22° 18′ 20″	No information	No information	No information
De Aar/Bellary	30° 39′ 35″	24° 00′ 47″	No information	No information	No information
Douglas	29° 03′ 28″	23° 46′ 11″	No information	No information	No information
Eksteenskuil	28° 42′ 20″	21° 01′ 46″	No information	No information	No information
Fraserburg	31° 54′ 50″	21° 30′ 49″	No information	No information	No information
Garies	30° 34′ 19″	17° 59′ 16″	No information	No information	No information
Griekwastad	28° 50′ 49″	23° 15′ 02″	No information	No information	No information
Groblershoop Upington Louisvale/Oranjevallei	28° 54′ 08″	21° 59′ 01″	No information	No information	No information
Henkries	18° 05′ 49″	28° 58′ 22″	10.00	Namakwa Water	Orange River
Hondeklipbaai	30° 19′ 15″	17° 17′ 15″	No information	No information	No information
Hutchinson	31° 29′ 51″	23° 11′ 21″	No information	No information	No information
Kakamas/Lutzburg/Cillie	28° 44′ 44″	20° 37′ 46″	No information	No information	No information
Kamieskroon	30° 13′ 11″	17° 55′ 26″	No information	No information	No information
Kanoneiland	28° 39′ 18″	21° 05′ 05″	No information	No information	No information
Karos-Geelkoppen	No information	No information	No information	Karos-Geelkoppen Water Board	Orange River
Keimoes/Tierberg	28° 43′ 16″	20° 59′ 18″	No information	No information	No information
Kenhardt	29° 20′ 51″	21° 09′ 20″	No information	No information	No information
Kharkams	30° 22′ 08″	17° 53′ 14″	No information	No information	No information
Kleinzee	29° 40′ 39″	17° 01′ 49″	No information	No information	No information
Klippunt	28° 34′ 42″	21° 08′ 57″	No information	No information	No information

LOWER ORANGE WMA (SOUTH AFRICA)

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Koingnaas (De Beers Mine)	30° 11′ 60″	17° 17′ 01″	No information	No information	No information
Komaggas	29° 47′ 47″	17° 29′ 15″	No information	No information	No information
Kuboes	28° 26′ 56″	16° 59′ 34″	No information	No information	No information
Lime Acres	26° 02′ 46″	28° 06′ 26″	No information	No information	No information
Loxton	31° 28′ 42″	22° 20′ 47″	No information	No information	No information
Marchand	28° 43′ 56″	20° 30′ 05″	No information	No information	No information
Marydale	29° 24′ 39″	22° 06′ 10″	No information	No information	No information
Matjieskloof/Simonsig	29° 39′ 37″	17° 53′ 47″	No information	No information	No information
Mier	26° 17′ 15″	20° 16′ 54″	No information	No information	No information
Nababeep	29° 35′ 33″	17° 47′ 02″	No information	No information	No information
Niekerkshoop	29° 19′ 18″	22° 50′ 09″	No information	No information	No information
Okiep	29° 35′ 43″	17° 52′ 51″	No information	No information	No information
Onseepkans	28° 44′ 59″	19° 18′ 02″	No information	No information	No information
Pella	29° 01′ 42″	19° 09′ 01″	No information	No information	No information
Pelladrift	No information	No information	Unknown (assumed 5.16)	Pella Water Board	Orange River
Pofadder	29° 07′ 43″	19° 23′ 36″	No information	No information	No information
Port Nolloth	29° 14′ 34″	16° 52′ 50″	No information	No information	No information
Prieska	29° 40′ 06″	22° 44′ 38″	15.00	Siyathemba Municipality	Orange River
Richmond	29° 52′ 28″	30° 16′ 38″	No information	No information	No information
Springbok/Bergsig	29° 39′ 57″	17° 53′ 02″	No information	No information	No information
Steinkopf	29° 15′ 36″	17° 44′ 03″	No information	No information	No information
Strydenburg	29° 56′ 23″	23° 39′ 45″	No information	No information	No information
Sutherland	32° 23′ 31″	20° 29′ 20″	No information	No information	No information
Upington Municipality	21° 15′ 39″	28° 27′ 02″	60.00	Kharahais Water Board	Orange River
Vanwyksvlei	30° 20′ 44″	21° 49′ 30″	No information	No information	No information
Victoria West	31° 24′ 08″	23° 07′ 14″	No information	No information	No information
Vioolsdrift	28° 46′ 30″	17° 37′ 30″	No information	No information	No information
Vosburg	30° 34′ 33″	22° 52′ 35″	No information	No information	No information
Westerberg/Koegasburg	29° 17′ 37″	22° 22′ 49″	No information	No information	No information
Williston	31° 20′ 59″	20° 54′ 59″	No information	No information	No information

