10. THE GOURITZ WMA

10.1 GENERAL DESCRIPTION

The Gouritz WMA falls predominantly within the Western Cape Province, with small portions in the Eastern Cape and the Northern Cape Provinces. The Gouritz WMA is the largest WMA in the Western Cape with a total surface area of 53 139 km2. The Gouritz River is the main river, contributing 41% of the surface flow in the WMA. The other main rivers, which drain the inland area, are the: Buffels, Touws, Groot, Gamka, Olifants, and Kammanassie Rivers. The Duiwenhoks River Dam supplies 1.1 million m^3/a to the Duiwenhoks Rural Water Supply Scheme, of which 0.7 million m^3/a is transferred into the Breede WMA to supply farmers. There are no inter-basin transfers into the Gouritz WMA and approximately 70% of the available water is surface water.

The agricultural sector provides a wide range of products including wine grapes, fruit, fodder, vegetables, grains, hops, dairy, timber, tobacco, ostriches, sheep, cattle, and goats. The fish and shellfish industry are significant for the economy of the coastal region. The ostrich industry also plays a part in the region’s economy. Land use in the WMA, from a water resources perspective, is dominated by irrigation and afforestation activities (DWA, 2010). ***Figure 10.1.1*** shows the Gouritz WMA.

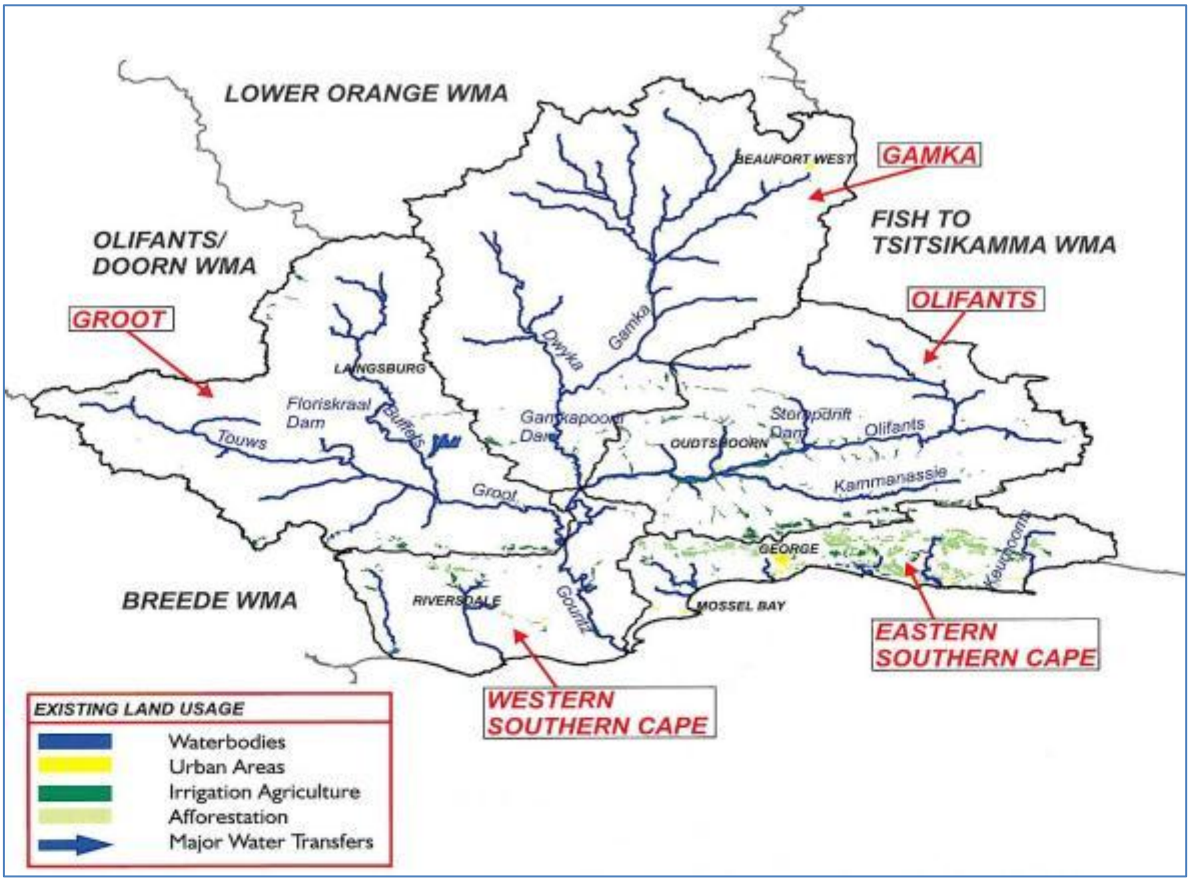

Figure 10.1.1 The Gouritz WMA

10.1.1 Topography, Rainfall and Landuse

The topography and climate within the Gouritz WMA is such that three distinct water resource zones can be distinguished. These are the:

- The semi-arid Great Karoo consisting of the Gamka River catchment to the north of the Swartberg Mountains and the Touws/Buffels/Groot River catchments, to the west of the Klein Swartberg Mountains.
- The Olifants River which is fed by mountain streams rising in the Swartberg Mountains to the north, the central Kammanassie Mountains and the coastal Outeniqua Mountains in the south.
- The Coastal Belt which includes the Gouritz/Goukou/Duiwenhoks catchments, extending from the western boundary of the WMA to (and including) the catchment of the lower Gouritz River, and the remaining coastal belt to the eastern boundary of the WMA.

A hot and dry Karoo climate predominates in the Great Karoo and Olifants regions whilst along the coastal belt the climate is more temperate with significantly higher rainfall, occurring year round. Cold fronts approaching from the south-west bring rain to the coastal belt, whilst thunderstorms occur over the inland Karoo and Olifants River catchments between February and April. The MAP decreases from east to west, ranging from as high as 1000mm in the south-east to as low as 160 mm in the north of the WMA. Frost occurs in the Central Karoo in winter, typically from June to August.

10.1.2 Geological Setting

The geological setting of the Gouritz WMA is complex due to the wide range of Groups, Sub-groups and Formations. The geological setting of the Gouritz WMA is shown in ***Figure 10.1.2***. The older rock types in the area are mainly part of the Kaaiman/Kango and Table Mountain Groups. They have a predominantly west-east trend and are significantly folded. These rock types are part of the southern portion of the Cape Feld Belt. North of the Laingsburg/Prince Albert line of latitude the Karoo basin starts occurring with predominantly argillaceous rock types which constitute flat lying sediments of the Karoo. To the north of Beaufort West dolerite dykes and sills start outcropping. In the southern coastal portion of the WMA Quaternary age deposits occur.

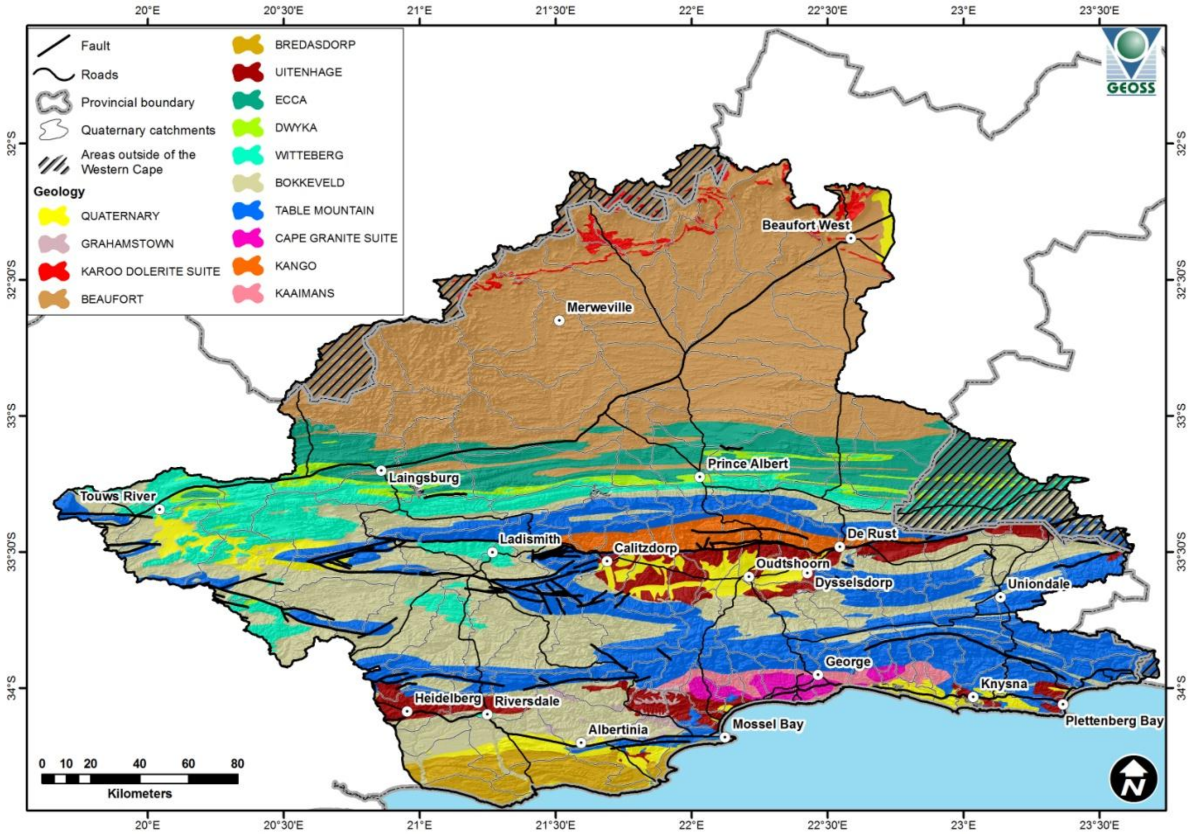

Figure 10.1.2 Geological Setting of the Gouritz WMA

10.2 WATER QUALITY

In terms of surface water quality, elevated salinity occurs naturally within the inland catchments of the Great and Little Karoo as a result of natural geology and high evaporation. Farming practices (crop selection, for example) have been adapted to suit. In the developed urban areas, particularly the more densely populated coastal towns, man-made interventions such as the discharge of water containing waste, and diffuse pollution, impact on water quality.

