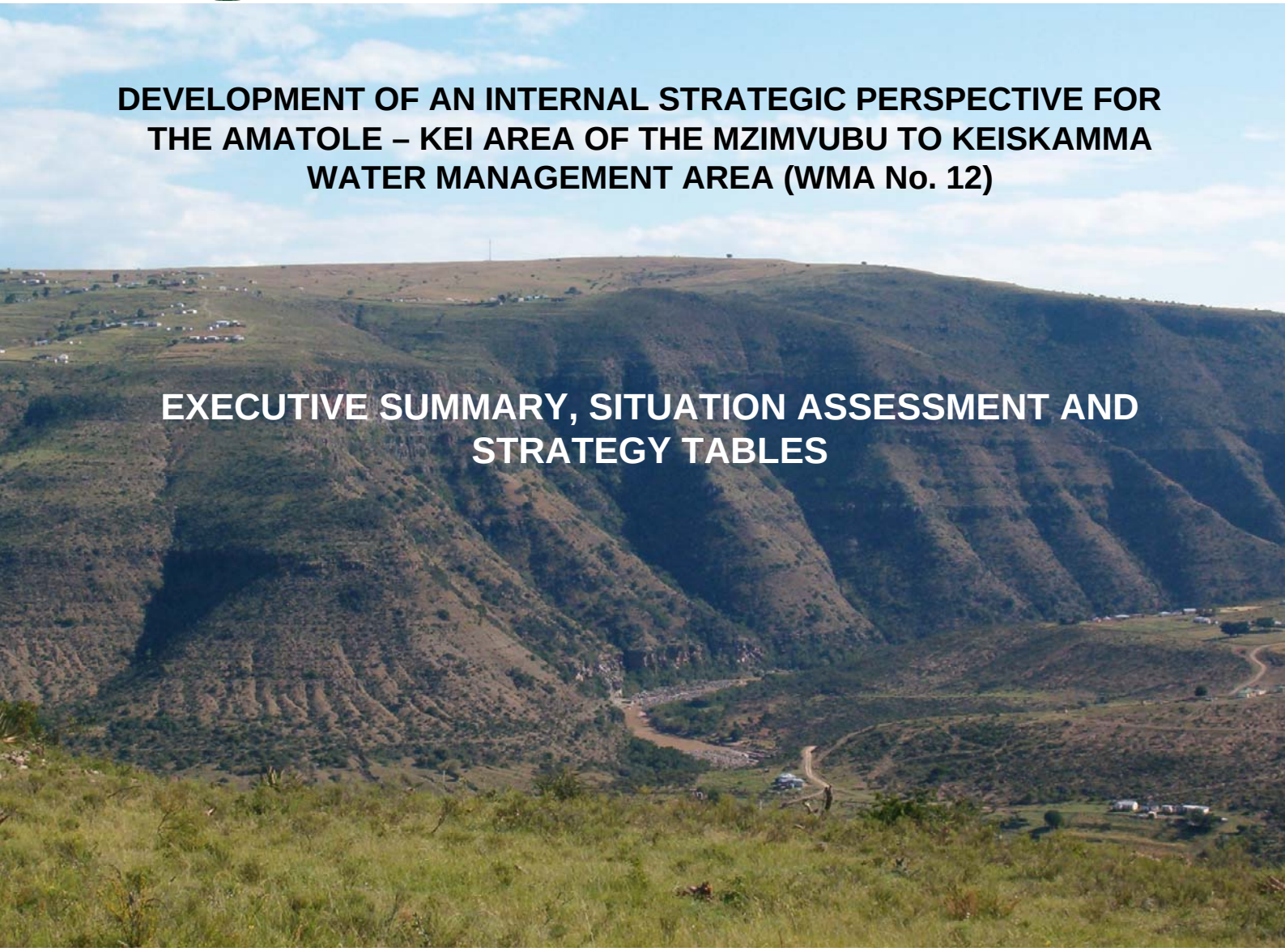
REPORT NO. P WMA 12/000/00/0404

Department of Water Affairs and Forestry
Directorate : National Water Resource Planning

# DEVELOPMENT OF AN INTERNAL STRATEGIC PERSPECTIVE FOR THE AMATOLE – KEI AREA OF THE MZIMVUBU TO KEISKAMMA WATER MANAGEMENT AREA (WMA No. 12)



## EXECUTIVE SUMMARY, SITUATION ASSESSMENT AND STRATEGY TABLES

**August 2004**

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**Department of Water Affairs and Forestry**
**Directorate : National Water Resource Planning**

# DEVELOPMENT OF AN INTERNAL STRATEGIC PERSPECTIVE FOR THE AMATOLE – KEI AREA OF THE MZIMVUBU TO KEISKAMMA WATER MANAGEMENT AREA (WMA No. 12)

## APPROVAL

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| **Title** | : | **Mzimvubu to Keiskamma Water Management Area: Amatole – Kei Internal Strategic Perspective** |
| **DWAF Report No.** | : | P WMA 12/000/00/0404 |
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**STUDY TEAM:** **Approved for FST Consulting Engineers (Pty) Ltd**

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## INVITATION TO COMMENT

This report will be updated on a regular basis until it is eventually superseded by the Catchment Management Strategy. Water users and other stakeholders in the Mzimvubu to Keiskamma WMA and other areas are encouraged to study this report and to submit any comments they may have to the Version Controller (see box overleaf).

## ELECTRONIC VERSION

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- DWAF website:
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# VERSION CONTROL

## Mzimvubu to Keiskamma WMA
## Amatole – Kei Internal Strategic Perspective

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The most significant amendments included in the latest version will be indicated on this page.

# EXECUTIVE SUMMARY

## AMATOLE – KEI INTERNAL STRATEGIC PERSPECTIVE

## 1. INTRODUCTION

The National Water Act (NWA No. 36 of 1998) specifies that the Government, as the public trustee of the nation's water resources, must ensure that water is protected, used, developed, conserved, managed and controlled in an equitable and sustainable manner for the benefit of all the people of South Africa. To achieve these objectives, the Department of Water Affairs and Forestry (DWAF) as the responsible custodian Department has been engaged in the ongoing development of a National Water Resource Strategy (NWRS) as a framework for the management of the water resources of South Africa. The NWRS was published in November 2003 after extensive national public consultation and participation.

The NWA provides for the decentralisation and devolution of the responsibility and authority for water resource management from DWAF to nineteen Catchment Management Agencies (CMAs) covering all the river catchments of South Africa. The core purpose of the CMAs will be to manage and ensure the sustainable use of water resources in their areas of operation in line with the overall intent of the NWA. Once established, each CMA must develop and implement a Catchment Management Strategy (CMS) that is aligned with the NWRS for the water resources within its own Water Management Area (WMA). These CMSs will form the most important instrument for the integrated management of water resources in each WMA.

In the interim period, until such time as the CMAs are established and CMSs developed, it is important that strategic direction and further insight is gained by DWAF in order :

- for DWAF Regional Offices to manage the water resources in each WMA in accordance with the NWA and the NWRS,
- to prioritise actions for implementation of the National Water Act (NWA), and
- to structure and prioritise future planning studies.

With this objective, DWAF have embarked on an exercise to develop Internal Strategic Perspectives (ISPs) for each of the WMAs or sub-areas of the WMAs.

The region covered by this ISP is the Amatole – Kei area, which forms the western part of the Mzimvubu to Keiskamma Water Management Area (WMA No. 12) and lies wholly within the Eastern Cape Province. A separate ISP study will be undertaken for the remainder of the WMA.

## 2. LOCALITY AND PHYSICAL CHARACTERISTICS

The Amatole – Kei ISP area comprises the Amatole and Kei primary catchments (R and S) and is located in the Mzimvubu to Keiskamma Water Management Area (WMA 12) of

the Eastern Cape. A separate ISP is being developed for the Mbashe to Mzimvubu catchments. The Amatole – Kei area has been divided into five sub-areas for the development of an Internal Strategic Perspective. These sub-areas are :

- The Amatole sub-area - catchments R20/30
- The Keiskamma sub-area - catchments R10/40/50
- The Upper Kei sub-area - catchments S10/20/31/32
- The Middle Kei sub-area - catchments S40/S50
- The Lower Kei sub-area - catchments S60/70

The map following this Executive Summary shows the demarcation of the Amatole – Kei ISP area.

The topography of the area is defined by the Amatola mountain range which divides the two primary catchments :

- The Amatola coastal catchments (7 936 $km^2$) with their headwaters draining the southern slopes of the Amatola mountain range at an altitude of some 1960 masl. The main rivers of the Buffalo, Keiskamma and Nahoon Rivers drain in a south-easterly direction into the Indian Ocean along the coastline either side of East London.
- The Great Kei catchment (20 485 $km^2$) which drains the northern slopes of the Amatola mountain range and the southern slopes of the Stormberg / Drakensberg range at an altitude of 2400 masl with the upper Kei Catchment centred around Queenstown. The middle and lower Great Kei River reaches are characterized by a deeply incised valley, which exits into the Indian Ocean at Kei Mouth north of East London.

The area consists predominantly of the Beaufort Series of sandstones, shales and mudstones interspersed with dolerite dykes and sills.

The climate and temperature variations of the ISP area are closely related to elevation and proximity to the coast. The study area experiences a temperate climate along the coast to more extreme conditions inland with snowfalls occurring on high ground during most winters. Annual rainfall along the coastline varies from approximately 500 mm in the west to approximately 1000 mm in the east, and over 1200 mm in the Amatola mountains. Annual rainfall in the Kei catchment varies from a low of approximately 400 mm in the Upper Kei catchment around Sterkstroom, to 700 mm in the Middle Kei catchment, to 1000 mm at Kei Mouth.

## 3. VEGETATION AND LAND USE

The vegetation of the area is predominantly savanna in the Amatole catchment and grasslands in the Great Kei catchment. Indigenous and commercial forests in the Amatola mountains and valley thicket in the river valleys are the other important vegetation types.

Land use has been influenced by the previous homeland policy, where former South African areas are predominantly private small stock and cattle farms, and the former Ciskei and Transkei areas are mainly communal subsistence and grazing lands. Intensive vegetable and dry-land pineapple farms are located in the Amatole catchments with commercial forestry in the Amatola mountains. A number of large but defunct irrigation schemes are found in the former Ciskei and Transkei areas based on large dams viz. Binfield Park, Sandile, Cata, Waterdown and Oxkraal Dams in the former Ciskei, and Xonxa, Lubisi and Ncora Dams in the former Transkei homeland. These schemes are currently being revitalized by the Provincial Department of Agriculture and the District Municipalities.

## 4. DEMOGRAPHY

The only large urban area is centered in the Buffalo City Municipal (BCM) area around East London. Other significant towns are Queenstown and Butterworth. The population of the ISP area was estimated at 1 761 000 in the year 2000, with 953 000 (54%) people residing in the Amatole catchment and 808 000 (46%) in the Great Kei catchment. The only area expected to experience significant growth in the future is the Buffalo City Municipal area where employment opportunities will attract people from the smaller urban centres and rural areas. Little change in the overall population of the ISP area is expected over the next ten years.

## 5. LAND TENURE

As with land use, land tenure in the area is characterised by the different systems found within South Africa and those of the former Ciskei and Transkei. Due to many factors associated with the tribal land tenure system such as overgrazing on communal lands, using land as collateral for bank loans etc, attempts have been made in the past to change the system but to date these have not met with much success.

## 6. ECONOMIC DEVELOPMENT

There are four main economic activities in the area viz. manufacturing, agriculture, forestry and tourism. These four sectors have been identified by the Provincial Government in their Growth and Development Strategy as being the basis upon which further economic growth will occur and be promoted.

The industrial and manufacturing activities are based mainly in the BCM area with vehicle manufacturing being the dominant industry. The main industrial opportunities for further economic growth will continue to be based on the development of industries and trade in the BCM area (East London - King William's Town corridor). This has been recognized by government and the East London Industrial Development Zone (ELIDZ) is presently being established as an incentivised trade zone on the west bank of the Buffalo River, close to the harbour.

Cultivation of dry land crops, irrigated agriculture, and stock farming are practised throughout the rural areas. Regeneration and expansion of rural economic activities will

take place once the defunct irrigation schemes in the former Ciskei and Transkei are revitalised and placed on a sound and sustainable economic footing. This is being actively driven by the Provincial Government as one of the main pillars for economic growth and poverty eradication in the rural areas.

The commercial forestry industry is centred in the Amatola mountains around Stutterheim and opportunities have been largely exploited. There is additional potential for the manufacture and processing of products from these commercial forestry activities.

East London, the surrounding pristine coastline and its estuaries, and the Amatola mountains are also increasingly becoming the focus for regional tourism. Further expansion of tourism facilities will create labour enhancing opportunities in an area where the unemployment rate exceeds 50%.

## 7. WATERWORKS

Several major dams have been constructed for urban/industrial supply, irrigation supply and for hydropower generation. Those dams with a live storage greater than 10 million $m^3$ are listed below.

**Major Dams in the Amatole – Kei ISP Catchments**

| Dam Name | River | Purpose | Live Storage Capacity (million $m^3$) | Firm Yield* (million $m^3$/a) |
|---|---|---|---|---|
| **Amatole Primary Catchment (R)** | | | | |
| Binfield Park | Tyume/Keiskamma | Domestic, irrigation | 36,8 | 16,5 |
| Bridle Drift | Buffalo | Domestic | 101,7 | 30,7 |
| Cata | Keiskamma | Irrigation | 12,1 | 6,2 |
| Laing | Buffalo | Domestic | 21,0 | 14,9 |
| Nahoon | Nahoon | Domestic, irrigation | 20,7 | 7,8 |
| Sandile | Keiskamma | Domestic, irrigation | 30,9 | 18,0 |
| **Kei Primary Catchment (S)** | | | | |
| Doring River | Indwe | Domestic, irrigation | 17,8 | 3,4 |
| Lubisi | Indwe | Irrigation | 135,0 | 28,5 |
| Ncora | Tsomo | Irrigation, hydropower | 120,0 | 98 |
| Oxkraal | Oxkraal/Klipplaat | Irrigation | 17,8 | 6,2 |
| Tsojana | Tsojana/Tsomo | Domestic | 9,3 | 3,2 |
| Waterdown | Klipplaat | Domestic, irrigation | 36,6 | 16,5 |
| Wriggleswade | Kubusi | Domestic, irrigation | 91,2 | 25,4 |
| Xilinxa | Gcuwa | Domestic | 14,5 | 9,4 |
| Xonxa | White Kei | Irrigation | 126,0 | 27,6 |

* At a 1 in 50 year assurance

The only water transfer scheme out of the ISP area is that from the Ncora Dam to the adjacent Mbashe catchment for irrigation at the Ncora Irrigation Scheme (20 million $m^3$/a), and for hydropower generation at Ncora Dam itself and at Collywobbles hydropower station lower down in the Mbashe catchment (85 million $m^3$/a). Within the ISP area, the two large internal transfer schemes are the Wriggleswade Scheme for transfer of raw water from the Kubusi catchment (Wriggleswade Dam) to supplement the Amatole Water Supply System supplying the BCM area (18 million $m^3$/a), and the Klipplaat Government Water Scheme, which includes the transfer of water from

Waterdown Dam to Queenstown and Sada / Whittlesea (8,25 and 4,2million $m^3$/a respectively).

Future large waterwork schemes that will be required within the next eight to ten years include an additional water supply for Queenstown (possibly from Xonxa Dam), which is currently suffering from ongoing water restrictions, and an additional water supply for the Buffalo City Municipality. Options for Queenstown are presently being investigated by DWAF. Optimal use of existing resources and new sources of additional water for the BCM will need to be investigated and firm proposals made within the short term.

Groundwater is widely used to supply small coastal villages, rural villages and some towns. However, the bulk of the population receives water from surface water supplies, which are generally adequate where the infrastructure is in place. A large number of rural villages still do not have adequate and safe water supplies for domestic use nor adequate sanitation facilities. There is an ongoing programme implemented by the District Municipalities and supported by DWAF for the construction of water supply infrastructure to all the inhabitants of the area, within the financial and manpower constraints of government.

## 8. WATER RESOURCES AVAILABILITY

### Surface water resources

The natural mean annual run-off (MAR) for the ISP area is 1 586 million $m^3$/a, with the Amatole catchments contributing 559 million $m^3$/a (35%) and the Great Kei catchment 1 027 million $m^3$/a (65%).

By far the largest allocated water use in the ISP area is for irrigation making up about 51% of total water use. The next largest water use is for domestic/industrial use which accounts for about 43% of total water use. There is a significant area of afforestation, which is estimated to reduce the yield available to other users by approximately 15 million $m^3$/a.

### Groundwater resources

Although it is estimated that significant quantities of groundwater exist in the ISP area, the actual use of groundwater is relatively small. This is mainly due to the generally well watered nature of the area and the wide occurrence of perennial surface streams, which reduces the need for groundwater abstraction.

Groundwater occurrence is very variable over the area with borehole sources located either in fractured rock or the primary/intergranular aquifers. The recharge to these aquifers and the run-off into the region's rivers are largely dependent on the climate/rainfall which is in turn controlled by the Amatola mountain range that transects the ISP area from west to east, the high lying Winterberg in the north west and the foothills of the Stormberg in the north east. The Amatola mountains receive the greatest amount of rainfall, which reflects in the recharge potential of the area.

Information and data on the groundwater potential of the ISP area is lacking with the result that it is not currently possible to quantify the available groundwater resources. The groundwater figures given in the table below are a reflection of the actual groundwater use rather than the available potential, which is believed to be of the same order of magnitude as the surface water resources.

The total water available for use in the Amatole and Kei primary catchments has been analysed in the ISP study and the results have been compared to the NWRS figures as shown in the following table.

**Comparison of Water Availability between the ISP and the NWRS (Year 2000) (million $m^3$/a)**

| Type of Water Resource | NWRS | | ISP | |
|---|---|---|---|---|
| | Amatole Primary Catchment | Kei Primary Catchment | Amatole Primary Catchment | Kei Primary Catchment |
| Total surface water resource yield[1] | 135 | 372 | 135 | 372 |
| Subtract: | | | | |
| - Ecological Reserve | 7 | 35 | 21 | 35 |
| - Invasive alien plants | 6 | 12 | 6 | 12 |
| Net surface water yield available for use | 122 | 325 | 108 | 325 |
| Available groundwater resource | 1 | 14 | 1 | 14 |
| Usable return flows | 26 | 20 | 19 | 20 |
| **Total Local Yield** | **149** | **359** | **128** | **359** |

(1) After allowance for the impacts on yield of ecological Reserve, river losses, invasive alien plants, dry land agriculture and urban run-off.

From the above table it can be seen that the available yield figures in the Kei primary catchment are the same for both the NWRS and ISP. However, for the Amatole primary catchment the available yield is lower for the ISP than that determined for the NWRS. The difference is due to the higher ecological Reserve and lower usable return flows that were more accurately determined as part of the Amatole System Environmental Study (**Ref. 26**) which was completed after the NWRS estimates were done. It is recommended that the ISP figures be used.

## 9. WATER REQUIREMENTS AND WATER RECONCILIATION

A similar comparison has been undertaken as part of this ISP study to compare the NWRS water requirement figures with the ISP figures based on the latest available information.

**Comparison of Water Requirements between the ISP and NWRS (Year 2000) (million $m^3$/a)**

| Sector | NWRS | | ISP | |
|---|---|---|---|---|
| | Amatole Primary Catchment | Kei Primary Catchment | Amatole Primary Catchment | Kei Primary Catchment |
| Irrigation | 33 | 135 | 29 | 98 |
| Urban | 57 | 18 | 70 | 21 |
| Rural | 5 | 10 | 6 | 11 |
| Afforestation | 4 | 11 | 2 | 13 |
| **Total Local Requirements** | **99** | **174** | **107** | **143** |

Within the Amatole catchment the difference can mainly be attributed to the latest estimate for water requirements within the Buffalo City Municipality (BCM) based on figures contained in the Water Services Development Plan (**Ref. 5)**, which indicates a higher requirement than the NWRS estimate.

The difference between the ISP and NWRS figures for the Kei catchment is largely due to the determination of irrigation requirements in the Black Kei sub-catchment. Further investigation and analysis of information contained in the Water Resources Situation Assessment (**Ref. 24),** the WARMS database and the WSAM database revealed that the NWRS figures had overestimated the water requirements for irrigation. This was confirmed through consensus at the ISP workshops. Until such time as a more accurate figure for scheduled irrigation areas in the Kei primary catchment is determined, it is recommended that the ISP figures be used.

Based on the above comparative tables for water availability and water requirements, a comparative water balance between the NWRS and ISP figures is presented in the following two tables. The first table shows the water balance **without** transfer from the Wriggleswade Dam in the Kubusi catchment to the Buffalo/Nahoon catchments. The second table shows the water balance **with** transfer from the Wriggleswade Dam in the Kubusi catchment to the Buffalo/Nahoon catchments.

**Comparison of Water Balance between the ISP and the NWRS (Year 2000) (million $m^3$/a) without inter-basin transfer from Wriggleswade Dam**

| Description | NWRS | | ISP | |
|---|---|---|---|---|
| | Amatole Primary Catchment | Kei Primary Catchment | Amatole Primary Catchment | Kei Primary Catchment |
| Total local yield | 149 | 359 | 128 | 359 |
| Transfer in | 0 | 0 | 0 | 0 |
| Total yield | 149 | 359 | 128 | 359 |
| Local requirement | 99 | 174 | 107 | 143 |
| Transfer out | 0 | 85 | 0 | 105 |
| Total requirement | 99 | 259 | 107 | 248 |
| **Water Balance** | **50** | **100** | **21** | **111** |

**Comparison of Water Balance between the ISP and the NWRS (Year 2000) (million $m^3$/a) with inter-basin transfer from Wriggleswade Dam**

| Description | NWRS | | ISP | |
|---|---|---|---|---|
| | Amatole Primary Catchment | Kei Primary Catchment | Amatole Primary Catchment | Kei Primary Catchment |
| Total local yield | 149 | 359 | 128 | 359 |
| Transfer in | 0 | 0 | 18 | 0 |
| Total yield | 149 | 359 | 146 | 359 |
| Local requirement | 99 | 174 | 107 | 143 |
| Transfer out | 0 | 85 | 0 | 123 |
| Total requirement | 99 | 259 | 107 | 266 |
| **Water Balance** | **50** | **100** | **39** | **93** |

The ISP study area is one of the few in the country that has surplus water resources available. However, it must be emphasised that the catchment wide figures of the Amatole - Kei area can be misleading as local deficits are experienced in some quaternary catchments, such as in the Upper Buffalo River in the Amatole sub-area and in the Upper Kei sub-area.

The Amatole sub-area is highly regulated and developed and is presently in balance with respect to existing water use and existing supplies sourced from within the sub-area. As growth in demand is experienced in the sub-area mainly from Buffalo City, it will be necessary to implement the inter-basin transfer of water from Wriggleswade Dam on the Kubusi River to the Amatole sub-area catchments. It is estimated that even with this transfer and demand side management and water re-use, the Amatole sub-area which includes Buffalo City is likely to experience a water deficit by the year 2012.

In the Upper Kei sub-area an overall surplus balance is shown. However, the Klipplaat River, a tributary of the Black Kei River, has relatively large areas allocated for irrigation. This, together with the urban requirements of Queenstown and Sada/Whittlesea and the domestic requirements of the large rural population, has resulted in an over-allocation of

the water resources from Waterdown Dam compared to the available yield. As a result there is a local deficit in the Klipplaat catchment resulting in irrigators receiving water at a relatively low level of assurance.

The Middle Kei sub-area is presently showing a slight water deficit due to the transfer of water from the Ncora Dam on the Tsomo River to the Mbashe catchment for irrigation requirements at the Ncora irrigation scheme and hydropower generation by Eskom at Ncora Dam and at Collywobbles.

## 10. WATER QUALITY

The quality of surface water in the ISP area varies markedly from one catchment to another. Within the Amatole catchments, the coastal rivers that fall outside the BCM urban complex generally have good quality raw water, although increasing soil erosion is reducing the quality of the rivers and estuaries. Rivers within the BCM area such as the middle and lower Buffalo River, Nahoon and smaller urban catchments have been heavily impacted by urbanization. The most impacted river is the Buffalo River due to the multiple use of the river water, the treated effluent return flows, which due to overloaded waste treatment works are often not of an acceptable standard, and the general poor state of sewerage infrastructure leading to raw sewage overflows. Within the Kei catchment, the surface water quality is average with increasing soil erosion due to poor land use practices impacting on the water quality.

Data on groundwater quality is lacking, but in general the water quality improves with distance from the coast where groundwater salinity is a problem in most boreholes. Increased “urbanization” of rural villages and soil erosion impacts on the groundwater resources in these areas. This a cause for concern as new domestic water supplies for rural villages are increasingly being sourced from groundwater resources.

## 11. PERSPECTIVE ON THE SUB-AREAS

As part of the situation analysis of the five identified sub-areas, a large number of concerns and issues have been identified. The most important ones are listed below. These issues have been explored further in each detailed strategy.

### The Amatole Sub-area

- BCM’s future water supply source needs to be addressed timeously.
- Increasing pollution of the Buffalo, Nahoon and small urban rivers within the BCM area is a cause of great concern to the inhabitants of the area.
- The fragmented ownership, operation and maintenance of the Amatole Water Supply System complicates the operation of the system and inhibits the optimal use of the available raw water resources.
- Poorly constructed and maintained water and sewerage infrastructure especially in Mdantsane within the BCM is the cause of expensive water wastage and

pollution due to excessive leaks. An urgent water conservation and demand management programme has been identified by the BCM for implementation.

- A lack of financial and skilled manpower resources within DWAF, the District Municipalities, the BCM and the smaller local municipalities is a major constraint for the optimal management and maintenance of the water supply systems in the area.

**The Keiskamma Sub-area**

- Whilst an accurate water balance for the Keiskamma River is not known due to a lack of data records, the upper river system could be approaching a stressed state, especially if the existing irrigation schemes are fully rehabilitated and ecological Reserve releases occur. The surplus water in the Keiskamma system dams (Sandile and Binfield Park) is also seen as a potential future raw water source to augment the Amatole Water Supply System for BCM. An accurate systems yield analysis will need to be performed in order to confirm this as a possibility.

- Rehabilitation of the three irrigation schemes at Tyume, Zanyokwe and Keiskammahoek and the establishment of WUAs is a priority in terms of economic growth and poverty eradication in the area.

**The Upper Kei Sub-area**

- The over-allocation of water from the Waterdown Dam for the Klipplaat Government Water Supply Scheme and for the urban requirements of Queenstown and Sada/Whittlesea needs to be urgently addressed and reconciled. Together with this, is the urgent need to augment Queenstown's water supply as well as revitalise the defunct irrigation schemes in the former Ciskei. Two studies are presently being conducted to address these issues.

- In addition to the irrigation schemes in the former Ciskei, it is critical for growth and poverty eradication that the large defunct irrigation schemes in the former Transkei (Xonxa, Qamata, Ncora) are also revitalised and brought into production on a sustainable basis using the large water allocations from Xonxa, Lubisi and Ncora Dams.

- Soil erosion due to bad land use management practices is leading to an increase in the turbidity of the rivers and high dam sedimentation rates. This issue is currently being discussed as part of a co-operative governance initiative by DWAF and the Provincial Department of Agriculture. A soil conservation programme similar to DWAF's WfW is envisaged. A "Working for Soil (WfS)" initiative could also form part of Government's Expanded Public Works Programme.

**The Middle Kei Sub-area**

- The cost/benefit use of water from the Ncora Dam mainly for hydropower generation, where very few local benefits are generated, requires an in-depth study between DWAF and Eskom to ascertain whether more beneficial use of the

water could be derived for the poverty stricken local population. In the first instance, the actual yield and existing use of the dam needs to be accurately defined. A study on this aspect is currently being undertaken by DWAF as part of the Emerging Farmer Support Programme.

**The Lower Kei Sub-area**

- Serious pollution of the Gcuwa River and the Kei River downstream of Butterworth is caused by run-off from the large unlicensed solid waste site on the banks of the river as well as pollution from the few remaining industries in the town.

## 12. ISP STRATEGIES

The many issues and concerns identified in the ISP area will be addressed through the implementation of appropriate regional water management strategies, some of which are already in place. DWAF has identified the essential strategies required to manage the Amatole – Kei ISP area. Further strategies will be added as necessary.

Ten broad strategy groups that cover all necessary current and required future water management activities, have been identified from current DWAF Regional Office activities and the requirements of the NWA and the NWRS. These main strategies are:

- ⇨ Water balance and reconciliation
- ⇨ Water resources protection
- ⇨ Water use management
- ⇨ Water conservation and demand management
- ⇨ Institutional development and support
- ⇨ Social and environmental considerations
- ⇨ Integration and co-operative governance
- ⇨ Waterworks development and management
- ⇨ Monitoring and information management
- ⇨ Implementation.

Under each of these main strategy groups, specific strategies particular to the Amatole – Kei ISP area have been developed.

For each strategy, the following aspects are addressed:

- **Management objectives,** in terms of the envisaged solutions for the strategy.
- **Situation assessment,** providing a synopsis of the current situation with a focus on the issues.
- **Strategic approach,** stating the approach or plan that DWAF will follow to reach its objectives for the strategy.
- **Management actions,** stating the required actions to implement the strategy.
- **Responsibility.** The responsible offices or Directorates are named.
- **Priority,** in terms of the ISP rating system (1 – 5, where 1 indicates the highest priority).

## 13. CONCLUSIONS AND RECOMMENDATIONS

This ISP document provides a first attempt at compiling a perspective of how DWAF wishes to manage the water resources of the Amatole - Kei catchments. Reference has been made to the enabling legislative and environmental frameworks within which water plays an essential role. Water demands must be met in such a way that its use fully supports social and economic development, equity, sustainability and efficient and effective use of water.

Together with the many studies and reports on the area, the Eastern Cape Regional Office of DWAF has provided a wealth of regional water management information. The issues and concerns that were identified during the preliminary interviews and follow up workshops are discussed under the various strategies that have been developed for implementation.

Strategies with a strong regional emphasis on the Amatole – Kei have been developed for implementation under the ten main strategy groups. Generic and national strategies have not been included in this ISP.

Unlike many catchments within South Africa, the Amatole – Kei catchments have an overall surplus water yield. However, this general statement can be misleading as local deficits are experienced in some quaternary catchments.

Continued urban and industrial growth in the BCM area and the resultant growth in water demand, will require the implementation of effective conservation and demand management measures, including water re-use. Additional development of water resources will nevertheless be required, sometime between the years 2012 to 2015 depending on the success of the East London IDZ in attracting industries. At the same time, the quality of water of the main rivers currently supplying the BCM is rapidly deteriorating and a comprehensive water quality management plan will need to be put in place in the short term to address the situation.

Within the Upper Kei Catchment there has been an over-allocation of water from Waterdown Dam which is Queenstown's main water supply. With the revitalisation of the defunct irrigation schemes established during the period of the former Ciskei and Transkei and the taking up of water rights and allocations, the assurance of water supply to Queenstown is decreasing. A study is presently being undertaken to address the problem, and implementation of the recommendations is on the critical path as the town is currently suffering from water restrictions.

A very important support role will be required from DWAF in aligning itself with the Eastern Cape Provincial Government's Growth and Development Strategy, which has as one of its main pillars for the eradication of poverty, the revitalisation and expansion of agriculture (irrigation) especially in the former Ciskei and Transkei areas. Close co-operative governance and liaison will be required between officials of DWAF, the Provincial Department of Agriculture and the Amatole and Chris Hani District Municipalities in order to ensure the efficient, effective and timeous allocation of available water for this purpose.

While it is recognised that the groundwater resources of the region must play an important part in securing the future water supplies, the lack of knowledge, understanding and data on this valuable resource needs to be urgently addressed if this resource is to play a meaningful role.

With the role of DWAF in the future focusing on support, monitoring and regulation rather than direct service delivery, it is vital that the monitoring and information systems within DWAF both at a regional and national level are upgraded and become fully functional and populated with reliable data. This is critical for the future success of DWAF in supporting not only DWAF officials but also the wider public service and civil society.

Ensuring effective implementation of the ISP is the major challenge that lies ahead. The key to success will be to appoint staff to be responsible for the various strategies and their implementation. The responsible DWAF staff need to buy-in and take ownership of these strategies, develop them further and refine and improve them until such time as the Catchment Management Agency assumes responsibility.

The ISP provides the basis for further development of the identified strategies and possible new ones. Any proposed action must in the first instance conform to these strategies or require special evaluation against ISP priorities if it is to be supported.

The various actions required to implement the ISP strategies have as far as possible been identified and listed under each strategy. The general lack of adequate skilled manpower and financial resources will however influence the scope of work that can actually be addressed under the various strategies. This limitation should not be underestimated if the strategies are to be successfully developed in the future. Each strategy has been prioritised. Following on from this study, a further requirement is that the actions listed under each strategy should be revisited and prioritised to be in line with the available resources and funding to implement each strategy. The possibility of repositioning or retraining DWAF staff to be able to address the identified strategy priorities must be considered. Alternatively, obtaining additional staff resources with the right training and mindset must receive the highest consideration.

It was not possible to develop all possible strategies that may be required for the Amatole-Kei ISP area. For example, a detailed strategy to deal with the East London IDZ development with respect to water re-use may still be necessary. The critical issue of soil conservation needs a detailed co-operative strategy that must be compiled together with the Provincial Department of Agriculture. Other required strategies may become apparent and should be developed as they become necessary. Some strategies combine aspects that may need to be expanded into separate strategies. The issues and problems encountered with water supply and sanitation infrastructure programmes, especially in rural areas, are not addressed in this ISP.