Note:

D Design

Unknown Data was not available in the existing reports used to obtain information. Where source of water is unknown, the source is generally local rivers.

These coordinates are not exactly those of the purification works, but of the nearby town.

(Source: ORASECOM, 2007a)

LOWER ORANGE (NAMIBIA)

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source
	Latitude	Longitude			
Aussenkehr	Unknown	Unknown	Unknown	Unknown	Unknown
Gobabis	Unknown	Unknown	Unknown	Unknown	Unknown
Hardap	Unknown	Unknown	Unknown	Unknown	Unknown
Karasburg	Unknown	Unknown	Unknown	Unknown	Unknown
Naute	Unknown	Unknown	Unknown	Unknown	Unknown
Noordoewer	Unknown	Unknown	Unknown	Unknown	Unknown
Oanob	Unknown	Unknown	Unknown	Unknown	Unknown
Rosh Pinah	Unknown	Unknown	Unknown	Unknown	Unknown

Source: Ministry of Agriculture, Water and Forestry

MOLOPO–NOSSOB (BOTSWANA)

Purification works name	Position		Capacity (Mℓ/d)	Owner/operator	Raw water source*
	Latitude	Longitude			
Bokspits Treatment Plant	26° 55′ 35″	20° 40′ 18″	0.38	Water Utilities Company	BH 6192, BH 9679
Hunhukwe Treatment Plant	23° 24′ 43″	21° 36′ 34″	0.24	Water Utilities Company	BH 8547, BH 8548
Khawa Treatment Plant	26° 16′ 58″	21° 22′ 5″	0.10	Water Utilities Company	BH 7429
Khuis Treatment Plant	26° 39′ 27″	21° 50′ 19″	0.41	Water Utilities Company	BH 10696, BH 8822, BH 10701, BH 10697
Ngwatle Treatment Plant	23° 41′ 52″	21° 4′ 54″	0.10	Water Utilities Company	BH 9218
Tsabong Treatment Plant	26° 01′ 12″	22° 24′ 20″	0.72	Water Utilities Company	BH 9088, BH 5089, BH 9397, BH 9441, BH 9442

Source: Personal communication Lesego Raditsebe, Botswana Water Utilities Company