Groundwater quality obtained directly from the TMG aquifers is generally excellent whilst that from shallow weathered-and-fractured aquifers in pre-and post TMG rocks is generally of poorer quality. In the Little Karoo poor quality brackish groundwater (generally unfit for human consumption but supportive of livestock) is associated with Bokkeveld and Cretaceous (Uitenhage Group) aquifers, whilst the quality of water in the primary alluvial aquifers is variable.

10.2.1 Water Quality Monitoring

The water quality monitoring points within the Gouritz WMA and the various institutions responsible for undertaking that monitoring are shown in **Figure 10.2.1**. In Chapter 7 of this report the River Health monitoring programme was described and those monitoring points that are located in this WMA are shown on **Figure 10.2.2**.

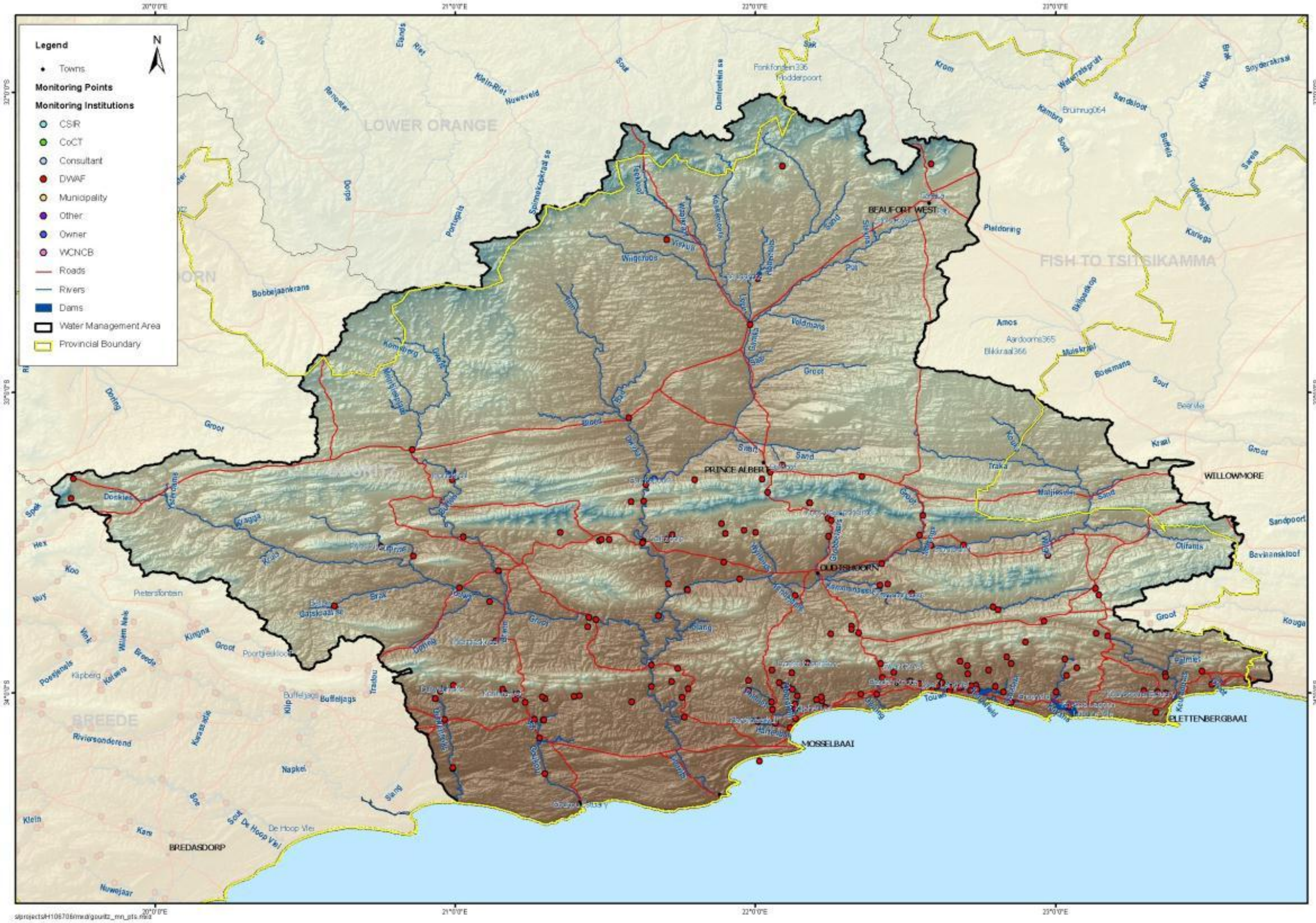

Figure 10.2.1 Water quality monitoring points in the Gouritz WMA.

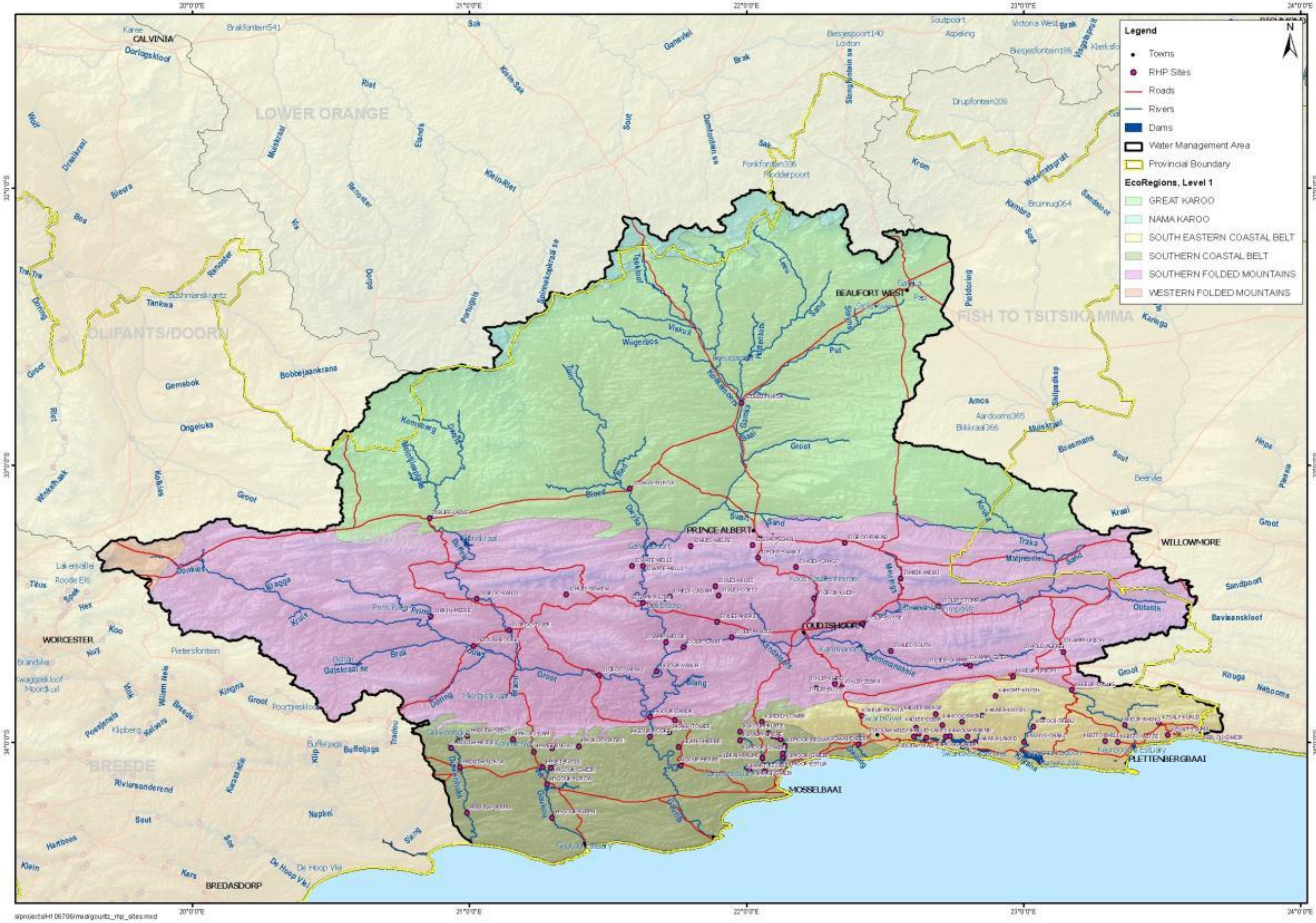

Figure 10.2.2 River Health Programme monitoring points in the Gouritz WMA.

10.2.2 Surface Water Quality Status in the Gouritz WMA

The water quality of the Gouritz River is characterised by elevated salt concentrations. Water quality is good in the headwaters of the tributaries but salinity increases in a downstream direction due to the geology of the region, high evaporation, and agricultural impacts.

A graphical interpretation of the water quality status in the Gouritz WMA is presented in **Figure 10.2.4** which shows a summary at the selected monitoring point of the compliance of the water quality variable at that point along the river, in comparison with a generic set of Resource Water Quality Objectives (RWQO) that are applicable to all the rivers across the entire country. The figure shows that the general trend is one of higher salinity in the Karoo catchments than within the coastal belt. However the impacts on water quality in the larger urban centres along the coast are also evident, whilst some of the Garden Route Rivers still show healthy water quality characteristics. These observations are briefly explained below. **Annexure F** provides the detailed records of water quality in the Gouritz WMA on which the hexagon "fit for use" summaries at each monitoring point are based.