It is recognised that there are likely to be some omissions and unforeseen priorities, but this ISP provides the basis for further development. Where the need for certain strategies has been identified but the information for a detailed situation assessment is lacking, future management action will be required to develop such strategies. This aspect applies specifically to the following areas:

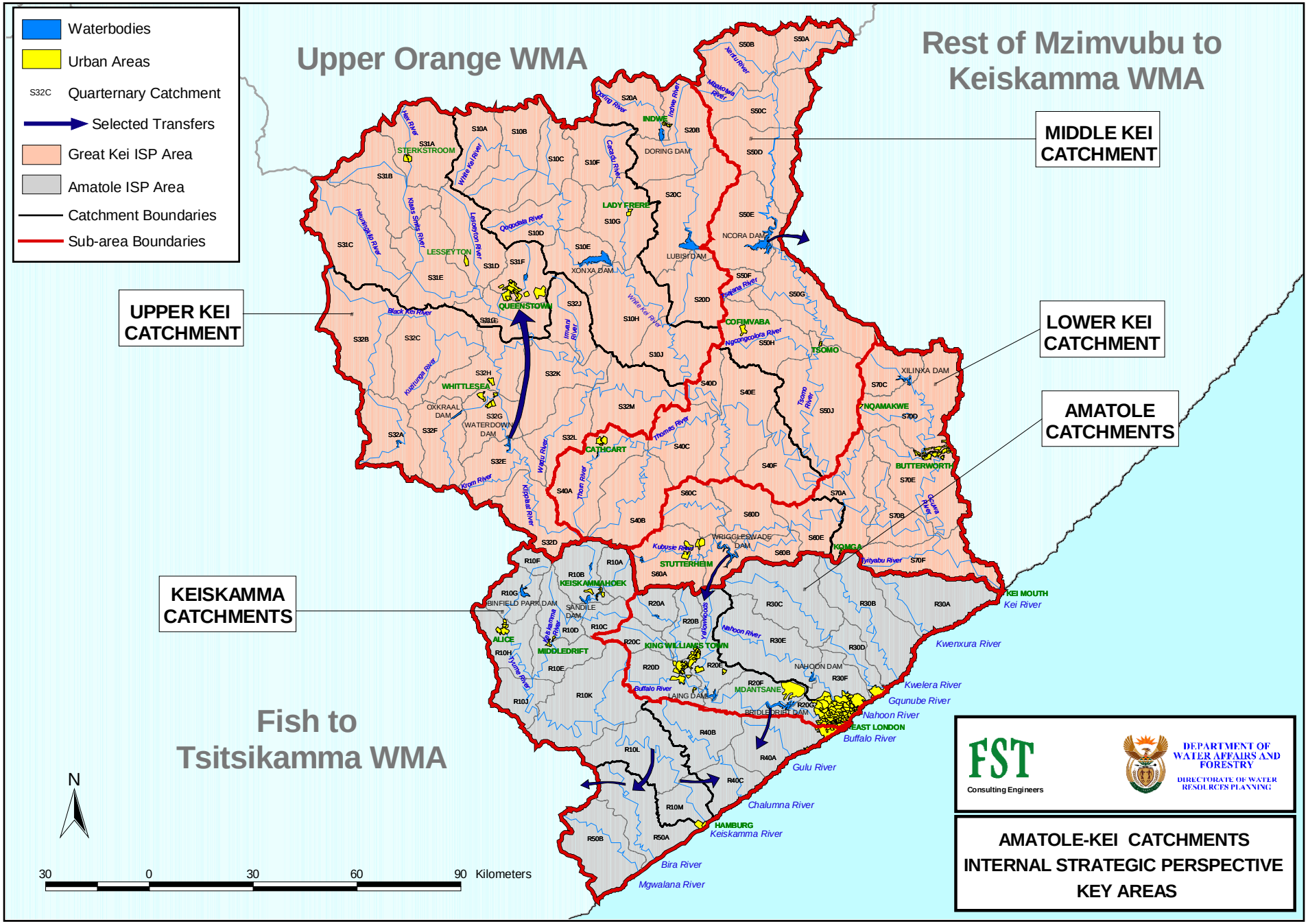
- Transfer of water from Ncora Dam to the Mbashe catchment for generation of hydropower by Eskom and for the Ncora Irrigation Scheme.

- Need for a comprehensive Soil Conservation Programme to be undertaken by the Provincial Department of Agriculture with the support of DWAF in order to protect the water resources from sediment run-off.

- The removal and/or licensing of invasive alien wattle plantations in the ISP area requires further investigation due to their importance (existing and potential) for the local rural economy. This should be connected to a strategy for further commercial forestry in the area, which at present has not been considered as a possibility.

- Due to the pristine nature and environmental sensitivity of the area's rivers and estuaries, it is vital that the ecological Reserves are analysed to a level which instills confidence in their use. Only then can a detailed strategy be developed for implementation of Reserve releases and monitoring.

This ISP will form the basis on which the water resources of the ISP area will be managed until the Catchment Management Agency has been established and starts functioning effectively. It is expected that the ISP will provide a valuable basis for the future Catchment Management Agency to use and from which it can develop its own catchment management strategy.


Waterbodies
Urban Areas
S32C Quarternary Catchment
Selected Transfers
Great Kei ISP Area
Amatole ISP Area
Catchment Boundaries
Sub-area Boundaries
Upper Orange WMA
Rest of Mzimvubu to Keiskamma WMA
Fish to Tsitsikamma WMA
UPPER KEI CATCHMENT
MIDDLE KEI CATCHMENT
LOWER KEI CATCHMENT
AMATOLE CATCHMENTS
KEISKAMMA CATCHMENTS
QUEENSTOWN
INDWE
LADY FRERE
COFIMVABA
TSOMO
CATHCART
STUTTERHEIM
WHITTLESEA
STERKSTROOM
LESSEYTON
KEISKAMMAHOEK
KING WILLIAMS TOWN
ALICE
MIDDLEDRIFT
BUTTERWORTH
NQAMAKWE
KOMGA
EAST LONDON
KEI MOUTH
HAMBURG
DORING DAM
XONXA DAM
LUBISI DAM
NCORA DAM
XILINXA DAM
OXKRAAL DAM
WATERDOWN DAM
WRIGGLESWADE DAM
BINFIELD PARK DAM
SANDILE DAM
LAING DAM
BRIDLEDRIFT DAM
NAHOON DAM
MDANTSANE
Kei River
Kwenxura River
Kwelera River
Gqunube River
Nahoon River
Buffalo River
Gulu River
Chalumna River
Keiskamma River
Bira River
Mgwalana River
N
30 0 30 60 90 Kilometers
FST Consulting Engineers
DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE OF WATER RESOURCES PLANNING
AMATOLE-KEI CATCHMENTS
INTERNAL STRATEGIC PERSPECTIVE
KEY AREAS

# AMATOLE – KEI INTERNAL STRATEGIC PERSPECTIVE

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ADM | Amatole District Municipality |
| AW | Amatola Water Board (more commonly known as Amatola Water) |
| AWSS | Amatole Water Supply System |
| BCM | Buffalo City Municipality |
| BoTT | Build, Operate, Train and Transfer (type of contract) |
| CCAW | Co-ordinating Committee for Agricultural Water |
| CEIMP | Consolidated Environmental Implementation and Management Plan |
| CHDM | Chris Hani District Municipality |
| CMA | Catchment Management Agency |
| CMIP | Consolidated Municipal Infrastructure Programme |
| CMS | Catchment Management Strategy |
| DLA | National Department of Land Affairs |
| DEAET | Eastern Cape Department of Economic Affairs, Environment and Tourism |
| DEAT | National Department of Environmental Affairs and Tourism |
| DM | District Municipality |
| DWAF | National Department of Water Affairs and Forestry |
| ECA | Environmental Conservation Act |
| EIA | Environmental Impact Assessment |
| EMF | Environmental Management Framework |
| EPP | Emergency Preparedness Plans |
| GA | General Authorisation |
| GIS | Geographical Information System |
| GRIP | Groundwater Resource Information Programme |
| GWS | Government Water Scheme |
| IAC | Irrigation Action Committee |
| IDP | Integrated Development Plan |
| IDZ | Industrial Development Zone |
| ISP | Internal Strategic Perspective |
| IWRM | Integrated Water Resources Management |
| LA | Local Authority |
| LM | Local Municipality |
| MAE | Mean Annual Evaporation |
| MAP | Mean Annual Precipitation |
| MAR | Mean Annual Run-off |
| NEMA | National Environmental Management Act |
| NGDB | National Groundwater Data Base |
| NGO | Non-government Organisation |
| NWA | National Water Act |
| NWRS | National Water Resource Strategy |

| | |
|---|---|
| PDoA | Provincial Department of Agriculture |
| PGDP | Provincial Growth and Development Plan |
| PLC | Provincial Liaison Committee |
| RAMSAR | Conservation areas classified in terms in of this convention on wetlands |
| RO | Regional Office (DWAF) |
| RDM | Resource Directed Measures |
| RQO | Resource Quality Objectives |
| SFRALAAC | Licence assessment advisory committee for stream flow reduction activities |
| TINWA | Team for Implementation of the National Water Act |
| TDS | Total Dissolved Solids (mg/l) |
| VIP | Ventilated Improved Pit Latrine |
| WARMS | Water-use Authorisation and Registration Management System |
| WCDM | Water Conservation and Demand Management |
| WfW | Working for Water |
| WfWetlands | Working for Wetlands |
| WMA | Water Management Area |
| WQM | Water Quality Management |
| WRC | Water Research Commission |
| WRM | Water Resources Management |
| WRSA | Water Resources Situation Assessment |
| WRSM | Water Resources System Management |
| WSAM | Water Situation Assessment Model |
| WSDP | Water Services Development Plan |
| WTW | Water Treatment Works |
| WU | Water Utilisation |
| WUA | Water User Association |
| WWTW | Waste Water Treatment Works |

**Units**

| | |
|---|---|
| ha | hectare |
| km² | square kilometers |
| masl | metres above sea level |
| m³ | cubic metre |
| $m^3/a$ | cubic metres per annum |
| ppm | parts per million |
| % | percent |

# GLOSSARY OF TERMS

| | |
|---|---|
| Aquiclude | An impermeable geological unit that cannot transmit water at all. (Very few natural geological materials are considered aquicludes). |
| Aquifer | A saturated permeable geological unit that can transmit significant (economically useful) quantities of water under ordinary hydraulic gradients. Specific geologic materials are not innately defined as aquifers and aquitards, but within the context of the stratigraphic sequence in the subsurface area of interest. |
| Aquitard | A saturated geological unit of relatively lower permeability within a stratigraphic sequence relative to the aquifer of interest. Its permeability is not sufficient to justify production wells being placed in it. (This terminology is used much more frequently in practice than aquiclude, in recognition of the rarity of natural aquicludes). |
| Assurance Of Supply | The reliability at which a specified quantity of water can be provided, usually expressed either as a percentage or as a risk. For example "98% reliability" means that, over a long period of time, the specified quantity of water can be supplied for 98% of the time, and less for the remaining 2%. Alternatively, this situation may be described as a "1 in 50 year risk of failure" meaning that, on average, the specified quantity of water will fail to be provided in 1 year in 50 years, or 2% of time. |
| Condensed Area | The equivalent area of alien plants with a maximum concentration/density that represents the more sparsely distributed alien plants that occurs over a large area. |
| Catchment | The area of land drained by a river. The term can be applied to a stream, a tributary of a larger river or a whole river system. |
| Commercial Farming | Large scale farming, the products of which are normally sold for profit. |
| Commercial Forests | Forests that are cultivated for the commercial production of wood or paper products. |
| Confined Aquifer | An aquifer that is physically located between two aquicludes, where the piezometric water level is above the upper boundary of the aquifer. The water level in a well tapping a confined aquifer usually rises above the level of the aquifer. If the water rises above ground level, the aquifer is called artesian. |
| Deficit | Describes the situation where the availability of water at a particular assurance of supply is less than the unrestricted water requirement. |
| Discharge Area | The area or zone where ground water emerges from the aquifer naturally or artificially. Natural outflow may be into a stream, lake, spring, wetland, etc. Artificial outflow may occur via pump wells. |
| Drainage Region | The drainage regions referred to in this document are either single large river catchments, or groups of contiguous catchments or smaller catchments with similar hydrological characteristics. They follow the division of the country into drainage regions as used by the Department of Water Affairs and Forestry. |

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| Ecosystem | A unit made up of all the living and non-living components of a particular area that interact and exchange materials with each other. |
| Environmentally Sensitive Area | A fragile ecosystem, which will be maintained only by conscious attempts to protect it. |
| Groundwater | Water in the subsurface, which is beneath the water table, and thus present within the saturated zone. In contrast, to water present in the unsaturated or vadose zone which is referred to as soil moisture. |
| Irrigation Quota | The quantity of water, usually expressed as $m^3$/ha/y, or mm/y, allocated to land scheduled under the scheme. This is the quantity to which the owner of the land is entitled at the point at which he or she takes delivery of the water and does not include conveyance losses to that point. |
| Mean Annual Runoff | Frequently abbreviated to MAR, this is the long-term mean annual flow calculated for a specified period of time, at a particular point along a river and for a particular catchment and catchment development condition. In this report, the MARs are based on the 70-year period October 1920 to September 1990 inclusive. |
| Opportunistic Irrigation | Irrigation from run-of-river flow, farm dams, or compensation flows released from major dams. As storage is not provided to compensate for reduced water availability in dry years, the areas irrigated generally have to be reduced in dry years. |
| Porosity | The degree to which the total volume of soil or rock is permeated with spaces or cavities through which water or air can move. |
| Potable Water | Water which is free from impurities that may cause disease or harmful physiological effects, such that the water is safe for human consumption. |
| Potentiometric or Piezometric Surface | An imaginary surface formed by measuring the level to which water will rise in wells of a particular aquifer. For an unconfined aquifer the potentiometric surface is the water table; for a confined aquifer it is the static level of water in the wells. (Also known as the piezometric surface). |
| Primary Aquifer | Aquifers in which the water moves through the spaces that were formed at the same time as the geological formation was formed, for instance intergranular porosity in sand (for example alluvial deposits). |
| Quaternary Catchment | The basic unit of area resolution used in the WR90 series of reports published by the Water Research Commission and also in this report. The primary drainage regions are divided into secondary, tertiary and quaternary catchments. The quaternary catchments are numbered alpha-numerically in downstream order. A quaternary catchment number, for example R30D, may be interpreted as follows : the letter R denotes Primary Drainage Region R, the number 3 denotes secondary catchment 3 of Primary Drainage Region R, the number 0 shows that the secondary catchment has not, in this case, been sub-divided into tertiary catchments, and the letter D shows that the quaternary catchment is the fourth in sequence downstream from the head of secondary catchment R30. |
| Reconciliation | Process to effect (or establish) a favourable yield balance |
| Reliability Of Supply | Synonymous with assurance of supply. |

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|---|---|
| Reserve | The quantity and quality of water required (a) to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997) for people, who are now or who will, in the reasonably near future, be (i) relying upon; (ii) taking water from; or (iii) being supplied from, the relevant water resource; and (b) to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource as indicated in the National Water Act (Act No. 36 of 1998). |
| Resource Directed Measures | Measures that focus on the quality and overall health of water resources. |
| Reservoir | The lake formed behind a dam wall. In this report the colloquial term dam is generally used for reservoir. |
| Resource Quality | The quality of all the aspects of a water resource including:<br><br>(a) the quantity, pattern, timing, water level and assurance of in-stream flow; (b) the water quality, including the physical, chemical and biological characteristics of the water; (c) the character and condition of the in-stream and riparian habitat; and (d) the characteristics, condition and distribution of the aquatic biota. |
| Resource Quality Objective | Quantitative and verifiable statements about water quantity, water quality, habitat integrity and biotic integrity that specify the requirements (goals) needed to ensure a particular level of resource protection. |
| River System | A network of rivers ranging from streams to major rivers and, in some cases, including rivers draining naturally separate basins that have been inter-connected by man-made transfer schemes. |
| Salinity | The concentration of dissolved salts in water. The most desirable drinking water contains 500 ppm or less of dissolved minerals. |
| Saturated Zone | The subsurface zone below the water table where pores within the geologic matrix are filled with water and fluid pressure is greater than atmospheric. Aquifers are located in this zone. |
| Scheduled Land | Irrigable land to which a water quota has been allocated. |
| Secondary Aquifer (Also known as a Fractured-Rock Aquifer) | Aquifers in which the water moves through spaces that were formed after the geological formation was formed, such as fractures in hard rock. |
| Semi-Confined Aquifer (Also known as a Leaky Aquifer) | An aquifer that is physically located between two aquitards, and where the piezometric water level is above the upper boundary of the aquifer. |
| Source Directed Controls | Measures primarily designed to control water use activities at the source of impact, through tools such as standards, and conditions in water use authorisations. |
| Sub-Catchment | A sub-division of a catchment. |
| Subsistence Farming | Small-scale farming where almost all produce is consumed by the farmer's household or within the local community. |
| Surplus | Describes the situation where the availability of water at a particular assurance of supply is more than the unrestricted water requirement. |

| | |
|---|---|
| Unconfined Aquifer (also known as a water table aquifer) | An aquifer, which is not restricted by any confining layer above it. Its upper boundary is the water table, which is free to rise and fall. The water level in a well tapping an unconfined aquifer is at atmospheric pressure and does not rise above the level of the water table within the aquifer. An unconfined aquifer is often near to the earth's surface and not protected by low permeable layers, causing it to be easily recharged as well as contaminated. |
| Unsaturated Zone | An area, usually between the land surface and the water table, where the openings or pores in the soil contain both air and water. |
| Water Imports | Water imported to one drainage basin or secondary sub-catchment from another. |
| Water Table | The top of an unconfined aquifer where water pressure is equal to atmospheric pressure. The water table depth fluctuates with climate conditions on the land surface above and is usually gently curved and follows a subdued version of the land surface topography. |
| Water Transfers | Water transferred from one drainage basin or secondary sub-catchment to another. Transfers-in are synonymous with water imports. |
| Yield | The maximum quantity of water obtainable on a sustainable basis from a dam or river in any hydrological year, in a sequence of years, and under specified conditions of catchment development and dam operation. |
| Yield Balance | The comparison of available water to water requirement. The balance could show a deficit or a surplus or be in equilibrium. |

# SECTION 1 : SITUATION ASSESSMENT

# DEPARTMENT OF WATER AFFAIRS AND FORESTRY

## DEVELOPMENT OF AN INTERNAL STRATEGIC PERSPECTIVE FOR THE AMATOLA - KEI CATCHMENT AREA OF THE MZIMVUBU TO KEISKAMMA WMA

## 1. BACKGROUND TO THE INTERNAL STRATEGIC PERSPECTIVE EXERCISE

### 1.1 Location of the Mzimvubu to Keiskamma WMA

**Figure 1.1** shows the location of the Mzimvubu to Keiskamma WMA, which falls within the Eastern Cape Province. For the purpose of undertaking the Internal Strategic Perspective (ISP) exercise, the WMA has been divided into two areas viz. the Amatole – Kei catchments and the Mbashe – Mzimvubu catchments. Separate ISPs have been produced for each area. This report covers the area of the Amatole – Kei catchments, which form the western part of the WMA (refer **Figure 2.1**).

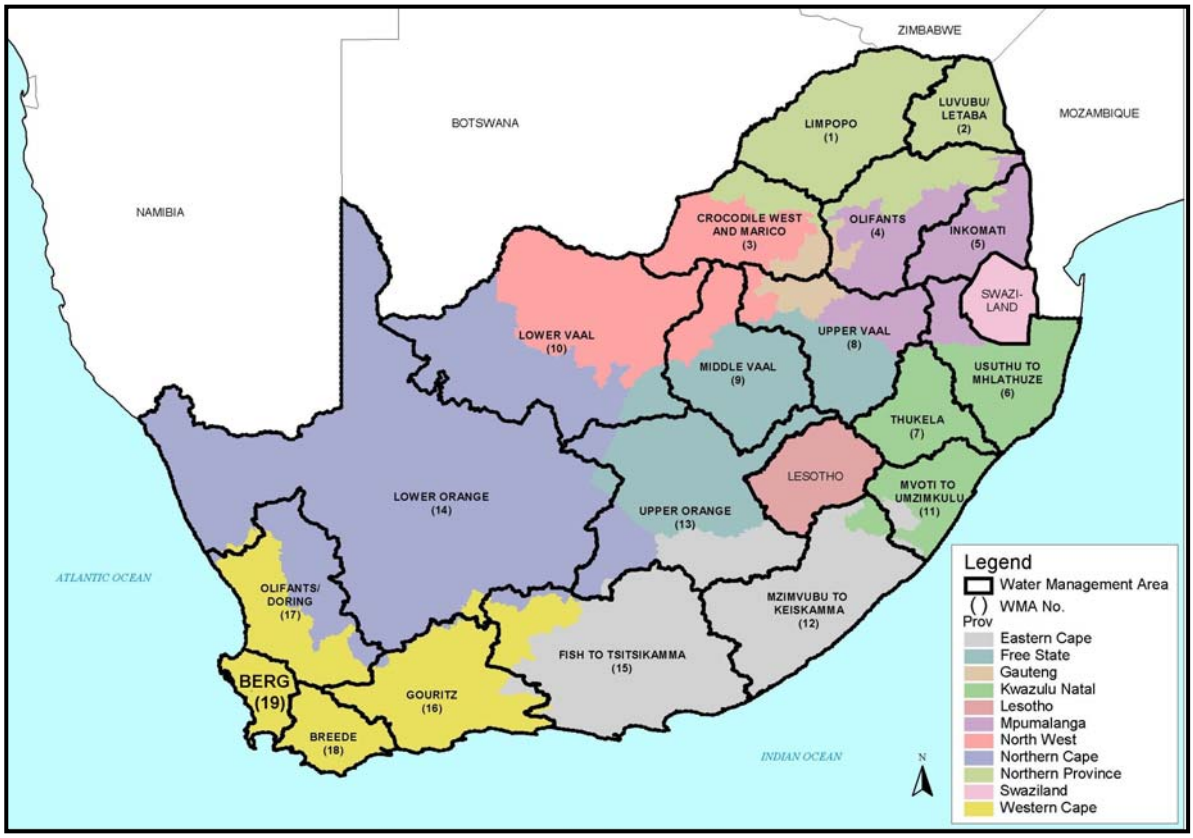


**Figure 1.1: Location of the Mzimvubu to Keiskamma WMA**

### 1.2 Water Legislation and Management

Water is one of the most fundamental and indispensable of all natural resources. It is fundamental to life and the quality of life, to the environment, food production, hygiene,

industry, and power generation. The availability of affordable water can be a limiting factor for economic growth and social development, especially in South Africa where water is a relatively scarce resource that is distributed unevenly, both geographically and through time, as well as socio-politically.

Prosperity for South Africa depends upon sound management and utilisation of our many natural and other resources, with water playing a pivotal role. South Africa needs to manage its water resources optimally in order to further the aims and aspirations of its people. Current government objectives for managing water resources in South Africa are set out in the National Water Resources Strategy (NWRS) as follows:

- **To achieve equitable access to water.** That is, equity of access to water services, to the use of water resources, and to the benefits from the use of water resources.
- **To achieve sustainable use of water**, by making progressive adjustments to water use to achieve a balance between water availability and legitimate water requirements, and by implementing measures to protect water resources and the natural environment.
- **To achieve efficient and effective water use** for optimum social and economic benefit.

*The NWRS also lists important proposals to facilitate achievement of these policy objectives, such as:*

- Water will be regarded as an indivisible national asset. The Government will act as the custodian of the nation's water resources, and its powers in this regard will be exercised as a public trust.
- Water required to meet basic human needs and to maintain environmental sustainability will be guaranteed as a right, whilst water use for all other purposes will be subject to a system of administrative authorisations.
- The responsibility and authority for water resource management will be progressively decentralised by the establishment of suitable regional and local institutions, with appropriate community, racial and gender representation, to enable all interested persons to participate.

### 1.2.1 The National Water Act (NWA)

The NWA of 1998 is the principal legal instrument relating to water resource management in South Africa. The Act is now being implemented incrementally. Other recent legislation which supports the NWA includes the Water Services Act (Act 108 of 1997) and the National Environmental Management Act (Act 107 of 1998).

### 1.2.2 The National Water Resource Strategy (NWRS)

The NWRS is the implementation strategy for the NWA and provides the framework within which the water resources of South Africa will be managed in the future. All authorities and institutions exercising powers or performing duties under the NWA must give effect to the NWRS. This strategy sets out policies, strategies, objectives, plans, guidelines, procedures and institutional arrangements for the protection, use, development, conservation, management and control of the country's water resources. The purpose of the NWRS is to provide the following:

- The National framework for managing water resources;
- The framework for preparation of catchment management strategies in a nationally consistent way;
- Information, in line with current legislation, regarding transparent and accountable public administration; and
- The identification of development opportunities and constraints with respect to water availability (quantity and quality).

### 1.2.3 Catchment Management Strategies (CMS)

The country has been divided into 19 Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level will be achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA will progressively develop a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA.

The Department's eventual aim is to hand over certain water resource management functions to CMAs. Until such time as the CMAs are established and are fully operational, the Regional Offices (ROs) of DWAF will have to continue managing the water resources in their areas of jurisdiction.

## 1.3 Internal Strategic Perspectives (ISPs)

### 1.3.1 The Objectives of the ISP Process

The objective of the ISP will be to provide a framework for DWAF's management of the water resources in each Water Management Area, until such time as the Regional Offices can hand over the management functions to the established CMA. This will ensure consistency when answering requests for new water licences, and informing existing water users (including authorities) on how the Department will manage the water resource within the area of concern. Stakeholders must be made aware of the bigger

picture as well as the management detail associated with each specific water resource management unit.

### 1.3.2 Approach Adopted in Developing the ISP

The ISP for the Amatole – Kei area of the WMA was developed in five stages as follows:

i) Determining the current status of water resource management and relevant water resource management issues and concerns in the Amatole – Kei catchment areas. This was achieved through interviews with individual members of DWAF's RO in Cradock, King William's Town, East London and Port Elizabeth and by collating information from the NWRS, WMA reports, Water Resource Situation Assessment (WRSA) reports and other catchment study reports. The following topics were discussed with Regional Office staff and their issues and concerns documented:

- Water Situation
- Resource Protection
- Water Use
- Water Reconciliation
- Water Infrastructure
- Monitoring and Information
- Water Management Institutions
- Co-operative Governance
- Planning Responsibilities.

A starter document of the identified issues and concerns was produced as a discussion document for the first workshop.

ii) The first workshop was held with attendees from the Regional Office, the Integrated Water Resource Planning (IWRP) Chief Directorate of the Department as well as the consulting team. The workshop focussed on the lists of general issues in the ISP area as well as area-specific issues. The issues were clarified and refined during the workshop. Strategies were discussed and developed to address the issues.

iii) The third stage involved the preparation of the second workshop document to be used for refining strategies to address the various issues and concerns, during the second workshop.

iv) The fourth stage was the second workshop. During this workshop the overall management of the water resources in the ISP area was discussed along with the ISP management strategies and the relevant issues and concerns. The priorities

and responsibilities for carrying out the strategies were identified. First workshop attendees were again involved, as were representatives of several DWAF Head Office Directorates.

v) The fifth stage was the finalisation of the ISP document.

As can be deduced from the above this ISP document was prepared internally within the Department, and captures the Department's perspectives. Once approved by DWAF Management, it is intended that the Regional Office will make the ISP available to Water User Associations (WUAs), Water Service Providers (WSPs), Water Service Authorities (WSAs) and other forums for discussion and comment. These comments will be considered and worked into later versions of the ISP. By adopting this procedure this ISP becomes a working document, which will be progressively updated and revised by DWAF. Public participation forms part of the CMS process, for which the ISP serves as a foundation.

The ISP does not formulate all the details pertaining to every strategy but provides a suggested framework for each strategy around which the details will be developed by the responsible authority. Where relevant and readily available, certain details have been included in the strategies. The responsible authority for the further development of each strategy is indicated. This is predominantly the Regional Office, which remains responsible for involving the relevant DWAF directorates.

### 1.3.3 Updating of the ISP Report

The ISP strategies should not lag behind national developments, become outdated or differ from related ISPs regarding trans-boundary management. There is therefore a need to have a standard process for updating strategies, and to prevent strategies becoming outdated by ensuring adequate feedback from national developments. Furthermore, the proposal and introduction of new strategies needs to be accommodated. It is suggested that each strategy has a version-control system. The following is necessary:

- Keep abreast of changes in national legislation and policy changes or refinements by keeping a list of all relevant legislation and supporting documents relevant to the ISP;
- Ensure consistency between the ISP strategies and national strategies through a regular review-and-update procedure;
- Annually review and ensure consistency and agreement regarding trans-boundary ISP management issues by liasing with the responsible managers of other areas and updating relevant ISP strategies if necessary;
- Annually review the priorities of required management actions and align budgets accordingly;

- Monitor the implementation of the ISP (review actions, progress, implementation and stumbling blocks);
- Incorporate feedback from stakeholders;
- Rigorously apply ISP version control.

*Updating and Version Control*

The actual frequency of ISP revision will be determined by the number and extent of revisions to management approaches as reflected in Strategy amendments. All updates to this report, particularly with respect to amendment to the Strategies, need to be passed on to and vetted by the Catchment Manager for the WMA. The current incumbent is Mr T Geldenhuys, who has been delegated the task of managing version control.

### 1.3.4 The Authority of Information Contained in the ISP

The NWRS is a statutory document, subject to a high level of public scrutiny and input, and signed off by the Minister. The information contained in the NWRS is the best information and knowledge available at the time. The information in Chapter 2 and Appendix D of the NWRS Strategy on water requirements, availability and reconciliation was updated with comments received from the public participation process in the second half of 2002. To enable the finalisation of the NWRS, these figures were "closed" for changes in February 2003.

Underlying the figures in Chapter 2 and Appendix D of the NWRS is a set of 19 reports "Overview of Water Resources Availability and Utilisation", one for each WMA. These reports contain more detailed information on each WMA than was summarised for the NWRS and are referred to, in short, as "WMA Reports". The WMA reports were also finalised with the February 2003 information.

Still deeper in the background lies another set of reports (one per WMA), the so-called Water Resource Situation Assessment Reports. These reports contain a wealth of information on each WMA, but the figures on requirements, availability and reconciliation have been superceded by the WMA report and the NWRS.

The ISPs for all WMAs used the information contained in the NWRS and WMA reports as the point of departure. However, an inevitable result of the ISP process has been that better information has emerged in some cases. The reason is that the level of study is more detailed and intense for the ISP. This included very close scrutiny of the numbers used in the NWRS, and in some cases a reworking of base data and some re-modelling. Where the ISPs contain yield balance data which differs from the NWRS, these discrepancies are carefully explained. Where other differences from the NWRS are necessary these are also detailed in the ISP, with accompanying explanations.

It is required that the Department work with the best possible data so that the best possible decisions can be taken. Where the ISPs have improved upon the NWRS then this is the data that should be used. The new data contained in the ISP will also be open to public scrutiny as the ISP reports will be published on the Internet and in hardcopy, and will be presented and discussed at WMA forums. Comments received will be considered and worked into subsequent versions of the ISP on a regular (yearly) basis. The NWRS will be updated to reflect the latest understanding in each new edition.

## 1.4 Integrated Water Resource Management (IWRM)

It is imperative that the natural, social, economic, political and other environments and their various components are adequately considered when conducting water resources planning and management. Water as a strategic component also interacts with other components in all environments. For example, human activities such as the use of land, the disposal of waste, and air pollution can have major impacts on the quantity and quality of water which is available for human use and for proper life support to natural biota.

Taking an even broader view, water must also be managed in full understanding of its importance for social and economic development. It is important to ensure that there is conformity between the water-related plans and programmes of the CMAs, and the plans and programmes of all other role players in their management areas. The CMAs must therefore establish co-operative relationships with a wide range of stakeholders, including other water management institutions, water services institutions, provincial and local government authorities, communities, water users ranging from large industries to individual irrigators, and other interested persons.

This integrated planning and management approach is intended, through co-operative governance and public participation, to enable water managers to meet the needs of all people for water, employment, and economic growth in a manner that also allows protection and, where necessary, rehabilitation of aquatic ecosystems. Above all, Integrated Water Resource Management (IWRM) will enable water managers to use our precious water resources to assist us in poverty eradication and removal of inequity.

One of the big opportunities to formally integrate a large number of actions in water resource management presents itself during the compulsory licensing process.

Compulsory licensing is identified in the NWRS as a very important action for implementing the NWA. However, it is not a simple action of issuing licences but a complex process of closely related and interdependent activities that will in itself formalise IWRM to a great extent. The process of IWRM is diagrammatically depicted in **Figure 1.2**.

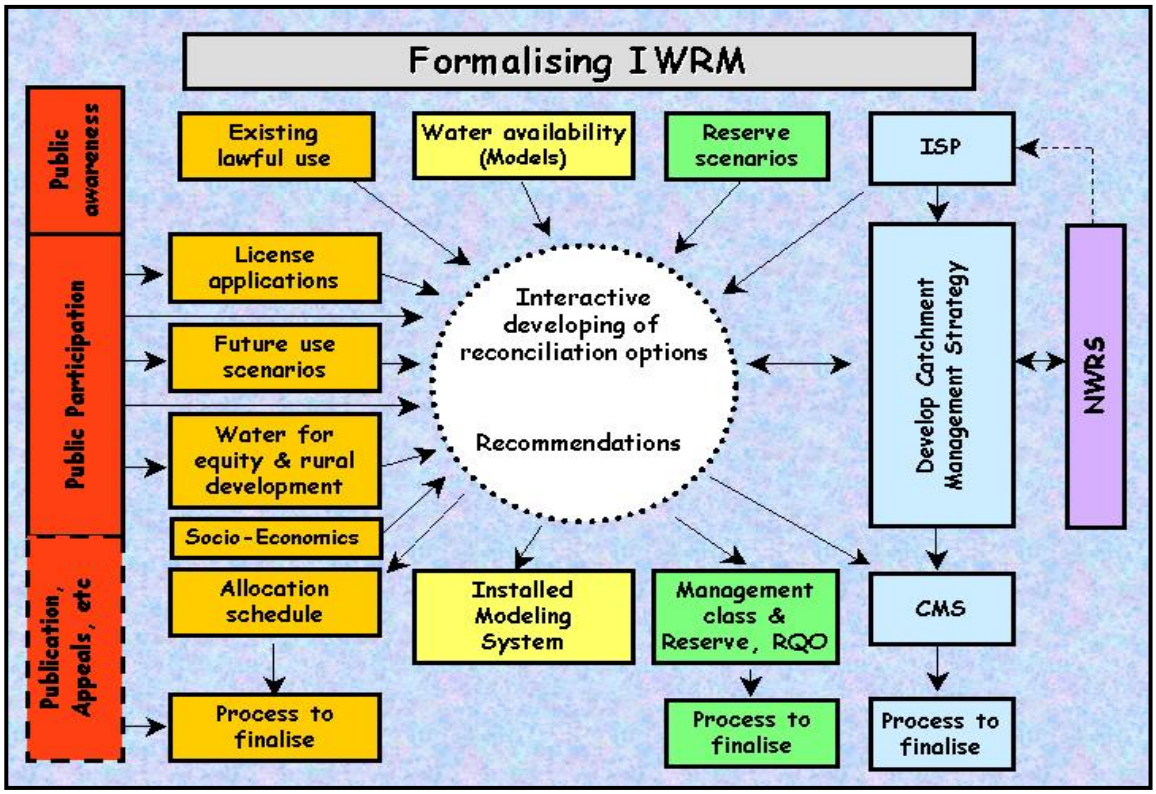


**Figure 1.2 : Diagram Showing DWAF Integrated Water Resources Management Approach**

Before an allocation schedule can be determined and the legal steps followed to finalise compulsory licensing (through the issuing of licences to all users), many other aspects must be addressed:

- Existing use and the lawfulness of that use must be verified, all users (existing and new) must apply for licences, a good understanding of future use scenarios must be developed and water required for equity purposes and rural development must be clearly understood.

- Water availability must be understood as thoroughly as possible with "best available" existing information used to model all possible reconciliation options.

- Reserve scenarios must be developed for all significant resources in the catchment, for instance, the river flow requirements for all possible classes that may be considered.

- The development of strategies for implementing the licensing (abstraction controls, for example), the Reserve and Resource Quality Objectives (i.e. incrementally over time) must go hand in hand with the rest of the processes to ensure that practical, workable solutions are found.

The processes will then enter a very intensive, interactive phase of developing realistic reconciliation options. This would entail, for example, the selection of a specific management class to be scrutinised for its impact on the number of licences that could be issued for use, with its concomitant impacts on the social and economic structure of the catchment.

The active participation of stakeholders in this process will then hopefully crystallise clear recommendations on an allocation schedule, management classes for the various reaches of the rivers and the resultant ecological Reserve and Resource Quality Objectives, as well as strategies for the implementation.