* BH = borehole

WASTEWATER WORKS

South Africa

UPPER VAAL WMA

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Ancor WCW	28° 28′ 57″	26° 15′ 58″	13.50	Biofilters and activated sludge	Discharge into the Blesbokspruit
Benoni WCW	28° 18′ 53″	26° 12′ 37″	18.00	Activated sludge	Discharge into the Benoni Canal
Bethal STW	Unknown	Unknown	Unknown	Biofilters and activated sludge	Unknown
Bethlehem WCW	Unknown	Unknown	Unknown	Biofilters and activated sludge	Discharge into Jordaan
Bickley WCW	28° 26′ 52″	26° 26′ 40″	3.59	Biofilters and activated sludge	Discharge into the Blesbokspruit
Blyvooruitzicht Gold Mines WCW	27° 23′ 25″	26° 23′ 15″	Unknown	Unknown	Discharge into the Wonderfonteinspruit
Bushkoppies	27° 56′ 10″	26° 18′ 35″	200.00	Activated sludge	Discharge into the Harringtonspruit
Carletonville (Oberholzer)	27° 21′ 30″	26° 09′ 50″	8.00	Biological filtration system (activated sludge and oxidation dam)	Discharge into the Wonderfonteinspruit
Daveyton WCW	28° 27′ 47″	26° 08′ 14″	16.00	Conventional	Discharge into the Blesbokspruit
Deelkraal Mine	27° 18′ 00″	26° 28′ 20″	Unknown	Unknown	Discharge into the Loopspruit
Dekema	28° 10′ 00″	26° 19′ 35″	36.00	Biofilters and activated sludge	Discharge into the Natalspruit
Doornfontein Gold Mine WCW	27° 19′ 50″	26° 24′ 35″	Unknown	Unknown	Discharge into the Wonderfonteinspruit
Elandsrand	27° 21′ 45″	26° 27′ 45″	Unknown	Unknown	Discharge into the Varkenslaagtespruit
Ennerdale WCW (Johannesburg Water)	Unknown	Unknown	8.00	Activated sludge	Unknown
Ermelo STW	29° 59′	26° 30′	Unknown	Activated sludge, biosystems and air blowing system	Discharge into the Klein Drinkwaterspruit
Flip Human	27° 46′ 14″	26° 10′ 51″	50.00	Activated sludge systems	Discharge into the Wonderfonteinspruit
Fochville WCW decommissioned, built new Kokosi WCW as shown below	Unknown	Unknown	Unknown	Activated sludge	Discharge into the Loopspruit
Goudkoppies	27° 55′ 30″	26° 16′ 25″	150.00	Activated sludge	Discharge into the Harringtonspruit
Grundlingh WCW	28° 28′ 14″	26° 23′ 66″	2.71	Biofilters and activated sludge	Discharge into Nigel Dam
Hannes van Niekerk	Unknown	Unknown	26.50	Activated sludge systems and biofiltration systems	Discharge into the Wonderfonteinspruit
Harrismith STW (1)	Unknown	Unknown	3.90	Biofilters and activated sludge	Discharge into the Wilge River
Tshiame STW (Harrismith 2)	Unknown	Unknown	Unknown	Unknown	Unknown
Heidelberg WCW	28° 19′ 44″	26° 32′ 23″	8.00	Biofilters	Discharge into the Blesbokspruit

UPPER VAAL WMA

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Impumelelo WCW in Lesedi Local Municipality (Heidelberg)	Unknown	Unknown	12.00	Unknown	Unknown
Jan Smuts WCW	28° 22′ 27″	26° 13′ 18″	9.00	Biofilters and activated sludge	Discharge into Jan Smuts Dam
JP Marais WCW	28° 23′ 42″	26° 10′ 08″	21.00	Biofilters and activated sludge	Discharge into the Benoni Canal
Kokosi WCW (new) services Kokosi, Fochville and Greenspark areas	Unknown	Unknown	7.50	Activated sludge	Discharge into the Loopspruit
Khutsong	27° 18′ 32″	26° 21′ 11″	7.50	Activated sludge	Discharge into the Wonderfonteinspruit
Klerksdorp	26° 37′ 10″	26° 53′ 80″	21.90	Activated sludge	Discharge into the Schoon Spruit
Kloof Mine WCW	Unknown	Unknown	Unknown	Maturation ponds	No discharge proved
Kroonstad STW	Unknown	Unknown	Unknown	Activated sludge and biological seep beds	Unknown
Leeudoorn Mine WCW	Unknown	Unknown	4.00	Unknown	Discharge into the Loopspruit
Leeuwkuil	Unknown	Unknown	41.00	Activated sludge and biofiltration systems	Discharge into the Vaal River
McComb WCW	28° 27′ 53″	26° 12′ 49″	9.00	Activated sludge	Discharge into the Benoni Canal
Meyerton	28° 58′ 30″	26° 34′ 30″	Unknown	Unknown	Discharge into the Fouriespruit
Olifantsvlei (construction of an additional 50 Mℓ/d has begun. To be completed by 2015)	27° 53′ 55″	26° 19′ 05″	200, currently being upgraded	Activated sludge	Discharge into the Klip River
Palmietfontein	Unknown	Unknown	Unknown	Unknown	Unknown
Parys STW	Unknown	Unknown	Unknown	Biological filters	Unknown
Potchefstroom	27° 05′ 40″	26° 44′ 50″	23.75	Biological filtration and activated sludge	Discharge into the Wonderfonteinspruit
Randfontein	Unknown	Unknown	20.00	Activated sludge and biofiltration systems	Discharge into the Elandsvlei to Hartebeespoort Dam
Ratanda WCW	28° 28′ 36″	26° 09′ 34″	5.00	Unknown	Unknown
Rietspruit WCW (in Vanderbijlpark for Emfuleni Municipality)	Unknown	Unknown	36.00	Activated sludge and biofiltration systems	Discharge into the Rietspruit
Rondebult	28° 13′ 20″	26° 17′ 45″	36.00	Activated sludge	Discharge into the Natalspruit
Rynfield WCW	28° 28′ 36″	26° 09′ 34″	13.00	Activated sludge	Discharge into the Benoni Canal
Standerton STW	29° 13′ 56″	26° 57′ 27″	Unknown	None	Discharge into the Vaal River
Sebokeng WCW (Emfuleni Local Municipality)	Unknown	Unknown	100.00	Activated sludge	Unknown
Standerton (Sakhile)	29° 13′ 56″	26° 57′ 27″	Unknown	None	Discharge into the Vaal River
Tsakane WCW	28° 21′ 58″	26° 22′ 35″	7.72	Biofilters and activated sludge	Discharge into the Kaydalespruit