10.2.3 Water Quality Concerns in the Gouritz WMA

The following water quality issues and landuse concerns have been identified:

- ***Salinity in the Great and Little Karoo***

The elevated salinity found in the Gouritz River and its major tributaries occurs naturally over the inland catchments of the Great and Little Karoo as a result of the natural geology and high evaporation. This is a historical situation and one to which the ecology and the farmers have adapted. The selection of crop types by farmers has allowed them to continue financially viable farming operations, making best use of the available water for irrigation. Outside of government controlled irrigation schemes, irrigation is largely opportunistic in the inland catchments. Elevated salinities do not occur to the same extent in the coastal catchments.

- ***Nutrient enrichment and eutrophication***

Concerns have been expressed about nutrient enrichment and eutrophication problems in the Olifants River downstream of Oudtshoorn and the Goukou River as well as estuaries such as the Hartenbosch estuary, Knysna lagoon, Goukou estuary, and the estuary near Stilbaai. Nutrient enrichment of surface water is the result of farming activities (fertiliser leaching and washoff, dairy and animal wastes), and WWTW discharges high in nutrient concentration. Problems associated with nutrient enrichment include excessive growth of rooted and free-floating aquatic plants and algae, and choking of river channels with water plants and reeds.

- ***Urban impacts on water quality***

In the developed urban areas, particularly the more densely populated coastal towns, man-made activities result in problems commonly associated with urban water use. These include discharge of water containing waste, WWTWs not meeting their required effluent water quality standards, and diffuse pollution from informal settlements. Concerns were also raised about the impacts of a number of tanneries in the Oudtshoorn area.

- ***Sewage and wastewater treatment systems***

In the larger urban centres such as Oudtshoorn, vandalism of the sewage reticulation and pump station infrastructure occasionally leads to sewage spills into the Olifants River. The industrial expansion taking place in the Oudtshoorn area would introduce additional loads on the WWTW and upgrading of the works will be necessary to avoid spills. Runoff from informal settlements and poorly serviced housing areas has resulted in pollution of rivers near urban areas such as the Olifants River and Knysna lagoon. The location of the WWTWs in the Gouritz WMA is shown in **Figure 10.2.3**.

- ***Disposal of wood processing waste***

The disposal of wood processing waste is a potential problem throughout the coastal catchments. Many saw mills operate without the necessary permits for discarding their waste. Leachate, consisting of organic acids and of high COD concentration, from sawdust and woodchips, is undesirable from a water quality perspective. The extent of unlawful disposal of this waste is not well known and the extent of impact on water quality has not been determined yet.

- ***Dissolved oxygen and dairy farming***

Concerns have been expressed about the organic loading of rivers and streams from dairy farming activities and dairy processing facilities in the George and Riversdale areas.

- ***Sand mining and turbidity***

Concerns have been raised about sand mining in the K catchments and at Wittedrift near Plettenberg Bay. Elevated turbidity causes silting of water ways, smothering of aquatic ecosystem habitats, and suspended sediment particles create idea sites for adsorbing phosphates and water-borne pathogens (DWA, 2010).

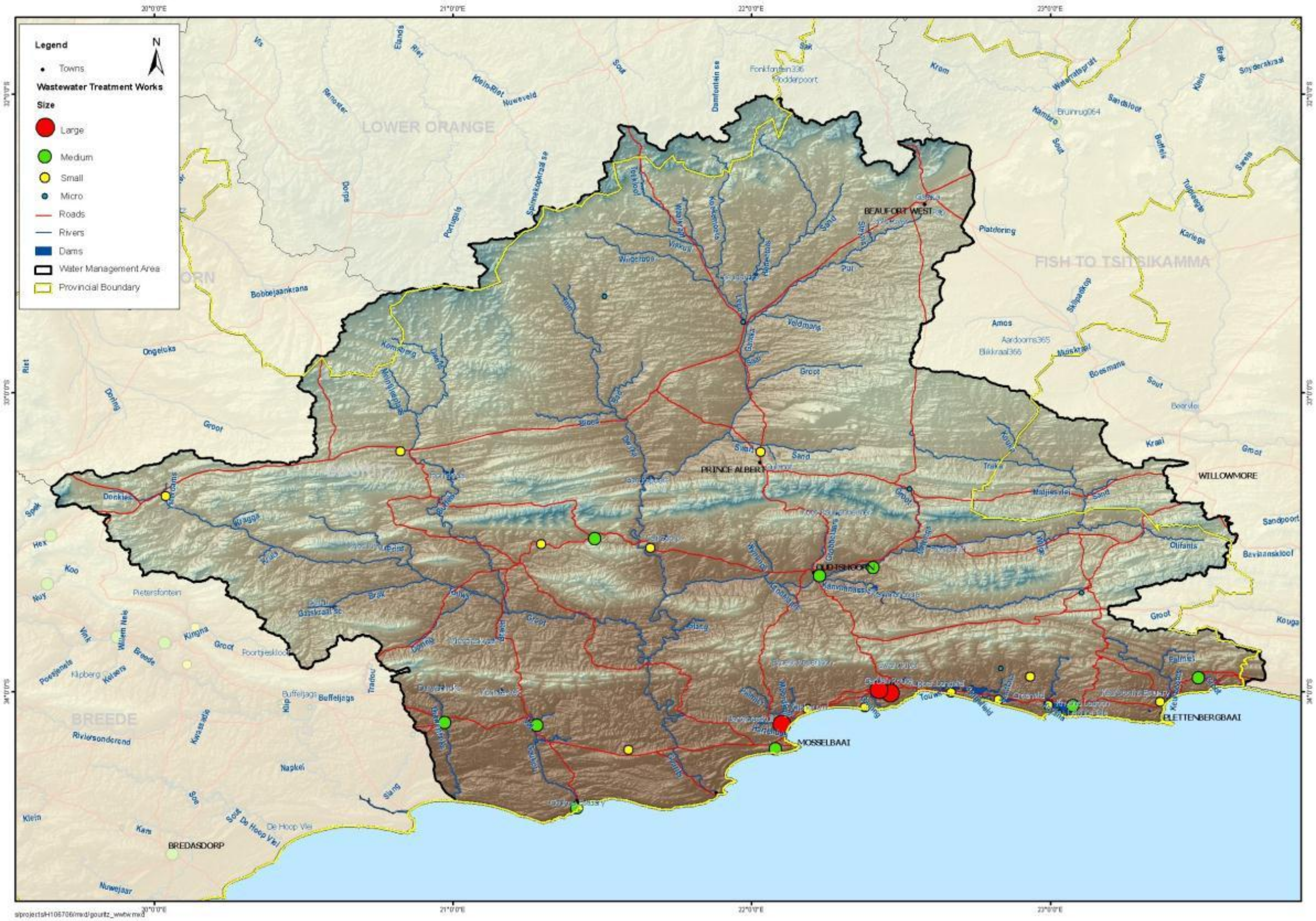

Figure 10.2.3 Location of WWTWs in the Gouritz WMA.

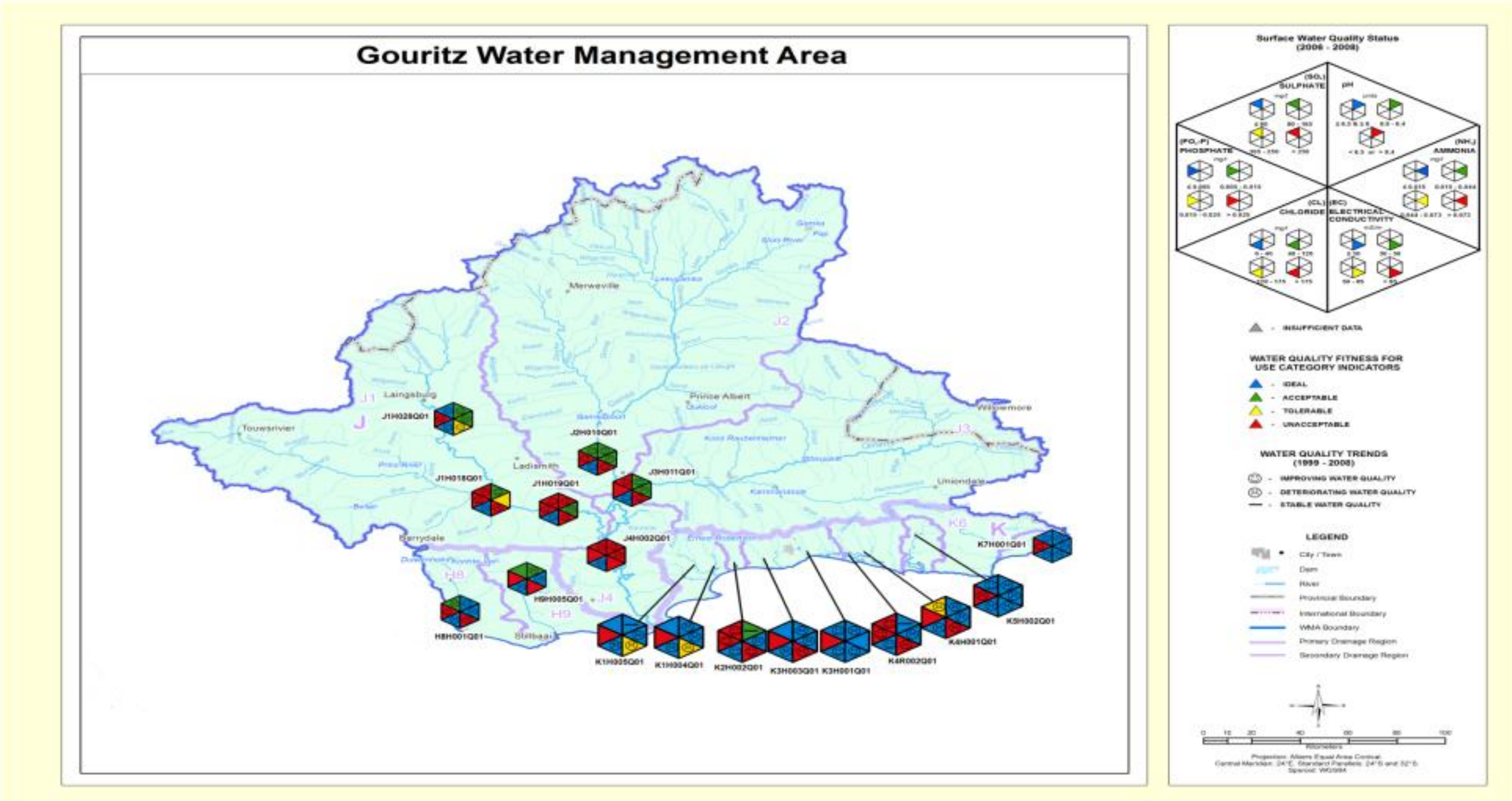

Figure 10.2.4 Water quality status "Fit for use" for the Gouritz WMA. (Source: DWA, 2010)

10.3 GROUNDWATER

A number of wellfield development options have been identified of which some are currently being implemented. These include:

- The Deep Artesian Groundwater Exploration for Oudtshoorn Municipal Supply (DAGEOS) led to the current investigation of the Blossoms wellfield and pipeline to augment the supply to Oudtshoorn.
- The Klein Karoo Rural Water Supply Scheme (KRWSS) offers potential for limited further development, particularly for drought relief in the Calitzdorp area.