Although the Department will play a very strong role in guiding this process, it is extremely important to have the CMA actively involved. Preferably, at least the Board of the CMA must be in place to drive the public participation for the process.

## 1.5 Caring for the Environment

DWAF is responsible for water resource development and management in terms of the NWA, and within the broader framework of other environmental legislation. The Department also strongly reflects the will to make sound decisions which ensure the development of society and the economy whilst maintaining, and where possible enhancing, ecological integrity. The concept of management of the environment has evolved from the exclusivity of protection of plants and animals to balancing the complex interaction of society, the economy, and ecology. “Environmental management is the integration of social, economic and ecological factors into planning, implementation and decision-making so as to ensure that development serves present and future generations” (NEMA).

The key legislative Acts to which DWAF is required to refer are the National Environmental Management Act (NEMA, Act 107 of 1998) and the Environment Conservation Act (ECA, Act 73 of 1989). DWAF has prepared a Consolidated Environmental Implementation and Management Plan (CEIMP) as a requirement of NEMA. This describes the Department’s functions, policies, plans and programmes, and states how these comply with environmental legislation. Through the CEIMP the Department has committed itself to developing and implementing an integrated Environmental Management Framework (EMF) to ensure that its approach is aligned with the principles prescribed in NEMA and the ECA. The EMF will inform the Department at a strategic decision-making level, bring about environmental legal compliance, and help in achieving environmental sustainability through the promotion of sound environmental management practices. Integrated Environmental Management is a co-operative governance effort with DWAF as a full partner in the process.

This ISP has the responsibility of raising and maintaining the environmental consciousness of the Department's water resource planners and managers. The control over water has a very broad range of influence and impact for which strategies and planning need to account. Impacts come from many different angles.

Some of these angles of impact which are considered through this ISP are noted below:

- The direct impact of physical structures (environmental constraints to construction e.g. of weirs or dams)
- The implications of allocating and licensing water for use. Forestry and irrigation are examples of users where development based on water can mean the transformation of extensive areas of otherwise 'natural' environments.
- The allocation of water for equity. Here we can include approaches towards the application of Schedule 1 Use, General Authorisations, the revitalisation of irrigation schemes, etc.
- Failure to support equity, or appropriate development – noting the consequential impacts of poverty.
- Sanitation systems and the impacts on groundwater quality.
- The implementation of the Reserve.
- The ability to monitor and manage compliance, thus protecting the resource and with it the environment.

All decisions regarding water are critical to the environment. Decisions must be made on a balance of social, economic and ecological costs and benefits, considering both the immediate and the long-term, and always with an eye out for the unintended consequence. It is the intention of the ISP to provide the basis for integrated decision-making. The principles of environmental management underpin every strategy developed in this document.

There are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- The Reserve (groundwater, rivers, wetlands and estuaries)
- Water quality - surface and groundwater
- The approach towards the clearing of Invasive Alien Plants
- The management of wetlands
- Land degradation. Erosion and sedimentation (land care)
- Land use and especially how this is impacted by land reform and the re-allocation of water.

The roles of Co-operative Governance and the need for awareness raising and capacity building are key strategic elements of many strategies.

In reality all strategies and all aspects of management have a strong interaction with the biophysical environment. This ISP endeavours to capture all of these concerns in discussion and through a strategic approach which emphasises the will of the Department to manage the environment to the best benefit of the country and its people.

The approach set out above applies to all Water Management Areas and associated ISPs, and is not repeated within the Strategy Tables (**Section 2**). It reflects the way the Department views Integrated Water Resource Management and the importance of the biophysical aspects of decision-making. There may nevertheless be specific ecological and biophysical aspects of management which require specific attention and which may not be captured in the above-mentioned or other strategies. The ISP therefore still includes environmental strategy aspects (as part of other strategies) which serve to make pertinent those issues of the environment which might not otherwise be covered.

## 1.6 The Social Environment

The utilisation of water resources is aimed at the benefit of society, and at society through the economy. As noted in **Section 1.5** this should not be at undue cost to ecological integrity.

Impacts on society are a core element of this ISP, and decisions are often complicated by the risk of unintended consequence. As a typical example the over-zealous implementation of the ecological Reserve may benefit the river, to the intended benefit of society, but the cost of lack of use of that water to employment and to livelihoods may lead to other strains on natural resources that undo the benefits.

The implementation of the NWA requires that society be kept at the forefront of all decision-making. This principle is now deep-seated within the Department and is integral to all strategies. Water resource allocation and use has critical social impact, as does water quality management. But pivotal to the social component is the question of equity. What can be done and what is being done to redress past inequities? Within this, strategies have been developed to consider the provision of water to Resource Poor Farmers, the use of water under Schedule 1, Licensing and General Authorisations, etc. Whilst water supply and sanitation are not part of the brief of the ISP, the provision of water to meet these needs most certainly is. The urban poor, and the poor in rural villages, are as important in the consideration of the distribution and use of water resources as are the rural subsistence poor, and this should not be forgotten in the urgencies of land reform and the enthusiasm to establish a substantial class of farmers from amongst the previously disadvantaged.

This ISP aims to see water benefiting society. This can be through access to water in livelihood strategies, through small-farmer development programmes, through water

supply and sanitation and especially the provision of good quality drinking water, and through the maintenance and growth of income-producing, job creating, and tax paying agricultural, commercial and industrial strategies.

Consultation and public participation are cornerstones of the social component of any strategic document. These requirements are repeatedly stressed throughout the National Water Act. This ISP has been prepared as DWAF's position statement with respect to the management of water resources and, although strategies and plans have been captured without consultation with the stakeholders, it remains an open and transparent document where the understanding of the Department, its visions and its principles are made clear for all to see and to interact with. This is amplified in the Implementation Strategy (**Section 2: Strategy No. 10**) of this ISP.

## 1.7 Water Quality Management

Much of the emphasis in water resource management has revolved around ensuring that users have sufficient quantities of water. However, as more water gets used and re-used, as quantities get scarce and feedback loops get even tighter, it is quality that begins to take on a dominant role.

Water availability is only as good as the quality of that water. Both quantity and quality need to be considered at the correct level of detail, and this can mean that at times they should be considered with similar emphasis and with similar expenditure of resources. Too often we have failed to integrate the issues of quantity and quality – both with regard to surface water and groundwater. The concept of Available Assimilative Capacity, the ability of the water resource to absorb a level of pollution and remain 'serviceable', is as important in water resource management as is the concept of Systems Yield.

Quantity and quality can no longer be managed in isolation of each other. Not that this isolation has ever been total. The importance of releasing better quality water from Brandvlei Dam in the Western Cape for freshening the saline water in the lower reaches of the Breede River, and of the addition of freshening releases from the Vaal Barrage to bring water back to an acceptable quality has, inter alia, long been standard practice. The consequences of irrigation, the leaching of fertilisers, and more importantly the leaching of salts from deeper soil horizons can render both the lands themselves and the receiving rivers unsuitable for use. Diffuse agricultural 'effluent' may be less visible than direct discharges of sewage or industrial effluent, but are no less pernicious.

Direct discharges to rivers are licensed and managed on the basis of assimilative capacities of those rivers, and on Receiving Water Quality. Where these limits are exceeded, often through the cumulative impact of diffuse discharges, water becomes unavailable to some, or even all, users downstream. DWAF will licence users to take water, and again to discharge it in recognition that there is generally a cost to the

resource in terms of a reduction in quality and a reduction in its further assimilative capacity. It is for this reason, and in order to bring about additional management and a strong incentive, that the Waste Discharge Charge System is being developed. Discharge users will be obliged to pay, depending on the quantity and quality of their discharge.

Surface water quality is affected by many things including sediment and erosion, the diffuse discharges from irrigated farmland (both fertilisers and salinity through leaching), domestic and urban run-off, industrial waste, and sewage discharges. Of these, industrial waste and sewage discharges are the easiest to licence and control, but this does not mean that this is problem-free. The Department has found that the situation with regard to sewage discharges often far exceeds the standards and conditions demanded by licences. There is a problem of compliance with regard to Local Authorities and private operators responsible for waste management systems. Diffuse discharges only compound the problem by reducing the assimilative capacity until the water becomes unfit for use, very expensive to purify, and a danger to human health.

Groundwater quality requires equal attention, and more so as we recognise the importance of groundwater in supplementing our meagre resources, and providing water to remote communities. Although our groundwater resources are for the most part to be found at a relatively deep level (50-100m is quite typical) this water can easily be polluted by surface activity. The leaching of fertilisers is one such problem but of greater concern is the influx of nitrates, primarily a consequence of human habitation and sanitation. Pit latrines are on the one hand so necessary, and have the huge advantage of not requiring volumes of water, but disposal is ‘on-site’, and often responsible for the longer-term pollution of the underlying aquifers which feed and water the communities above.

Water quality is a very important aspect of strategy within this ISP – considered primarily within the Water Quality Strategy and also under Groundwater. Industrial wastewater discharge, diffuse agricultural discharges, wastewater treatment works, the location and management of solid waste disposal sites, the siting of new developments, informal settlements and the impacts of sanitation systems, are all elements considered with great concern in this and other ISPs. Despite this attention it may be that Water Quality has still not taken its rightful place in the integrated management of the water resource. But the Department is moving towards IWRM and the integration of quantity and quality issues. Managers have now been given crosscutting responsibilities that will ensure a far more integrated approach in future.

**Actions recommended within the Department include:**

- The need to actively workshop the integration process. Resource Management, Planning and Allocations of Groundwater and Surface Water Quantity and Quality.
- The review and incorporation of knowledge from recent Water Research Commission Studies on both radioactivity and nitrates (groundwater quality issues).
- A review of all water quality literature reflecting situational knowledge and understanding within this WMA (and each and every WMA).
- Ensure that Water Quality monitoring is fully integrated into WMA water resources monitoring.

## 1.8 Groundwater

The ISP process in all of the Water Management Areas of South Africa has highlighted the role and importance of groundwater as part of the total water resource. Although groundwater has always been important in some areas this overall vision is a significant advance on our previous understanding of the potential for groundwater use. With the surface water resources in many WMAs now fully utilised, almost the only opportunity left for further development lies in the exploitation of groundwater. More particularly it is recognised that many of the more remote towns and villages, far from surface supplies, can in fact supply or supplement existing sources through groundwater, and that this must become a priority option. So, too, many small communities and subsistence farmers can avail themselves of groundwater when it would otherwise be impossible or impractical to lay on piped supplies. This can also reduce the pressure on existing users and perhaps even circumvent the need for Compulsory Licensing. The Department will be developing its capacity to explore and encourage the use of groundwater.

Of obvious concern is the likelihood of an interaction between groundwater and surface water. If the interaction is strong then additional use of groundwater may simply be reducing the surface water resource already allocated to someone else. In some instances (such as in the case of dolomitic aquifers) this interaction can indeed be very strong, whilst across many areas of the country it is so weak as to be negligible. In these circumstances groundwater comprises a huge pool of available water which is only of benefit if it is utilised. Care must always be taken with the issuing of licences to ensure that both the Groundwater Reserve and other downstream users do not end up being the losers.

The realisation in this and other ISPs is that groundwater offers a huge resource of water which can be tapped, and that this can be a very significant supplement to the national water resource.

See also the **Groundwater Strategy No 1.2 in Section 2** of this ISP.

## 1.9 Public Recreation - The Use of Dams and Rivers

The use of water for recreational purposes is one of the 11 water uses regulated in terms of the NWA (Section 21j). The Department is developing a national policy towards "Recreation on Dams and Rivers" and this should, in the first instance, be adhered to. Recreational use can take many forms and only occasionally has any direct impact on the water resource. Most obvious are activities such as power-boating, sailing and swimming which can have quality / pollution impacts. Far more significant in terms of both quantity and quality is the release of water to allow for canoeing and other water sports downstream (The Berg, Dusi and Fish River canoe marathons being prime examples). These activities can bring very significant economic benefits to the WMAs concerned, and where water releases can be accommodated, particularly through alignment with the needs of the ecological Reserve or other downstream users, then so much the better.

It is noted in this ISP that water resources offer a very significant recreational outlet and that recreation is an important public and social asset necessary for national health and productivity. A central philosophy is that recreational opportunity should not be unreasonably and unnecessarily denied to users, and that the implementation of policy should ensure that disadvantaged and poor people should also be able to avail themselves of opportunities.

The Department has already transferred responsibility for the management of many public waters to Local Authorities and will continue with this process. Responsibility will therefore devolve upon these Authorities, but within the broad principles as laid down by the Department.

## 1.10 Co-operative Governance – The Place of the ISP

The ISP is DWAF's approach to the management of water resources within the WMA. This will, in the longer term, be replaced by a fully consultative Catchment Management Agency. What is most important, in the medium term is that the ISP has a good fit with the Provincial Growth and Development Plan, with regional and other Environmental Management Plans, with plans and expectations of the Departments of Agriculture, Land Affairs, the Environment and others. It must also be aligned with the Integrated Development Plans and Water Services Development Plans now required for each District Municipality. Water is very often a constraining feature in development and co-operative governance planning and implementation is essential in matching what is wanted with what is possible.

# 2. OVERVIEW OF THE AMATOLE – KEI ISP AREA

This chapter provides a general water-related overview of the whole Amatole-Kei ISP area. Based on common characteristics as described in **Section 2.6**, the ISP area has been divided into five sub-areas in order to facilitate appropriate and more detailed situation assessments which are provided in **Chapters 3 to 7**.

## 2.1 Location

The Amatole – Kei ISP area comprises the Amatole (R) and Kei (S) primary catchments and is located in the Mzimvubu to Keiskamma Water Management Area (WMA 12) (refer **Figure 2.1**). These two primary catchments form the western boundary of the WMA. The ISP study area is bounded by the Great Fish River catchment in the west, the Orange River catchment in the north, and the Mbashe River catchment in the east. A second ISP study incorporating the remaining catchments (Mbashe, Mtata, Mzimvubu and Wild Coast) will complement this ISP study for WMA 12.

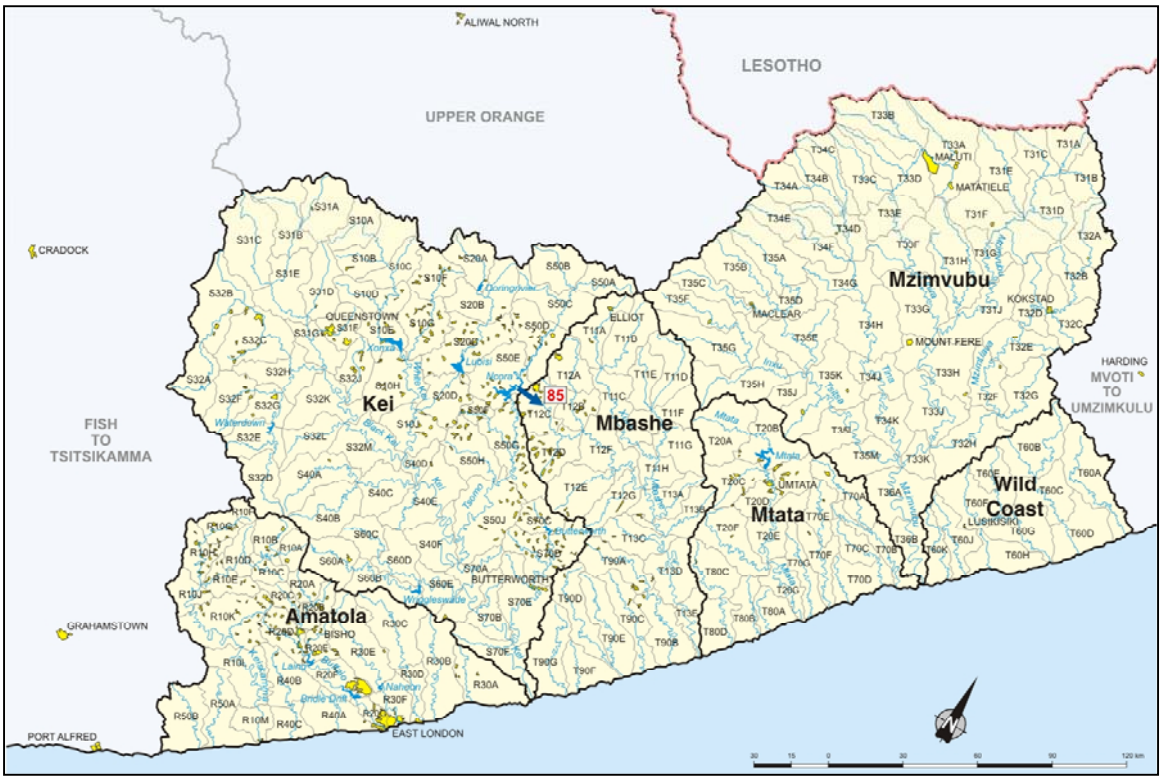


**Figure 2.1 Locality of the Amatole - Kei ISP Area within WMA 12**

The catchments encompass an area of 28 421 km$^2$ divided between the Amatole coastal catchments (R) of 7 936 km$^2$ and the Great Kei catchment (S) of 20 485 km$^2$. East London is the main city in the area with Queenstown serving as the inland regional centre.

(Note : “Amatole” is the Xhosa word for heifers. Over time this was changed to “Amatola” by some sections of the population, and was used to name things such as the mountain range and the water board. Both spellings are used in this report as appropriate. There is currently a move to standardise the spelling to “Amathole” but this has not yet been approved).

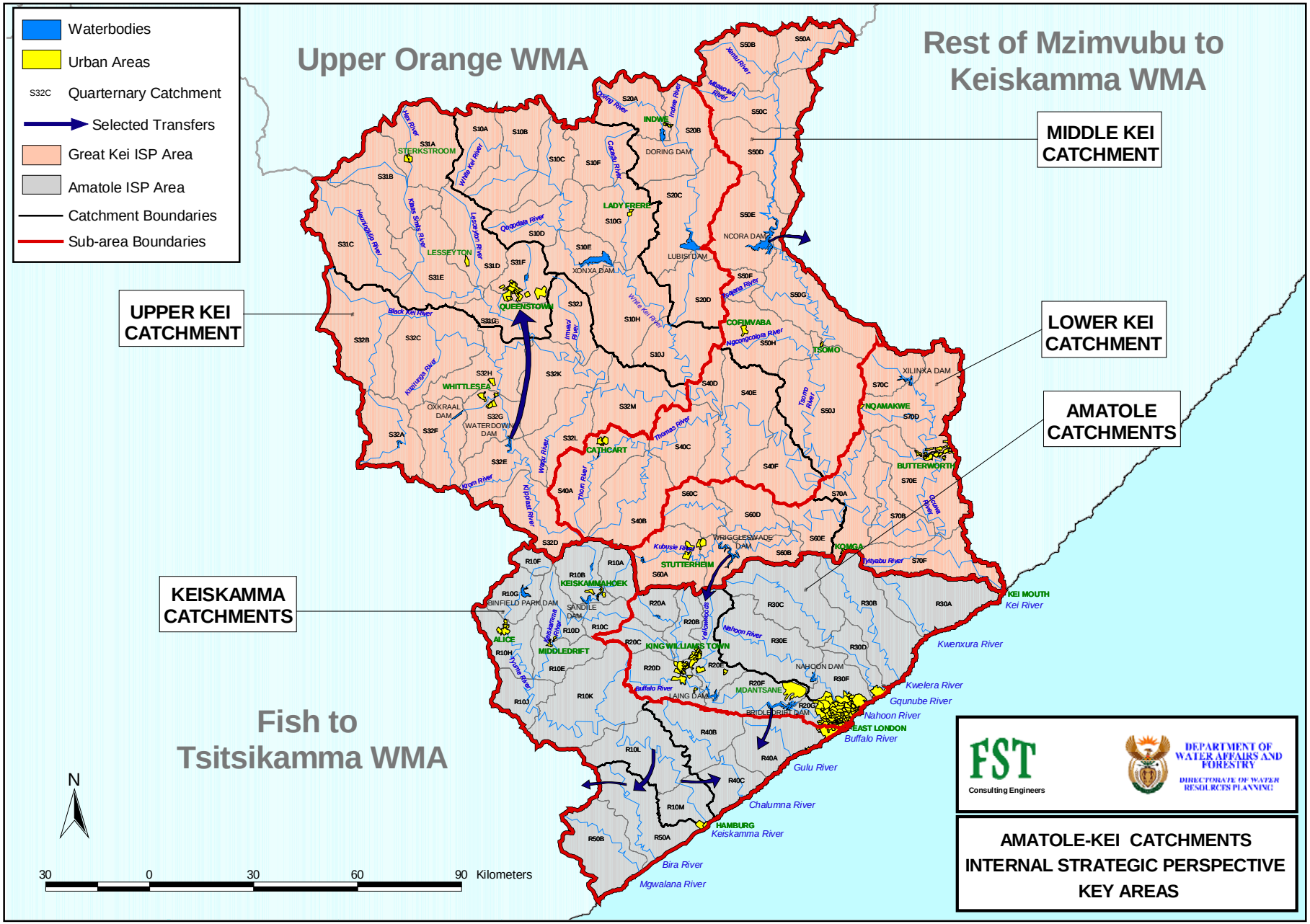


**Figure 2.2 : Amatole-Kei ISP Sub-areas**

## 2.2 Physical Characteristics

### 2.2.1 Topography and Rivers

The topography of the ISP area is shown in **Figure 2.3**.

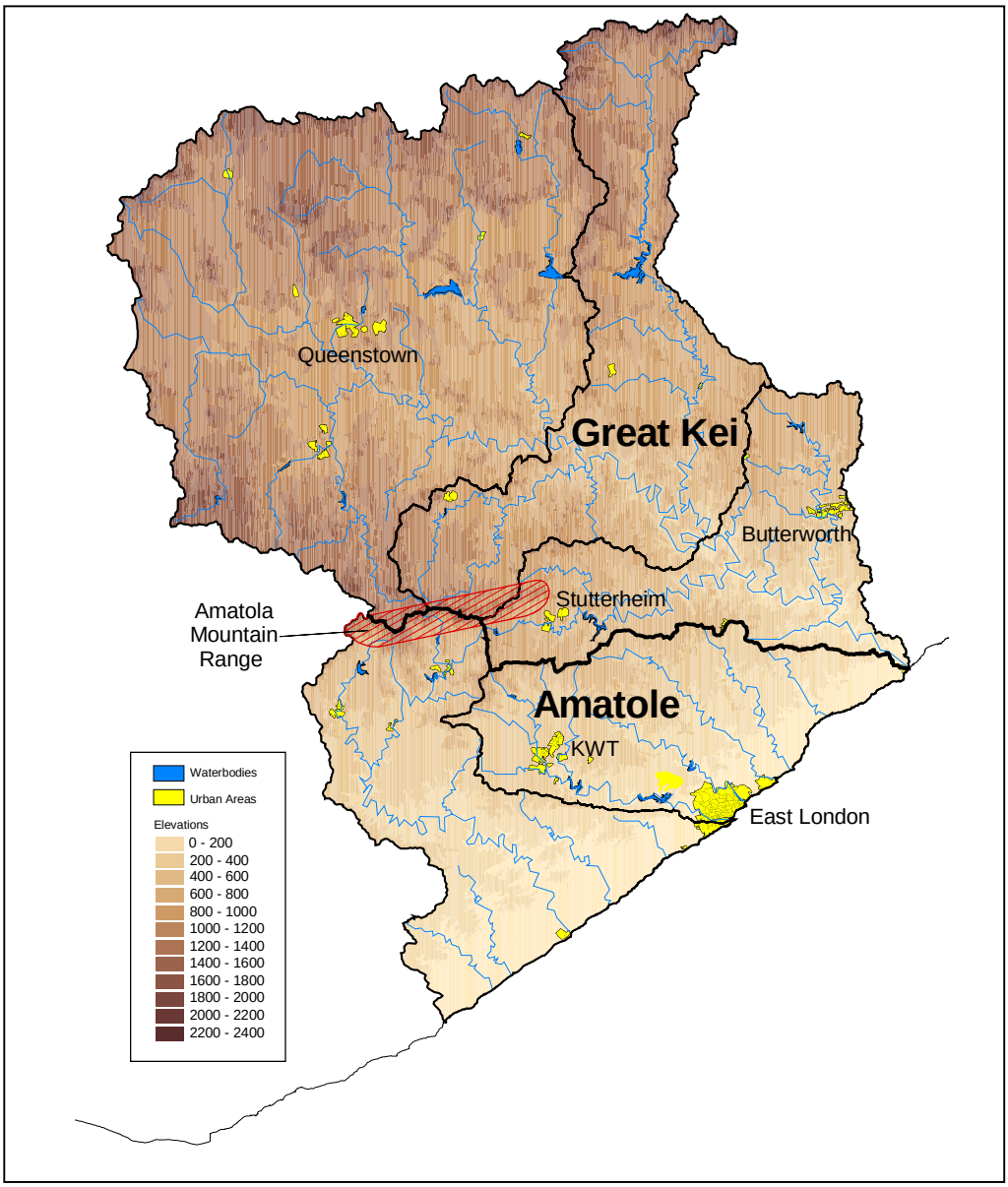


**Figure 2.3 Topography of the ISP Area**

**The Amatole catchments** have their headwaters in the southern foothills of the Amatola mountain range. This range forms the primary catchment boundary between the Amatole and Great Kei catchments for much of its length, stretching from Stutterheim in the east to Bedford in the west and reaches an altitude of approximately 1960 masl in the well-known Hogsback area. The main rivers in the Amatole area are the Keiskamma, Buffalo, Nahoon and Gqunube Rivers, all flowing in a south easterly direction from the Amatola mountains to exit into the Indian Ocean along the coastline around East London.

**The Great Kei catchment** is a single fan shaped catchment draining an area bounded by the Amatola mountain range in the south, the Winterberg in the east and the Stormberg / Drakensberg range to the north of Queenstown at an altitude of 2400 masl. In the east the catchment is bounded by undulating hills running in a north-south direction to the coast separating the Kei catchment from the Mbashe catchment.

The Great Kei can be divided into three distinct areas viz. the Upper, Middle and Lower Kei catchments (refer **Figure 2.2**).

- Upper Kei tributaries include the Black Kei and Klipplaat Rivers with their headwaters in the northern slopes of the Amatola mountain range. These rivers drain in a northerly direction before turning east to join up with the non-perennial Heuningklip and Klaas Smits Rivers, which have their headwaters in the northeast. The remainder of the Upper Kei catchment consists of the White Kei and Indwe Rivers with their headwaters in the southern slopes of the Stormberg / Drakensberg range.

- In the Middle Kei catchment, the Great Kei River is joined by the Thomas River flowing from the Amatola mountain range in the west, and the Tsomo River in the east with its source in the southern Drakensberg foothills near the town of Elliot.

- In the Lower Kei catchment, the Great Kei River is joined by the Kubusi River flowing from the Amatola mountain range in the west, and the Gcuwa River from the east. The middle and lower Great Kei River is characterized by a deeply incised valley before exiting into the Indian Ocean at Kei Mouth.

### 2.2.2 Geology

The ISP area consists predominantly of the Beaufort Series of the **Karoo Supergroup** with the Adelaide subgroup between the coast and the Amatola mountains, the overlying Tarkastad subgroup between the Amatola mountains and the Stormberg / Drakensberg range, and the **Cape Supergroup** (Molteno and Elliot formations) along the northern boundary.

The Adelaide subgroup comprises mostly mudstones alternating with lithofeldspathic sandstones. The Tarkastad subgroup is characterized by a greater proportion of sandstone and red coloured mudstone. The Molteno formation contains yellow grey sandstones alternating with olive mudstones and grey shale. The Elliot formation which overlies the Molteno formation comprises an upward fining cycle of sandstone, siltstone and mudstone.

There are extensive intrusive hypabyssal dolerite sills and dykes throughout the area with characteristic ring structure formations in the Upper Kei catchment around Queenstown. The Amatola mountain range forms the southern boundary of one of these ring structures.

A characteristic of the geology and soils of the area is that once the vegetation is removed by whatever means, erosion of the topsoil is rapid due to the nature of the dispersive soils derived from the underlying geology. This in turn causes high turbidities/suspended solids in the rivers and reduced quality of the water in the rivers and dams as well as siltation of dams.

Reference should be made to **Section 2.7.3** : Groundwater Resources, for insight into the relationship between geology and groundwater in the ISP area.

### 2.2.3 Climate and Rainfall

The climate and temperature variations of the ISP area are closely related to elevation and proximity to the coast. The area experiences a temperate climate along the coast to more extreme conditions inland. Most rainfall occurs during the summer months.

Temperature variations along the coast are less pronounced than inland where frost (and sometimes snow) is regularly experienced during the winter months while temperatures regularly exceed $40^0$C during the summer months.

Rainfall increases from the west to the east and from inland to the coast with a local high along the Amatola mountain range. Annual rainfall along the coastline varies from approximately 500 mm in the west to approximately 1000 mm in the east, and over 1200 mm in the Amatola mountains.

Annual rainfall in the Kei catchment varies from a low of approximately 400 mm in the Upper Kei area around Sterkstroom, to 700 mm in the Middle Kei, to 1000 mm at Kei Mouth. The highest rainfall area is again in the Amatola mountains.

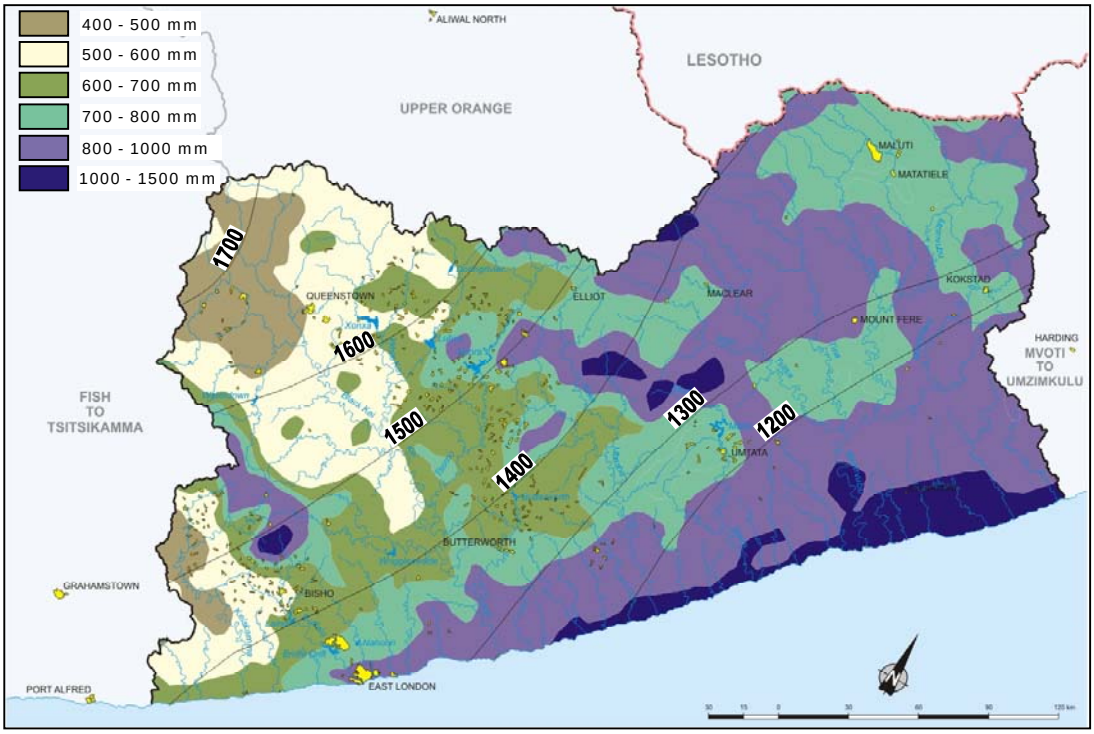


**Figure 2.4 Rainfall in WMA 12**

### 2.2.4 Vegetation

The ISP area can be described in terms of indigenous (natural vegetation) and exotic (generally formal afforestation and alien invasives) vegetation.

- **Indigenous Vegetation**. The Eastern Cape is considered to be South Africa's most geologically diverse province, supporting all seven identified biomes and the second greatest plant species richness after the Western Cape. Within the ISP area four natural biomes occur; forest, grassland, savanna and thicket. In the Amatole catchments the dominant biomes is savanna (eastern thorn bushveld and coastal thornveld) followed by grassland (coastal grassland and Dohne sourveld). Within the Upper and Middle Kei catchments, grasslands (highveld) dominate, followed by savanna (eastern thorn bushveld) and valley thicket (valley bushveld) in the Kei River valley. This diversity is being threatened by alien invasives, overgrazing, wood gathering, veld burning and poor farming activities.

- **Forestry.** Most forests (commercial and indigenous) are in the high rainfall areas of the Amatola mountains and consist of approximately 380 $km^2$ of commercial Pinus and Eucalypt species, and indigenous afromontane forests.

- **Alien Plants**. Alien plant species considered as invasives consist mainly of black and silver wattle and eucalypt species and can be found throughout the area. The main problem areas are in the southern foothills of the Amatola mountain range (between King William's Town, Stutterheim and Keiskammahoek) and in the former Transkei area between Butterworth and Nqamakwe. Weed invasives (*Lantana, Sesbania* etc) can also be found in most riparian vegetation.

  In addition to the above land based alien invasives, water weed (hyacinth, etc) and algal blooms are an increasing problem in some of the larger dams (Bridle Drift, Laing, Wriggleswade, Nahoon) in the Amatole catchments due to nutrients originating from waste water treatment works, pollution from urban run-off and resultant eutrophication.

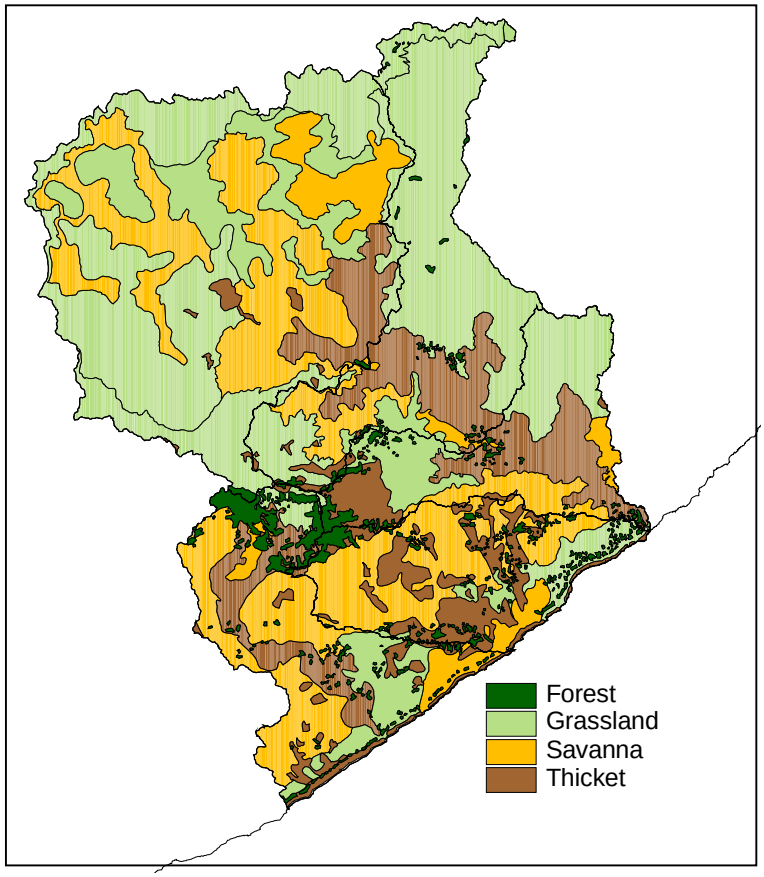


**Figure 2.5 Biomes Map of the ISP Area**

2.2.5 Land Use

Land use activities in the ISP area comprise the following :

- Livestock farming (beef, dairy, sheep, goats) throughout the area
- Subsistence farming (maize, vegetables) mainly in the former Ciskei, Transkei and Development Trust areas
- Commercial vegetable farming (tomatoes, cabbages etc) around East London and the Komga and Kubusi areas
- Pineapple farming along the coastal areas
- Several irrigation developments (including citrus) in the former Ciskei and Transkei areas are gradually being rehabilitated. These are located in the Keiskamma catchment below Binfield Park, Sandile and Cata Dams (Keiskammahoek, Zanyokwe and Tyume schemes), in the Klipplaat catchment below Waterdown and Oxkraal Dams (Shiloh scheme), below the Xonxa and Lubisi Dams (Xonxa and Qamata schemes) and from the Ncora Dam (Ncora scheme).
- Commercial afforestation is practised in the higher rainfall areas of the Amatola mountains along the upper catchments of the Keiskamma, Kubusi, Klipplaat and Buffalo Rivers.