UPPER VAAL WMA

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Vlakplaats	28° 11′ 00″	26° 21′ 15″	83.00	Activated sludge	Discharge into the Natalspruit
Waterval	28° 05′ 45″	26° 26′ 30″	105.00	Activated sludge	Discharge into the Klip River
Wedela	27° 22′ 30″	26° 29′ 13″	2.00	Activated sludge	Discharge into the Loopspruit
Welgedacht	Unknown	Unknown	77 increasing to 177 in the near future	Unknown	Discharge into the Blesbokspruit
Welverdiend	27° 15′ 21″	26° 22′ 17″	1.00	Activated sludge	Discharge into the Wonderfonteinspruit
West Driefontein (owned by a mine in Carletonville)	Unknown	Unknown	Unknown	Unknown	Discharge into the Loopspruit
Western Deep Levels Mine WCW	27° 25′ 30″	26° 27′ 00″	Unknown	Unknown	Re-use

WCW: Water care works

STW: Sewage treatment works

Sources: DWA, 2002a; updated (in green) using Aganang Consulting (2008) and DWA (2010/2011); confirmed by municipal offices

South Africa

UPPER ORANGE WMA

Name of wastewater treatment works	Position	Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
Aliwal North STW	Unknown	Unknown	Biological filters	Unknown
Bainsvlei	West of Bloemfontein	5.00	Biofilters and activated sludge	Discharge into stormwater balancing dams draining the Modder River
Bloemfontein: Bloemspruit Airforce Base STW	West of Bloemfontein	0.55	Conventional	Unknown
Bloemfontein: Bloemspruit STW	29° 07′ 24″ S; 26° 16′ 51″ E	57.00	Biofilters and activated sludge	Discharge into the Bloemspruit
Bloemfontein: Langenhovenpark STW	Unknown	5.00	Biofilters and activated sludge	Unknown
Bloemfontein: Meriting STW	Unknown	1.20	Oxidation ponds	Unknown
Bloemfontein: Noordelike STW	N of Bloemfontein; 29° 02′ 43″ S 26° 12′ 13″ E	0.75	Conventional	Unknown
Bloemfontein: South-eastern	On road to Dewetsdorp	30.00	Unknown	Unknown
Bloemfontein: Welvaart STW	W of Bloemfontein; 29° 13′ 11″S; 26° 07′ 21″ E	6.50	Biofilters and activated sludge	Discharge into the Kaalspruit
Botshabelo	Botshabelo	20.00	Unknown	Discharge into the Klein Modder River
Brandfort STW	Unknown	Unknown	Oxidation ponds	No returns
Clarens STW	Unknown	3.60	Unknown	Small returns to Klein Caledon River
Clocolan STW	Unknown	7.20	Oxidation ponds	No returns, used for irrigation
Dealesville STW	Unknown	0.70	Oxidation ponds	No returns
Dewetsdorp STW	Unknown	Unknown	Oxidation ponds	No returns
Edenburg STW	Unknown	Unknown	Oxidation ponds	Reed beds in spruit
Fauresmith STW	Unknown	Unknown	Oxidation ponds	No returns, used for irrigation
Ficksburg STW	Unknown	6.20	Activated sludge	Caledon River
Fouriesburg STW	Unknown	Unknown	Aerators and dams	No returns, used for irrigation
Hobhouse STW	Unknown	Unknown	Oxidation dams	Evaporation
Ikgomotseng STW	Unknown	0.30	Oxidation ponds	No returns
Jacobsdal STW	Unknown	Unknown	Oxidation dams	Evaporation
Jagersfontein STW	Unknown	1.20	Oxidation dams	Some discharge, mainly evaporation
Koffiefontein STW	Koffiefontein	1.80	Heismann – Vertical	Discharge into the Riet River