In terms of regional scale monitoring, the density and representivity of data is inadequate to interpret regional groundwater patterns. However from observations at Beaufort West, Leeu-Gamka and Laingsburg (all in the Karoo) it has been possible to deduce that regional aquifer recharge is event (flood) response driven, occurring in some years and not in others.

Artificial aquifer recharge has recently been investigated in the Sedgefield, Prince Albert and Plettenberg Bay areas and shows promising opportunity.

10.3.1 Aquifer types

Fractured aquifers predominate (94%) in the WMA and the aquifer yields are closely correlated with lithological types (***Figure 10.3.1***). Interestingly high aquifer yields are indicated to the south and north-east of Beaufort West, even higher yielding than the Table Mountain Group lithologies. These high yields south of Beaufort West have been confirmed (GEOSS, 2011). The main intergranular aquifers are present south of Albertinia (the N2) down to the coast. The other significant intergranular aquifer extends west-east, just south of Oudtshoorn. A number of springs occur in the southern outcrop of intergranular aquifers. ***Table 10.3.1*** shows the percentage coverage of the broad aquifer types. ***Table 10.3.2*** indicates the percentage coverage for the aquifer types and sub-classes. The most extensively occurring fractured and intergranular aquifers have a yield of 0.5-2.0 ℓ/s.

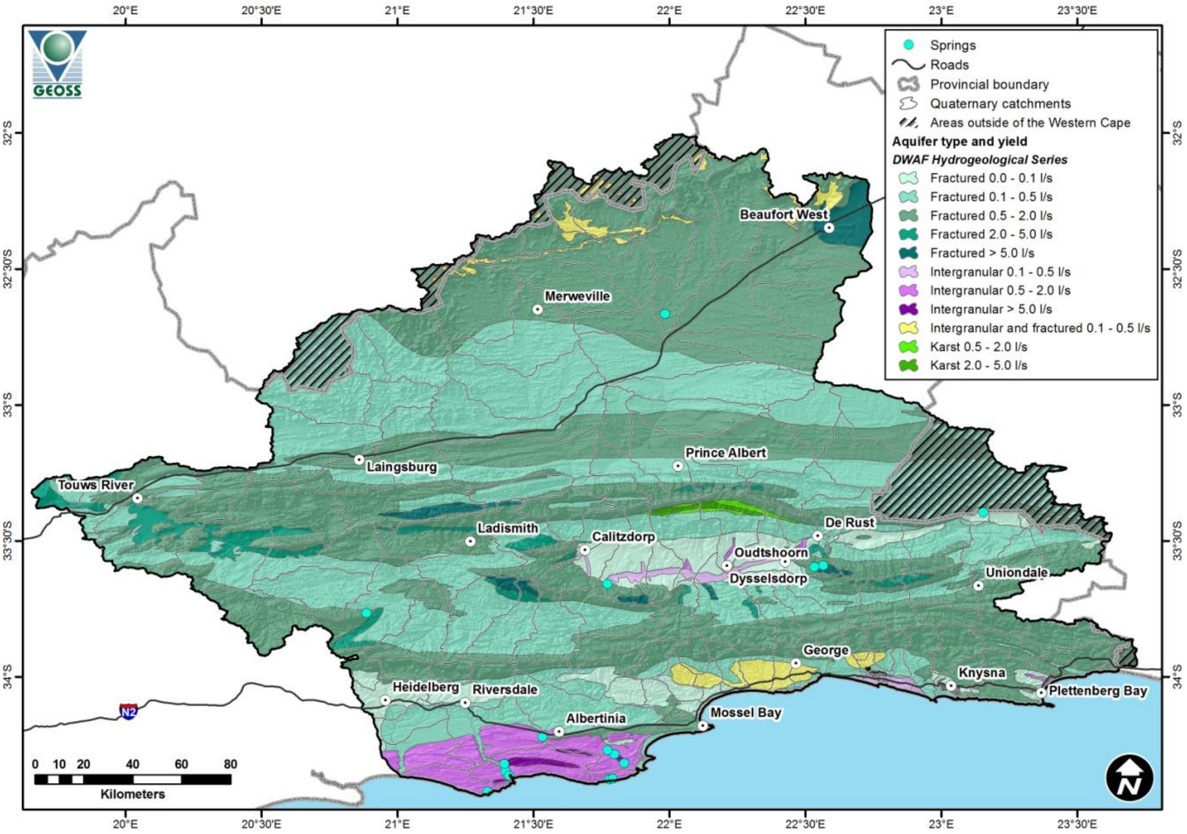

Figure 10.3.1 Aquifer Types of the Gouritz WMA.

Table 10.3.1 Extent of aquifer types within the Gouritz WMA

Aquifer Type	Percentage coverage of the Gouritz WMA (Western Cape)
Fractured	94 %
Intergranular	4 %
Intergranular and fractured	1.7 %
Karst	0.3 %

Table 10.3.2 Aquifer types, sub-classes and coverage for the Gouritz WMA

WMA	Aquifer type and yield	Area (km^2)	% Area of the Gouritz WMA in Western Cape
GOURITZ	Fractured 0.0 - 0.1 l/s	2636	5
GOURITZ	Fractured 0.1 - 0.5 l/s	18023	37
GOURITZ	Fractured 0.5 - 2.0 l/s	23976	49
GOURITZ	Fractured 2.0 - 5.0 l/s	1051	2
GOURITZ	Fractured > 5.0 l/s	665	1
GOURITZ	Intergranular 0.1 - 0.5 l/s	268	0.5
GOURITZ	Intergranular 0.5 - 2.0 l/s	1461	3

WMA	Aquifer type and yield	Area (km^2)	% Area of the Gouritz WMA in Western Cape
GOURITZ	Intergranular > 5.0 l/s	120	0.2
GOURITZ	Intergranular and fractured 0.1 - 0.5 l/s	873	2
GOURITZ	Karst 0.5 - 2.0 l/s	90	0.2
GOURITZ	Karst 2.0 - 5.0 l/s	77	0.2

10.3.2 Groundwater Recharge

The recharge distribution is closely linked to rainfall patterns for the WMA. The highest recharge occurs along the coastal zone, especially the more rugged coastal zones. It is relatively high across the more rugged mountainous areas (e.g. Swartberg) and then reduces significantly in the Karoo basin, pick up slightly north of Beaufort West in the Nuweberg Mountains. ***Figure 10.3.2*** shows the volume of direct groundwater recharge for the Gouritz WMA, per Quaternary catchment.

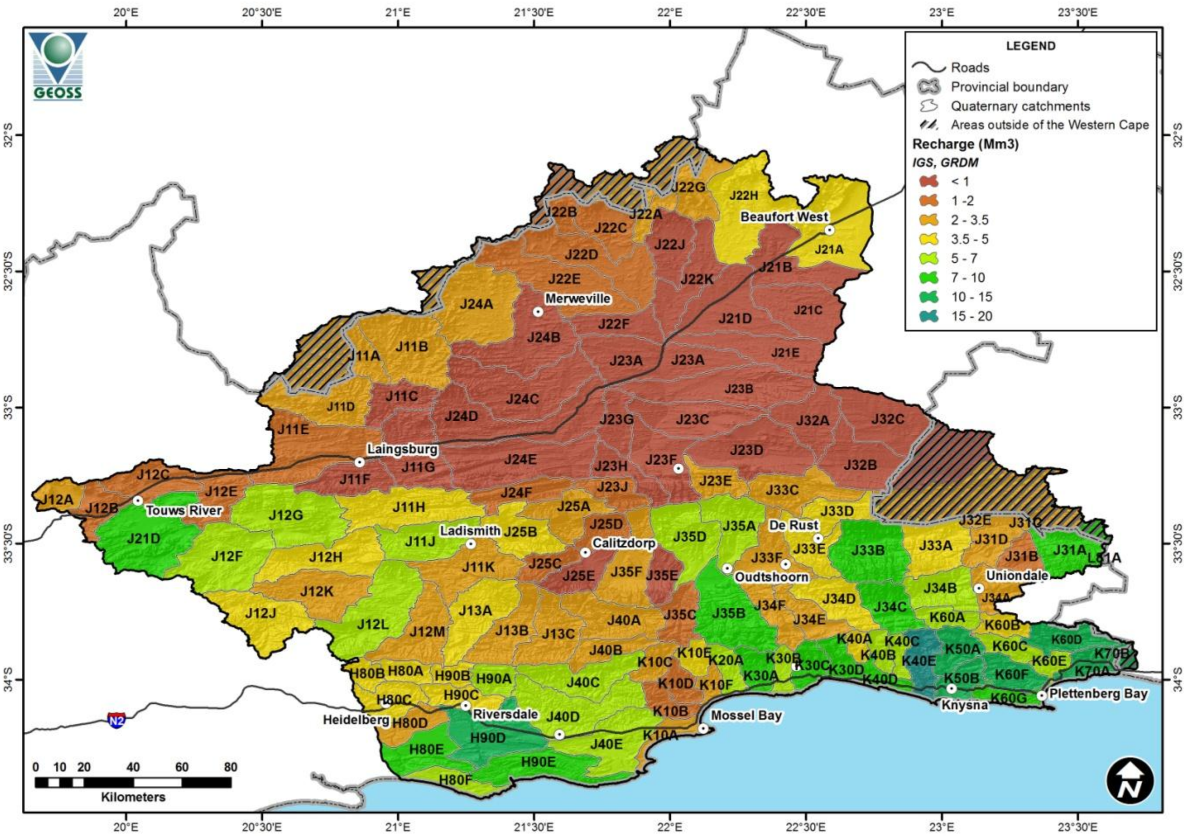

Figure 10.3.2 Groundwater Recharge of the Gouritz WMA.