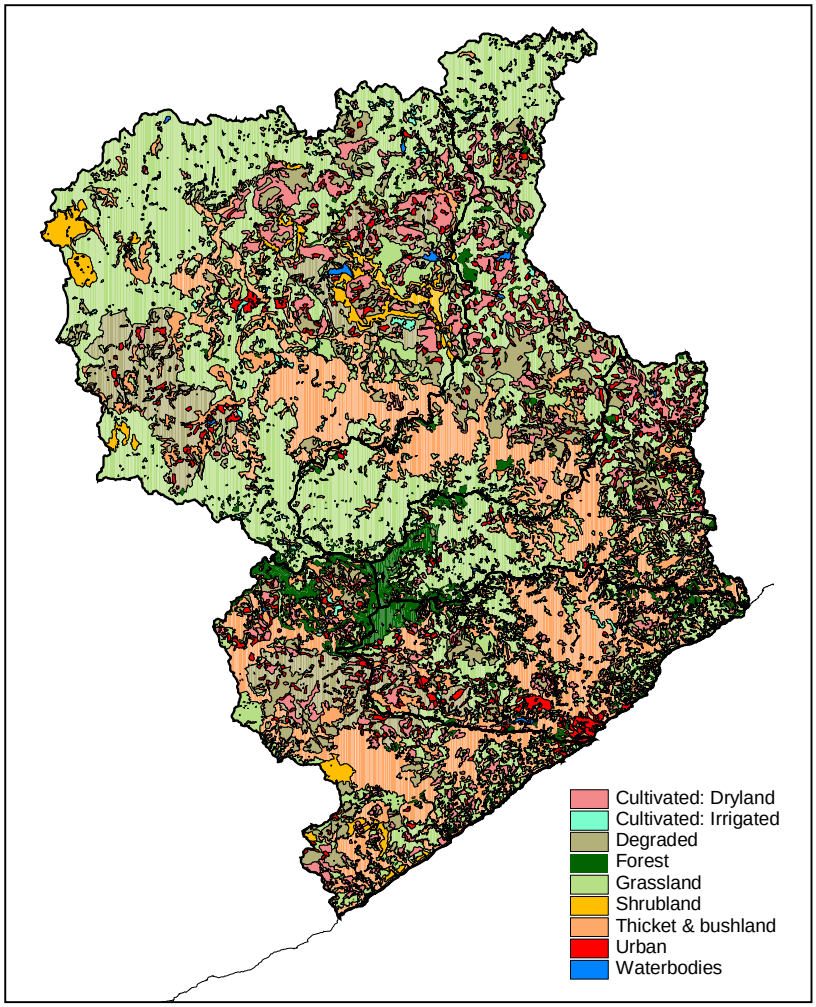


**Figure 2.6 Land Use Map of the ISP Area**

## 2.3 Demography

The estimated population of the ISP area in the year 2000 was some 1,761,000 with 953,000 (54%) people residing in the Amatole catchment and 808,000 (46%) in the Kei catchment (**Ref. 6** and **24**). Of this total population approximately 26% live in urban or peri-urban areas and 74% live in rural areas. The population in the Amatole catchment is projected to grow to approximately 1,2 million by the year 2025, while the population within the Kei catchment is expected to decline very slightly. The main reasons for this will be due to migration of people from the rural areas to urban areas for economic reasons, and the impact of HIV/AIDS especially after 2005. The only urban area expected to experience significant growth in the future is the Buffalo City Municipal area where employment opportunities will attract people from the smaller urban centres and rural areas.

The Amatole area is characterized by a large urban and peri-urban population within the Buffalo City Municipal area (East London – Mdantsane – Bisho – King William's Town corridor), which contains some 730,00 people (2000) or some 77% of the total population of the Amatole catchment. The remaining population reside in small rural towns and scattered rural villages. Queenstown, Stutterheim and Butterworth are the

largest formal urban centres in the Kei catchment with most people living in scattered rural villages.

The ISP area comprises large portions of the former Ciskei and Transkei. These areas are characterized by large, dense rural settlements (villages) with populations often in excess of 10,000 people.

## 2.4 Land Tenure

Land tenure in the area is characterised by private ownership on the one hand, and the different systems found in the former Ciskei and Transkei where there are five categories of land tenure :

- Tribal land, sometimes coupled with the quitrent system. This constitutes over 80% of the former homelands areas
- Freehold land
- State land
- Municipal land
- Institutional land (churches etc)

Within what was the former South African component of the area, the majority of land is held under freehold title either by individuals or farming syndicates. The remaining areas are state, municipal and institutional lands.

Due to some of the difficulties associated with the tribal land tenure system such as overgrazing on communal lands etc, attempts have been made in the past to change the system but these have not met with much success.

## 2.5 Economic Development

East London, with its airport and harbour, is the centre of economic activity in the ISP area. This is enhanced by rail links to the interior and a national road system. The Eastern Cape Provincial Government has identified the following four sectors which will form part of its Growth and Development Strategy for the next ten years.

A number of **manufacturing industries** have established themselves in East London, the largest being the Daimler Chrysler motor manufacturing where vehicles are exported worldwide. Other main industries include tanneries, textiles (Da Gama), toiletries (Johnson & Johnson), pharmaceuticals (Pharmacare) and confectionery (Nestle).

With little incentive for large scale economic development elsewhere in the region, other than expansion of agricultural activities, the main opportunities for further economic growth will continue to be based on the development of industries and trade in the Buffalo City Municipal area (BCM) consisting of the East London - King William's Town corridor. This has been recognized by government, and the East London Industrial Development Zone (ELIDZ) is presently being established as an incentivised trade zone.

Queenstown (Ezibeleni), Dimbaza and Butterworth previously had a strong core of manufacturers, but these collapsed and/or relocated once the regional industrial development programme supporting the previous government's homeland policy was disbanded. Only a small number of industries remain in these industrial areas, serving mainly the local populace.

East London and the surrounding coastline is increasingly becoming the focus for regional **tourism**. Further expansion of tourism facilities will create labour enhancing opportunities in an area where the unemployment rate exceeds 50%.

Economic activity outside of the BCM area is largely based on farming and **agricultural related activities**. These include meat (beef and mutton), wool, dairy, pineapples, tomatoes, vegetables and a once thriving citrus industry in the Tyume - Kat River area. Some growth of local rural economic activities and poverty alleviation should take place once the irrigation schemes in the former Ciskei and Transkei homelands are rehabilitated and placed on a sound and sustainable economic footing.

The **commercial forestry** industry is centred in the Amatola mountains around Stutterheim. Potential exists for the manufacture and processing of products from these primary agricultural and forestry activities.

The area has no exploitable minerals other than construction aggregates (sand and stone) and some minor coal seams in the Indwe area.

## 2.6 Identification of Sub-areas

In order to undertake meaningful situation assessments to identify the main water resource management issues and to develop applicable management strategies, the Amatole - Kei ISP area has been divided into five sub-areas based on common features such as catchments, water supply systems and land use. It is recognized that the selection of catchments making up each sub-area is to some extent subjective and different possibilities exist. The following sub-division is considered practical and manageable. Coastal catchments were grouped based on current and future inter-dependence.

Five sub-areas have been identified as follows (refer **Figure 2.2**) :

- The Amatole sub-area - catchments R20/30
- The Keiskamma sub-area - catchments R10/40/50
- The Upper Kei sub-area - catchments S10/20/31/32
- The Middle Kei sub-area - catchments S40/S50
- The Lower Kei sub-area - catchments S60/70

A detailed situation assessment for each of the five sub-areas is given in **Chapters 3 to 7**.

### 2.6.1 The Amatole Sub-area

The main rivers in this sub-area are the Buffalo (R20), Nahoon, Gqunube, Kwelera and Kwenxura Rivers (R30).

The reason for this sub-area is the regional Amatole Water Supply System (AWSS) which supplies the Buffalo City Municipality. Although not part of this sub-area, the upper Kubusi catchment including the Wriggleswade and Gubu Dams forms part of the AWSS as the infrastructure exists to transfer up to 18 million $m^3$/a of water from the Wriggleswade Dam to the Buffalo/Nahoon/Gqunube catchments for use in the Buffalo City Municipal area.

### 2.6.2 The Keiskamma Sub-area

The main river in this sub-area is the Keiskamma River (R10) together with the small coastal rivers of Magwalana and Bira (R50), and Chalumna and Gulu (R40). This sub-area has been selected due to the users in these two coastal catchments who generally obtain their water requirements from the Keiskamma River.

Most of this sub-area previously fell within the borders of the former Ciskei. As such, the area is characterized by rural towns and settlements with subsistence farming and communal grazing being the main land uses. A number of irrigation schemes (Keiskammahoek, Tyume, Zanyokwe) are located in the upper part while dry land pineapple schemes exist in the lower part of the area. These are at various stages of being revitalised after lying moribund for a number of years. A number of small resorts/towns are located along the coastline south of East London.

### 2.6.3 The Upper Kei Sub-area

The main rivers in this sub-area are the White Kei (S10), the Indwe (S20), the Heuningklip and Klaas Smits (S31), and the Black Kei and Klipplaat Rivers (S32).

The main reasons for the sub-area grouping is geographical as well as water supply to Queenstown and surrounding users. The sub-area catchments, water resources and water developments have been analysed in the past in DWAF studies (**Ref. 19 and 20**).

The main demographic feature of the sub-area is the urban area of Queenstown, which acts as the regional centre for the Upper Kei Catchment. The town obtains most of its raw water supply from the Waterdown Dam on the Klipplaat River. Queenstown is currently facing a water supply crisis due to a severe drought in the region and the taking up of water allocations from Waterdown Dam for irrigation. Possible future supplementary water supply for Queenstown could come from the Xonxa Dam on the White Kei River. A number of irrigation schemes (Shiloh, Xonxa, Qamata) are located in the former Ciskei and Transkei areas and these are also in various stages of being rehabilitated.

2.6.4 The Middle Kei Sub-area

The main rivers in this area are the Thorn and Thomas (S40), and the Tsomo Rivers (S50).

This sub-area epitomizes the variation within the Great Kei Catchment from a land use point of view. While the S40 catchment is characterized by large scale privately owned livestock farms, the S50 catchment reflects the rural settlements and subsistence farms of the former Transkei. The Ncora Dam scheme on the Tsomo River transfers approximately 105 million $m^3$/a of water to a tributary of the Mbashe River in the Mzimvubu – Mbashe part of WMA 12. Of this, 85 million $m^3$/a is allocated for hydropower at the Ncora Dam itself and at Collywobbles lower down in the Mbashe catchment, and 20 million $m^3$/a is allocated to the Ncora Irrigation Scheme, also in the Mbashe catchment. The Ncora scheme is the only scheme transferring bulk raw water into a different ISP area, although still within the same WMA.

2.6.5 The Lower Kei Sub-area

The main rivers in this sub-area are the lower reaches of the Great Kei River to its estuary including the Gcuwa River (S70) and the Kubusi River (S60).

As for the Middle Kei sub-area, this sub-area is characterized by large scale privately owned irrigation and livestock farms in the Kubusi catchment, while the S70 catchment reflects the rural settlements and subsistence farms of the former Transkei. The main urban centres are Butterworth and Stutterheim.

## 2.7 Water Resources Overview

This section provides a general overview of the water resources situation in the ISP area including water quality and the state of water infrastructure. Separate sections on surface and groundwater aspects are included although the level of detail and accuracy of knowledge of the latter is not on a par with the surface water aspects. As part of this study differences have been identified between the National Water Resources Strategy (**Ref. 8)** and the ISP water resource yield and water requirement figures. A comparison is made between the ISP and the NWRS figures in **Chapter 8**.

2.7.1 Institutional Arrangements

Water resources and water supply fall under the jurisdiction of DWAF, the District Municipalities (DMs) as the Water Service Authorities (Amatole and Chris Hani DMs) and Water Service Providers, which include some of the local municipalities (BCM) and the Amatola Water Board (AW) (refer **Appendix B7**). Owing to historical reasons, water supply schemes are currently owned, operated and maintained to a lesser or greater degree by the above institutions, with areas of overlap. An example of this is that all dams on the Buffalo and Nahoon Rivers except for Bridle Drift Dam are owned by DWAF and operated by the AW respectively. BCM owns and operates Bridle Drift Dam. This has implications with respect to optimal operation of water resources, water supply and tariffing. Small local municipalities, which have been authorised to act as Water Service Providers have in general not been able to fulfil this function adequately

and the DMs are assuming this role where necessary. Realignment of roles according to the Water Act is ongoing but is constrained by the lack of financial and skilled manpower resources.

Representative Catchment Forums for this ISP area are scheduled to be in place by April 2004. The establishment of Water User Associations is being encouraged by DWAF, but the process is likely to take several years to complete.

2.7.2 Surface Water Resources, Water Infrastructure and Water Quality

Based on the NWRS and supporting reports (**Ref. 8 and 9**), catchment wide figures are presented in **Tables 2.1 to 2.3** for the natural mean annual runoff (MAR) and estimated requirements for the ecological component of the Reserve, water requirements for the year 2000 and available water in the year 2000. Comparative ISP figures, compiled in **Chapters 3 to 7,** are compared with the following NWRS figures in **Chapter 8**. Where differences occur, these differences have been explained with justifications for recommending that the revised ISP figures be used.

**Table 2.1 Natural Mean Annual Runoff and Ecological Reserve**

| Primary Catchment | Natural MAR (million $m^3/a$) | Ecological Reserve (million $m^3/a$) |
|---|---|---|
| Amatole | 559 | 116 |
| Kei | 1 027 | 154 |
| **Total** | **1 586** | **270** |

A summary of the sectoral water requirements in each of the primary catchments in this ISP area is given in **Table 2.2.** All requirements are given at a 98% assurance of supply.

**Table 2.2 Water Requirements in the Year 2000 (million $m^3/a$)**

| Primary Catchment | Irrigation | Urban (1) | Rural (1) | Mining & Bulk Industrial (2) | Power Gener-ation (3) | Affore-station (4) | Total Local Require-ments | Transfers out | Grand Total |
|---|---|---|---|---|---|---|---|---|---|
| Amatole | 33 | 57 | 5 | 0 | 0 | 4 | 99 | 0 | 99 |
| Kei | 135 | 18 | 10 | 0 | 0 | 11 | 174 | 85 | 259 |
| **Total** | **168** | **75** | **15** | **0** | **0** | **15** | **273** | **85** | **358** |

(1) Includes component of Reserve for basic human needs at 25 l/c/d.
(2) Mining and bulk industrial water uses which are not part of urban systems.
(3) Includes water for thermal power generation only. Water for hydropower, which represents a small portion of power generation in South Africa, is generally available for other uses as well.
(4) Quantities given represent impact on yield only.

The total water available for use in the Amatole – Kei ISP area at the Year 2000 development levels was estimated in the NWRS and is given in **Table 2.3**.

**Table 2.3 Available Water in the Year 2000 (million $m^3$/a)**

| Sub-area | Natural resource | | Usable return flows | | | Total local yield | Transfers in | Grand total |
|---|---|---|---|---|---|---|---|---|
| | Surface water (1) | Ground Water (2) | Irrigation | Urban | Mining and bulk | | | |
| Amatole | 122 | 1 | 2 | 24 | 0 | **149** | 0 | **149** |
| Kei | 325 | 14 | 14 | 6 | 0 | **359** | 0 | **359** |
| **Total** | **447** | **15** | **16** | **30** | **0** | **508** | **0** | **508** |

1) After allowance for the impacts on yield of: ecological component of Reserve, river losses, invasive alien plants, dry land agriculture and urban run-off.
2) Groundwater quantities estimated to be in current use. Potential may be greater than this figure.

From **Tables 2.2 and 2.3**, the NWRS shows that there is a surplus water balance in the Amatole and Kei catchments of 50 million $m^3$/a and 100 million $m^3$/a respectively.

Although the rainfall in the Amatole - Kei area is not especially high, water demand is currently less than the available yield of the catchments, with the result that the area is one of the few in the country that has surplus water available on a catchment wide basis. This is partly due to the number of large dams that have been built on the major rivers and tributaries in the former Ciskei and Transkei components of the ISP area with a view to downstream irrigation development. Much of this development did not take place, and where it did the irrigation schemes and infrastructure have fallen into a state of disrepair and are only now being rehabilitated, supported in part by DWAF's Emerging Farmers Support Programme.

These dams include Binfield Park, Sandile and Cata Dams on the Keiskamma River, the Xonxa, Lubisi and Ncora Dams on the White Kei, Doring and Tsomo Rivers respectively, and the Oxkraal and Waterdown Dams on the Klipplaat River (refer **Appendices B6 and B10**). The Ncora Dam was built for the generation of hydropower at the dam itself, the transfer of water to the Mbashe catchment for further hydropower generation at Collywobbles, and for irrigation at the Ncora irrigation scheme. There are a number of small dams in the ISP area, such as Pleasant View Dam outside Alice, which are not being used.

Waterdown Dam serves as the main raw water supply to Queenstown and Sada / Whittlesea. Queenstown is also supplied from the small Bongolo Dam. The allocation from Waterdown Dam for these urban areas and for irrigation presently exceeds the yield of the dam. However, due to the scheduled rights for the Shiloh irrigation scheme not being exercised and adequate rainfall in the catchments of the dams over the past few years, no water shortages have as yet been experienced (Note : Water restrictions were introduced in December 2003). This may change, as the rehabilitation of the Shiloh irrigation scheme is presently underway. The bulk water infrastructure (treatment and pipelines) is operating close to full capacity and, depending on the

source of additional raw water supply, this aspect will also need to be addressed in the near future.

Within the Amatole Water Supply System (AWSS) the development of dams has been such that with inter-basin transfer from the Kubusi River to the Buffalo/Nahoon Rivers, the system will be in surplus until approximately 2012. Large dams within the AWSS system include the Maden, Rooikrantz, Laing, Bridle Drift, Nahoon, Gubu and Wriggleswade Dams. However, while there is currently an overall surplus of raw water available, there is an urgent need for the implementation of additional water treatment facilities and bulk supply infrastructure to provide treated water to the growing demand in the Buffalo City municipal area.

Planning studies for the augmentation of additional water supplies to both the Buffalo City Municipal area and the Queenstown area have been ongoing for a number of years. Water Service Development Plans (WSDPs) recently completed for these two municipalities outline the strategies for future water supplies and include as a high priority the need for water conservation and demand management programmes. Water re-use has been considered in the WSDPs but this is currently viewed as being an expensive option for domestic water supply augmentation. However, consideration is being given to a treated effluent supply from the East Bank Reclamation Works in East London to the new ELIDZ for use as industrial water. A sea outfall raw effluent discharge works is presently under construction in East London at Hood Point, but further work has been delayed due to a lack of funds.

Water supply infrastructure to smaller towns is adequate with most schemes having been upgraded through funds from the Consolidated Municipal Infrastructure Programme. No serious infrastructure problems have been identified in any of the towns in the ISP area, although as mentioned the lack of skilled manpower and finances is seriously affecting the operation and maintenance of most small town water supply schemes.

There has been a major emphasis in the past decade in addressing the backlogs in water supply infrastructure in the rural areas with many rural water supply schemes having been commissioned. The main thrust for this has been through DWAF's Community Water Supply and Sanitation programme, which has included the BoTT programme in the Eastern Cape. These schemes included both surface and groundwater supplies throughout the rural areas. Latest census figures show that approximately 63% of people in the Eastern Cape have access to treated water from a tap. Much has been achieved, but full water supply coverage will only be achieved with ongoing support from DWAF and the Local Authorities. This is expected to take at least another 10 years at the present rate of progress. Sanitation infrastructure lags behind water supply infrastructure, with only some 30% of people having access to acceptable toilet facilities. This has serious implications for health and for the water quality aspects of both the rivers and groundwater resources, especially in the rural areas where the problem is widespread and where many people still obtain their water from rivers, springs and boreholes which are exposed to contamination.

Water quality in the rivers in the Amatole sub-area catchments varies from good in some of the smaller rural coastal catchments, to medium in the larger less impacted rivers such as the Keiskamma and Gqunube Rivers, to poor in the severely impacted urban rivers i.e. the Buffalo and Nahoon Rivers and small rivers in East London. The reasons for the water quality problems include high turbidities due to soil erosion, overloaded sewage treatment works, runoff from unlicensed solid waste sites, poorly designed and maintained sewerage infrastructure, urban runoff, runoff from informal settlements without adequate sanitation and illegal industrial pollution. These same pollutants impact on the groundwater resources of the area. Within the rural areas, where adequate sanitation only serves some 30% of the population and water is often sourced from boreholes and springs without treatment, pollution of the groundwater poses a serious threat to the health of the people.

Within the Upper and Middle Kei catchments, river water quality can be described as medium, with the main impacts being from soil erosion and runoff from rural settlements where adequate sanitation does not exist. In the Lower Kei catchment and more especially the Gcuwa tributary which runs through Butterworth, serious pollution results from poorly maintained and operated sewage works and infrastructure, a large unlicensed solid waste site located on the river bank, and effluent discharges from industries such as tanneries.

Ecological Reserve determinations for all the rivers in the ISP area have been performed at desktop level during compilation of the NWRS. Intermediate ecological Reserve determinations have been conducted for the Nahoon, Kubusi, Buffalo and Upper Kei Rivers during various situation assessment studies. Some water quality objectives were also established during this exercise.

### 2.7.3 Groundwater Resources

Although it is estimated that significant quantities of groundwater could be abstracted in the ISP area, the actual use of groundwater is relatively small over most of the area. This is mainly attributed to the generally well-watered nature of the area and the wide occurrence of perennial surface streams, which reduces the need for groundwater abstraction.

As a result the role of groundwater resources has been primarily to supply rural villages, farmers and small coastal resorts where surface water does not exist. The quantity and quality of the groundwater varies from poor along the coastline, to medium to good within the Amatola mountains and within the Upper Kei catchment, especially when associated with dolerite structures. Water of high salinity is found along the coast and at some inland locations where the rainfall is low and the geology is unfavourable.

Many rural villages have in the past been supplied with groundwater due to its low cost in comparison with surface water supplies. These groundwater supplies have often been of low quantity (< 25 l/c/d) due to poor siting, drilling and testing techniques. In addition, the necessary management and operational skills have often been lacking with the result that groundwater supplies are generally perceived as been unreliable.

However, with the advance in groundwater knowledge and technical skills, the success of using groundwater for rural village water supplies is improving. Due to its potential as a low cost basic water supply to remote rural villages, groundwater is currently considered as a first step for almost all new rural water supply schemes in the region where it is available.

Alluvial groundwater extraction for irrigation purposes is practised, mainly along the Klaas Smits and Heuningklip Rivers in the Upper Black Kei catchment. The potential for further large scale use of groundwater for irrigation is largely unknown but is considered high especially in the low rainfall parts of the ISP area. This will depend on improved knowledge of the groundwater resources of the region and the identification of areas where high yielding boreholes can be developed.

Rural coastal villages and resorts either side of East London have historically relied on small groundwater schemes of varying quantity and generally poor water quality. Where feasible these schemes are gradually being replaced with surface water supplies sourced from a number of regional water supply schemes.

The groundwater quantity and quality throughout the area reflect the underlying geology, which is dominated by the upper Beaufort Group (Tarkastad Subgroup) and overlying formations in the uplands area, and the Witteberg, Ecca and lower Beaufort Group (Adelaide Subgroup) on the coastal plateau. Major Karoo dolerite sills and dykes are also a conspicuous feature of the geology. There are minor coastal dune areas south of East London, and areas of alluvial gravel and sand along the rivers in the Upper Kei Catchment. Based on the regional geology and tectonic history, the porosity, permeability and transmissivity of the aquifers are different and several Geohydrological Provinces can be identified according to the catchments. The Eastern Cape Lowlands and the Amatola - Stormberg Uplands Geohydrological Provinces respectively consist of three and two sub-areas.

**Table 2.4 Geohydrology of the Amatole - Kei Region**

| Hydrogeological Province (Subprovince) | Catchments | Geology/Hydrogeology | Preferred Groundwater Targets |
|---|---|---|---|
| **Eastern Cape Lowlands** | | | |
| Keiskamma | R50, R10 | (Karoo dolerites)<br>Adelaide Subgroup<br>Ecca Group<br>Witteberg Group (upper) | Karoo dykes in upper R10; Witteberg sandstone in R50 |
| Buffalo | R40, R20, R30 | Karoo dolerites<br>Tarkastad Subgroup (in downfaulted blocks)<br>Adelaide Subgroup | Karoo dyke and sill structures; Katberg sandstone near fault zones |
| Lower Kei | S60, S70 (less S70C & S70D) | Karoo dolerites<br>Adelaide Subgroup | Karoo dyke and sill structures |
| **Amatola-Stormberg Uplands** | | | |
| Katberg | S32, S40, (plus S50G, S50G, S50J, S70C, S70D) | Tertiary-Quaternary alluvials<br>Karoo dolerites<br>Burgersdorp Formation<br>Katberg Formation | Karoo dykes and ring (sill) structures; Fractured Katberg sandstone |
| Stormberg Foothills | S31, S10, S20, S50A-S50E | Tertiary-Quaternary alluvials<br>Karoo dolerites<br>Drakensberg Formation<br>Clarens Formation<br>Elliot Formation<br>Molteno Formation<br>Burgersdorp Formation | Karoo dykes and ring (sill) structures, in conjunction with sandstone members in otherwise generally shaly units (e.g., Indwe Sandstone in Molteno Fm) |

The central Amatola-Stormberg Uplands (Katberg) area receives the greatest amount of rainfall in the region, which reflects in the recharge potential. Snowfalls on the Winterberg and Stormberg probably add to this. Surface water runoff as well as the groundwater gradient drains off the Amatola mountains to the hinterland into the tributaries of the Upper Kei River as well as to the coast into the Keiskamma and the smaller tributaries of the Middle and Lower Kei River in the east.

The R20, R30 and R40 catchments comprise the Buffalo sub-area of the Eastern Cape Lowlands Hydrogeological Province. These rivers drain from Beaufort shale and is Karoo dolerite dominated. It appears that some boreholes drilled into this sub-area have targeted the dolerite structures (dyke/sills) that extend along WNW/ESE trends between King William's Town and East London. Some springs may also be aligned along these features. These dykes and associated faults represent recent tectonic activity and are related to the separation of the Falkland Plateau during the break-up of Gondwanaland, therefore better yielding boreholes and associated springs. Boreholes drilled to the east however appear to have been more randomly sited.

It is also evident that the springs, which feed the larger perennial rivers in this ISP area are associated with the dolerite ring structures (refer **Appendix B4.2**). The ring structures in the area north of East London have not been adequately explored However, from a water resources perspective the ring structures have great significance and several communities are dependent on ring structures as a single or conjunctive water resource. The long time dependence of Komga (until recently) on groundwater and the fresh water springs feeding into the Kei River south of Butterworth and north and east of Komga are typical of this hydrogeological pattern. It is unknown

to what extent the groundwater investigations in the Toleni district intercepted or targeted this aquifer.

The Amatola mountains are dominated by what is called the Cathcart Ring Structure, which has at its centre the village of Cathcart. North of Queenstown is the well studied but smaller Qoqodala Ring Structure. Immediately north of Cathcart there are a series of smaller ring structures lying east-west in a band on the northern foothills of the Amatola. These structures are interspersed with a number of old land surfaces with extensive alluvial deposits from which a number of springs emerge. This land surface is present at two elevations, viz ~1100-1200 masl and ~ 900 masl.

There is limited understanding of variations in spring discharge with climate variations, snowfall and natural impacts on base flow versus anthropogenic or abstraction influence. Current understanding of the relationship of different aquifers to spring flow and base flow is undocumented and not considered in either surface water or groundwater management or regulatory decisions. This is of particular importance in evaluating the groundwater reserve for estuaries and unregulated rivers and in aquifer protection.

The groundwater quality varies significantly between the fractured rock aquifers and the groundwater found in the “intergranular (weathered) and fractured”, or more traditionally termed regolith aquifers that lie to the north and south of the Amatola mountains, and which overlie generally impermeable shale-dominated formations. While the former generally have a total dissolved solids (TDS) of less than 300 mg/l, the regolith aquifers yield groundwater with a TDS greater than 300 mg/l and as high as 2000 mg/l. The groundwater in the high lying alluvium is generally of good quality while the coastal dunes yield poorer quality water

The fractured rock aquifers are vulnerable to contamination by pollution from unregulated industry and poor construction or maintenance of Ventilated Improved Pit Latrines (VIPs). Also of concern is the threat to groundwater quality posed by poor management or maintenance of urban effluent treatment works in Komga, Butterworth, King William’s Town and East London. These towns are situated on regional dykes and ring structures along and in which pollutants will have preferred flow paths. The aquifers supplying the small coastal resorts and the towns in the north-eastern sector are also vulnerable.

The impact of the soil erosion evident throughout the area should not be underestimated and should be treated as a matter of urgency. It results in increasingly reduced recharge to the aquifers, thus exacerbating any decline in groundwater table due to natural drought, poor management or increasing demand. This initiates the desertification process that results in declining spring flows and resultant famine.

The borehole distribution documented in the NGDB (refer **Appendix B4.3**) illustrates the dominance of groundwater usage in the Hewu, Alice and Middledrift areas, as well as in the R50B and R50A catchments southwest of Peddie. There is a more or less even spread of boreholes throughout the rest of the area except in the north-eastern

sector between Cofimvaba, Lady Frere, and Cala. The borehole distribution pattern reflects the underlying or exposed pattern of dolerite dykes and sills, although a great number of boreholes particularly north of the border corridor indicate more random targeting. Reference should be made to **Appendices B4.1 to B4.6** for additional information.

Current groundwater monitoring sites are shown in **Appendix B4.3** with only seven sites monitored for the whole area. No springs are equipped with V-notches or flow gauges.

# 3. SITUATION ASSESSMENT FOR THE AMATOLE SUB - AREA

## 3.1 General Overview

### 3.1.1 Topography and Rivers

This sub-area consists of quaternary catchments from the Amatole primary catchment (R20 and R30). The main rivers in the sub-area are :

- The Buffalo River (R20)
- The Nahoon River (R30E/F)
- The Gqunube River (R30 C/D)
- The Kwelera River (R30B)
- The Kwenxura River (R30A)

In addition to the water resources in the above catchments, the infrastructure exists for the inter-basin transfer of 18 million $m^3$/a water from the Wriggleswade Dam on the Kubusi River (S60), a tributary of the Great Kei River, to the Buffalo and Nahoon Rivers.

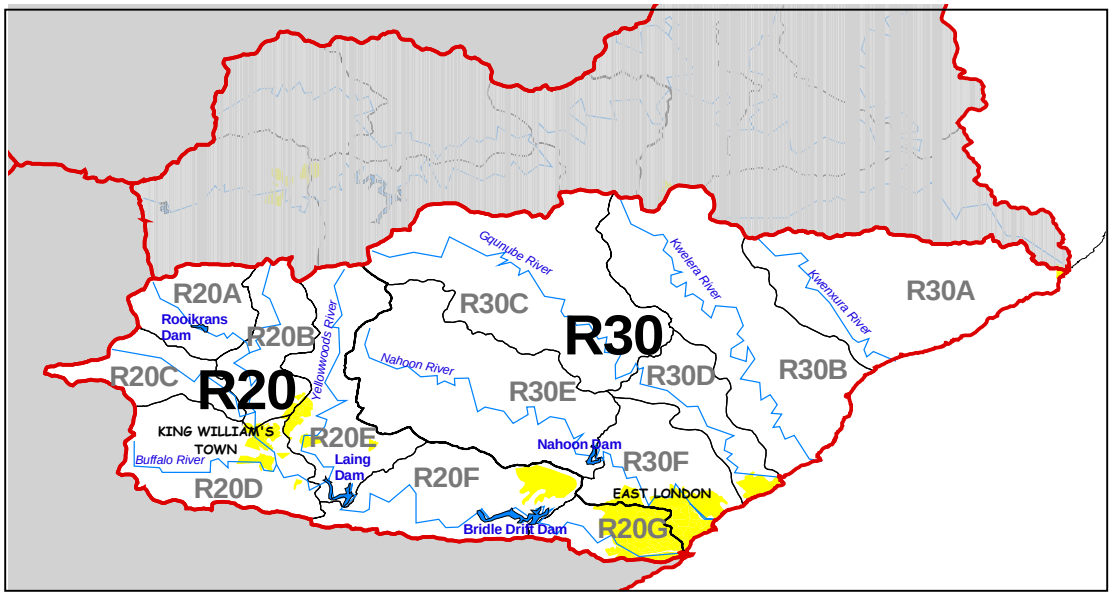


**Figure 3.1 The Amatole Sub-area**

The area can be divided into the following three basic topographical zones:

- The coastal belt
- The coastal plateau, and
- The mountain highlands or escarpment zone

The coastal belt, which is about 10 km wide, and the coastal plateau which rises to between 600 and 900 masl and covers most of the sub-area, are characterized by incised river valleys which run parallel to each other in a south easterly direction. This topography impacts significantly on settlement patterns and the cost of provision of infrastructure within the area. The escarpment zone, which lies between the coastal plateau and the catchment divide is characterized by steep slopes and high altitudes in the upper Buffalo catchment.

### 3.1.2 Climate and Rainfall

The climate is moderate for most of the year, but with hot, humid periods from December to February. Although the area does receive rainfall throughout the year, it is primarily a summer rainfall region, with the months of June and July being the driest. The mean annual precipitation (MAP) varies from 500 mm in some of the river valleys to over 1 000 mm in the upper Buffalo River catchment (refer **Fig. 2.4**). The mean annual evaporation (MAE) varies from between 1300mm and 1400mm along the coastal belt, increasing in a north westerly direction to between 1400mm and 1500mm.