Name of wastewater treatment works	Position	Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
Ladybrand STW	Unknown	Unknown	Unknown	Discharge into spruit
Luckoff	Unknown	0.44	Oxidation ponds	No returns
Maseru	Unknown	10.00	Unknown	Discharge into Caledon River
Oppermans STW	Unknown	Unknown	Oxidation ponds	No returns
Philippolis STW	Unknown	Unknown	Oxidation ponds	No returns
Reddersburg STW	Unknown	0.47	Oxidation ponds	Some discharge into spruit
Rosendal STW	Unknown	Unknown	Oxidation ponds	No returns
Rouxville STW	Unknown	Unknown	Oxidation ponds	No returns
Selosesha STW	Thaba Nchu	6.00	Activated sludge	Discharge into the Sepanespruit
Smithfield STW	Unknown	0.52	Oxidation ponds	Discharge to Groenspruit
Soutpan STW	Unknown	0.04	Oxidation ponds	No returns
Springfontein STW	Unknown	Unknown	Oxidation ponds	No returns
Sterkwater STW	South east of Bloemfontein	10.00	Biofilters and activated sludge	Discharge into the Renosterspruit
Thaba Patchoa STW	Unknown	Unknown	Oxidation ponds	Evaporation dams
Tweespruit STW	Unknown	Unknown	Oxidation ponds	No returns, used for irrigation
Wepener STW	Unknown	Unknown	Oxidation ponds	No returns
Zastron STW	Unknown	Unknown	Conventional	Unknown

WCW: Water care works
STW: Sewage treatment works
Source: DWA, 2002d

South Africa

MIDDLE VAAL WMA

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Allanridge STWs (2)	Unknown	Unknown	3.10	Oxidation ponds	No discharge
Arlington STW	Unknown	Unknown	Unknown	Oxidation ponds	No discharge
Beatrix Mine STW	Unknown	Unknown	3.80	Unknown	For irrigation and a portion to Theronspruit
Bothaville STWs (2)	Unknown	Unknown	5.00	Dasveer system	No discharge
Bultfontein STW	Unknown	Unknown	1.00	Oxidation ponds	No discharge
Edenville STW	Unknown	Unknown	Unknown	Oxidation ponds	Evaporation ponds
Free State Geduld	Unknown	Unknown	5.00	Unknown	Unknown
Heilbron STW	Unknown	Unknown	4.10	Activated sludge	Oxidation ponds
Henneman STWs (2)	Unknown	Unknown	1.80	Biological/oxidation	Irrigation and a small proportion into the Rietspruit
Hoopstad	Unknown	Unknown	0.45	Oxidation ponds	No discharge
Joel Mine STW	Unknown	Unknown	1.50	Unknown	Irrigation and a small proportion into the Theronspruit
Klerksdorp STW	Unknown	Unknown	21.90	Activated sludge	Discharge into the Schoon Spruit
Kroonstad STW	Unknown	Unknown	8.00	Activated sludge and biological seep beds	Discharge into Vals River
Lindley STW	Unknown	Unknown	Unknown	Unknown	No discharge
Marquard STW	Unknown	Unknown	Unknown	Oxidation ponds	No discharge
Midvaal WCW	Unknown	Unknown	10.00	Activated sludge, extended aeration	Unknown
Odendaalsrus STWs (2)	Unknown	Unknown	10.00	Biofilters and activated sludge	All effluent re-used by mines
Ohenimuri WCW (for Midvaal Municipality in Walkerville)	Unknown	Unknown	0.30	Activated sludge	No discharge
Oryx Mine STW	Unknown	Unknown	1.20	Unknown	Irrigation and into the Bosluisspruit
Paul Roux STWs (2)	Unknown	Unknown	Unknown	Oxidation ponds	No discharge
Petrus Steyn STW	Unknown	Unknown	0.60	Oxidation ponds	No discharge
Senekal STW	Unknown	Unknown	3.00	Unknown	Discharge into Sand River