10.3.3 Groundwater Quality

The Gouritz WMA is characterised by good groundwater quality as well. The vast mountain ranges (e.g. Swartberg) comprising mainly Table Mountain Group result in good quality groundwater. Even the coastal areas comprise acceptable quality groundwater. Although the Great Karoo is indicated as having acceptable groundwater quality (which is often the case) the variability in groundwater quality is higher and in places depending on the geological setting the groundwater may be unsuitable for use. Recharge rates in the Great Karoo are generally lower and over-abstraction can occur relatively easily resulting in groundwater level declines and groundwater quality deterioration. It is essential to carefully optimise (i.e. balance abstraction versus recharge) for boreholes located in the Karoo. The more saline groundwater is associated with mainly the more argillaceous Bokkelveld Group. The spatial variability in electrical conductivity (salinity) is shown in ***Figure 10.3.3***.

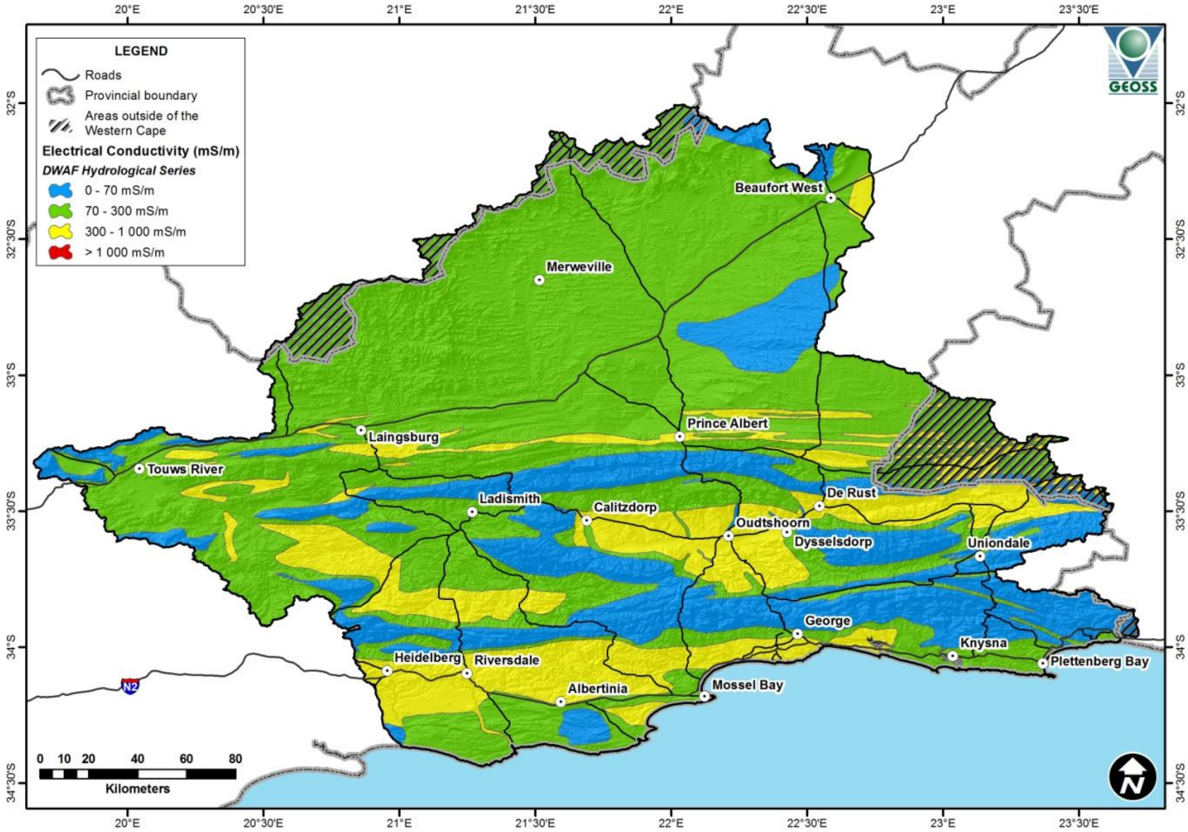

Figure 10.3.3 Groundwater quality (EC) of the Gouritz WMA.

10.3.4 Groundwater Abstraction

Groundwater abstraction does occur throughout the WMA mainly for domestic municipal supply and for agriculture. Many towns make use of groundwater for their supply, either solely or conjunctively (in conjunction) with surface water supplies. The towns such as Touws River, Matjiesfontein, Laingsburg, Merweville, Beaufort West, Prince Albert, Dysseldorp and Uniondale make extensive use of groundwater and more recently much work has gone into supplying coastal towns with groundwater (e.g. Mossel Bay, Sedgefield, Knysna and Plettenberg Bay). For the Gouritz WMA the highest groundwater abstraction is in the Karoo, south of Leeu Gamka and in the Beaufort West area (see ***Figure 10.3.4***).

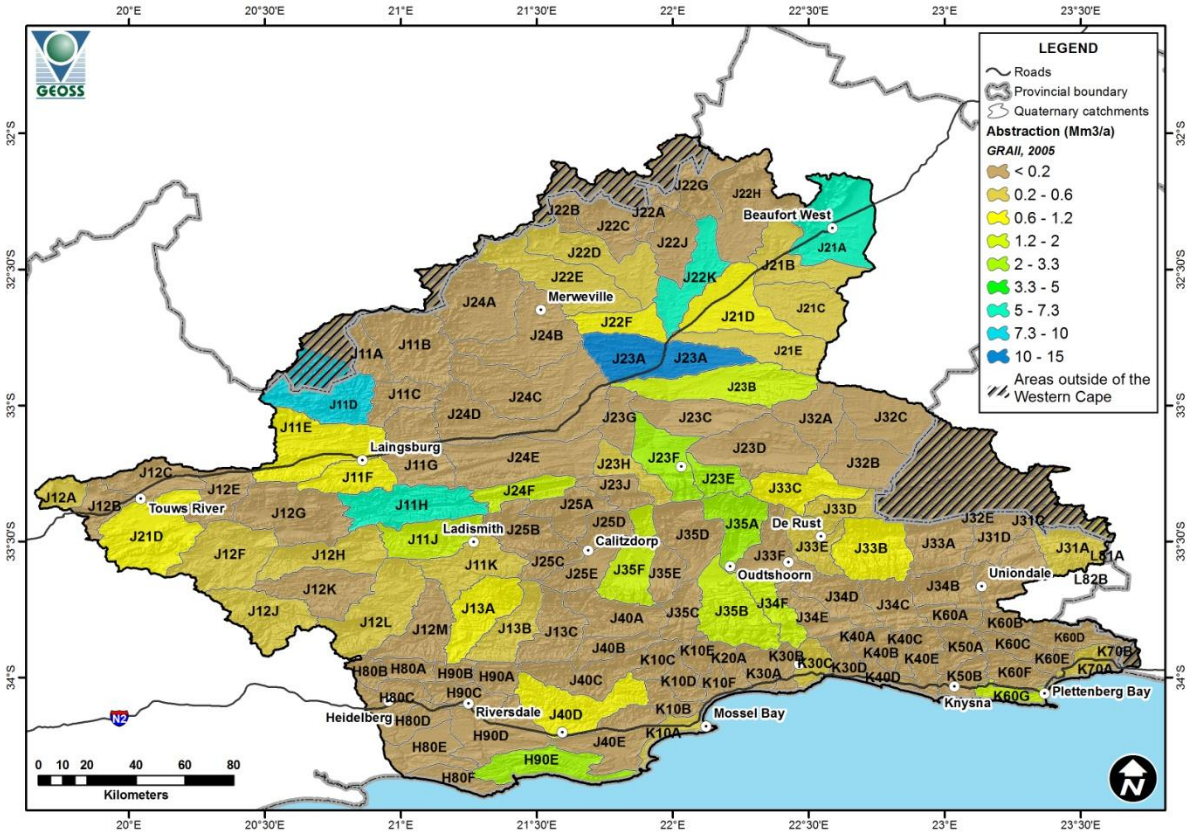

Figure 10.3.4 Groundwater abstraction of the Gouritz WMA.

10.3.5 Groundwater Stress Index

Within the southern portion of the WMA the groundwater abstraction is well within the volumes recharged. However, in the northern portion of the WMA there are numerous Quaternary catchments with stress indices that are too high. Groundwater is an absolutely crucial resource in these areas which highlights the necessity for accurate and detailed groundwater monitoring in the Karoo to ensure sustainable usage of groundwater. ***Figure 10.3.5*** shows the groundwater stress index per Quaternary catchment.