### 3.1.3 Vegetation

Natural vegetation consists mainly of thornveld or sourveld with areas of dense thicket and indigenous forest in the coastal belt, in the river valleys and in the mountain zone (refer **Fig. 2.5**). Invasive wattle (black and silver) is found throughout the area with large concentrations in the Upper Buffalo catchment between King William's Town and Stutterheim. Exotic weeds are also found to be invading all riparian zone vegetation on an increasing scale.

Soils are generally moderate to deep clayey loams with alluvial soils in the river valleys.

### 3.1.4 Land Use and Settlement Patterns

Land is used predominantly for stock and dairy farming or dry land cultivation, with approximately 5 000 ha being cultivated under irrigation, primarily vegetables (tomatoes, cabbages etc). Commercial forestry is located mainly in the upper Buffalo River catchment in the higher rainfall areas of the Amatola mountains and covers an area of approximately 2 400 ha (refer **Fig. 2.6**).

A high relative percentage of the area is urbanized and used for housing and industrial needs. This occurs in the Buffalo City Municipal area (East London – King William's Town corridor) and the coastal suburbs either side of East London centre. Coastal resorts such as Morgan Bay, Haga-Haga and Cintsa also exhibit a continuous growth trend, which is limited by the available infrastructure (roads, water, electricity), but is nevertheless expected to continue.

In addition to the peri-urban and rural settlements in the Buffalo City Municipal area such as Zwelitsha and Newlands, there are also a large number of scattered settlements of significant size. These are mainly located in the Kwelera – Mooiplaas areas to the north of East London (former SA Development Trust lands), the Kei Road

– Frankfort area to the north east of Bisho, and between King William's Town and Dimbaza.

### 3.1.5 Demography

The total population of the sub-area was estimated based on 1995 data (**Ref. 24**) and Census 2001 data (**Ref. 6**) at approximately 730,000 people in the year 2000. It should be noted that there is some doubt regarding this population estimate. The BCM gives an estimate for the year 2000 population in their municipal area, which is smaller than this sub-area, at 888,000 people (**Ref. 5**). The population in the BCM area is expected to grow at 2.1% p.a. to approximately 1,209,000 in the year 2015 (**Ref. 5**). Accurate population numbers and expected growth rates need to be determined and agreed upon. The population of the Amatole sub-area is projected to grow mainly due to the expanding economic base and employment opportunities in BCM, which will cause an influx of people from the rural areas. BCM accommodates the highest population density in the region compared to the inland areas.

**Table 3.1 Population Estimates of the Amatole Sub-area (Year 2000)**

| Quaternary Catchment | Population |
|---|---|
| R20 | 679,000 |
| R30 | 51,000 |
| **Totals** | **730,000** |

### 3.1.6 Economic Development

BCM is the centre of economic activity not only for the sub-area but for the entire ISP area. The city is positioned at a pivotal junction between the N6 and N2 national roads, rail lines, a harbour and an airport, all of which serve the Amatole – Kei area with a population of some 1,8 million people. The City is the second largest urban complex in the Eastern Cape after the Nelson Mandela Metropole and incorporates East London, King William's Town, Bisho, Mdantsane and smaller surrounding villages and towns. Bisho is the seat of administration of the Provincial Government of the Eastern Cape. This fact enhances its position as the most important administrative region in the province. Buffalo City expects to gain metropolitan status in the near future.

Compared to the rest of the ISP area, the Amatole sub-area, and more particularly Buffalo City, has a diverse economic base due to its importance as an administrative, educational and manufacturing centre. In 1994 the Gross Geographic Product (GGP) of East London comprised 24% of that of the whole Eastern Cape Province (**Ref. 5**).

The main manufacturing activities are focused on:

- Motor manufacturing (Daimler-Chrysler)
- Textiles (Da Gama)

- Tanneries
- Toiletries (Johnson & Johnson)
- Pharmaceuticals (Pharmacare)
- Food (Nestle)

Increased industrial growth can be anticipated once the East London IDZ becomes operational in 2005/2006. Other economic activities that are expected to show growth into the future include tourism and downstream activities related to commercial forestry.

## 3.2 Water Resources Overview

### 3.2.1 Surface Water

(a) Raw Water Resources and Supply Systems

The main rivers and dams within the Amatole sub-area are given in **Table 3.2** and **Appendix B10**. The Buffalo and Nahoon Rivers presently supply the water requirements for BCM. The resources of these rivers can be augmented by the inter-basin transfer of water from the Wriggleswade Dam in the adjacent Kubusi catchment (S60).

**Table 3.2 Main Rivers and Dams in the Amatole Sub-area**

| Catchments | Rivers | Main Dams | Owner |
|---|---|---|---|
| R20 | Buffalo | Maden/Rooikrantz<br>Laing<br>Bridle Drift | DWAF<br>DWAF<br>BCM |
| R30E/F | Nahoon | Nahoon | DWAF |

The other main coastal rivers of Gqunube, Kwelera and Kwenxura are not regulated at present and are used mainly for run-of-river irrigation schemes. These rivers together with the Keiskamma and Great Kei Rivers have been identified as possible future raw water sources to meet the growing demand area of BCM. Some smaller coastal resorts obtain their water supplies from small coastal rivers by means of run-of-river schemes and abstraction weirs with or without off-channel storage. The effect of these abstractions on these relatively pristine rivers has not been assessed and is unkown.

There are a considerable number of farm dams in the catchments of the main storage dams. In addition, the large number of farm dams in the catchments of the non-regulated rivers (Gqunube, Kwelera, Kwenxura) together with weirs and run-of-river abstractions (sometimes illegal) decrease the level of confidence in determining their impact on these rivers. More accurate information on these structures and abstractions is required for effective management.

The available water in the Amatole sub-area is presented in **Table 3.3**.

**Table 3.3 Available Water in the Amatole Sub-area (Year 2000)**

| Type of Water Resource | Without Inter-basin Transfer (million $m^3$/a) | With Inter-basin Transfer (million $m^3$/a) |
|---|---|---|
| Total surface water resource yield | 82 | 82 |
| Transfer in from Wriggleswade Dam | | 18 |
| Subtract: | | |
| - Ecological Reserve | 17 | 17 |
| - Invasive alien plants | 4 | 4 |
| Net surface water yield available for use | 61 | 79 |
| Available groundwater resource | 1 | 1 |
| Usable return flows | 18 | 18 |
| **Total Local Yield** | **80** | **98** |

At present the dams in the sub-area are not being operated to allow for ecological Reserve releases. Investigations are required to determine if the outlets are capable of accommodating the required environmental releases. With the implementation of releases for the Reserve, this water will no longer be available to other users. These figures have been factored into the water balance for each key area as discussed below.

Return flows from sewage treatment works in the middle and upper Buffalo River catchment and from the overloaded and poorly maintained sewerage reticulation in Mdantsane contribute to the yield. The return flows from industrial and sewage treatment works closer to the coast are assumed to be negligible because they are either discharged directly to the sea via effluent pipelines or close to river mouths downstream of dams where further abstraction is not feasible. Return flows do however contribute to the environmental requirements of the estuaries in terms of quantity. Some effluent is used to irrigate coastal golf courses. A sea outfall effluent discharge works is presently under construction on the West Bank in East London. However, due to a lack of funds the submarine outfall pipeline has not yet been constructed and raw screened effluent is presently being discharged into the surf zone.

The total usable return flow is approximately 18 million $m^3$/a. This excludes the 10 million $m^3$/a from the East Bank Sewage Treatment Works, which is presently being discharged into the sea, but is being considered for use as industrial water in the East London IDZ.

Growth in water demand will be met in the short to medium term up until the year 2012 with water transferred from Wriggleswade Dam on the Kubusi River to the Buffalo River catchment in the upper reaches of the Yellowwoods River. The transfer system (tunnel and canal) can also discharge into the headwaters of the Nahoon and Gqunube Rivers

if required. Concern has been expressed that the increase in flow in the headwaters of these rivers from Wriggleswade may cause environmental impacts. This should be confirmed by undertaking the necessary EIAs.

The following components of the AWSS serve the sub-area :

- The Upper Buffalo system from Maden and Rooikrantz Dams
- The Middle Buffalo system from Laing Dam
- The Lower Buffalo system from Bridle Drift Dam
- The Nahoon system from Nahoon Dam
- Inter-basin transfer from Wriggleswade Dam in the Kubusi system

Before these raw water supplies have been fully utilised, optimal use will have to be made of existing supplies through water conservation and demand management, water re-use and optimising of the yield of the system by improved operation and management etc. Once these options have been exhausted, preliminary studies (**Ref. 4**) have indicated that additional raw water could be sourced to the west from the existing Binfield Park and Sandile Dams on the Keiskamma River, and to the east from future dams on the Nahoon, Gqunube, Kwelera and Kei Rivers. Previous studies that identified the Toise River as part of a possible future raw water supply, did not take account of the ecological Reserve of that river. This source is now no longer believed to be a viable option. Further studies will be required to evaluate the available water, and identify and optimise the location of the dams and the timing for construction. Refer to **Section 3.2.5** : Future Water Requirements.

Some of the smaller coastal resorts (Morgan Bay, Haga-Haga and Cintsa) obtain raw water from small coastal rivers. The water balance and environmental requirements for these smaller rivers is not known, but the catchments could be stressed both in terms of quantity and quality due to the almost pristine nature of the estuaries. Accurate flow data for these smaller rivers is required in order to determine the firm yield of the rivers and corresponding environmental requirements.

Dimbaza and the surrounding villages, which are located within the Buffalo City Municipality but partly outside the ISP sub-area obtain their water requirements from the Sandile Dam on the Keiskamma River. Similarly, the western coastal part of Buffalo City to the Keiskamma River mouth, which also lies outside this sub-area (catchments R40A and C) obtains its water from the Keiskamma River as part of the Peddie/Wesley/Chalumna RWSS.

(b) Water Treatment Infrastructure

Most of the water demand in the sub-area occurs in the Buffalo and Nahoon catchments and the adjacent coastal strip. The Amatole Water Supply System (AWSS) infrastructure for Buffalo City is a complex one that has developed from a

number of separate water supply schemes, some of which have become interlinked as their supply areas have been extended.

In 2000 the surplus raw water available for increased urban use from the AWSS including transfer from Wriggleswade Dam exceeded the existing treatment capacity in the Buffalo/Nahoon system by approximately 16 million $m^3$/a. In order for the BCM to fully utilise this available raw water for urban supply, additional water treatment works will have to be commissioned to meet the growing demand for treated water. Various studies have been undertaken to analyse the need and location of future water treatment works (**Ref. 4**). These studies have highlighted the need for additional treatment in the system as well as various options for the location of this treatment.

Additional raw water will be sourced from the Wriggleswade Dam on the Kubusi River. This water can be discharged into the Buffalo, Nahoon and Gqunube catchments at a high level and as such the raw water could also be treated at a high level treatment works and distributed by gravity towards the coast. Alternatively, the raw water could be released into the catchments to be extracted at one or more of the existing dams lower in the catchments (Laing, Bridle Drift, Nahoon) where the main growth in water demand is expected. Current options (**Ref. 5**) include additional or augmented treatment capacity as follows :

- Upper Buffalo System : Augment Rooikrantz treatment works (0,4 million $m^3$/a)
- Middle Buffalo System : Augment Laing treatment works and/or new works adjacent to the Yellowwoods River or at Kei Road (10 million $m^3$/a)
- Lower Buffalo System : Augment the Umzoniana WTW at Bridle Drift Dam (20 million $m^3$/a) and Nahoon WTW (6 million $m^3$/a). The former is currently under investigation for augmentation by the year 2006.

(c) Water Supply Infrastructure

While there is an imbalance between the raw water available and the treatment facilities, there is a reasonable balance between the water treatment works and the bulk distribution pipelines supplying the main demand areas in the Buffalo and Nahoon catchments. Any increase in treatment capacity will therefore require a corresponding increase in distribution capacity. The one area within the BCM area that is not adequately served at present is the coastal area in the R40A catchment, which lies outside this sub-area but obtains its water from the Buffalo River by means of the Ncera Regional Water Supply Scheme (RWSS).

The condition of water supply infrastructure varies both with respect to quality and capacity. Parts of the water supply infrastructure especially in former Ciskei areas such as Mdantsane are in various states of disrepair. Addressing the resultant leakages could assist in delaying the need for bulk water supply and treatment infrastructure as well as the need for additional raw water resources and water treatment in the short term. If fully implemented the WCDM programme is expected to “save” approximately 6% of the existing urban water demand of the AWSS. The BCM

Water Services Development Plan **(Ref. 5)** has prioritized the need for a water conservation and demand programme, especially in Mdantsane.

(d) Institutional Arrangements

The system of ownership, operation and maintenance of the Amatole Water Supply System infrastructure is complex with dams and related infrastructure falling under the Buffalo City Municipality (BCM), the Amatola Water Board (AW), the Amatole District Municipality (ADM) and the Department of Water Affairs and Forestry (DWAF). These organizations have different cost and tariff structures, which not only influence where water is sourced from, but also results in a less than optimum use of the maximum potential yield of the system. For example, BCM chooses to use as much water as possible from Bridle Drift Dam, which they own, rather than purchase water sourced from Nahoon, Laing and Wriggleswade Dams, which are DWAF owned and operated by AW. As part of the process of optimising the yield of the system, the institutional arrangements for water supply need to be investigated and optimised. Furthermore, the realignment of roles and transfer of infrastructure according to the Water Act needs to be continued and ways found to overcome the existing financial and manpower constraints that are experienced by all the above organisations.

### 3.2.2 Groundwater

The total available groundwater resource in the area is not well understood with estimates varying widely. The best groundwater potential is in the north west part of the sub-area with the potential reducing in a south easterly direction towards the coast. However, due to the relatively low average borehole yields (generally below 2 l/s), the high salinity and hardness of the water especially towards the coast, and the fact that surface water supply schemes cover most of the sub-area where the major demand exists, the groundwater resource is only used for providing domestic supplies to smaller settlements and coastal resorts. There is thus not likely to be any major expansion in groundwater use.

Notwithstanding these problems, groundwater has been the main source of water for a number of rural villages including Newlands, Mooiplaas and Kwelera (R30). Because of the problems associated with groundwater, a surface water supply scheme from Nahoon Dam and WTW has recently been developed for the Newlands area (year 2000 pop. 26,000). The growth of rural settlements at Kwelera (year 2000 pop. 23,000) and Mooiplaas (year 2000 pop. 36,000) has been such that the existing groundwater supply infrastructure can no longer adequately satisfy the water requirements of these settlements. The problem is further exacerbated by the presence of nitrates indicating human waste contamination, and inadequate monitoring, operation and maintenance of the groundwater systems with the result that there is an unacceptable water supply situation in these two areas. Recommendations for the development of a surface water supply scheme from the Kwenxura River for the Mooiplaas area and for increased boreholes for the Kwelera area have been made (**Ref. 2**).

### 3.2.3 Current Water Requirements

The water requirements for the Amatole sub-area for the year 2000 are as follows:

**Table 3.4 Local Water Requirements* in the Amatole Sub-area (Year 2000)**

| Sector | Amount (million $m^3/a$) |
|---|---|
| Irrigation | 19 |
| Urban** | 59 |
| Rural*** | 3 |
| Afforestation | 1 |
| **Total Local Requirement** | **82** |

*At 1 in 50 year assurance.

**Industrial demand has been included in the urban demand.

*** Stockwatering has been included in the rural water requirements.

The urban water use for BCM has been updated based on the latest information contained in the WSDP of BCM (**Ref. 5**). These figures for water requirements for urban water use are higher in the ISP than in the NWRS. The urban / industrial sector in the sub-area accounts for an estimated 72% of the total water requirements. Irrigation is also a significant water user at 23% of the total requirement. However, the types of crops and areas under irrigation are not well known and have changed over the years. The above figures need to be confirmed.

The water requirements for urban use in the sub-area is estimated to grow to 70 million $m^3/a$ in the year 2005 increasing to 79 million $m^3/a$ by the year 2012 (**Ref. 5**) for the high growth scenario which assumes a high demand from the ELIDZ.

### 3.2.4 Yield Balance

Based on the available yield of the system and water requirements as described above, the water balance in the year 2000 for the sub-area is summarized below.

**Table 3.5 Reconciliation of the Amatole Sub-area in Year 2000**

| Description | Without Inter-basin Transfer (million $m^3/a$) | With Inter-basin Transfer (million $m^3/a$) |
|---|---|---|
| Total local yield | 80 | 80 |
| Transfer in | 0 | 18 |
| Total yield | 80 | 98 |
| Local requirement | 82 | 82 |
| Transfer out | 0 | 0 |
| Total requirement | 82 | 82 |
| **Water Balance** | **- 2** | **16** |

Based on the above, the Amatole sub-area is in a water balance deficit as the AWSS is currently being operated without any transfers from Wriggleswade Dam. This deficit is probably being taken up by the environment which over time will have a detrimental effect on it. The available water from Wriggleswade Dam is reserved for urban use within the BCM and transfers will only be made during serious droughts and as the demand within the BCM grows. Detailed operating rules to ensure that transfers take place timeously yet efficiently need to be developed.

In addition to the overall deficit within the sub-area without inter-basin transfer, there are also local deficits in the Amatole sub-area catchments. The upper Buffalo catchment (R20A and R20B) is in deficit. This is due to an over-allocation of the water resources of Rooikrantz and Maden Dams. The scheduled area under irrigation exceeds the area that can be supplied using the available water resources, resulting in lower levels of assurance of supply. No additional licence applications can be approved in these catchments without additional water resource developments or transfer from other catchments.

### 3.2.5 Future Water Requirements

The status of future water requirements is likely to be as follows:

Urban / Industrial use : There will be continued urbanization and industrial growth in the Buffalo City area especially in the new ELIDZ area at the coast. Based on the estimated growth in urban water demand from 59 million $m^3$/a in the year 2000 to 79 million $m^3$/a by the year 2012, ie an increase of 20 million $m^3$/a compared to the available surplus of 16 million $m^3$/a, BCM may begin to experience water shortages within the next eight years should drought conditions be experienced. In order to meet future water requirements in the area, major reconciliation efforts need to be addressed as a matter of urgency. These should include WCDM measures which could save up to 6% of the present water demand, optimisation of the operations of the AWSS, use of treated effluent by industry as well as detailed studies to investigate future raw water supplies for the AWSS.

Due to the time lag for implementation of new schemes it is important that studies to determine future raw water supplies be continued to the next level of detail. Current studies have identified the Nahoon, Gqunube and Kwelera Rivers within the sub-area and the Keiskamma River (Sandile and Binfield Park Dams) and Great Kei River as possible future raw water supply sources for the Buffalo City Municipality (BCM). A future water supply scenario and reconciliation study for water supply to Buffalo City should be regarded as a very high priority. This study should identify and reserve all possible surplus water supplies where required for use by BCM. The implication of this is that expansion of irrigation should only be considered once the future BCM requirements have been addressed.

Groundwater is not expected to play a major role except for supply to the rural settlements mentioned previously.

Commercial forestry : There is a demand for expansion of commercial forestry in the upper Kubusi catchment above Gubu and Wriggleswade Dams. However, as the surplus yield from this catchment has been reserved for supply to the AWSS, no additional forestry should be allowed at present. This demand can only be addressed once the future BCM requirements have been addressed and the yield balance has been revised.

Alien plants : Invasive alien trees (black and silver wattle) are widespread in the upper Buffalo and Kubusi catchments. Continuation of the WfW programme in the area would benefit the base flow in these two rivers, but it is recognised that it will be very difficult to eradicate all invasive alien plants. Investigations are also continuing into the possibility of transforming some of these alien plant areas into formal plantations.

Irrigation : All surplus water within the supply catchments of the AWSS must be reserved for urban supply to BCM. No additional water can be made available for irrigation developments.

3.2.6 Water Quality

(a) Surface Water Quality

The quality of water in the rivers of the sub-area varies. The upper Buffalo and Nahoon River catchments have not been heavily impacted by urbanisation and water quality is generally good. The same applies to the Gqunube, Kwelera and Kwenxura Rivers. However, the middle and lower reaches of the Buffalo, Nahoon and smaller rivers within the East London urban area have the most degraded water quality in the ISP area. Pollution sources that have been identified include the following :

- Point sources : Overloaded sewage treatment works. The Buffalo City WSDP (**Ref. 5**) lists twelve treatment works of which seven are either at full capacity or overloaded by a factor of up to 160%. These works are either owned by the BCM or the Amatole District Municipality (ADM). Irrigated effluent still leaching from King Tanning (now closed) and Da Gama Textiles on the banks of the Buffalo River finds its way into the river system. Unlicensed solid waste sites in the catchments all produce leachate, which enters the rivers. Sewer leaks especially in Mdantsane, but also from inadequately sized and maintained sewers throughout the urban areas regularly discharge raw sewage into the Buffalo, Nahoon and smaller coastal rivers (Quinera, Inhlanza, Blind Rivers) in East London.

- Non-point sources : Stormwater run-off from the urban areas contributes to the poor water quality of the rivers, as does the runoff from informal settlement areas such as Newlands.

The result of this pollution is to cause mineralisation and salinization of the rivers and dams, with a significant impact being felt in the Laing and Bridle Drift Dams due to the “closed loop” effect. This is especially noticeable in dry years when there is little dilution and a spiralling deterioration in water quality is experienced.

A further result of the above pollution is eutrophication (high phosphorus levels) in the Laing, Bridle Drift and Nahoon Dams resulting in the growth of aquatic plants and algal blooms and sometimes blue-green algae.

The result of the above is a marked deterioration in the environmental condition of the rivers, sometimes leading to fish kills. Specialised and expensive water treatment facilities are required to bring the water to acceptable drinking standards. Sewage spillage on the main beaches in East London regularly cause the beaches to be closed. This in turn has an effect on the tourism market and employment opportunities in the region.

Although the serious problems have been previously identified, the lack of adequate manpower and financial resources within the BCM is resulting in a continuously deteriorating situation. Urgent attention and measures are required to address the situation.

(b) Groundwater Quality

Geology in the region is generally of marine origin giving rise to high salinity problems in the groundwater of the sub-area especially along the coast. This is further exacerbated by over-extraction of borehole water and ingress of seawater. Groundwater resources are also polluted because of inadequate sanitation facilities such as septic tanks and unlined VIPs.

## 3.3 Key Issues

Based on a detailed situation assessment of the Amatole System sub-area as outlined above the following key issues have been identified.

### 3.3.1 Water Balance and Reconciliation

Issue : Buffalo City Municipality's future water supply is a high priority issue in this sub-area. Refer to Strategy No. 1.3.

### 3.3.2 Water Resources Protection

Issue : Serious pollution is occurring in the Buffalo, Nahoon and smaller rivers and on the tourist beaches in the urban areas of Buffalo City due primarily to inadequate sewage infrastructure (treatment and infrastructure) with resultant spillages into the water courses. Implementation of the Reserve (quantity and quality) is urgently required. Refer to Strategy Nos. 2.1 and 2.2.

### 3.3.3 Water Use Management

Issue : The fragmented ownership, operation and maintenance of the Buffalo, Nahoon and Kubusi water supply system (the Amatole Water Supply System) complicates the operation of the system and the optimal use of the available raw water resources. Refer to Strategy No. 8.1.

### 3.3.4 Water Conservation and Demand Management

Issue : Poorly designed, constructed and maintained water infrastructure especially in Mdantsane is the cause of expensive water wastage due to excessive leaks. Refer to Strategy No. 1.3.

### 3.3.5 Integration and Co-operative Governance

Issue : A lack of financial and skilled manpower resources within DWAF, the District Municipalities, the Buffalo City Municipality, the Amatola Water Board and the smaller local municipalities is a major constraint for the optimal management of the water resources of the area. Refer to Strategy No. 8.1.

# 4. SITUATION ASSESSMENT FOR THE KEISKAMMA SUB-AREA

## 4.1 General Overview

### 4.1.1 Topography and Rivers

This sub-area consists of the R10, R40 and R50 quaternary catchments. The main river in the sub-area is the Keiskamma River (R10). Smaller coastal rivers include the Chalumna and Gulu Rivers (R40) up the coast from the Keiskamma River, and the Bira and Magwalana Rivers (R50) down the coast.

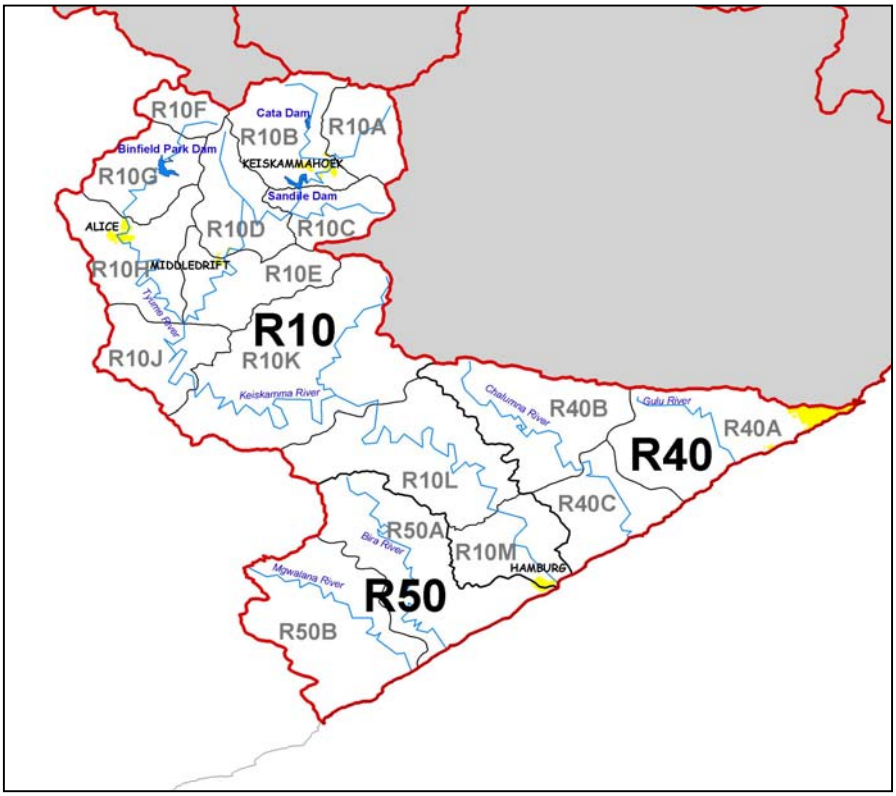


**Figure 4.1 The Keiskamma Sub-area**

As with the Amatole sub-area, the area can be divided into the following three basic topographic zones:

- The coastal belt
- The coastal plateau, and
- The mountain highlands or escarpment zone.

The coastal belt broadens in this sub-area to about 20km wide. The coastal plateau, which extend to the foothills of the Amatola mountain range lies between 600 and 900 masl and covers most of the sub-area. Both the plateau and coastal belt are characterized by the incised Keiskamma River valley, which bisects the area. The remaining rivers are coastal and rise and drain only the lower rainfall coastal belt. As

such, the flows in these smaller rivers tend to be very variable and in most years the estuaries are closed due to the low runoff. The escarpment zone, which lies between the coastal plateau and the catchment divide and includes the Hogsback area is characterized by steep slopes, high altitudes (1938 masl) and high rainfall in the mountains.

The main source of water for use in the sub-area is the Keiskamma River (R10), which has its headwaters in the mountains above Keiskammahoek and flows eastwards to enter the Indian Ocean at Hamburg. Its main tributary is the Tyume River with its headwaters in the Hogsback area.

### 4.1.2 Climate and Rainfall

The climate in this sub-area is similar to that of the Amatole sub-area but with less humidity and slightly lower average temperatures down the coast and inland. The Amatola mountain areas from above Keiskammahoek to the Hogsback area experience very cold temperatures during the winter months with occasional snowfalls. The mean annual precipitation (MAP) varies from 600 mm along the coast to a low of 450 mm in parts of the dryer coastal plateau areas to over 1 200 mm on the mountain peaks (refer **Fig 2.4**). Rain falls predominantly in the summer months with June and July being the driest months.

### 4.1.3 Vegetation

The natural vegetation consists mainly of coastal grasslands, savanna (thornveld or sourveld) in the coastal areas up to the escarpment with areas of dense bush (valley thicket) in the river valleys and indigenous forest in the mountain zone (refer **Fig. 2.5**). Invasions of black and silver wattle are found throughout the area with the largest concentrations in the Upper Keiskamma and Tyume catchments. Exotic weeds are also found in all riparian vegetation but the problem is not as serious as in the Amatole sub-area.

### 4.1.4 Land Use and Settlement Patterns

The catchment is relatively undeveloped with most land being communal and used predominantly for stock grazing or dry land cultivation. Less than 1 500 ha is cultivated under irrigation. The largest scheduled irrigation areas include the Keiskammahoek (854 ha), Zanyokwe (471 ha) and Tyume (231 ha) irrigation schemes in the upper catchment. These schemes, which were located in the former Ciskei are not fully operational and rehabilitation of the schemes and establishment of Water User Associations is currently underway. Commercial forestry (less than 1000ha) is located in the Hogsback and Upper Keiskamma catchment in the higher rainfall areas in the Amatola mountain range.

The majority of the area once fell within the borders of the former Ciskei and the residential settlement pattern is mainly scattered rural type villages located throughout the catchment. The main formal towns in the area are Hamburg at the mouth of the Keiskamma River and Alice, Middledrift, Keiskammahoek and Dimbaza in the upper

catchment. Peddie town, although located in the catchment of the Fish River, which is outside this ISP area, obtains its water from the Keiskamma River (the Peddie RWSS).

Small coastal towns/resorts with permanent populations are located along the coast especially between Winterstrand, Kidds Beach and Kaysers Beach. Small holiday resorts are found further down the coast, the largest being at Bira and the Fish River Hotel complex. Marginal growth is expected in these coastal areas in the medium term.

### 4.1.5 Demography

The total population of the sub-area was estimated based on 1995 data (**Ref. 24**) and Census 2001 data (**Ref. 6**) at approximately 223,000 people in the year 2000. The bulk of the population lives in the small formal towns and associated peri-urban areas where services and educational facilities are available. The population is expected to show little growth mainly due to the lack of employment opportunities in the rural areas and the resultant outward migration to large towns and cities. Alice with its educational facilities (University of Fort Hare), and Keiskammahoek and Dimbaza, which serve as dormitory towns for King William's Town are expected to be the main growth areas.

**Table 4.1 Population Estimates of the Keiskamma Sub-area (Year 2000)**

| Quaternary Catchment | Population |
|---|---|
| R10 | 161,000 |
| R40 | 32,000 |
| R50 | 30,000 |
| **Totals** | **223,000** |

### 4.1.6 Economic Development

The West Bank and the new ELIDZ within Buffalo City Municipality (catchment R40A), which forms part of this sub-area has been discussed in **Chapter 3** as part of the Amatole sub-area of which it forms a part. Other than this area aligned to BCM, the area is economically deprived. The only other formal industrial complex in the sub-area is located at Dimbaza. The area was established under the previous government's homelands policy to attract industries to the former Ciskei. As with other such areas most of the industries have now relocated and the area is in decline with very few industries remaining.

Economic related activities in this sub-area are mainly based on commercial agricultural activities including the cultivation of pineapples, oranges, commercial forestry and dairy farming. Proposals for the establishment of an export-orientated industry based on eel farming in the catchment have been made, but progress is unknown. Small-scale tourism in the Hogsback area and along the coastline provides some employment to an economically deprived region. Post-school educational activities are based at Fort Hare University and Lovedale College in Alice.

Rehabilitation of the irrigation schemes at Tyume, Zanyokwe and Keiskammahoek is seen as the main catalyst for economic growth in this sub-area.

## 4.2 Water Resources Overview

### 4.2.1 Surface Water

(a) Raw Water Resources and Supply Systems

The Keiskamma River and its tributary, the Tyume River, are the main sources of water for this sub-area. The R40A coastal catchment receives its water supply from the Buffalo River as part of the Amatole Water Supply System (AWSS).

The only coastal rivers of any importance with respect to water resources and supply potential are the Bira and Chalumna Rivers. Bira River was previously used for supply to Peddie and to some coastal villages, but due to the unreliability of supply this scheme has been replaced by the Peddie RWSS, which obtains water from the middle reaches of the Keiskamma River. The Chalumna area is now also supplied with water from the Peddie RWSS. The other smaller coastal rivers in the sub-area are mainly non-perennial rivers, their importance being their attraction for tourism at the estuaries. Small-scale irrigation and stock watering is the main consumptive user of water from these smaller rivers.

Many of the rivers and estuaries are pristine with no major impacts and are therefore highly valued for their ecological importance. Overgrazing and subsequent erosion in the area is however on the increase. This will in turn lead to an increase in sediment in the rivers and deterioration in the quality of the water.

The water resources of the upper reaches of the catchment are fairly well developed with the Sandile, Binfield Park, Cata and Mnyameni Dams providing the assurance for water supply to irrigation schemes, towns and rural villages (refer **Appendix B10**). Other smaller DWAF owned dams in the upper catchment include the Dimbaza, Debe and Pleasant View Dams, which are currently used mainly for stock watering. As these dams do not generate any income and do not form part of DWAF's strategy for water resource management, the Department is keen to transfer them to the Amatole District Municipality (Water Services Authority), or Water User Associations, due to their requirement for ongoing maintenance. This especially applies to Pleasant View Dam.

**Table 4.2 Main Rivers and Dams in the Keiskamma Sub-area**

| Catchments | Rivers | Main Dams | Owner |
|---|---|---|---|
| R10 | Keiskamma | Mnyameni | DWAF |
| | | Cata | DWAF |
| | | Sandile | DWAF |
| | Tyume | Binfield Park | DWAF |
| | | Pleasant View | DWAF |
| | Debe | Debe | DWAF |

The water available from the catchment before accounting for the ecological Reserve or invasive alien plants is estimated at 53 million $m^3$/a (1 in 50 year assurance). Based on a desktop assessment undertaken as part of the NWRS, the impact of the ecological Reserve on the yield is estimated at 4 million $m^3$/a. More than half of this yield is from the R10B/G catchments, with the major contributions coming from the Sandile Dam (20 million $m^3$/a) and Binfield Park Dam (19 million $m^3$/a). Total return flows are negligible and add only about 1 million $m^3$/a to the yield.

**Table 4.3 Available Water in the Keiskamma Sub-area (Year 2000)**

| Type of Water Resource | Amount (million $m^3$/a) |
|---|---|
| Total surface water resource yield | 53 |
| Subtract: | |
| - Ecological Reserve | 4 |
| - Invasive alien plants | 2 |
| Net surface water yield available for use | 47 |
| Available groundwater resource | 0 |
| Usable return flows | 1 |
| **Total Local Yield** | **48** |

(b) Water Supply Infrastructure

The domestic water supply system in this sub-area consists of a number of separate schemes. In the upper catchment, water supply from Binfield Park Dam is treated and reticulated to Alice and surrounding rural villages. Sandile Dam supplies water to Middledrift, Dimbaza and surrounding rural villages. Cata and Mnyameni Dams supply Keiskammahoek and surrounding villages.

In addition to domestic water supply schemes, these dams all have allocations for water supply to scheduled irrigation schemes viz. Binfield Park Dam to the Tyume scheme (231 ha), Sandile Dam to the Zanyokwe scheme (471 ha) and Cata/Mnyameni Dams to the Keiskammahoek scheme (854 ha) (refer **Appendix B6**). These schemes have been allowed to fall into a state of disrepair, but new efforts are being made to rehabilitate the schemes either partially or wholly through poverty alleviation schemes supported by DWAF, the Provincial Department of Agriculture (PDoA), and the Amatole District Municipality (ADM). It is expected that at least some of the water allocations will be taken up in the next few years. The establishment of Water User Associations (WUAs) for the use of this water is already progressing with the recent establishment of the Keiskammahoek WUA.