MIDDLE VAAL WMA

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Theunissen STWs (3)	Unknown	Unknown	4.90	Activated sludge and oxidation ponds	No discharge
Vaal Marina WCW (owned by Midvaal Local Municipality, next to the Vaal Dam)	Unknown	Unknown	2.00	Activated sludge (sequential batch reactor)	Unknown
Ventersburg STWs (2)	Unknown	Unknown	1.70	Oxidation ponds	No discharge
Viljoenskroon STW	Unknown	Unknown	3.50	Activated sludge	Swamp
Virginia STWs (2)	Unknown	Unknown	46.00	Activated sludge	Re-use and a proportion into the Sand River
Wesselsbron STW	Unknown	Unknown	3.40	Oxidation ponds	No discharge
Winburg STW	Unknown	Unknown	0.50	Activated sludge	Discharge into the Winburgspruit
Wolmaranstad STW	Unknown	Unknown	Unknown	Biosphere	Discharge into Makwassiespruit
Witpan STW (Welkom)	Unknown	Unknown	22.00	Biological	Discharge onto Witpan
Thabang STW (Welkom)	Unknown	Unknown	14.00	Biological	Discharge into the Sand River
Theronia STW (Welkom)	Unknown	Unknown	15.00	Biological	Discharge onto Flamingo Pan

(2) Number of sewage treatment works
WCW: Water care works
STW: Sewage treatment works
Sources: DWA, 2002b; updated (in green) and DWA (2010/2011) confirmed by municipal offices

South Africa

LOWER VAAL WMA

Name of wastewater treatment works	Position		Peak rated design flow capacity* (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Hartswater	27° 40′ 12″ *	24° 49′ 48″ *	1.20	Unknown	Unknown
Hotazel	27° 19′ 48″ *	22° 26′ 24″ *	0.50	Unknown	Unknown
Jan Kempdorp	27° 6′ 36″ *	24° 33′ 36″ *	3.00	Unknown	Unknown
Kimberley	28° 43′ 12″ *	24° 16′ 48″ *	8.00	Unknown	Unknown
Olifantshoek	27° 53′ 24″ *	22° 6′ 36″ *	0.38	Unknown	Unknown
Pampierstad	27° 13′ 12″ *	24° 6′ 36″ *	Unknown	Unknown	Unknown
Postmasburg	28° 33′ 36″ *	23° 10′ 12″ *	2.40	Unknown	Unknown
Schweizer-Reneke	27° 10′ 12″ *	25° 43′ 12″ *	3.00	Unknown	Unknown

* Google Earth coordinates
WCW: Water care works
STW: Sewage treatment works

LOWER ORANGE WMA (SOUTH AFRICA)

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
De Aar	30° 36′ 30″	24° 01′ 40″	2.70	Activated sludge	Unknown
Niekerkshoop	22° 49′ 43″	29° 19′ 47″	0.00	Oxidation	Unknown
Postmasburg	23° 05′	28° 21′	1.48	Activated sludge	Unknown
Prieska	22° 45′ 59″ *	29° 40′ 0″ *	1.55	Oxidation	Unknown
Richmond	23° 56′ 31″	31° 24′ 53″	0.07	Evaporation ponds	Unknown
Springbok	17° 53′ 24″	29° 39′ 36″	1.23	Oxidation	Unknown
Upington	21° 14′ 57″ *	28° 26′ 39″ *	48.00	Biofilter and activated sludge	Unknown