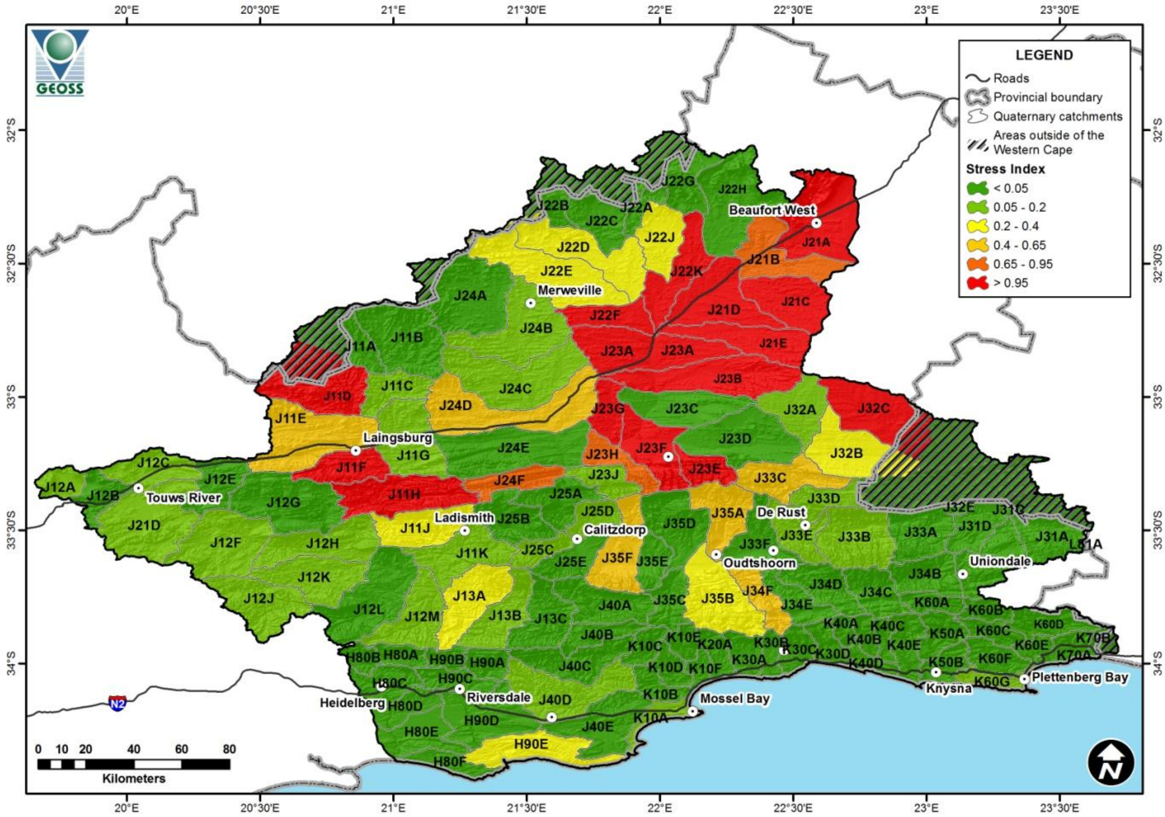

Figure 10.3.5 Groundwater stress index of the Gouritz WMA.

10.3.6 Groundwater contribution to river base flow

Groundwater plays a significant role in the southern portion of the WMA in terms of providing base flow to river systems, particularly in the George and Knysna areas. It does not play a role in the western and northern part of the WMA. The groundwater contribution is shown per Quaternary catchment in ***Figure 10.3.6***.

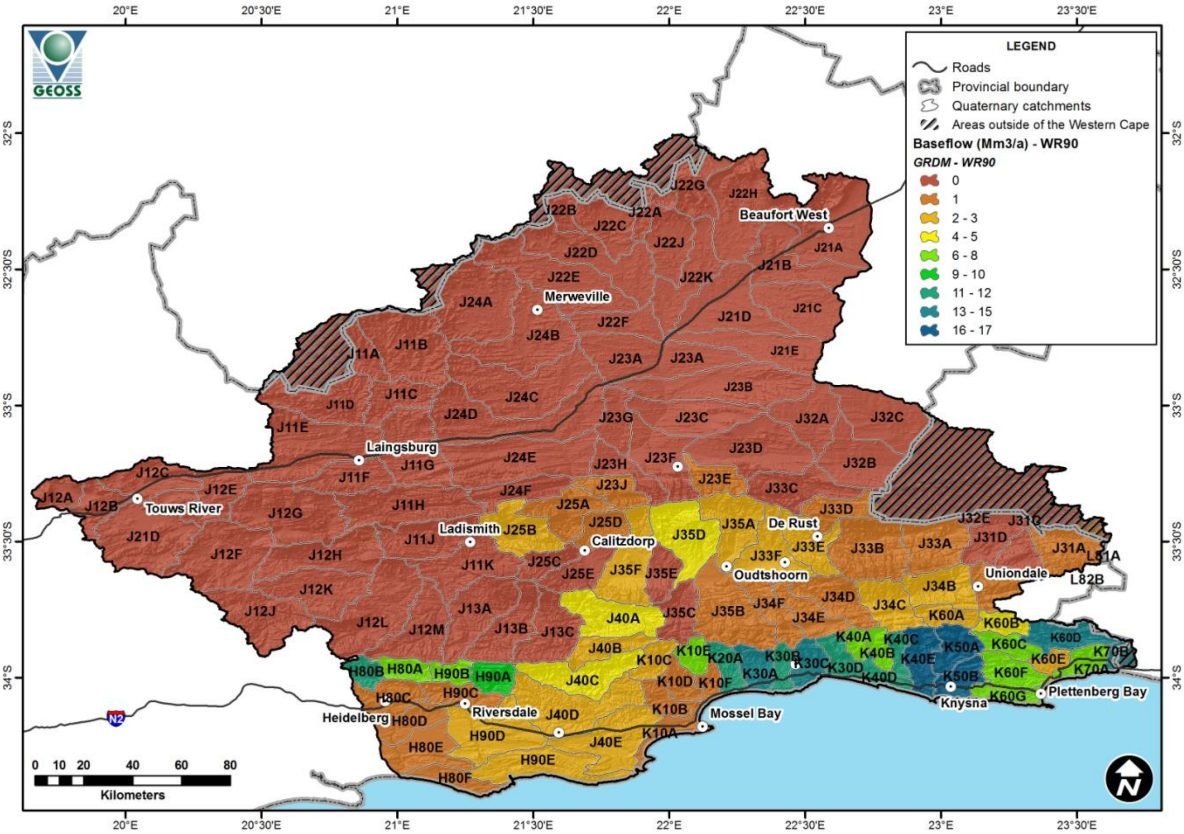

Figure 10.3.6 Groundwater contribution to river base flow of the Gouritz WMA.

10.3.7 Proposed Fracking in the Karoo

The groundwater in the Karoo is generally remarkably shallow and the sedimentary type fractured aquifers can extend from just a few metres below the surface to approximately 80 metres below ground level. The fractured aquifers in the Karoo are also enhanced significantly by the intrusion of doleritic sills and dykes. This setting means that aquifer characteristics can vary greatly over short distances. The groundwater quality also varies significantly over short distances depending on recharge mechanisms and dynamics. However the Karoo is an arid area and groundwater recharge rates are typically low – so it is a scarce and precious resource, and due to the limited surface water flows in the Karoo is a key resource in terms of domestic, municipal and agricultural supply. Thus the impact of using groundwater for the drilling of deep gas boreholes has to be carefully taking into account, especially the impact on existing users (including environmental requirements).

The great depths of the gas drilling and the hydraulic fracturing will probably not affect the groundwater resources, due to the thick overlying compacted sedimentary strata. However the concern is that the drilling process will need to puncture the groundwater "layer" and that the gas will be drawn back through this layer. In theory if the sealing off of the aquifer during the drilling process (with continuous steel casing – that does not corrode with time) is done correctly with high levels of safety the groundwater should not be impacted by the fracking process. At this stage there is a lot of uncertainty about the process i.e. how much water is needed for the drilling of the boreholes, what is the diameter of the boreholes, what drilling fluids are used, what is the contamination risk of the fracturing chemicals used, how toxic is the gas extracted, how is the used drilling fluid dealt with etc. More data needs to be collected, and then even possibly a pilot project of just one or two fracking boreholes allowed to proceed to collect as much data about the process as possibly.

A very cautious approach is recommended with regard to the fracking in the Karoo, especially as groundwater is so scarce in the area yet plays such an important role in sustaining socio-economic and environmental functioning. Currently a moratorium has been placed on the fracking applications in the Karoo region, in order to determine more information about the process, its potential impacts and international best practice requirements. **Annexure G** includes "A critical review of the application for a Karoo Gas exploration Right by Shell Exploration Company B.V conducted by Havemann Inc. Specialist Energy Attorneys.

10.3.8 Groundwater – general comments

Table 10.3.3 lists the 37 quaternary catchments (out of a total of 132) in this WMA where the groundwater abstraction exceeds the groundwater recharge and the volume of groundwater required to meet the groundwater Reserve allocation. Intervention measures are required to ensure sustainable use of groundwater in these Quaternary Catchments.