In the middle Keiskamma catchment, water released from Binfield Park and Sandile Dams is abstracted from the Craig Head Weir and treated at the Peddie regional treatment works. Water is supplied to Peddie town and the surrounding rural villages

(Peddie RWSS), to Hamburg and down the coast to Wesley and Bira (Bira/Wesley RWSS) and up the coast to Chalumna within the BCM area.

Sandile Dam on the Keiskamma River has been considered as a possible future raw water source for supplementing the Amatole Water Supply System (**Ref. 4**). However, in view of the numerous new schemes that abstract water from the Keiskamma River, the uncertainty of the ecological Reserve and the possibility that the allocation for some irrigation will be exercised in the future, a comprehensive yield analysis of the Keiskamma System will be required to ascertain the extent and location of available water supplies.

(c) Institutional Arrangements

The large dams in the sub-area are owned by DWAF but are operated by Amatola Water (AW) (refer **Appendix B10**). Regional water supply schemes have been funded and implemented by DWAF over the past ten years and they are currently in the process of being transferred to the Amatole District Municipality (ADM) as the local Water Service Authority. Operation of the bulk schemes is being undertaken by the AW acting as the Water Service Provider. Operation of any rehabilitated irrigation schemes will require the establishment of Water User Associations (WUAs) as required by DWAF.

4.2.2 Groundwater

The total available groundwater resource in the area is unknown but the area generally displays a low potential (**Ref. 17**). The best groundwater potential is located in the upper catchment of the Keiskamma River above Sandile Dam in the high rainfall area with potential reducing towards the coast. The Peddie Regional Groundwater Scheme, which was commissioned in 2002, is based in an isolated area where moderate groundwater potential was identified and developed due to a lack of adequate surface water resources. However, the groundwater varies in term of both quality and quantity and proposals to link the scheme to the Peddie RWSS are being considered.

Until recently the villages to the east of Alice were supplied with groundwater but due to the inadequacy of the supply, these villages now receive water from regional surface water supply schemes from Binfield Park and Sandile Dams. Hamburg is now part of the Bira/Wesley RWSS having been previously reliant on a borehole scheme.

Small borehole schemes are known to supply some of the small coastal resorts. These tend to suffer from quantity and salinity problems. Most rural settlements have to date been provided with a treated surface water supply due to the generally poor groundwater yields and quality in the sub-area.

4.2.3 Current Water Requirements

Water use in the catchment is limited. The major water allocations are for the irrigation sector (40%) and the urban and rural domestic water sector (56%). The actual water use for irrigation is substantially less than the allocations as the main irrigation

schemes of Tyume, Zanyokwe and Keiskammahoek are currently in a state of disrepair. Proposals are currently being considered for rehabilitating these schemes either partially or wholly.

Water available from the Binfield Park, Sandile, Mnyameni and Cata Dams of 43,0 million $m^3$/a (at 98% assurance) (**Ref. 24**) exceeds the irrigation water requirements/ allocations of 11,85 million $m^3$/a for the Tyume, Zanyokwe and Keiskammahoek irrigation schemes. The Binfield Park Dam also supplies water to Alice and surrounding rural villages but appears to have the largest surplus available for other uses (9,2 million $m^3$/a). The main allocation from Sandile Dam is for supply to Dimbaza (domestic and industrial), Middledrift and surrounding rural villages. This together with the relatively high ecological Reserve requirements should be taken into account when considering the use of Keiskamma water for future supply to the BCM. A comprehensive study is needed to determine the water requirements (domestic, industrial and irrigation) of the area that could be supplied from these dams. Previous studies have also investigated the use of surplus water from Binfield Park Dam for the proposed Hogsback Pumped Storage Scheme, but these proposals appear to have been shelved.

**Table 4.4 Local Water Requirements* in the Keiskamma Sub-area (Year 2000)***

| Sector | Amount (million $m^3$/a) |
|---|---|
| Irrigation | 10 |
| Urban** | 11 |
| Rural*** | 3 |
| Afforestation | 1 |
| **Total Local Requirement** | **25** |

*At a 1 in 50 year assurance.

**Industrial demand has been included in the urban demand.

*** Stockwatering has been included in the rural water requirements.

### 4.2.4 Yield Balance

Based on the available yield of the system and water allocations as described above, the yield balance in the year 2000 is summarised below.

**Table 4.5 Reconciliation of the Keiskamma Sub-area in Year 2000**

| Description | Amount (million $m^3/a$) |
|---|---|
| Local yield | 48 |
| Transfer in | 0 |
| Total yield | 48 |
| Local requirement | 25 |
| Transfer out | 0 |
| Total requirement | 25 |
| **Water Balance** | **23** |

These figures are based on data that needs to be confirmed by way of a comprehensive study into the water requirements and system yield of the Keiskamma River. It should be noted the water requirements in the table take into account the water needed for the revitalisation of the former irrigation schemes. The surplus available in the Keiskamma catchment is due to dams such as Sandile, Cata, Binfield Park and Mnyameni. The releases from the above-mentioned dams are also supporting the existing water use in the lower catchments of the Keiskamma sub-area.

4.2.5 Future Water Requirements

Due to the apparent surplus of water in the Keiskamma catchment, the Keiskamma River could be an important future source of water for the Amatole Water Supply System (**Ref. 4 and 5**). A comprehensive system yield analysis, including requirements for a more accurate ecological Reserve and water allocation for irrigation, needs to be undertaken as part of the AWSS reconciliation strategy to confirm this possibility.

4.2.6 Water Quality

(a) Surface Water Quality

The quality of water in the Keiskamma River and the smaller rivers is presently average to good and is determined mainly by the erosion in the catchment due to poor farming techniques and effluent run-off from the urban areas, especially Dimbaza. The latter needs to be quantified as it was a serious problem when the Dimbaza industrial complex was fully occupied but may no longer be so. Some pollution from solid waste sites has been identified, but this is mainly an operational problem as all solid waste sites have either recently been upgraded or are in the process of being upgraded. It is believed that some of the smaller estuaries, which should be in relatively pristine conditions, are being impacted by sewage run-off either from septic tanks or small sewage treatment plants (Kidds Beach).

The capacity of the dams in the system to release water for ecological Reserve purposes is currently under investigation with a view to releasing water in the near future.

(b) Groundwater Quality

As with the Amatole sub-area groundwater quality is generally poor with high salinity problems especially along the coast.

## 4.3 Key Issues

Based on a detailed assessment of the Keiskamma System sub-area as outlined above, the following key issues have been identified.

### 4.3.1 Water Balance and Reconciliation

Issue : Numerous regional water supply schemes which extract water from the Keiskamma River have been implemented over the past decade. Desktop estimates also show a high relative ecological Reserve requirement for the Keiskamma River. It is not known if these Reserve requirements are being fully met at present. However, due to the current under-utilisation of the water allocations from the dams, it is believed that they are being met. It must be emphasised that the hydrology and yield balance of the system is not accurately known and until studies reveal the actual situation, comments on water surpluses/deficits are made with a low degree of confidence. The perceived surplus/unused water in the Keiskamma system dams is also seen as a potential future raw water source to augment the AWSS which supplies BCM. A detailed system yield analysis is required for the Keiskamma catchment. Refer Strategy No. 1.1.

### 4.3.2 Water Resource Protection

Issue : Accuracy of the ecological Reserve and RQOs of the Keiskamma River need to be addressed as part of the recommended system yield analysis.

### 4.3.3 Institutional Development and Support

Issue : Support for the rehabilitation of the three irrigation schemes at Tyume, Zanyokwe and Keiskammahoek and the establishment of WUAs is a priority in terms of poverty relief in the area and in order to enable DWAF to transfer assets.

Issue : Ownership of Pleasant View Dam and other DWAF owned dams and infrastructure that require maintenance but produce no income. These need to be transferred to the Water Services Authority or WUAs who could use the infrastructure.

# 5. SITUATION ASSESSMENT FOR THE UPPER KEI SUB- AREA

## 5.1 General Overview

### 5.1.1 Topography and Rivers

The Upper Kei sub-area comprises the upper portion of the Great Kei catchment down to the confluence of the Black and White Kei Rivers. It consists of the S10, S20, S31 and S32 quaternary catchments. The main rivers are :

- The White Kei River (S10)
- The Indwe River (S20)
- The Klaas Smits and Heuningklip Rivers (S31)
- The Black Kei and Klipplaat Rivers (S32)

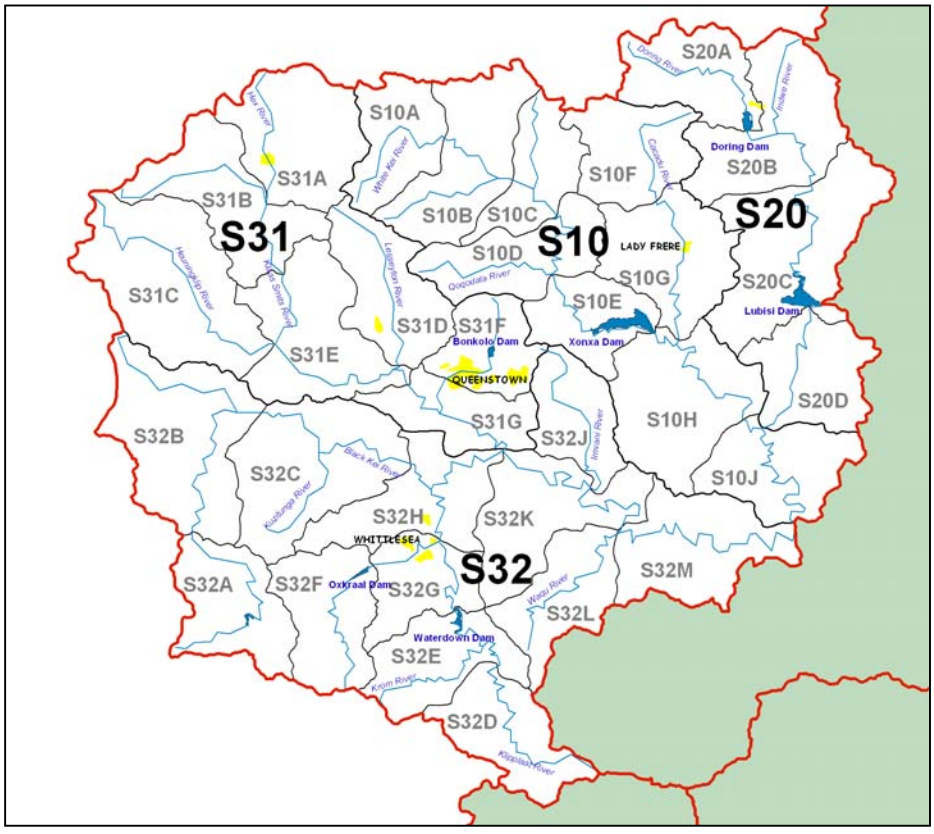


**Figure 5.1 The Upper Kei Sub-area**

The Upper Kei catchment is approximately 11 500 km$^2$ in extent. This is 55,8% of the total Great Kei catchment area of 20 699 km$^2$. The area falls within the inland plateau topographical zone and occupies a broad undulating plateau with river valleys. The catchment area, which is almost circular in shape is contained by the Amatola mountain range in the south, the Winterberg in the east and the Stormberg in the north with the outlet of the catchment in the southeast. The altitude of the plateau lies between 1100 and 1400 masl with the surrounding mountains varying from 1900 masl in the south to 2100 masl in the north.

### 5.1.2 Climate and Rainfall

The climate in the catchment is very harsh, varying from hot and dry in the summer months (> $40^0$ C) to very cold in the winter months (-$10^0$ C minima). Widespread frost and snowfalls on the high lying ground are experienced in winter.

There is a high temporal and spatial variation in rainfall over the catchment. The Mean Annual Precipitation (MAP) varies from approximately 400 mm in the west of the catchment to 900 mm in the east to a maximum of 1200 mm in the Amatola mountains in the south. Rain falls predominantly in the summer months (70% - 80%), generally in the form of high intensity thunderstorms often accompanied by hail. Variability of rainfall from season to season is high with frequent dry spells and droughts occurring. Mean Annual Evaporation (MAE) rates vary from 2000mm in the west to 1700mm in the east and 1400mm in the south.

### 5.1.3 Geology, Soils and Vegetation

The area is underlain by horizontal to very gently dipping rocks of the Karoo Supergroup (shale, mudstones and sandstones) with dolerite intrusions often in the form of ring structures. Soils are poorly developed, being shallow and rocky and mostly not suitable for crop production. In general shallow residual soils and rock occur on hilltops with talus on the slopes and slightly deeper residual soils in the valleys.

The plateau area is predominantly covered by grassveld and savanna with varying degrees of invasion by Acacia Karoo (thornveld). Valley thicket is located in the lower reaches of the Black Kei River valley. There are no significant indigenous forests in the catchment with only some 800ha of commercial forestry in the headwaters of the Klipplaat River. Although there are some invasive alien plants (black and silver wattle) mainly around the Queenstown area, these are not yet a significant problem.

### 5.1.4 Land Use and Settlement Patterns

Land use patterns have been influenced by the fact that the sub-area was until 1994 divided into the former Ciskei and Transkei as well as South Africa. The area is characterised by dispersed rural village settlements (although often urban and dense in nature) and communal subsistence farming and grazing in the former Ciskei and Transkei areas. The former RSA component of the area (mainly in the S31 and S32D, E, L catchments) comprises largely privately owned commercial stock and game farms. Queenstown within the Lukhanji Municipality is the main town reflecting the only large urban node where most services and higher order infrastructure are to be found.

Natural pasture covers over 93% of the sub-area with communal and private stock farming being the main activity.

It is estimated that some 17 000ha of land in the sub-area is irrigated of which only 8 600 ha have assured water supplies from dams as part of formal irrigation schemes. The remaining irrigated areas rely on run-of-river schemes or opportunistic irrigation mainly in the upper Klipplaat, Heuningklip and Klaas Smits catchments. The largest scheduled irrigation schemes include the Klipplaat Government Water Scheme (1905ha) from Waterdown Dam, Oxkraal (541 ha) from Oxkraal Dam, Nthabethemba

(1200 ha) from five small dams, Xonxa (1643 ha) from Xonxa Dam and Qamata (3050ha) from Lubisi Dam. Most of these schemes are located in the former Ciskei and Transkei and have either not been developed or have been developed but are now either defunct or only partially used. The actual irrigation areas and water use is thus substantially less than the scheduled irrigation areas mentioned above. Rehabilitation of some of the schemes and establishment of Water User Associations are in various stages of implementation, which is proving to be a slow process.

Other smaller irrigation schemes include the Doornrivier scheme with its raw water source from the Doringrivier Dam near Indwe and the Zweledinga scheme in the upper Oxkraal River with water from the Bushmanskrantz Dam.

The predominant irrigation practice in the S31 catchment is “opportunistic”, occurring on a large scale when water is available in the Klaas Smits and Heuningklip Rivers. Groundwater normally extracted from “wellpoints” alongside the rivers is also used for irrigation in this catchment. There is also irrigation development along the upper Klipplaat River, which relies on run-of-river flow.

Severe erosion has occurred in the upper reaches of the White Kei and its tributaries, and in the Upper Black Kei (Hewu and Nthabathemba Districts) due to settlement patterns and poor land use practices resulting in degradation of the land. This has resulted in an increase in the turbidity of the rivers and sedimentation of dams.

### 5.1.5 Demography

The residential pattern in the former Ciskei and Transkei areas is mainly rural with many large rural villages (populations often greater than 10,000 people). Although the so-called rural population comprises over 70% of the population, most of these people reside in what are essentially urbanised villages. A characteristic of these areas is the density of population of approximately 55 persons per $km^2$ compared to approximately 4 persons per $km^2$ in the former South African component of the sub-area.

The main urban centre is Queenstown with a population approaching some 80,000 in the year 2000. The second largest urban area is Sada/Whittlesea in the former Ciskei. Other small formal towns include Sterkstroom, Indwe and Lady Frere. The total population of the sub-area was estimated based on 1995 data (**Ref. 24**) and Census 2001 data (**Ref. 6**) at approximately 408,000 people in the year 2000. This population is not expected to increase substantially in the future due mainly to the lack of employment opportunities and the resultant outward migration of people from the sub-area.

**Table 5.1 Population Estimates of the Upper Kei Sub-area (Year 2000)**

| Quaternary Catchment | Population |
|---|---|
| S10 | 140,000 |
| S20 | 75,000 |
| S31 | 64,000 |
| S32 | 129,000 |
| **Totals** | **408,000** |

It should be noted that more recent data (**Ref. 7**) indicate that there is likely to be a slight decline in overall population numbers in the area from the year 2005 to the year 2015 due to many factors including the effect of HIV/AIDS, outward migration etc.

5.1.6 Economic Development

The former Ciskei and Transkei areas have minimal commercial development and the population in these areas generally rely on income from migrant workers and state social grant benefits. Unemployment rates in these areas exceed 60%. The only industrial complex is located at Ezibeleni outside Queenstown, which was established as a border industrial area for the former Transkei. Since 1994 many of the industries have moved away and there has been a general decline in economic opportunities in the area.

The Chris Hani WSDP (**Ref. 7**) gives GGP figures for sectoral contribution for the whole Chris Hani District, but which would be very similar for this sub-area. These figures show that the Community Service sector is by far the largest contributor at 49%, followed by Trade at 15%. Agriculture, Finance and Manufacturing contribute approximately only 7 – 9% each.

“With agriculture being regarded as the only sector within the district economy with the potential for future development, the small contribution of 8,97% to the district GGP is evidence of the current under performance of this sector” (**Ref. 7**). The CHDM have prioritised agriculture and irrigation development, which is important when considering DWAF support to irrigation schemes and poverty alleviation programmes.

There are a number of private and public game farms and nature reserves in the catchment covering an area of approximately 34,000 ha.

There is very little significant mining activity in the area other than quarry mining for construction aggregate. Whilst coal deposits do occur fairly widely in the catchment, the only marginally viable deposit is located near Indwe. Although coal is not commercially mined at present there has been renewed interest and limited mining activity may recommence in the future.

Small but important wetlands occurring in the upper Klipplaat, Oxkraal and White Kei catchments give rise to the sources of these rivers.

## 5.2 Water Resources Overview

5.2.1 Surface Water

(a) Raw Water Resources and Supply Systems

A considerable amount of bulk raw water supply infrastructure (dams, pipelines and canals) has been developed in the sub-area, aimed at meeting urban needs and to supply water for irrigation especially in the former Ciskei and Transkei. All the main rivers are regulated by dams.

**Table 5.2 Main Rivers and Dams in the Upper Kei Sub-area**

| Catchments | Rivers | Main Dams | Owner |
|---|---|---|---|
| S10 | White Kei<br>Cacadu | Xonxa<br>Macubeni | DWAF<br>DWAF |
| S20 | Indwe | Doring River<br>Lubisi | DWAF<br>DWAF |
| S31 | Heuningklip<br>Klaas Smits<br>Lesseyton<br>Bonkolo | -<br>-<br>-<br>Bongolo | -<br>-<br>-<br>Lukhanji LM |
| S32A - C | Black Kei | Glenbrock<br>Mitford<br>Tentergate<br>Limietskloof<br>Thrift | DWAF<br>DWAF<br>DWAF<br>DWAF<br>DWAF |
| S32D - H | Klipplaat<br>Oxkraal | Waterdown<br>Bushmanskrantz<br>Oxkraal<br>Shiloh | DWAF<br>DWAF<br>DWAF<br>DWAF |

Due to the high sedimentation rates in the sub-area, the original yields of the dams may be substantially reduced. Furthermore, accurate flow gauging data is not available for many of the rivers in the former Ciskei and Transkei, resulting in hydrological calculations with a low degree of confidence.

The total surface water resource available from the Upper Kei catchment before specific allocations for the ecological Reserve or afforestation is estimated at 151 million $m^3$/a. Groundwater availability is estimated at 12 million $m^3$/a. Return flows from this catchment are estimated at 10 million $m^3$/a. The impact of the ecological Reserve based on a desktop analysis undertaken as part of the NWRS is estimated at 16 million $m^3$/a. Return flows from Queenstown are used extensively by irrigators in the Lower Klaas Smits River area. There is a reasonable amount of groundwater use especially in the Hewu District in the Black Kei catchment. The groundwater resource availability is discussed in **Section 5.2.2**.

**Table 5.3 Available Water in the Upper Kei Sub-area (Year 2000)**

| Type of Water Resource | Amount (million $m^3/a$) |
|---|---|
| Total surface water resource yield | 151 |
| Subtract: | |
| - Ecological Reserve | 10 |
| - Invasive alien plants | 4 |
| Net surface water yield available for use | 137 |
| Available groundwater resource | 12 |
| Usable return flows | 10 |
| **Total Local Yield** | **159** |

Due to the important role that Queenstown plays in the sub-area, it is imperative that sufficient raw water is always available to meet the town's requirements. Bulk raw water supply for Queenstown is currently supplied from the small Bongolo Dam just outside the town and from Waterdown Dam some 40 km away on the Klipplaat River. A number of studies have been undertaken to investigate possible future raw water supplies for the town (**Ref. 19 and 20**). These studies indicated that additional raw water would be required by the year 2000, but were based on the assumption that the full water allocation for irrigation was being used, which is not presently the case. Water restrictions were introduced in December 2003 in Queenstown due mainly to the fact that the main supply pipeline from Waterdown Dam could not deliver the peak water requirements and that there was very little water available from the Bongola Dam.

(b) Water Supply Infrastructure

The Klipplaat River Government Water Supply Scheme serves Queenstown and the Sada/Whittlesea complex, and irrigation along the Klipplaat River downstream of the Waterdown Dam to the confluence with the White Kei River. Water is supplied from Waterdown Dam to Queenstown through 46 km of pipeline(s). A booster pumpstation some 16 km from Queenstown increases the flow in the pipeline. An off-take supplies Sada. The capacity of this scheme to augment supplies to Queenstown is limited. Queenstown is also served by the small Bongolo Dam.

Cacadu RWSS is the largest regional rural surface water supply scheme. The scheme obtains water from the Macubeni Dam and supplies approximately 70,000 people living in Lady Frere and surrounding villages. Expansion of this RWSS and possible sedimentation of Macubeni Dam has placed a question mark over the assurance of supply for this scheme. The town of Indwe is supplied from the Doring River Dam.

Other domestic water supply schemes are based mainly on groundwater schemes. The largest of these include borehole supplies to Sterkstroom, Ilinge and the Hewu groundwater scheme. Under the DWAF BoTT programme numerous small village water supply schemes have been installed based largely on groundwater.

(c) Institutional Arrangements

The majority of bulk water infrastructure in this sub-area has been developed, and operated and maintained by DWAF. The process of transferring assets and the responsibility for operation and maintenance to the Chris Hani District Municipality (CHDM) was initiated in July 2003 and is scheduled to be complete by June 2005. As with other sub-areas in this ISP area, the lack of financial and skilled manpower resources will be a major constraint on successfully achieving this goal.

5.2.2 Groundwater

There is believed to be a considerable amount of good quality groundwater available for use in the catchment with estimates ranging up to 200 million $m^3/a$, which is far in excess of current demand. Based on technology used to date, this groundwater has usually only been found in small quantities with low yielding boreholes. It has been estimated that under good conditions up to 40 successful boreholes spread over an area of about 50 $km^2$ are required for a supply of 1 million $m^3/a$. Groundwater has therefore been difficult to exploit in any meaningful quantities for large schemes but has normally been considered for small individual village schemes. Due to the lack of adequate groundwater monitoring, the groundwater resources have often been over exploited with resultant failure and loss of confidence in this type of water supply. In addition, the quality of groundwater has sometimes been impacted due to polluted run-off.

New siting methods for boreholes based on satellite imagery and specialist geological knowledge of the characteristic dolerite ring structures in the sub-area are showing promise, with experimental boreholes delivering up to 30 l/s. Notwithstanding the surplus of surface water resources in this sub-area, DWAF support for the development of this groundwater resource especially for small village water supply schemes will continue.

5.2.3 Current Water Requirements

By far the largest water allocation within this area is for irrigation, making up over 80% of the total requirement. The water resources are mostly not being fully utilised due to the state of disrepair of irrigation schemes in the former Ciskei and Transkei areas. Within the former South African areas irrigation is mainly opportunistic based on run-of-river flows or alluvial groundwater.

The main urban use of water is for the Queenstown and Sada/Whittlesea areas with a number of regional rural water supply schemes throughout the sub-area supplying basic levels of service.

**Table 5.4 Local Water Requirements* in the Upper Kei Sub-area (Year 2000)**

| Sector | Amount (million $m^3$/a) |
|---|---|
| Irrigation | 69 |
| Urban** | 10 |
| Rural*** | 5 |
| Afforestation | 0 |
| **Total Local Requirement** | **84** |

*At a 1 in 50 year assurance.

**Industrial demand has been included in the urban demand.

*** Stockwatering has been included in the rural water requirements.

Existing water allocations have been used as the water use in most of the irrigation schemes in this sub-area is not well known due to the lack of information on areas under production. Actual water use is currently much less.

While irrigation is the largest user based on allocations from existing dams, the actual use of water for this purpose is only a fraction of the allocation. Water allocations from dams are mainly for irrigation in the sub-area and only the Waterdown Dam has a significant allocation for domestic use. While the dams are in place to supply irrigation water in the former Ciskei and Transkei areas, much of the downstream infrastructure has fallen into a state of disrepair. As this sector has been identified as the top priority for growth in the area by the CHDM, efforts are already underway to rehabilitate the former schemes and make use of these valuable water resources. DWAF and the Provincial Department of Agriculture (PDoA) can play a major role in assisting the DM to undertake this expensive task and ensure that development is based on sustainable practices. Assistance will also be required from DWAF in establishing WUAs as most of the schemes will be communally based.

### 5.2.4 Yield Balance

The water balance in the year 2000 for the Upper Kei catchment sub-area is as follows:

**Table 5.5 Reconciliation of the Upper Kei Sub-area in Year 2000**

| Description | Amount (million $m^3$/a) |
|---|---|
| Local yield | 159 |
| Transfer in | 0 |
| Total yield | 159 |
| Local requirement | 84 |
| Transfer out | 0 |
| Total requirement | 84 |
| **Water Balance** | **75** |

This large surplus is located mainly in the former Transkei area below the Xonxa and Lubisi Dams. Within the Black Kei catchment, local catchment deficits are experienced in the Klipplaat and Klaas Smits catchments due to run-of-river abstractions and an over-allocation of available water from the Waterdown Dam.

The present allocation for urban use from Waterdown Dam for Queenstown and Sada/Whittlesea is 8,25 and 4,2 million $m^3$/a respectively with a further allocation of 14,8 million $m^3$/a for irrigation. The actual yield of the dam (17,5 million $m^3$/a) is less than these allocations. Due to the fact that some of the allocation for irrigation is not currently used, no major water shortages have been experienced. This may change as the irrigation rights are taken up or alternatively converted to domestic allocations. Proposals for further studies into the future raw water supply scenario to the Lukhanji Municipality (Queenstown) are presently being addressed by DWAF and the CHDM. These studies will obtain more up to date information with respect to actual and future water supply requirements and use from Waterdown, Shiloh and Oxkraal Dams and other available raw water resources in the region such as Xonxa Dam. The studies will also investigate the optimal operation of the dams in the Oxkraal – Klipplaat system in order to maximise the available yield. The studies should also address the question of water conservation and demand management in Queenstown where it is estimated that unaccounted for water is anything between 10 and 30% (**Ref. 7**).

5.2.5 Future Water Requirements

Based on the above, there is a large amount of water available in the sub-area as a whole for further development. It is noted (**Ref. 7**) that "*an accurate assessment on the extent of the surplus water resources can only be made once the uncertainty regarding actual water use patterns and allocations is resolved*". The water sector plans and WSDP prepared for the area do not contain accurate or detailed information on this aspect. Other than water use for revitalised and expanded irrigation schemes, future growth in water use is mainly expected in the Queenstown and Sada/Whittlesea complex. Addressing this very important issue is further developed in Strategy No. 1.4.

5.2.6 Water Quality

(a) Surface Water Quality

Water quality of the rivers is generally suitable for domestic and agricultural use (**Ref. 19**). No major problems with respect to the water quality aspects of the rivers in the area have been detected although the number of monitoring points in the sub-area is small. No monitoring occurs downstream of Queenstown which is the largest potential source of pollution.

Large water supply schemes to Queenstown and Sada in turn generate waste water effluent. The adequacy of treatment and return flow to the rivers is controlled by the local authorities and no ongoing problems have been reported. Treated waste water from Queenstown is used to irrigate pasture lands in the lower Klaas Smits River.

Rehabilitation of irrigation projects and the use of fertilizers and poisons may result in the pollution of rivers and groundwater sources. RQOs should be considered for the rivers and a water quality monitoring programme instituted in the near future.

In general, due to the expansion of water supply to the rural areas it can be expected that the quality of the rivers and groundwater may deteriorate without the implementation of appropriate sanitation to these areas. Recent outbreaks of cholera in the nearby Engcobo area highlight the importance of providing safe drinking water and adequate sanitation. DWAF have recognised the importance of the latter and have embarked on a widespread sanitation implementation programme in the rural areas.

Leachate from unlicensed solid waste sites may be a cause of pollution of water resources. While the main towns have recently embarked on upgrading and licensing of their solid waste sites, unlicensed sites especially in the rural areas should be identified and corrective measures taken to prevent pollution.

A comprehensive soil conservation programme should also be implemented by the PDoA to reduce the loss of topsoil and the amount of sediment reaching the rivers and dams. The situation is particularly serious in parts of the former Ciskei and Transkei.

(b) Groundwater Quality

Groundwater quality in the area is generally good as is evidenced by its wide scale use. Refer to the above section on sanitation and groundwater pollution for additional comments.

## 5.3 Key Issues

Based on a detailed situation assessment of the Upper Kei catchment sub-area, the following key issues have been identified.

### 5.3.1 Water Balance and Reconciliation

Issue : Future water supply to Queenstown and Sada/Whittlesea. Refer Strategy No. 1.4.

### 5.3.2 Water Resources Protection

Issue : Water quality monitoring of surface and groundwater resources is insufficient.

Issue : Soil erosion due to poor land use management practices is leading to an increase in the turbidity of the rivers and high dam sedimentation rates.

### 5.3.3 Water Use Management

Issue : Large water resource developments (dams and canals) for irrigation purposes are in place but most of the available/allocated water is not used. The economic development of this region is linked to utilisation of this water and the development of agriculture.

### 5.3.4 Water Conservation and Demand Management

Issue : No WCDM programmes are in place in the sub-area either for urban or irrigation use. These are required especially in Queenstown and Sada/Whittlesea.

### 5.3.5 Institutional Development and Support

Issue : Rehabilitation of former irrigation schemes in the Ciskei and Transkei areas is very slow and requires assistance from DWAF. This assistance also includes help with the establishment of WUAs.

# 6. SITUATION ASSESSMENT OF THE MIDDLE KEI SUB - AREA

## 6.1 General Overview

### 6.1.1 Topography and Rivers

This sub-area consists of the middle reaches of the Great Kei River and two main tributaries, the Tsomo River with its headwaters in the Stormberg (S50), and the Thomas River with its headwaters in the Amatola mountain range (S40). Both rivers are regulated with the Ncora and Tsojana Dams in the Tsomo River catchment and the Sam Meyer Dam in the Thomas River catchment.

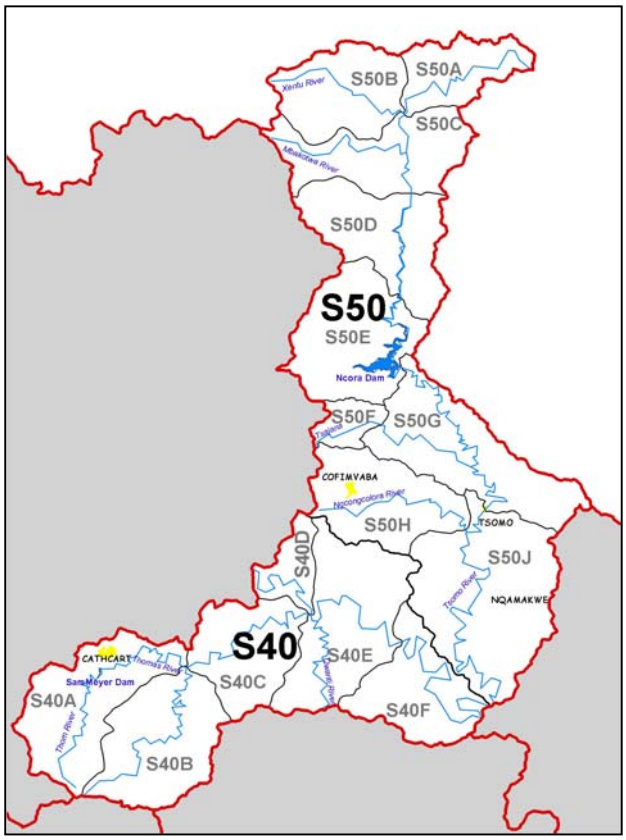


**Figure 6.1 The Middle Kei Sub-area**

The Middle Kei sub-area lies predominantly within the inland plateau topographical zone. The Tsomo River valley has its source in the southern Drakensberg range (the Stormberg) at an altitude of approximately 2 500 masl and then descends in a fairly steep valley to enter the Great Kei River at 850 masl. The Thomas River has its source on the north eastern slopes of the Amatola mountain range at an altitude of approximately 1 800 masl before flowing in an easterly direction to join the Great Kei River at 1 000 masl.

### 6.1.2 Climate and Rainfall

The climate in this sub-area shows a similar pattern to that of the Upper Kei sub-area with hot and dry summer months to very cold winter months i.e. temperatures of over

40° C in summer and very cold (-10° C) in winter with widespread frost and snowfalls on the high lying ground.

There is a high temporal and spatial variation in rainfall over the catchment with the Mean Annual Precipitation (MAP) varying from approximately 600 mm in the Great Kei valley to a maximum of 1 200 mm in the Amatola and Stormberg mountains in the east and north respectively. Rain falls predominantly in the summer months (70% - 80%), generally in the form of high intensity thunderstorms often accompanied by hail. Variability of seasonal rainfall is high with frequent dry spells and droughts occurring. Mean Annual Evaporation (MAE) rates of up to 1 700mm around the Cofimvaba area are experienced.

### 6.1.3 Geology, Soils and Vegetation

The area is underlain by horizontal to very gently dipping rocks of the Karoo Supergroup (shale, mudstones and sandstones) with the Molteno formation in the uplands of the Tsomo catchment and the Tarkastad formation over the remaining area. The area is characterised by dolerite intrusions often in the form of ring structures. The Thomas River and town of Cathcart are located within one such ring structure.

Soils are generally moderate to deep clayey loams in the Thomas River catchment with very shallow and rocky soils mostly not suitable for crop production in the Tsomo River catchment. Alluvial soils are found in the river valleys.