* Google Earth coordinates

Source: DWA, 2002e

LOWER ORANGE (NAMIBIA)

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Aranos	24° 08′ 00″	19° 07′ 01″	Unknown	Evaporation	Unknown
Ariamsvlei	26° 06′ 47″	19° 49′ 39″	Unknown	Dump site (no treatment)	Unknown
Aris	22° 45′ 00″	17° 08′ 00″	0.04	Trickling filter plant	River
Aroab	26° 48′ 00″	19° 39′ 00″	Unknown	Oxidation ponds	Unknown
Aus	26° 40′ 46″	16° 16′ 00″	Unknown	Dump site (no treatment)	Unknown
Berseba	25° 59′ 43″	17° 46′ 11″	Unknown	Oxidation ponds	Unknown
Bethanie	26° 30′ 08″	17° 09′ 38″	Unknown	Oxidation ponds	Unknown
Gammans (Windhoek)	22° 33′ 31″	17° 04′ 55″	27	Trickling filter plant/activated sludge	Unknown
Gibeon	25° 07′ 28″	17° 45′ 58″	Unknown	Evaporation	Unknown
Gobabis	22° 27′ 04″	18° 58′ 01″	Unknown	Oxidation ponds	Unknown
Gochas	24° 51′ 35″	18° 48′ 35″	Unknown	Evaporation	Unknown
Grünau	27° 43′ 59″	18° 22′ 44″	Unknown	Oxidation ponds	Unknown
Hoachanas	23° 55′ 01″	18° 03′ 00″	Unknown	Evaporation	Unknown
Kalkrand	24° 04′ 19″	17° 35′ 25″	Unknown	Evaporation	Unknown
Karasburg	28° 01′ 19″	18° 44′ 42″	Unknown	Oxidation ponds/activated sludge	Unknown
Keetmanshoop	26° 34′ 28″	18° 07′ 59″	Unknown	Oxidation ponds	Unknown
Klein Aub	23° 47′ 35″	16° 37′ 51″	Unknown	Oxidation ponds	Unknown
Koës	25° 56′ 15″	19° 07′ 13″	Unknown	Dump site (no treatment)	Unknown
Kosis	26° 42′ 16″	17° 18′ 04″	Unknown	Oxidation ponds	Unknown
Leonardville	23° 30′ 22″	18° 47′ 34″	Unknown	Oxidation ponds	Septic tanks
Lüderitz	26° 38′ 46″	15° 09′ 11″	Unknown	Oxidation ponds/anaerobic wetlands	Unknown
Maltahöhe	24° 50′ 00″	16° 58′ 59″	Unknown	Oxidation ponds	Unknown
Mariental	24° 37′ 15″	17° 57′ 33″	Unknown	Oxidation ponds	Unknown
Noordoewer	28° 42′ 56″	17° 37′ 07″	Unknown	Dump site (no treatment)	Unknown
Otjinene	21° 08′ 06″	18° 47′ 13″	Unknown	Oxidation ponds/trickling filter	Unknown
Otjomuise (Windhoek)	22° 33′ 31″	17° 04′ 55″	6.5	Trickling filter plant/activated sludge	Unknown
Rehoboth	23° 19′ 01″	17° 05′ 01″	Unknown	Oxidation ponds	Unknown

LOWER ORANGE (NAMIBIA)

Name of wastewater treatment works	Position		Peak rated design flow capacity (Mℓ/day)	Treatment process description	Effluent disposal process
	Latitude	Longitude			
Stampriet	24° 20′ 37″	18° 24′ 09″	Unknown	Evaporation	Unknown
Tses	25° 53′ 03″	18° 07′ 20″	Unknown	Oxidation ponds	Unknown
Ujams ponds (Windhoek)	22° 33′ 31″	17° 04′ 55″	Unknown	Oxidation ponds	Unknown
Warmbad	28° 26′ 53″	18° 44′ 03″	Unknown	Oxidation ponds	Unknown
Witvlei	22° 24′ 26″	18° 29′ 51″	Unknown	Anaerobic	Septic tanks

Source: MAWF, 2011a,b,c,d

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