Table 10.3.3 Quaternary catchments where groundwater abstraction exceeds recharge and the Reserve - Gouritz WMA

WMA	Quaternary Catchment	Allocable Volume (Mm^3/a)	% Area of Quat included
GOURITZ	H80A	-2.38	100
GOURITZ	H80B	-6.02	100
GOURITZ	H90A	-3.87	100
GOURITZ	H90B	-3.23	100
GOURITZ	J11D	-5.99	65
GOURITZ	J11F	-0.77	100
GOURITZ	J11H	-2.72	100
GOURITZ	J21A	-2.34	100
GOURITZ	J21C	-0.16	100
GOURITZ	J21D	-0.61	100
GOURITZ	J21E	-0.13	100
GOURITZ	J22F	-0.56	100
GOURITZ	J22K	-5.41	100
GOURITZ	J23A	-10.69	100
GOURITZ	J23B	-1.34	100
GOURITZ	J23E	-1.11	100
GOURITZ	J23F	-2.24	100
GOURITZ	J23G	-0.01	100
GOURITZ	J32C	-0.01	77
GOURITZ	J35F	-0.50	100
GOURITZ	J40A	-1.68	100
GOURITZ	J40B	0.00	100
GOURITZ	K10E	-3.07	100
GOURITZ	K20A	-4.81	100
GOURITZ	K30A	-6.57	100
GOURITZ	K30B	-5.69	100
GOURITZ	K30C	-5.80	100
GOURITZ	K30D	-2.78	100
GOURITZ	K40A	-2.31	100
GOURITZ	K40B	-1.33	100
GOURITZ	K40C	-4.07	100
GOURITZ	K40D	-3.62	100
GOURITZ	K40E	-0.04	100
GOURITZ	K50A	-2.58	100
GOURITZ	K50B	-3.75	100

WMA	Quaternary Catchment	Allocable Volume (Mm^3/a)	% Area of Quat included
GOURITZ	K60B	-0.39	100
GOURITZ	K70B	-2.81	47

10.4 WATER RESOURCE INFRASTRUCTURE

Water resource developments in the Gouritz have to a large extent evolved through the implementation of local water supply schemes, augmented as and when necessary. The diverse variation in precipitation has led to distinctly different approaches to water resource management and resource development.

In the Great Karoo and Olifants River catchments rainfall is very erratic and some dams take up to 10 years to fill, only reaching full capacity after major flood events. Thereafter storage levels decrease significantly over periods of up to 3 years, and fluctuate at low levels until the next flood event of sufficient size allows the dam to fill again.

In the interior catchments of the Karoo and Olifants River, runoff from many of the catchments in the Swartberg, the Outeniqua and Langeberg Mountains is perennial and the normal flows are diverted into farm dams or into earth canals for run-of-river irrigation on a shared basis (such as at Oudtshoorn for example). Flood runoff from these mountains and from the Great and Little Karoo is also used for opportunistic run-of-river irrigation, but most is stored in dams for later use by irrigators. The largest of these being the Kammanassie, Stompdrift and Gamkapoort Dams, where low assurance of supply is linked to variability in runoff coupled with over-allocation of that water which is available.

Groundwater is used extensively for water supply to the urban sector, and for rural domestic use, stock watering and irrigation to a lesser extent. Along the coastal belt, the relatively deeply incised perennial rivers in the eastern areas (from Wilderness eastwards) are predominantly utilized on a run-of-river basis to supply urban areas. Some irrigation with very limited storage is provided. Some of this storage comes through the use of off-channel dams and some in-channel dams on smaller rivers and tributaries.

In the west storage dams supply towns and irrigators, the greatest storage being in the dams supplying the urban and industrial areas of George (Garden Route Dam) and Mossel Bay (Wolwedans Dam). Groundwater usage is mainly for stock watering and as a supplement to some urban supplies. Afforestation takes place in the higher rainfall coastal areas in the foothills of the Langeberg and Outeniqua Mountains.

10.5 STRATEGIC PERSPECTIVES FROM THE GOURITZ WMA ISP

The Gouritz WMA ISP (completed in 2004) which serves to guide the strategic management of water resources in this WMA until such time as a CMA is in place and has developed its CMS. The following key strategic objectives and concerns are extracted from that ISP:

Strategic Objectives:

- A review of water availability and water requirements based on existing available information and expert input should be undertaken, with a particular focus on the Mossel Bay region. This has subsequently been implemented through the DWA All Towns Strategy for this region.
- Further water resource development for urban use in the Olifants catchment will require that licenses be purchased from existing irrigators.
- Surface water resource development shall largely be limited to off-channel storage. Groundwater shall be further developed to meet future water requirements.
- The coastal catchments and estuaries are of highest priority in terms of Reserve determination.

- Clearing of Invasive Alien Plants in the catchments between George and Mossel Bay must be prioritised.

Concerns:

- Proliferation of invasive alien vegetation in the higher rainfall areas, and
- The impact of the final Reserve when implemented in the Coastal Catchments.

10.6 GOURITZ WMA WATER AVAILABILITY AND UTILIZATION

In 2005, the water availability, utilisation and resulting water balance for the Gouritz WMA (based on the Gouritz WMA ISP) is as shown in ***Figure 10.6.1***.

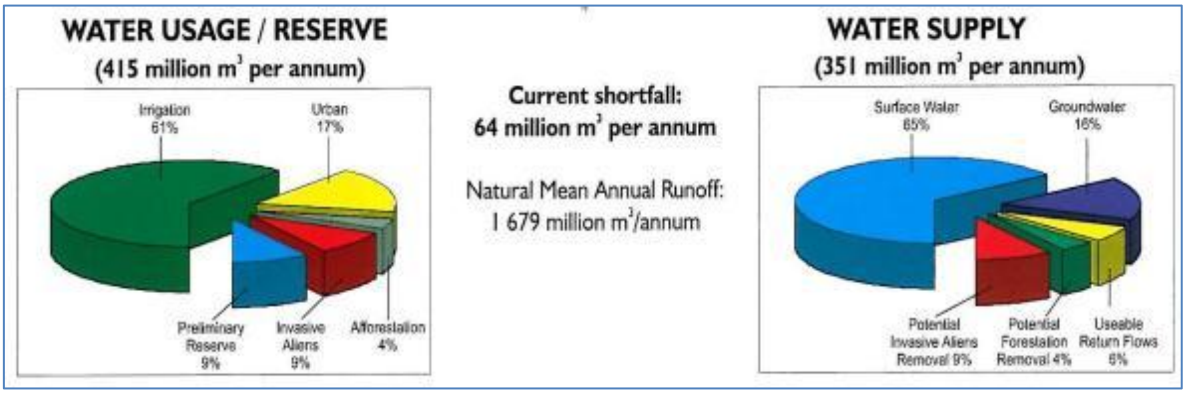

Figure 10.6.1 Gouritz WMA water availability and utilisation (2005).

It is relevant to note that in 2005:

- Irrigation comprised more than 60% of the total water requirement.
- Surface water sources provided for approximately 65% of the water availability and groundwater 16%
- A shortfall of 64 million m^3/a occurred of which 43 million m^3/a occurred in the Eastern Southern Cape region.

Whilst various interventions have since been implemented in the coastal catchments towards alleviating the water shortages in that area (further discussed in Section 10.7), it was observed during the public participation meeting held in Oudtshoorn that there are significant grievances by the farmers relating to the scarcity of water in that area and the limitation that this has on the potential for irrigation development.

Over-allocation of water from the Stompdrift and Kammanassie Dams further aggravate the situation. The perception is that more storage will bring relief but the cost of providing such infrastructure is unlikely to be affordable to the irrigators. Furthermore, the infrequent occurrence of rainfall and related sporadic runoff is unlikely to allow such dams to routinely fill, further adding to the unit cost of water from new dams, which in average years would not fill.

It is relevant to note that in terms of infrastructure development and financing thereof, the DWA Pricing Strategy for Raw Water Use Charges indicates that the costs associated with new water resource development schemes for purposes of Commercial Irrigation are to be recovered at full financial cost recovery (Ref: Government Gazette No 27732, July 2005).

10.7 RECENT INTERVENTIONS

Since 2005, a number of interventions have either been implemented, are being implemented or are being investigated by the local authorities towards alleviating the water shortages, with particular focus having been placed on the Coastal catchments between Mossel Bay and Natures Valley (see ***Figure 10.7.1***).

DWA's All Town Strategies can be referred to for the water resource situation at all other towns within the Gouritz WMA. A brief summary of the recent interventions identified for being undertaken for the coastal catchments is provided hereafter.

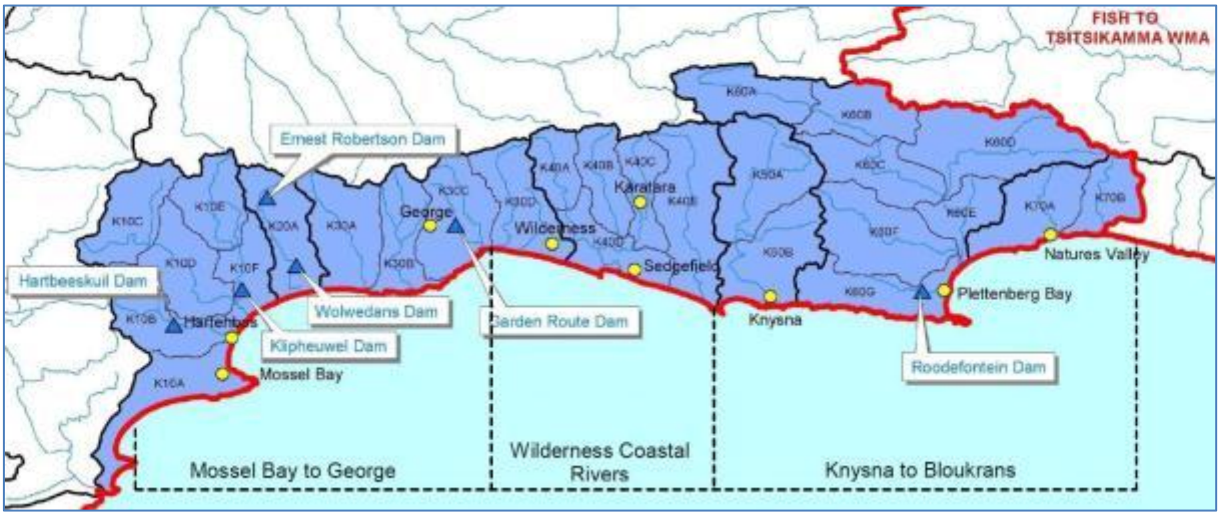

Figure 10.7.1 The Garden Route coastal catchments.

10.7.1 Mossel Bay

The Mossel Bay Regional Water Supply Scheme supplies Mossel Bay, Danabaai, Hartenbos, the resorts of Vleesbaai and Boggomsbaai and the inland town of Brandwacht. Raw water sources include the Wolwedans Dam and the Klipheuwel off-channel storage dam (fed by water pumped from the Moordkuil River).