Natural vegetation consists mainly of grassland in the Tsomo River catchment with a mix of savanna and grassland in the Thomas catchment. Valley thicket predominates in the Great Kei valley (refer **Fig. 2.5**). Areas of invasive alien wattle (black and silver) are found throughout the area.

### 6.1.4 Land Use and Settlement Patterns

The sub-area typifies the dichotomy that exists in terms of land use and settlement patterns in the ISP area. Within the Tsomo catchment land use is characterised by dispersed rural settlements and communal subsistence farming and grazing in the former Transkei area. Cala, Cofimvaba and Tsomo are the main formal towns in this catchment.

The Thomas catchment is located within the former RSA component of the area and comprises privately owned commercial stock farms. The only formal town in this catchment is the small town of Cathcart.

Natural pasture covers most of the sub-area with communal and private stock farming the main activity. There are no large irrigation schemes in the sub-area. Some small scale irrigation is carried out using run-of-river water abstractions. Water is however transferred from Ncora Dam to the Ncora Irrigation Scheme, which is located in the Mbashe River catchment.

There are small areas of afforestation in the upper catchments of both rivers.

Pressure on the land, poor soils and the harsh environment have resulted in unsustainable settlement and land use patterns especially in the former Ciskei and Transkei areas of the catchment. This has led to degradation of the land and vegetation and severe erosion in the Tsomo River catchment, with an increase in the turbidity of the rivers and sedimentation of the dams.

### 6.1.5 Demography

The residential pattern in the Tsomo River catchment (former Transkei area) is mainly rural with only three small towns, Cala, Cofimvaba and Tsomo and many small villages and settlements. The Thomas River catchment is sparsely populated due to the large farms with only the town of Cathcart.

The total population of the sub-area was estimated based on 1995 data (**Ref. 24**) and Census 2001 data (**Ref. 6**) at approximately 204,000 people in the year 2000. This population is not expected to increase substantially in the future due mainly to the lack of employment opportunities and the resultant outward migration of people from the sub-area.

**Table 6.1 Population Estimates of the Middle Kei Sub-area (Year 2000)**

| Quaternary Catchment | Population |
|---|---|
| S40 | 34,000 |
| S50 | 170,000 |
| **Totals** | **204,000** |

### 6.1.6 Economic Development

The local economy is in dire straits and has been in decline for a number of years. There are very few economic opportunities in the area. The Tsomo River catchment has minimal commercial development and the people in this area generally rely on income from migrant workers and state social grant benefits. Unemployment rates in the area exceed 70%.

Within the sub-area, agriculture is the only commercial sector supporting the local economy. There are however no irrigation schemes of any significance and stock theft is a major problem for cattle, sheep and goat farmers.

## 6.2 Water Resources Overview

### 6.2.1 Surface Water

(a) Raw Water Resources and Supply Systems

Development of the Tsomo and Thomas Rivers has centred mainly on three dams viz. the Ncora, Tsojana and Sam Meyer Dams. The Ncora Dam was built primarily for Eskom to generate hydropower at the dam itself and to transfer water (105 million $m^3/a$) into the adjacent Mbashe catchment for hydropower generation at the

Collywobbles power station (85 million $m^3$/a) and irrigation at the Ncora scheme (20 million $m^3$/a - 3,000 ha scheduled) although very little irrigation is currently practised. Due to high erosion rates in the catchment of Ncora Dam resulting in sedimentation, and the lack of accurate flow gauging, there is uncertainty as to the yield of the dam. Flow gauging apparatus is presently being installed at the dam outlet and in the Mbashe catchment. Investigations for a more accurate assessment of the dam yield are presently being undertaken by DWAF.

The Tsojana Dam supplies water to Cofimvaba and surrounding rural villages. The small Sam Meyer Dam was built for water supply to Cathcart and is also used for recreation. This small dam was recently raised to increase the assurance of supply. Run-of-river water use for irrigation in the Thomas catchment upstream of the dam could be leading to a stressed situation. Ecological Reserve determinations should be considered in the medium term for these catchments.

**Table 6.2 Main Rivers and Dams in the Middle Kei Sub-area**

| Catchments | Rivers | Main Dams | Owner |
|---|---|---|---|
| S40 | Thomas | Sam Meyer | Amahlati LM |
| S50 | Tsomo | Ncora<br>Tsojana | DWAF<br>DWAF |

The surface water resource available from the Middle Kei catchment before abstractions for the ecological Reserve, invasive alien plants or afforestation is estimated at 134 million $m^3$/a. The impact of the ecological Reserve based on a desktop analysis undertaken as part of the NWRS is estimated at 10 million $m^3$/a and the impact of invasive alien plants is estimated at 2 million $m^3$/a. The groundwater resource availability is estimated at less than 2 million $m^3$/a and is discussed in **Section 6.2.2.**

**Table 6.3 Available Water in the Middle Kei Sub-area (Year 2000)**

| Type of Water Resource | Amount (million $m^3/a$) |
|---|---|
| Total surface water resource yield | 134 |
| Subtract: | |
| - Ecological Reserve | 10 |
| - Invasive alien plants | 2 |
| Net surface water yield available for use | 122 |
| Available groundwater resource | 2 |
| Usable return flows | 0 |
| **Total Local Yield** | **124** |

Based on the above, there is a large amount of water available in the sub-area as a whole for further development. However a large part of this surplus (85 million $m^3/a$) is transferred to the Mbashe catchment from Ncora Dam for hydropower generation and for irrigation (20 million $m^3/a$) at the Ncora Irrigation Scheme. The uncertainty regarding the available yield from Ncora Dam must be resolved before an accurate assessment of the potential economic benefits and a revised allocation can be investigated.

(b) Water Supply Infrastructure

Cala obtains its water from the Zindhlwane stream, which is fed by springs above the town. In times of shortfall a weir on the Tsomo River is used to extract additional water. Cofimvaba obtains its water from Tsojana Dam by mean of a pipeline, which also supplies some 35 rural villages. There are plans to extend this supply to a further 35 villages which may exceed the capacity of the existing yield of the dam and infrastructure capacity. Tsomo obtains water from a small weir on the Tsomo River. Cathcart obtains its water from the recently refurbished Sam Meyer Dam. No problems with water availability due to resource constraints have been reported.

(c) Institutional Arrangements

The majority of bulk water infrastructure in this sub-area has been developed, operated, and maintained by DWAF. The process of transferring assets and the responsibility for operation and maintenance to the Chris Hani and Amatole District Municipalities was initiated in July 2003 and is scheduled to be complete by June 2005. As with other sub-areas in this ISP area, the lack of financial and skilled manpower resources will be a major constraint on successfully achieving this goal.

6.2.2 Groundwater

The total available groundwater resource in the area is unknown but it is estimated that there is moderate potential. Pollution of potential groundwater resources in the Tsomo River catchment caused by inadequate sanitation is gradually being addressed through

DWAF's sanitation programme. Recent outbreaks of cholera in the adjacent Mbashe catchment have highlighted the importance of this programme together with the need for a suitable surface and groundwater monitoring programme.

### 6.2.3 Current Water Requirements

By far the largest water allocation within this area is for irrigation, making up over 90% of the total requirement. However the bulk of the available water (105 million $m^3$/a) has been allocated to inter-basin transfer to the Mbashe catchment for hydropower generation and for irrigation. As with other irrigation schemes in this region of the former Transkei, the 20 million $m^3$/a irrigation allocation from the inter-basin transfer for the Ncora Scheme is mostly not being fully utilised due to the state of disrepair of the irrigation scheme. Within the Thomas River catchment irrigation is mainly opportunistic based on run-of-river flows.

**Table 6.4 Local Water Requirements* in the Middle Kei Sub-area (Year 2000)**

| Sector | Amount (million $m^3$/a) |
|---|---|
| Irrigation | 15 |
| Urban** | 1 |
| Rural*** | 3 |
| Afforestation | 2 |
| **Total Local Requirement** | **21** |

*At a 1 in 50 year assurance.

**Industrial demand has been included in the urban demand.

*** Stockwatering has been included in the rural water requirements.

### 6.2.4 Yield Balance

Based on the available yield of the system and water requirements, the yield balance in the year 2000 for the whole sub-area is summarized below.

**Table 6.5 Reconciliation of the Middle Kei Sub-area in Year 2000**

| Description | Amount (million $m^3$/a) |
|---|---|
| Local yield | 124 |
| Transfer in | 0 |
| Total yield | 124 |
| Local requirement | 21 |
| Transfer out | 105 |
| Total requirement | 126 |
| **Water Balance** | **- 2** |

The Middle Kei sub-area is in deficit if the ecological Reserve is taken into account. The transfer allocation to the Mbashe catchment estimated at 85 million $m^3$/a for the hydroelectric power generation at Collywobbles as well as 20 million $m^3$/a for the Ncora Irrigation Scheme is the major reason for the current deficit. Due to the lack of adequate flow gauging there is also uncertainty as to the actual amount being transferred to the Mbashe catchment. The actual volume being transferred must be confirmed and the Regional Office is presently determining this.

The benefit and costs of the hydropower generation to the catchment, the wider region and to the WMA as a whole will need to be assessed both from an environmental and economic aspect. Any future water requirements in the sub-area will have to be met either by curtailing the amount of water to be transferred for hydropower generation (after determining how much water is presently being transferred), developing additional water resources or transferring water from the Upper Kei area if the irrigation schemes in that sub-area are not rehabilitated. This is an issue that will require further strategic development once the basic parameters such as actual water transferred is known.

### 6.2.5 Future Water Requirements

Other than the deployment and use of existing allocations of water for the rehabilitated Ncora Irrigation Scheme and domestic supply to rural villages not yet supplied with basic water, future large-scale growth in water use is not expected.

### 6.2.6 Water Quality

#### (a) Surface Water Quality

Water quality of the rivers is generally suitable for domestic and agricultural use. No major problems with respect to the water quality aspects of the rivers in the area have been detected although the number of monitoring points in the sub-area is small.

In general, due to the expansion of water supply to the rural areas it can be expected that the quality of river water and groundwater may deteriorate without the implementation of appropriate sanitation to these areas. Recent outbreaks of cholera in the nearby Engcobo area highlight the importance of providing safe drinking water and adequate sanitation. DWAF have recognised the importance of the latter and have embarked on a widespread sanitation implementation programme in the rural areas.

Leachate from unlicensed solid waste sites in the smaller towns may be a cause of pollution of water resources.

A comprehensive soil conservation programme should also be implemented in the Tsomo River catchment by the PDoA to reduce the loss of topsoil and the amount of sediment reaching the rivers and dams.

(b) Groundwater Quality

Groundwater quality in the area is generally good as is evidenced by the wide scale use of groundwater. Refer to the above section for additional comments.

## 6.3 Key Issues

Based on a detailed situation assessment of the Middle Kei sub-area as outlined above the following key issues have been identified.

### 6.3.1 Water Balance and Reconciliation

Issue : Accurate yield analysis required for Ncora Dam taking account of sedimentation and operational requirements of Eskom.

Issue : Yield of Tsojana Dam needs to be balanced with the proposed water supplies to rural villages.

Issue : Run-of-river water use in upper Thomas River may be causing a stressed state in this quaternary catchment.

### 6.3.2 Water Resources Protection

Issue : Water quality monitoring of surface and groundwater resources is inadequate.

Issue : Soil erosion due to bad land use management practices is leading to an increase in the turbidity of the rivers and high dam sedimentation rates especially in the Tsomo River catchment.

### 6.3.3 Water Conservation and Demand Management

Issue : No WCDM programmes have been undertaken in the small towns.

# 7. SITUATION ASSESSMENT OF THE LOWER KEI SUB-AREA

## 7.1 General Overview

### 7.1.1 Topography and Rivers

The Lower Kei sub-area comprises the deeply incised lower reaches of the Great Kei River to its estuary and its two main tributaries, the Gcuwa River tributary (S70) on the left bank and the Kubusi River tributary (S60) on the right bank.

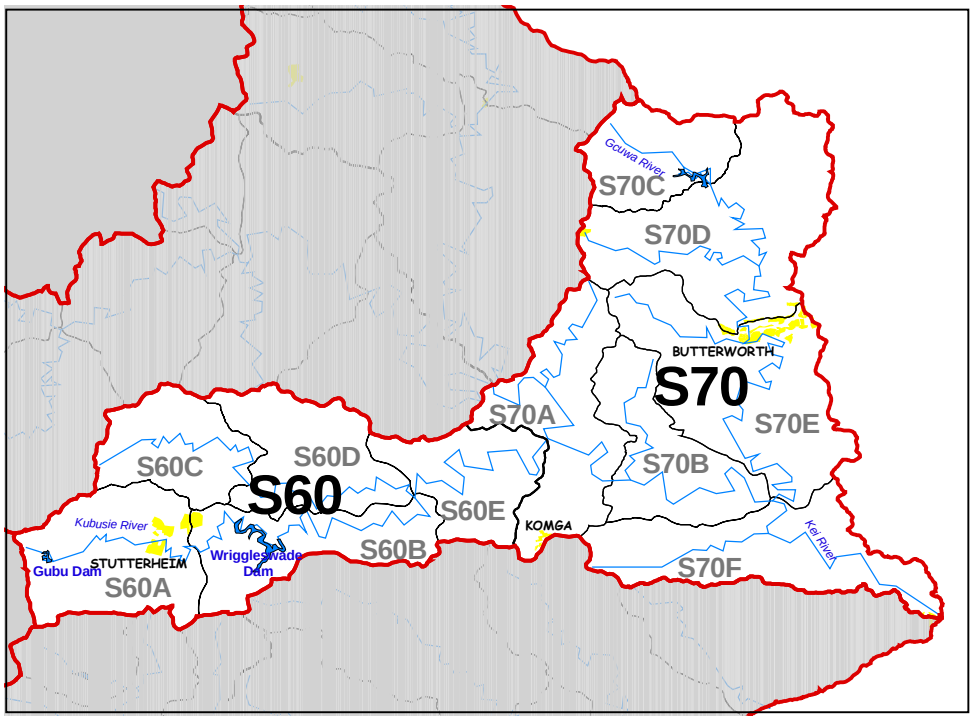


**Figure 7.1 The Lower Kei Sub-area**

The area is characterised by the picturesque Great Kei River valley, which is some 400 m below the surrounding plateau. On the left and right banks the valley rises steeply to meet the coastal plateau zone, which covers most of this sub-area. The Gcuwa River has its headwaters at the inland edge of this coastal plateau zone at 1200 masl. The topography of the Gcuwa River valley is undulating from its headwaters through to Butterworth before it steepens and enters the Great Kei River. The Kubusi River has its headwaters in the Amatola mountains above Stutterheim and meanders through the coastal plateau before falling away steeply to enter the Great Kei River. The coastal zone area comprises a very small section of the catchment around Kei Mouth.

### 7.1.2 Climate and Rainfall

As for the Amatole sub-area, the climate is moderate for most of the year, but with hot periods from December to February. Although the area receives rainfall throughout the year, it is primarily a summer rainfall region, with the months of June and July being the

driest. The mean annual precipitation (MAP) varies from 1 000 mm along the coast to 700 mm inland above Butterworth and 1200 mm in the Amatola mountains.

### 7.1.3 Geology, Soils and Vegetation

The area is underlain by the Adelaide and Tarkastad formations of the Beaufort series (shale, mudstones and sandstones) with dolerite intrusions, the largest of which is located on the left bank of the Great Kei River. Soils are derived from the underlying rock and are generally shallow and low in fertility.

The plateau area is predominantly covered by grassveld with large areas of valley thicket in the Great Kei valley and its small steep sided tributaries. There is significant commercial forestry in the Kubusi catchment. Alien invasive plants (black and silver wattle) occur throughout the area with some heavy infestation around the Nqamakwe area and in the upper Kubusi catchment.

### 7.1.4 Land Use and Settlement Patterns

Land use and settlement patterns are influenced by the previous political division of the area with the right bank of the Great Kei being part of South Africa and the left bank being part of the former Transkei. The former Transkei is characterised by dispersed rural settlements and communal subsistence farming and grazing. Butterworth and Nqamakwe are the main formal towns in this area.

Butterworth is the largest town in the sub-area reflecting the only urban node in the former Transkei area where most services and higher order infrastructure are to be found. The standards of these services have declined in recent years along with the economy of the town.

The right bank comprises privately owned commercial stock, game and vegetable farms. The only formal towns in this part of the sub-area are Stutterheim, Komga and Kei Mouth.

### 7.1.5 Demography

The residential pattern in the former Transkei area is mainly rural with many small villages and the two main towns of Butterworth and Nqamakwe. The population in this part of the sub-area is not expected to increase substantially in the future due mainly to the lack of employment opportunities and the resultant outward migration of people. Butterworth has a population of approximately 20,000 people with a very high proportion residing in informal settlements around the town. This has implications not only for water use and management but also for other services.

Within what was the South African component of the sub-area, Stutterheim and Komga serve as service centres for the surrounding privately owned farms. Kei Mouth is mainly a tourist town with a small permanent residential population. With the upgrading of the road to Kei Mouth, the town is experiencing a property boom and the seasonal tourist population can be expected to grow substantially in the short term.

The total population of the sub-area was estimated based on 1995 data (**Ref. 24**) and Census 2001 data (**Ref. 6**) at approximately 196,000 people in the year 2000.

**Table 7.1 Population Estimates of the Lower Kei Sub-Area (Year 2000)**

| Quaternary Catchment | Population |
|---|---|
| S60 | 44,000 |
| S70 | 152,000 |
| **Totals** | **196,000** |

As for other rural areas in the Eastern Cape there is likely to be a slight decline in overall population numbers in the area from the year 2005 to the year 2015 due to many factors including the effect of HIV/AIDS, outward migration etc.

7.1.6 Economic Development

This sub-area has irrigation, stock and game farming and forestry as the main economic generator in the Kubusi catchment. However in the former Transkei area the economy is very depressed. The population generally relies on income from migrant workers and state social grant benefits with unemployment rates exceeding 60%. The only industrial and commercial complex is located in Butterworth, which has been in decline since 1994 with removal of the Regional Industrial Development Programme. Most of the industries have moved away (notably SA Breweries) and there has been a general decline in economic opportunities. The service industry is by far the largest contributor to the local economy. A proposal for dune mining of heavy metals at Wavecrest with water extraction from the Lower Kei River has been postponed indefinitely.

Tourism at Kei Mouth and Morgan Bay is currently a small contributor to the local economy but has the potential to grow significantly in the future.

## 7.2 Water Resources Overview

7.2.1 Surface Water

(a) Raw Water Resources and Supply Systems

The main dams in the sub-area comprise the Gubu and Wriggleswade Dams on the Kubusi River, and the Xilinxa and Gcuwa Dams on the Gcuwa River. The development of these dams is mainly for domestic water supplies to the towns and rural villages in the sub-area as well as for inter-basin transfer of water from Wriggleswade Dam to the Buffalo City supply catchments.

Within the former RSA component of the sub-area, Komga obtains its main water supply from a pump station on the Kei River and from boreholes and a spring. The water from the groundwater sources has high concentrations of nitrates and this water is mixed with the treated surface water before distribution. Kei Mouth (and Morgan Bay) obtains it water from small coastal streams. As these two resort towns grow, a

source of water from the Great Kei River upstream of the tidal reach will need to be developed. The Gubu Dam, which supplies Stutterheim and surrounding villages has adequate yield to satisfy requirements to beyond the year 2015.

Within the former Transkei area, Butterworth obtains its raw water supply from the Gcuwa weir, which in turn obtains water released 50 km upstream from the Xilinxa Dam. The Gcuwa weir is over 90% silted up. The Xilinxa dam was constructed to supply rural and urban domestic and industrial requirements. The allocation from this dam is 9,4 million $m^3$/a. No allocation has been made for irrigation. The Xilinxa Dam also supplies raw water for the Kotana RWSS, which serves approximately 20 000 people in the surrounding rural area. The yield and allocation of water from Xilinxa Dam was undertaken by the former Transkei homeland authorities. Due to the changing demand patterns especially from Butterworth these allocations may no longer be applicable. It is reported that the system is not presently under stress but ecological Reserve requirements and requirements for water for additional rural villages in the area will need to be reconciled with the available yield from the system. Refer to Strategy No. 1.1.

The small town of Nqamakwe obtains its water from boreholes. The Toleni RWSS, supplying water to over 47 000 people, was recently rehabilitated under DWAF's BoTT programme based on water sourced from the small Toleni Dam and a new borehole supply. Water supply of approximately 10 – 12 l/c/d is provided at 98% assurance from these sources.

**Table 7.2 Main Rivers and Dams in the Lower Kei Sub-area**

| Catchments | Rivers | Main Dams | Owner |
|---|---|---|---|
| S60 | Kubusi | Gubu<br>Wriggleswade | DWAF |
| S70 | Gcuwa<br><br>Toleni | Xilinxa<br>Gcuwa<br>Toleni | DWAF<br>DWAF<br>DWAF |

Accurate flow gauging data is not available for the rivers in the former Transkei, resulting in hydrological calculations with a low degree of confidence.

**Table 7.3 Available Water in the Lower Kei Sub-Area (Year 2000)**

| Type of Water Resource | Amount (million $m^3$/a) |
|---|---|
| Total surface water resource yield | 87 |
| Subtract: | |
| - Ecological Reserve | 15 |
| - Invasive alien plants | 6 |
| Net surface water yield available for use | 66 |
| Available groundwater resource | 0 |
| Usable return flows | 10 |
| **Total Local Yield** | **76** |

(b) Water Supply Infrastructure

Bulk water supply infrastructure for Komga and the two RWSSs mentioned above has recently been upgraded. The state of water supply infrastructure within Butterworth and Nqamakwe is poor due to a lack of financial resources and poor operating and maintenance procedures. This results in large water losses especially in Butterworth. Recent attempts at instituting a water conservation and demand programme have met with apathy from the local municipality. A further motivation for this programme is the possible re-allocation of water from Xilinxa Dam for rural water supply schemes. No problems have been reported with respect to Kei Mouth's or Stutterheim's water supply infrastructure.

(c) Institutional Arrangements

The majority of existing bulk water supply infrastructure for the regional water supply schemes in this sub-area has been developed, operated and maintained by DWAF. The process of transferring assets and the responsibility for operation and maintenance to the Amatole District Municipality was initiated in July 2003 and is scheduled to be complete by June 2005. As with other sub-areas the lack of financial and skilled manpower resources will be a major constraint towards successfully achieving this goal.

7.2.2 Groundwater

Very little use is currently made of groundwater. The total available groundwater resource in the area is unknown with estimates varying by orders of magnitude. The best groundwater potential is in the inland areas of the sub-area with the potential reducing towards the coast. However, due to the fact that surface water supply schemes cover most of the sub-area where the major demand exists, the groundwater resource is only used for providing domestic supplies to smaller settlements and towns (Komga and Nqamakwe).

### 7.2.3 Current Water Requirements

The main feature of this area is the inter-basin allocation of 18 million $m^3$/a from Wriggleswade Dam to the Buffalo/Nahoon Rivers for urban use within the BCM. Local use is evenly split between irrigation, domestic/industrial and afforestation.

**Table 7.4 Local Water Requirements* in the Lower Kei Sub-area (Year 2000)**

| Sector | Amount (million $m^3$/a) |
|---|---|
| Irrigation | 14 |
| Urban** | 10 |
| Rural*** | 3 |
| Afforestation | 11 |
| **Total Local Requirement** | **38** |

*At a 1 in 50 year assurance.

**Industrial demand has been included in the urban demand.

*** Stockwatering has been included in the rural water requirements.

### 7.2.4 Yield Balance

Based on the above, the yield balance in the year 2000 for the Lower Kei sub-area is estimated to have a surplus water balance even with inter-basin transfer of 18 million $m^3$/a to the Buffalo / Nahoon catchments.

**Table 7.5 Reconciliation of the Lower Kei Sub-area in Year 2000 (million $m^3$/a)**

| Description | With Transfer from Wriggleswade Dam | Without Transfer from Wriggleswade Dam |
|---|---|---|
| Total local yield | 76 | 76 |
| Transfer in | 0 | 0 |
| Total yield | 76 | 76 |
| Local local requirement | 38 | 38 |
| Transfer out | 18 | 0 |
| Total requirement | 56 | 38 |
| **Water Balance** | **20** | **38** |

The inter-basin water transfer from Wriggleswade Dam to the AWSS is reserved for urban use within the BCM. Transfers are currently only made during serious droughts, but these transfers will increase as the demand within the BCM grows.

It should be borne in mind that the above reconciliation is based on a desktop study for the ecological Reserve requirements as undertaken in the NWRS. The level of

confidence on the Reserve requirements is low and it does not optimise the yield of the sub-area.

Water usage within Butterworth has changed substantially since 1994 when approximately 25% of the water was used by the brewery. This industry, together with almost all other large industries, has moved elsewhere. What was at one stage a scenario requiring the development of additional water resources and infrastructure has changed to a situation of surplus water. Because of this surplus and major institutional problems within the local municipality, little attention has been paid to the need for more water. However, with the need for ongoing provision of basic water supplies in the rural areas, the water requirements of Butterworth and the ecological Reserve of the catchment should be re-analysed.

### 7.2.5 Future Water Requirements

Future water requirements will come mainly from the extension of basic water supplies to the peri-urban population around Stutterheim, the rural population in the sub-area and for the growth of the Kei Mouth/Morgan Bay area. Recent feasibility studies have been undertaken into the possibility of mining ilmenite in the Wavecrest area and using water from the Great Kei River. The scheme has been postponed indefinitely. The study did however detail the feasibility of supplying water to the scheme from the Great Kei River.

### 7.2.6 Water Quality

#### (a) Surface Water Quality

Water quality of the rivers is generally suitable for domestic and agricultural use. However, serious pollution of the Gcuwa River is occurring downstream of Butterworth due to leachate from the unlicensed solid waste site on the banks of the river. This pollution is further exacerbated by stormwater runoff from the town, poor operation of the effluent treatment works and possible runoff from the few remaining industries in town (tanneries etc). These are not monitored. The number of monitoring points in the sub-area is small and no monitoring occurs downstream of Butterworth which is potentially one of the largest sources of pollution into the Kei River. Generally, Butterworth has expended little on infrastructure services in recent years. This is compounded by the lack of financial and skilled manpower resources to address the many problems. The ADM has been involved in feasibility studies for a regional solid waste site for the town for a number of years. A feasible site has been identified but the large capital cost for implementation is proving to be a stumbling block.

Due to the expansion of water supply to the rural areas it can be expected that the quality of the rivers and groundwater may deteriorate without the implementation of appropriate sanitation to these areas. DWAF have recognised this and have embarked on a widespread sanitation implementation programme in the rural areas.

A comprehensive soil conservation programme should also be implemented by the Department of Agriculture to reduce the loss of topsoil and the amount of sediment reaching the rivers and the estuary of the Great Kei catchment.

(b) Groundwater Quality

Groundwater quality in the inland area is generally good but deteriorates towards the coast.

## 7.3 Key Issues

Based on a detailed situation assessment of the Lower Kei sub-area as outlined above the following key issues have been identified.

### 7.3.1 Water Balance and Reconciliation

Issue : Water supply and allocations from the Gcuwa River system to Butterworth and the Regional Water Supply Schemes need investigation.

Issue : The importance of the ecological Reserve for the Great Kei estuary requires that a more accurate systems analysis and yield balance be undertaken.

### 7.3.2 Water Resources Protection

Issue : Serious pollution of the Gcuwa River and Kei River downstream of Butterworth is occurring.

### 7.3.3 Water Conservation and Demand Management

Issue : High water losses in Butterworth require the urgent implementation of a WCDM programme.

# 8. COMPARISON OF WATER AVAILABILITY AND USE BETWEEN THE NWRS AND THE ISP

## 8.1 Methodology Used

An exercise has been undertaken to compare the NWRS yield balance figures with revised figures based on the latest available information used in this ISP study. However, the five sub-areas identified in this ISP are smaller than the two primary catchments in the NWRS and therefore more detailed information was required. The following points are important when analysing the water resources of each of the five sub-areas to ensure consistent use of the same figures or to justify changes to the figures provided in the NWRS. This was done in the ISP with respect to comparing water resource availability and water requirements for each sub-area. The following approach was used in the ISP.

- The water availability and impact on the available water resource was determined based on the latest available information. This applies mainly to where the ecological Reserve requirements were determined at a higher level of confidence than for the NWRS.

- The water requirements for the Year 2000 development were updated based on the latest available information from various sources. The sources of water supply for the various water user sectors in the various catchments were identified. These sources were grouped together in five main categories, namely groundwater resources, surface water resources that are only available at a local (quaternary) level (for example farm dams), surface water resources that are available in other catchments (usually downstream and defined as “incremental”), inter-basin transfers and return flows.

- The water requirements and the sources of supply of these requirements at quaternary catchment level were determined. This was done in order to analyse where local deficits and local surpluses occur in each of the sub-areas. The purpose of providing water balance figures at quaternary catchment level is to provide the DWAF Regional Office with the first level assessment against which water resource allocations (licences) can be considered. This information will be provided to the Regional Office in a separate document.

The yield and requirement figures for the five ISP sub-areas were aggregated to reflect the two primary catchment areas given in the NWRS. A comparison was then made between the NWRS and the ISP water balance reconciliation figures and the results presented in the following tables in this chapter. The basis for determining the water balance figures as part of the ISP study was the same as for the NWRS. Where inconsistencies between the two studies were identified and a change to the NWRS figures is recommended, motivations are given for using the ISP figures.

## 8.2 Comparison of Available Yield

**Tables 8.1 and 8.2** present a comparison of the NWRS and the ISP water availability figures for the Amatole and Great Kei primary catchments respectively.

**Table 8.1 Amatole Primary Catchment**
**Comparison of Water Availability between the ISP and NWRS (Year 2000)**

| Type of Water Resource | Amount (million $m^3/a$) | | | |
|---|---|---|---|---|
| | Amatole sub-area* | Keiskamma sub-area | Total ISP | Total NWRS |
| Total surface water resource yield | 82 | 53 | 135 | 135 |
| Subtract: | | | | |
| - Ecological Reserve | 17 | 4 | 21 | 7 |
| - Invasive alien plants | 4 | 2 | 6 | 6 |
| Net surface water yield available for use | 61 | 47 | 108 | 122 |
| Available groundwater resource | 1 | 0 | 1 | 1 |
| Usable return flows | 18 | 1 | 19 | 26 |
| **Total Local Yield** | **80** | **48** | **128** | **149** |

* The inter-basin transfer from the Lower Kei sub-area (Kubusi catchment) to the Amatole sub-area is not included in the above comparative figures.

As can be seen from the above table, the estimate of the total local yield of the Amatole primary catchment determined for the ISP is lower than that determined for the NWRS. This is due to a higher ecological Reserve and lower usable return flows that were more accurately determined as part of an ecological Reserve study undertaken for the Amatole System (**Ref. 26**) after the NWRS estimates were done. It is recommended that the latest study estimate of 21 million $m^3/a$ for the ecological Reserve and 19 million $m^3/a$ for the return flows be used.

It should be noted that the return flows determined in the ISP are usable quantities returned to rivers and do not take into account flows being discharged into the Indian Ocean. For example, the treated effluent water from the East London West Bank Water Reclamation Works is presently discharged into the sea at Bats Cave and has not been included in the above figures. However, this water is available for re-use should a suitable customer be found. Only those return flows to rivers that are usable are considered in order to avoid the perception that there is more water available than is actually the case.

**Table 8.2 Kei Primary Catchment**
**Comparison of Water Availability between the ISP and NWRS (Year 2000)**

| Type of Water Resource | Available/impact (million $m^3/a$) | | | | |
|---|---|---|---|---|---|
| | Upper Kei sub-area | Middle Kei sub-area | Lower Kei sub-area | Total ISP | Total NWRS |
| Total surface water resource yield | 151 | 134 | 87 | 372 | 372 |
| Subtract: | | | | | |
| - Ecological Reserve | 10 | 10 | 15 | 35 | 35 |
| - Invasive alien plants | 4 | 2 | 6 | 12 | 12 |
| Net surface water yield available for use | 137 | 122 | 66 | 325 | 325 |
| Available groundwater resource | 12 | 2 | 0 | 14 | 14 |
| Usable return flows | 10 | 0 | 10 | 20 | 20 |
| **Total Local Yield** | **159** | **124** | **76** | **359** | **359** |

As can be seen from the above table the ISP and NWRS figures for the Kei primary catchment are the same.

## 8.3 Comparison of Water Requirements

**Tables 8.3 and 8.4** compare the water requirement figures between the ISP and the NWRS for the Amatole and Kei primary catchments respectively.

**Table 8.3 Amatole Primary Catchment**
**Comparison of Water Requirements between the ISP and NWRS (Year 2000)**

| Sector | Amount (million $m^3/a$) | | | |
|---|---|---|---|---|
| | Amatole sub-area | Keiskamma sub-area | Total ISP | Total NWRS |
| Irrigation | 19 | 10 | 29 | 33 |
| Urban | 59 | 11 | 70 | 57 |
| Rural | 3 | 3 | 6 | 5 |
| Afforestation | 1 | 1 | 2 | 4 |
| **Total Local Requirements** | **82** | **25** | **107** | **99** |

The significant difference between the NWRS and ISP water requirements is for the urban water use sector within the Amatole sub-area ie. Buffalo City. The ISP uses the latest water requirement figures for the Year 2000 for the Buffalo City Municipality based on the actual requirements as given in the WSDP (**Ref. 5**), which indicates a higher requirement than that used in the NWRS.

**Table 8.4 Kei Primary Catchment**
**Comparison of Water Requirements between the ISP and NWRS (Year 2000)**

| Sector | Amount (million $m^3/a$) | | | | |
|---|---|---|---|---|---|
| | Upper Kei sub-area | Middle Kei sub-area | Lower Kei sub-area | Total ISP | Total NWRS |
| Irrigation | 69 | 15 | 14 | 98 | 135 |
| Urban | 10 | 1 | 10 | 21 | 18 |
| Rural | 5 | 3 | 3 | 11 | 10 |
| Afforestation | 0 | 2 | 11 | 13 | 11 |
| **Total Local Requirement** | **84** | **21** | **38** | **143** | **174** |

The difference between the ISP and NWRS figures is largely due to the irrigation requirements. The irrigation requirements for this ISP were based on data obtained from the Water Resources Situation Assessment Report (**Ref. 24).** The NWRS used the WSAM database which in turn also quotes the same source. There is clearly a difference in interpretation of the source information given in the WRSA. Appendix F4 of the WRSA report gives an irrigation requirement of 106 million $m^3/a$ for the Great Kei catchment which is close to the figure used in this ISP report.

Further investigation and comparison of various sources indicates that the main difference lies in the Black Kei sub-catchment (S31/32). This ISP study based its irrigation requirement on the two established irrigation schemes in the area, namely the Klipplaat and Nthabethemba schemes, which have a 1:50 year assurance requirement of 26,1 million $m^3/a$. The WSAM database gives a total irrigation requirement of 68,2 million $m^3/a$. This large discrepancy was discussed at the two ISP workshops and there was consensus that the NWRS (WSAM data) had overestimated the irrigation requirements in the area.

A further independent comparison has been carried out which shows that the registered average irrigation water use in the WARMS database totals 19,9 million $m^3/a$ compared to the WSAM data figure of 68,2 million $m^3/a$.

Based on the above it is recommended that the irrigation figures in the NWRS be change to those given in this ISP until such time as a more accurate figure for the scheduled areas is determined.