The Ernest Robertson Dam supplies the Klein Brak Regional Water Supply Scheme, which can be linked to the Mossel Bay RWSS. The Hartebeeskuil Dam on the Hartenbos River can also supply this scheme but is not fully utilized due to its high salinity.

Water is pumped from the Wolwedans Dam to PetroSA (which has its own WTW) and to the Klein Brak WTW, and there is also an emergency supply connection to the Great Brak WTW. The Wolwedans Dam (see ***Figure 10.7.2***).

Figure 10.7.2 The Wolwedans Dam

Water shortfalls are currently being experienced, compounded by the recent severe drought situation in the Southern Cape. The following interventions have been implemented towards addressing the situation:

- Mossel Bay Municipality has implemented a water re-use scheme (July 2010) at Hartenbos whereby treated effluent is supplied to PetroSA in exchange for an equivalent reduction from their allocation from the Wolwedans Dam.
- A 15 Ml/day seawater desalination plant has been constructed at Voorbaai, partly funded by PetroSA. Once fully operational, the Petro SA allocation from the Wolwedans Dam will be further reduced pro rata, making more water available for Mossel Bay.
- As part of the emergency scheme the water from the Hartbeeskuil Dam, which is quite saline, will be diverted to the Klein Brak WTW, where it will be blended and used to augment the areas.

10.7.2 George

George is currently supplied with raw water from three sources namely the Garden Route Dam, the Kaaimans River and the Touw River. The main source of potable water for domestic consumption in the George Municipality is the Garden Route Dam on the Swart River (see ***Figure 10.7.3***)

Figure 10.7.3 The Garden Route Dam at George.

The supply area of the present water system covers the old George Area including Heroldsbaai, Pacaltsdorp, Wilderness (and surrounds), Hoekwil and Victoria Bay. The Garden Route Dam is owned and operated by the George Municipality.

Currently, the water supply situation in this area is critical as a result of severe drought conditions in the area. The available yield of the existing water source is insufficient under these circumstances to meet the present water requirements. The municipality's water conservation and demand management strategy for George must be rigorously implemented.

As a result of the current situation, the Municipality is in the process of implementing the following augmentation schemes:

- The proposed Malgas River pumping scheme comprises of a low diversion weir on the Malgas River with a pump station located downstream of a proposed future dam site. The pipeline to the water treatment works in George is currently being installed, but the pumpstation has not yet commenced. There is concern regarding the impact of abstraction on downstream water users and no water use licence has yet been issued.

- The potential raising of the Garden Route (of between 2-3m) is being investigated and the EIA is in progress. This scheme is unlikely to be viable if any Reserve releases are required from the raised dam.
- The Kaaimans River diversion was one of the first schemes supplying water to George, implemented to supplement the towns original supply from the Swart River Dam. The Municipality reinstated the Kaaimans River Weir and Pump Station Scheme during 2008/2009, and water is pumped into the headwaters of the Garden Route Dam.
- George Municipality has implemented a project involving the re-use of water from the Outeniqua WWTW, discharging approximately 10 Ml/day of treated water from the WWTW into the Garden Route Dam.
- Emergency boreholes have been drilled in close vicinity of the Garden Route Dam to supplement the water supply system. The boreholes are well located for inclusion into the town's water reticulation system, and selected boreholes are currently being brought into production.

Future interventions that have been determined as being feasible include the following:

- A dam on the Malgas River which could feed the George WTW under gravity via the proposed Malgas diversion described above, or a possible dam on the Maalgate River with pumping to the WTW;
- Increase water reuse via storage in the Garden Route Dam;
- Further development of groundwater sources, including the TMG; and
- Conjunctive use of surface and groundwater sources.

10.7.3 Knysna

The Knysna area is currently supplied with raw water from several different sources, namely the Knysna River, Gouna River, Glebe Dam, Akkerkloof Dam, Bigai Springs and boreholes.

Two run-of river schemes relay water to the Knysna WTW, namely the diversion from the Knysna River via the Charlesford Pump Station (see ***Figure 10.7.4***).

Figure 10.7.4 The Knysna River DWA gauge and Charlesford pumpstation.

Two existing dams also supply the WTW, namely the Glebe and Akkerkloof Dams. The latter also serves as a storage facility during low water requirement periods. Surplus water from the two run-of-river diversions is pumped back from the balancing dam at the WTW into the Akkerkloof Dam for use during periods of high water requirements.

Groundwater supply to Knysna is from the Bigai Springs as well as boreholes in the area.

Recent interventions include the following:

- Drilling of 27 boreholes in and around Knysna to augment the existing supplies during the current drought. Selected boreholes have been brought into production.
- A proposed increase in the Charlesford run-of-river scheme from 92l/s to 300l/s for which the EIA is in progress. Preliminary planning for a new pipeline and for augmentation of the existing pumpstation has been undertaken.
- A reverse osmosis desalination plant (1,5 Ml/day) has been installed at Sedgefield.

Future possible augmentation options for Knysna include:

- A number of potential dam sites have been investigated of which two possible sites on the Knysna River appear feasible. An EIA is scheduled to be undertaken in due course.
- Increased water re-use (current re-use only involves an irrigation scheme at Sparrebosch Golf Estate). The Treated Sewage Effluent Study (2009) has investigated various options, but concludes that the re-use of treated effluent in Knysna is not yet economically feasible when compared to the other options available at that time.
- Artificial aquifer recharge via dune filtration has been investigated for Sedgefield. Its viability could be influenced by the quality of treated effluent from the WWTW.
- Possible further groundwater development.

Potential integration of water resources between Bietou, Knysna and George have also been investigated (2009) but the outcomes suggest that at this stage, development of local sources appear to be more feasible options.

10.7.4 Plettenberg Bay

The main supply for Plettenberg Bay is abstracted on a run of river basis from the Keurbooms River with a diversion pipeline to the Plettenberg Bay WTW, and the scheme has a current capacity of 100l/s. This source is supplemented by groundwater and by the Roodefontein Dam on the Piesangs River which is owned by DWA and operated and maintained by the Bitou Local Municipality. Water can also be diverted from the Keurbooms River and stored in the Roodefontein Dam for use during drier periods but is limited to 32 ℓ/s due to the pipeline capacity. Groundwater supply to the Plettenberg Bay WTW consists of two boreholes that supplement the water supply during the peak demand months.

The current sources of supply to Plettenberg Bay are insufficient and augmentation is required to address current and future shortfalls.

Recent interventions that have been investigated include:

- A proposed off-channel storage dam (4,5 million m^3) for increased abstraction from the Keurbooms River up to 450l/s, for which a water use licence has been submitted. The pipeline from the Keurbooms River to the WTW has been upgraded to convey up to 450l/s. The EIA for the proposed off-channel dam is in progress.
- The EIA for a potential 2Ml/day desalination plant is in progress.

Future possible augmentation options for Plettenberg Bay include:

- Indirect water re-use through pumping treated effluent into Roodefontein Dam and mixing with water from the Keurbooms River.
- Expansion of the existing wellfield in the Kwanokathula Aquifer.

- Artificial recharge of TMG aquifer with winter surplus water and abstraction during peak summer months.

10.8 TOP PRIORITIES AS PER BITT REPORT

The BITT report has not prioritized (at DM level) the infrastructure development needs in the Central Karoo and Eden DMs, nor has it prioritized the skills requirements in those two DMs.

10.9 PROBLEM SYNTHESIS

The problems and gaps identified in this Chapter are broadly summarised as follows:

- The irrigation sector (notably the Stompdrift-Kamannassie region) has expressed concern regarding their water resource situation. The assurance of supply to farmers in the area is very low. Farmers are of the opinion that their concerns are not being taken seriously and despite recommendations from various previous studies (including the Oudtshoorn Agricultural Feasibility Study, 2007) none of these have yet been implemented. One such recommendation was that the potential raising of the Gamkapoort Dam be investigated.
- Opinion has been expressed by the farmers that building new dams will allow for infrequent foods to be captured rather than losing the water downstream. However, the erratic nature of rainfall and related sporadic runoff is unlikely to allow such dams to routinely fill, further adding to the unit cost of water from new dams.
- WCDM opportunities (canal refurbishment and lining) were also investigated in the above mentioned agricultural. Conveyance canals forming part of the Government Water Supply Scheme would be very expensive to refurbish but offers opportunity to substantially reduce water loss. However, the question of cost and who will pay for this work to state owned infrastructure is a challenge.
- It is relevant to note that in terms of infrastructure development and financing thereof, the DWA Pricing Strategy for Raw Water Use Charges indicates that the costs associated with new water resource development schemes for purposes of Commercial Irrigation are to be recovered at full financial cost recovery (Ref: Government Gazette No 27732, July 2005).
- This Oudtshoorn area is highly water stressed due to the over-allocation water, and should receive a high priority in terms addressing the over-allocation.
- Over-abstraction of groundwater of groundwater has been identified in 37 of the 132 quaternary catchments in this WMA, of which most occurs in the area between Beaufort West, Merweville and Laingsburg. This must be cautiously considered.
- Groundwater is an absolutely crucial resource in these areas which highlights the necessity for accurate and detailed groundwater monitoring in the Karoo to ensure sustainable usage of the resource.
- Groundwater plays a significant role in the southern portion of the WMA in terms of providing base flow to river systems, particularly in the George and Knysna areas. Increased groundwater abstraction from aquifers along the coast is also taking place and the operation and management of this abstraction is critical to avoid saline intrusion. Options for artificial recharge using treated effluent have been investigated and this has shown potential.
- Based on the 2005 Gouritz ISP, a shortfall in water availability of 43 million m^3/a occurred in the coastal catchments between Mossel Bay and Natures Valley. DWA have since undertaken the All Towns Study to identify how to best reconcile water availability and utilisation in the long-term. Mossel Bay, George, Knysna and Plettenberg Bay have all implemented recent water resource augmentation schemes towards managing their shortfalls during drought.
- Drought management planning by local authorities is critical.