## 8.4 Comparison of Water Balances

Based on **Sections 8.2 and 8.3** above, the comparative water balances for the ISP and NWRS are presented in **Table 8.5** without inter-basin transfer of water from Wriggleswade Dam on the Kubusi River to the Amatole Sub-area.

**Table 8.5 Comparison of Water Balance between the ISP and NWRS (Year 2000) without transfer from Wrigglewade Dam (million $m^3$/a)**

| Description | Amatole Primary Catchment | | | Kei Primary Catchment | | | |
|---|---|---|---|---|---|---|---|
| | Amatole Sub-area | Keiskamma Sub-area | Total | Upper Kei Sub-area | Middle Kei Sub-area | Lower Kei Sub-area | Total |
| Total local yield | 80 | 48 | 128 | 159 | 124 | 76 | 359 |
| Transfer in | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total yield | 80 | 48 | 128 | 159 | 124 | 76 | 359 |
| Local requirement | 82 | 25 | 107 | 84 | 21 | 38 | 143 |
| Transfer out | 0 | 0 | 0 | 0 | 105 | 0 | 105 |
| Total requirement | 82 | 25 | 107 | 84 | 126 | 38 | 248 |
| **ISP Water Balance per Sub-area** | **- 2** | **23** | **21** | **75** | **- 2** | **38** | **111** |
| **ISP Water Balance** | **21** | | | **111** | | | |
| **NWRS Water Balance** | **50** | | | **100** | | | |

The inter-basin transfer of 18 million $m^3$/a of water from the Kubusi catchment in the Lower Kei sub-area to the Amatole sub-area is not reflected in the NWRS. Transfers are only made during serious droughts, but the quantity is reserved for future urban use in the Amatole Water Supply System serving Buffalo City. **Table 8.6** shows the comparative water balance figures allowing for this transfer of 18 million $m^3$/a.

**Table 8.6 Comparison of Water Balance between the ISP and NWRS (Year 2000) with inter-basin transfer from Wrigglewade Dam (million $m^3$/a)**

| Description | Amatole Primary Catchment | | | Kei Primary Catchment | | | |
|---|---|---|---|---|---|---|---|
| | Amatole Sub-area | Keiskamma Sub-area | Total | Upper Kei Sub-area | Middle Kei Sub-area | Lower Kei Sub-area | Total |
| Total local yield | 80 | 48 | 128 | 159 | 124 | 76 | 359 |
| Transfer in | 18 | 0 | 18 | 0 | 0 | 0 | 0 |
| Total yield | 98 | 48 | 146 | 159 | 124 | 76 | 359 |
| Local requirement | 82 | 25 | 107 | 84 | 21 | 38 | 143 |
| Transfer out | 0 | 0 | 0 | 0 | 105 | 18 | 123 |
| Total requirement | 82 | 25 | 107 | 84 | 126 | 56 | 266 |
| **ISP Water Balance per Sub-area** | **16** | **23** | **39** | **75** | **- 2** | **20** | **93** |
| **ISP Water Balance** | **39** | | | **93** | | | |
| **NWRS Water Balance** | **50** | | | **100** | | | |

The reasons for the discrepancies in the comparative figures between the ISP and the NWRS have been explained in the previous sections together with motivations for using the above ISP figures in the future.

The ISP study area is one of the few in the country that has surplus water resources available. However, it must be emphasised that the catchment wide figures of the Amatole - Kei area can be misleading as local deficits are experienced in some quaternary catchments, such as in the Upper Buffalo River in the Amatole sub-area and in the Upper Kei sub-area.

The Amatole sub-area is highly regulated and developed and is presently in balance with respect to existing water use and existing supplies sourced from within the sub-area. As growth in demand is experienced in the sub-area mainly from Buffalo City, it will be necessary to implement the inter-basin transfer of water from Wriggleswade Dam on the Kubusi River to the Amatole sub-area catchments. It is estimated that even with this transfer and demand side management and water re-use, the Amatole sub-area which includes Buffalo City is likely to experience a water deficit by the year 2012.

In the Upper Kei sub-area an overall surplus balance is shown. However, the Klipplaat River, a tributary of the Black Kei River, has relatively large areas allocated

for irrigation. This, together with the urban requirements of Queenstown and Sada/Whittlesea and the domestic requirements of the large rural population, has resulted in an over-allocation of the water resources from Waterdown Dam compared to the available yield. As a result there is a local deficit in the Klipplaat catchment resulting in irrigators receiving water at a relatively low level of assurance.

The Middle Kei sub-area is presently showing a slight water deficit due to the transfer of water from the Tsomo River to the Mbashe catchment for irrigation requirements at Ncora and hydropower generation by Eskom at Ncora Dam and at Collywobbles.

**NOTE:** As part of the ISP study, water requirements and the sources of supply of these requirements were determined at quaternary catchment level. This was done in order to analyse where local deficits and local surpluses occur in each of the sub-areas. Water balance figures at quaternary catchment level have been provided in a separate document to the Regional Office as a first level assessment on which the water resource allocation (or licences) can be considered. It must be emphasised that there is a degree of uncertainty (risk) in the level of confidence of some figures used in the ISP reconciliation. Where the difference between available water resources and water requirements is small, then a detailed system analysis is recommended. Only then should a decision be made for water use allocation and licensing of the water resources. Where the differences are significantly positive (surplus water), then water use allocation can be considered and implemented with little or no risk of failure in the system.

# 9. CONCLUSIONS AND RECOMMENDATIONS

This ISP document provides a first attempt at compiling a perspective of how the Department wishes to manage the water resources of the catchments of the Amatole - Kei. Reference has been made to the enabling legislative and environmental framework within which water plays an essential role. Water demands must be met in such a way that its use fully supports social and economic development, equity, sustainability and efficient and effective use of water. An optimum balance needs to be sought between the social, economic and biophysical components of the environment for the benefit of all living organisms and for the sustainability of a healthy environment.

Together with the many studies and reports on the area, the Eastern Cape Regional Office of DWAF has provided a wealth of regional water management information. The issues and concerns that were identified during the preliminary interviews and follow up workshops are discussed under the various strategies that have been developed for implementation. Strategies with a strong regional emphasis on the Amatole – Kei have been developed for implementation under the ten main strategy groups.

The Amatole – Kei catchments have an overall surplus water yield. However, this general statement can be misleading as local deficits are experienced in some catchments such as the Klipplaat River in the Upper Kei catchment, the upper Buffalo River in the Amatole catchments, the upper Keiskamma River, the upper White Kei River below Macubeni Dam, the Tsomo River below Ncora Dam due to inter-catchment transfers, and in the upper Thomas River catchments due to run-of-river irrigation use. This situation is further dependent on the intermediate level ecological Reserve determinations still to be undertaken for some of these catchments.

Continued urban and industrial growth in the Buffalo City Municipal area and the resultant growth in water demand will require the implementation of effective conservation and demand management measures and water re-use options to limit demand. Additional development of water resources will nevertheless be required, some time between the years 2012 and 2015 depending on the success of the East London IDZ in attracting industries. The importance of timeously initiating studies for BCM's future water supplies should not be ignored. At the same time the quality of water of the main rivers currently supplying the BCM is deteriorating and a comprehensive water quality management plan will need to be put in place in the short term to address the situation.

Within the Upper Kei catchment there has been an over-allocation of water from Waterdown Dam which is Queenstown's main water supply. With the revitalisation of the defunct irrigation schemes established during the period of the former Ciskei and Transkei and the taking up of water rights and allocations, the assurance of water supply to Queenstown is decreasing. A study is presently being undertaken to address the problem, and implementation of the recommendations is on the critical path if the town is not to suffer from permanent water restrictions in the near future.

A very important support role will be required from DWAF in aligning itself with the Provincial Government's Growth and Development Strategy, which has as one of its main pillars for the eradication of poverty, the revitalisation and expansion of agriculture (irrigation) especially in the former Ciskei and Transkei areas. Close co-operative governance and liaison will be required between officials of DWAF, the Provincial Department of Agriculture and the District Municipalities in order to ensure the efficient, effective and timeous allocation of available water for this purpose.

While it is recognised that the groundwater resources of the region must play an important part in securing the future water supplies, the lack of knowledge, understanding and data on this valuable resource needs to be urgently addressed if this resource is to play a meaningful role.

With the role of DWAF in the future focusing on support, monitoring and regulation rather than direct service delivery, it is vital that the monitoring and information systems within the Department both at a regional and national level are upgraded and become fully functional and populated with reliable data. This is critical for the future success of DWAF in supporting not only DWAF officials but also the wider public service and civil society.

Ensuring effective implementation of the ISP is the major challenge that lies ahead. The key to success will be to appoint staff to be responsible for the various strategies and their implementation. The responsible DWAF staff need to buy-in and take ownership of these strategies, develop them further and refine and improve them. Champions i.e. specialised Directorates and staff in DWAF Head Office, who will support the implementation of the regional strategies are equally as important. Any proposed action must conform to these strategies or require special evaluation against ISP priorities if it is to be supported.

The various actions required to implement the ISP strategies have as far as possible been identified and listed under each strategy. The general lack of adequate skilled human and financial resources will however influence the scope of work that can actually be addressed under the various strategies. This limitation should not be underestimated if the strategies are to be successfully developed in the future. Each strategy has been prioritised. Following on from this study, a further requirement is that the actions listed under each strategy should be revisited and prioritised to be in line with the available resources and funding to implement each strategy. The possibility of repositioning or retraining DWAF staff to be able to address the identified strategy priorities must be considered. Alternatively, obtaining additional staff resources with the right training and mindset must receive the highest consideration.

It has not been possible to develop all possible strategies that may be required. For example, a detailed strategy to deal with the East London IDZ development with respect to water re-use may still be necessary. The critical issue of soil conservation needs a detailed co-operative strategy that must be compiled together with the PDoA. Other required strategies may become apparent, and should be developed as they become necessary. Some strategies combine aspects that may need to be expanded

into separate strategies. The issues or problems encountered with water supply and sanitation programmes, especially in rural areas, are not addressed in this ISP.

It is recognised that there are likely to be some omissions and unforeseen priorities, but this ISP provides the basis for further development. Where the need for certain strategies has been identified but the information for a detailed situation assessment is lacking, future management action will be required to develop such strategies. This aspect applies specifically to the following areas:

- The issue of transfer of water from the Tsomo catchment (Ncora Dam) to the Mbashe catchment for generation of hydropower by Eskom in the Mbashe catchment needs to be analysed in view of the extreme poverty in the Tsomo catchment.

- The need for a comprehensive Soil Conservation Programme to be undertaken by the Provincial Department of Agriculture with the support of DWAF in order to protect the surface and groundwater resources.

- The removal and/or licensing of alien wattle plantations in the ISP area requires further investigation due to their importance (existing and potential) for the local rural economy. This is connected to a strategy for further commercial forestry in the area, which at present has not been considered as a possibility.

- Due to the pristine nature and environmental sensitivity of the area's rivers and estuaries, it is vital that the ecological Reserves are analysed to a level which instills confidence in their use. Only then can a detailed strategy be developed for implementation of Reserve releases and monitoring.

This ISP will form the basis on which the water resources of the ISP area will be managed until the CMA for WMA 12 has been established. It is expected that the ISP will be updated annually as new information, requirements and priorities are established. This ISP will provide a valuable basis for the future CMA to use and from which it can develop its own catchment management strategy.

# SECTION 2 : STRATEGY TABLES

# AMATOLE – KEI INTERNAL STRATEGIC PERSPECTIVE

# STRATEGY TABLES

## INTRODUCTION

The water resource management strategies presented in this **Section 2** of the Amatole – Kei ISP draw on the information detailed in the previous situation assessment chapters provided in **Section 1**. The strategies presented provide a basis for DWAF's management of the water resources of the area until such time as responsibility can be handed over to a Catchment Management Agency (CMA).

The approach adopted in developing these strategies is given in **Section 1, Chapter 1.3.2**. It has not been possible in this first phase of the ISP process to formulate all the details pertaining to every strategy, but rather to provide a framework for each strategy within which the details will be developed, both by DWAF and the CMA once it has been established.

The strategies are grouped under ten main headings. Where the need for certain strategies has been identified, but the information for a detailed situation assessment is lacking, future management action will be required to further develop those strategies. This applies specifically to the following areas:

- Improved knowledge regarding ecological water requirements (Reserves) is essential to determine the volumes of water available to users.
- The removal and/or licensing of invasive alien wattle plantations in the ISP area could affect the local rural economy. This is connected to a strategy for further commercial forestry in the area.
- Need for a comprehensive Soil Conservation Programme to be undertaken by the Department of Agriculture with the support of DWAF in order to protect the water resources from sediment runoff.
- Transfer of water from Ncora Dam to the Mbashe catchment for the generation of hydropower by Eskom and for the Ncora Irrigation Scheme.

# STRATEGY NO. 1

# YIELD BALANCE AND RECONCILIATION

## Need for Yield Balance and Reconciliation Strategies

The various sectors within the Amatole – Kei ISP area have different overall water requirements and these requirements are generally at different levels of assurance of supply. The individual rivers in the sub-areas vary from stressed to unstressed catchments compared to the overall yield balance for the whole ISP area, which shows a surplus. Expected economic growth coupled with the need for urban expansion especially in the Buffalo City Municipality (BCM), and the revitalization and expansion of irrigation schemes in the former Ciskei and Transkei homeland areas will place further demands on the available water resources.

Yield balance and reconciliation strategies address the need to:

- ⇨ Clarify uncertainties and information gaps regarding the availability of surface water and groundwater.
- ⇨ Undertake detailed water requirement investigations including obtaining more accurate information on ecological Reserve requirements.
- ⇨ Develop and implement water reconciliation strategies for specific systems, geographical areas or water sectors. By far the most important strategy is for the Amatole Water Supply System (AWSS), which supplies BCM and some irrigation.
- ⇨ Implement compulsory licensing, if necessary.

The strategies further address the key elements of:

- Future water supply to the Queenstown/Sada region.
- The importance of irrigation as potentially the largest water user sector and one of the pillars for economic growth and poverty eradication.

Adequate amounts of water for urban, industrial and agricultural use at acceptable assurances of supply are required for BCM and Queenstown, rural towns and villages and for irrigation. This will require co-ordinated and timeous planning in order to meet future demands. Reference should be made to Strategy No. 3.1 (Water Allocations and Licensing) for additional information.

## Relevant Identified Strategies

The following specific strategies have been developed:

1.1 Water Availability, Use and Reconciliation
1.2 Groundwater Resources
1.3 Reconciliation Strategy for Buffalo City
1.4 Reconciliation Strategy for Queenstown
1.5 Water Supply to Irrigation Schemes in Former Homeland Areas
1.6 Re-use of Water

# 1.1 WATER AVAILABILITY, USE AND RECONCILIATION

**Management Objective**

To identify and address the uncertainties, assumptions and gaps in the information/data and methods used to determine the water availability and water demands in the various catchments and systems of the Amatole – Kei ISP area.

**Situation Assessment**

Reference should be made to Reconciliation Strategies for Buffalo City and Queenstown (Strategy Nos. 1.3 and 1.4).

The accuracy of the yield of the surface water and groundwater resources is dependent on the **reliability of the available input data**, of which rain gauge data (reliability and record length), flow gauge data, water abstraction, and land use are the most significant. Changes in land use activity (including removal of invasive alien plants), transfer of water authorisations, re-use of water and utilisation of groundwater resources will introduce both quantity and quality impacts.

It is difficult to make important decisions regarding water allocations based only on broad brush modelling estimates unless there is reliable input data. At present most of the data available for the former Ciskei and Transkei areas precedes 1980 with very little data having been collated in the past twenty years. In addition there are only a few reliable flow gauges. The installation and maintenance of additional stream flow gauges and rain gauges must receive a high priority in the ISP area. **Water availability** is also very dependent on the classification of the various freshwater bodies in terms of the ecological Reserve requirements, which should be estimated to at least an intermediate level (refer Strategy No. 2.2). The pristine nature of many of the rivers in the ISP area will require high ecological Reserves, which will need to be more accurately determined and taken to public consultation in areas where water deficits arise.

In order to accurately define the yield balance in any particular catchment, it is necessary to estimate the present water demands and the most likely growth pattern in the future. The latter depends on accurate **water use** data in the catchments, which is often not available due to the lack of water meters in the water distribution systems, as well as the inaccuracy of water meters especially after a number of years of use. Future growth patterns in any area depend on an interaction between demographic, socio-economic, environmental and political factors, HIV/AIDS, amongst others, which are not always well understood and which change over the years. It is therefore important that water availability and water requirements and the subsequent yield balances are updated for each catchment on a regular basis. Historically this has not happened in this ISP area, apart from the Amatole and Upper Kei systems, with the result that yield balances in most of the catchments of the area are not accurately defined and are best estimates based on outdated data.

**The Amatole Sub-area**

The yield of the area was updated and extended as part of the Amatole Water Resources System Analysis (Phase II) in 1999 (**Ref. 4 and 26**). The system consists of seven dams viz. the Maden, Rooikrantz, Laing and Bridle Drift Dams on the Buffalo River, the Nahoon Dam on the Nahoon River and the Gubu and Wriggleswade Dams on the Kubusi River, an inter basin transfer tunnel, canals, purification works, pump stations and bulk supply pipelines.

The quantity of water available in the sub-area including inter-basin transfer from Wriggleswade Dam on the Kubusi River to the Buffalo and Nahoon catchments at a 98% assurance is 98 million $m^3$/a with 78 million $m^3$/a allocated for domestic, urban and industrial use plus an allocation of 20 million $m^3$/a for irrigation and afforestation. Based on the BCM Water Services Development Plan (**Ref. 5**), the high

growth scenario for water demand in the region shows a growth in domestic, urban and industrial use from 50 million $m^3$/a in 1996, to 69 million $m^3$/a in 2005, to 101 million $m^3$/a in the year 2015 ie an average annual growth of approximately 3,5% p.a. No growth in the irrigation sector is expected. The low growth scenario for water demand is marginally less than the above high growth figures (less than 1%). The high growth scenario for the BCM area is almost double the growth projected for the whole Amatole sub-catchment of 1,9% p.a. for the years 2000 to 2025 (**Ref. 8 - NWRS**). This is based on the fact that most economic growth opportunities and population growth will occur within the BCM area.

Based on these figures and without water conservation and demand management programmes (WCDM), water re-use or alien plant removal, the available raw water supply is expected to meet the demand on the system up to the year 2012, at which time additional raw water supplies will be required. This date may be delayed depending of growth in the area and if WCDM, water re-use and invasive alien plant removal efforts are implemented successfully. The largest unknown factors in establishing the reconciliation for the area and the timing for new raw water supplies are :

- The projected water requirement scenario for the area. The water requirements of industry (especially wet industries) still to be attracted and established in the new East London Industrial Development Zone (ELIDZ) and the growth of the urban sector within the BCM can only be roughly estimated at this stage.
- The effect of WCDM measures still to be implemented. It is estimated that water use could be reduced by a least 6 million $m^3$/a.
- The additional water due to invasive alien plant removal in the upper Buffalo and Kubusi catchments. Preliminary estimates show that an additional 1,3 million $m^3$/a may be made available for use.
- The viability of treated effluent re-use for industry. The ELIDZ developers are currently conducting a feasibility study on the supply of treated effluent (approx. 6 million $m^3$/a) from the East Bank Water Reclamation Works to the new ELIDZ.

Once the available water resources of the present system have been fully utilized, additional raw water could possibly be made available from one of the following identified surface water resources:

- Transfer of water from the Keiskamma River catchment to the Buffalo River catchment – from Sandile and Binfield Park Dams if these dams are not fully utilized for local use or abstraction weirs in the middle and lower reaches of the catchment.
- Further regulation (dam) of the Nahoon River.
- New dams and/or abstraction works on the Gqunube, Kwelera and Great Kei Rivers.

The available water resources from these conceptual proposals have not been studied in detail. Accurate flow gauging data should be collated for these rivers in preparation for such a study together with revised water demand estimates for the catchments. A flow gauging weir will be installed in the lower Kwelera River within the next twelve months. Water re-use options could compare favourably with these options.

Groundwater resources are not expected to make any impact on the volume of available water other than for small coastal and rural village supplies

**The Keiskamma Sub-area**

This sub-area is mainly located in the former Ciskei homeland and has not been studied in any detail for over twenty years, with the result that there is low confidence in the available information. In view of the important role that the river and its dams (Binfield Park, Sandile, Cata and Mnyameni) will play in the rehabilitation of irrigation schemes, economic growth and poverty alleviation in the region as well as being a possible future source of raw water for BCM, it is imperative that an accurate assessment is undertaken of the available water resources as well as the water requirements within the catchment based on up to date information.

**Upper Kei Sub-area**

The Upper Kei Basin Study (**Ref. 19**) was completed in 1993 and included a detailed investigation into the yield balance in the catchments of this sub-area. The Queenstown Regional Water Supply Feasibility Study (**Ref. 20**) was completed in 1997. A DWAF follow up study is currently being undertaken to reconsider reconciliation intervention options and to develop an implementation strategy. This study will be complete in March 2005. The recommendations contained in this study will then be implemented by the Chris Hani District Municipality. The already completed studies indicated the following yield balances:

*Klipplaat/Oxkraal Catchment (S32D/E/F/H)*
The present allocation for urban use from Waterdown Dam for Queenstown and Sada/Whittlesea is 8,25 and 4,2 million $m^3$/a respectively with a further allocation of 14,8 million $m^3$/a for irrigation. The actual yield of the dam (17,5 million $m^3$/a) is less than these allocations. Due to the fact that some of the allocation for irrigation is not currently used, no major water shortages have been experienced.

This situation could change with the revitalization of the Shiloh Irrigation Scheme, the taking up of existing allocations for other irrigation and for urban use in Queenstown, and by the fact that the ecological Reserve may be larger than is assumed at present.

The yield from Oxkraal Dam, which could be used to supplement the above allocations, is 5,5 million $m^3$/a. However, there is still a substantial shortfall in the ability of the system to meet the water allocations at the required assurance of supply. This is exacerbated by the water losses in the river downstream of the dam.

It should also be noted that there is substantial use of water upstream of Waterdown Dam, both for opportunistic irrigation from small dams, as well as directly from the Klipplaat River. This usage represents some 20% of the runoff into the dam and has a significant impact on the yield of the dam.

Additional water could be made available for urban use by means of the following options :

- Operating the Waterdown and Oxkraal Dams as a system.
- Increase the yield of Waterdown Dam by raising the wall.
- Transfer of water from Xonxa Dam.
- Use the unused portion of yield from Bushmanskrantz Dam.
- Reduce the water allocation from Waterdown Dam for irrigation by trading of water rights.
- If possible, reduce the run-of-river use upstream of Waterdown Dam.
- Construct a dam on the Klaas Smits or Black Kei Rivers.
- Increase the use of groundwater (if found to be available) as an alternative supply for irrigation.

The current DWAF study to update the information contained in the previous Queenstown Water Supply Feasibility Study (1997) (**Ref. 20**) will address the above.

*Upper Black Kei Catchment (S32A/B/C)*
The catchment includes the Black Kei River down to its confluence with the Klipplaat River. The current and projected water requirements based on original developments at the Nthabethemba Scheme (excluding ecological Reserve requirements) are in excess of the available water resources. However these lands are no longer irrigated with only some 50ha at Tentergate and a small area at Glen Brock being irrigated. The Thrift and Limietskloof Dams in the upper catchment are currently unutilized. The Glen Brock and Thrift Dams have dam safety problems and a decision is needed on the future of these two dams. The Thrift Dam is important from a recreational perspective due to its use for trout fishing and could be sold.

If required, additional water resources could be harnessed by development of the groundwater resources in the catchment, which are believed to be favourable. Further study of this catchment is required due to the outdated data available.

*Klaas Smits Catchment (S31)*
Both the surface and groundwater resources of this catchment are heavily exploited, with water requirements exceeding the available water. A significant portion of the water requirements (allocation of 8,25 million $m^3$/a for Queenstown) is met by importing water from Waterdown Dam and by re-using water from the Queenstown effluent treatment works for irrigation purposes downstream of the town. Queenstown also obtains 1,5 million $m^3$/a of its supply from Bongolo Dam within the catchment. The water requirement for Queenstown was 7,3 million $m^3$/a in 2002. Based on the NWRS predicted population growth rates, the water requirement will increase to 7,7 million $m^3$/a in 2005 and 8,4 million $m^3$/a in 2015.

The bulk of water for irrigation is opportunistic either from run-of-river but mainly from alluvial groundwater resources. It has been estimated that groundwater abstraction rates may exceed the sustainable yield. But without adequate data on the groundwater resources in the catchment it is not possible to accurately estimate the water balance.

*Lower Black Kei Catchment (S32J/K/L/M)*
The main use of water in this catchment is for irrigation with water allocated from Waterdown Dam. However, this allocation makes no allowance for losses between the dam and the irrigation areas. In addition there is an over-allocation of water from the dam. This results in a shortfall between available resources and water requirements. Ecological Reserve requirements for the catchments are not well known.

*White Kei Catchment (S10)*
The available water resources within the overall catchment exceed the water requirements. However, within the upper catchment of the Cacadu catchment above Macubeni Dam, the water balance shows a deficit due to irrigation requirements, domestic use for Lady Frere and surrounding rural villages from Macubeni Dam, and for the ecological Reserve requirements. The catchments above and below Xonxa Dam have a surplus of water with the yield from the dam more than meeting the irrigation requirements. Although it is known that there is a surplus of water from Xonxa Dam (the dam is being considered for supply to Queenstown) accurate data will only be known on the conclusion of the update to the Queenstown Water Supply Study presently being undertaken.

It is believed that the groundwater resources of the catchment may be a great deal larger than previous estimates with reports of deep borehole drilling (300m) in the ring structures delivering yields in excess of 30 l/s. This aspect is being further investigated under a Water Research Commission (WRC) funded project.

*Doring and Indwe River catchments (S20)*
The available water resources within this catchment with the Doringrivier and Lubisi Dams exceed the water requirements. This provides the opportunity for the revitalisation and expansion of the Qamata irrigation scheme downstream of the Lubisi Dam. Ecological Reserve requirements need to be more accurately defined as do the groundwater resources.

**Middle Kei Sub-area**

The available water resources above the Ncora Dam on the Tsomo River exceed the requirements of the upper catchment. The transfer of water from the dam to the Mbashe catchment for the Ncora irrigation scheme (20 million $m^3$/a) and for hydropower generation by Eskom (85 million $m^3$/a) both at Ncora and Collywobbles is not adequately quantified. Flow gauging is currently being installed to measure the amount of water transferred to the Mbashe catchment for hydropower generation and at the start of the Ncora irrigation canal. The theoretical average figure previously used by DWAF is 85 million $m^3$/a. This figure is not an accurate estimate of previous transfers where in high rainfall years it is estimated that over 120 million $m^3$/a has been transferred and in poor years less than 65 million $m^3$/a. As part of the Emerging Farmer Study currently being undertaken by DWAF as well as the new gauging equipment, more accurate data will become available on the actual yield of Ncora Dam, water requirements and surplus water.

Below Ncora Dam the Tsomo River is joined by the Tsojana River with the Tsojana Dam in the upper catchment. There is a surplus of water below the confluence of these two rivers due to the unused yield from Tsojana Dam. This will need to be confirmed once the Ncora Dam water balance has been more accurately defined. This will entail high level interaction with Eskom in order to determine the most beneficial use of the water in the catchment.

Within the Thomas River catchment there is a water deficit due to the high run-of-river use for irrigation resulting in reduced water for ecological Reserve requirements. The water requirement and balance in this catchment need to be more accurately defined.

There is an overall small deficit in the water balance in this sub-area due to the large inter-basin transfer of water to the Mbashe catchment.

**Lower Kei Sub-area**

The lower Great Kei River has a surplus water balance but due to the river and estuary having a very important eco-status, it is necessary that at least an intermediate Reserve determination be undertaken.

Within the sub-area General Authorizations apply to the Kubusi catchment above Wriggleswade Dam and to the Gcuwa River above Xilinxa Dam. All surplus water resources in the former have been reserved for urban use in the catchment and for inter-basin transfer to the Buffalo City Municipality.

The available yield from Xilinxa Dam has been allocated to Butterworth and for rural domestic use. However, these water allocations have not been fully utilized due to the lack of development in Butterworth and the slow implementation of rural water supply. Owing to the unknown losses in the river between the dam and Butterworth as well as the ecological Reserve requirements, it is not possible to accurately define the water balance in this subcatchment. There is a need to undertake this exercise due to the pressing demand for water supply to the rural areas.

Future water requirements in this catchment will be mainly for rural water supply and for domestic supply to a developing Kei Mouth/Morgan Bay tourist resort. A proposed mining development at Wavecrest using water from the Great Kei River has been shelved for the present.

**Whole Amatole-Kei ISP Area**

The following issues and concerns have been identified :

- Available information on the following general aspects is inadequate:
  - Accurate yields from farm dams and run-of-river yields for all ISP sub-areas.
  - Ecological Reserve requirements of both rivers and estuaries and their effect on the yields of the water sources.
  - The impact of invasive alien plants on the yields of water sources.
  - The distribution, types and areas of crops irrigated and their water requirements.
  - The reasons for the limited use of the groundwater resource in relation to its apparent total potential, especially in the upper and middle Kei catchments. This aspect is currently being addressed in the latest Lukhanji (Queenstown) Water Supply Study due for completion in March 2005.
  - Up to date hydrology and yields for rivers and dams in the former Ciskei and Transkei homelands.
- Lack of sufficient flow and rainfall gauging stations, especially in the catchments of the former Ciskei and Transkei homelands. These catchments include the Keiskamma, the Black Kei, the Klipplaat, the White Kei, the Doring and the Tsomo Rivers.
- The need for revised yield balance scenarios for the Amatole Water Supply System using the results of the Amatole Environmental Study completed in 2002 and up to date projections for urban demand within BCM.
- The need for a revised yield balance scenario for the Klipplaat River Government Water Scheme, which includes supply to Queenstown. This aspect is currently being addressed in the latest Lukhanji Water Supply Study due for completion in March 2005.

- The need to re-assess the available yield from Xonxa Dam as a potential supply to Queenstown.
- The lack of information regarding the available sustainable yield of the groundwater resources in the ISP area.
- Implementation of the Provincial Department of Agriculture (PDoA), the Co-ordinating Committee for Agricultural Water (CCAW), and the District Municipalities (DMs) programme for the revitalization and expansion of irrigation schemes based on available funds.
- The lack of further surface water resources for domestic rural water supplies in the area presently supplied from Macubeni Dam. Further supply will have to be based on additional dams or groundwater resources.
- The present and future requirement for water for hydropower by Eskom from Ncora Dam.
- The available yield from Ncora Dam in order to include the ecological Reserve requirements and revise the allocation for basic needs, irrigation and hydropower.
- Land use, type of crops, farm dams and irrigation water requirements in the Thomas catchment.
- Revised water allocation from Xilinxa Dam on the Gcuwa River due to the changing growth pattern in Butterworth.

**Strategic Approach**

*Reliability of data*
Improve the knowledge of surface water availability by promoting the installation of more rain gauges and gauging stations throughout the ISP area. A priority list should be compiled. Increase the number of water level recorders in the catchments of important estuaries. Update the information with respect to existing and future water requirements in the catchments.

*Water availability*
Update the hydrology and yields of the river systems according to a priority list to be drawn up by the RO. The priority list should be based on specific needs, such as a water use licence applications or if there is reason to believe that the yields will change when more recent ecological Reserve requirements are taken into account.

Address the lack of groundwater information by initiating studies and installing systems that improve knowledge about groundwater availability throughout the area, but especially in the Great Kei catchment.

*Water use*
Complete water supply studies already started by DWAF eg. Lukhanji (Queenstown) Water Supply Study and the East Cape Resource Poor Farmer Study.

Reconciliation studies that take into account the most up to date information are required in the most critical areas of the study area. This especially applies to the Amatole Water Supply System.

Once accurate information regarding the use of water by Eskom becomes available, it will be necessary for DWAF to liaise with Eskom and establish their future hydropower needs and strategies for their hydropower stations in order to undertake a reconciliation study for Ncora Dam and the catchment.

**Management Actions**

1. Increase stream flow and rainfall gauging especially in those river catchments that were located in the former Ciskei and Transkei homelands (refer Strategy No. 9.1).
2. Determine run-of-river and farm dam yields for the prioritized catchments.
3. Undertake more detailed ecological Reserve determinations (intermediate to comprehensive) on the river systems based on a prioritized list (refer Strategy No. 2.2).
4. Calculate the present and potential impact of invasive alien plants on yields in this ISP area (refer Strategy No. 3.2).
5. Improve knowledge on irrigation areas, crop types and water use from the registration process where possible.

6. Undertake more detailed assessments of the availability and existing use of groundwater according to the Groundwater Strategy No. 1.2.
7. Update the yields of dams in the former Ciskei and Transkei homelands for various levels of assurance.
8. Initiate as a matter of urgency a detailed study on WCDM in the BCM area.
9. Initiate the proposed Amatole Water Supply Scheme Reconciliation Study in the near future (refer to Strategy Nos. 1.3 and 8.1).
10. Complete the Lukhanji (Queenstown) Water Supply Study and implement the recommendations contained therein. This study will include recommendations for solving the over allocation of water from Waterdown Dam as well as the possible use of water from Xonxa Dam and other dams in the catchment (refer Strategy Nos. 1.4 and 8.2).
11. Continue to assist the PDoA and DMs with an implementation programme for the revitalization and expansion of irrigation schemes (refer Strategy No. 6.1).
12. Undertake a groundwater study to determine the available groundwater resources for use in augmenting the Cacadu Regional Water Supply Scheme presently supplied from Macubeni Dam.
13. Initiate discussions with Eskom and determine their future strategy with respect to future hydropower generation at Ncora and Collywobbles. If necessary, initiate a study to determine alternative uses of water from the dams that will be more beneficial to the local population in terms of poverty eradication and economic growth. This latter aspect is being partially investigated in the East Cape Resource Poor Farmer Study.
14. Undertake a reconciliation study to investigate the possible re-allocation of water from Xilinxa Dam on the Gcuwa River.

**Responsibility**

DWAF Regional Office with the assistance of the Directorates : National Water Resource Planning, Options Analysis, and Information Programmes (Geohydrology).

**Priority**

Priority 2 – High.

# 1.2 GROUNDWATER RESOURCES

**Management Objective**

The key management objective is to evaluate the groundwater resource situation for the ISP area and to propose management actions to obtain better a understanding and management of groundwater resources in the WMA .

**Situation Assessment**

Groundwater primarily supplies rural villages and coastal resorts. The economic and/or social cost is high in the event of failure of supply and is almost always as a consequence of poor management. Due to the nature of the water supply programmes, limited resource evaluations on regional and local scales are available from studies documented in the DWAF BoTT programme and other local government programmes. It is a concern to DWAF RO that studies and development of groundwater are undertaken by other central government departments, local government, aid organizations and the private sector without a more integrated involvement by DWAF. As a result much information is lost. Groundwater use registration is incomplete.

Detailed knowledge of the following aspects could lead to a much greater understanding of the groundwater resources of the region:

- The contribution of the ring structures at Butterworth, Komga, Toleni and Cathcart.
- The variation of water quality between the fractured and intergranular rock.
- The contamination of groundwater resources due to poor construction of VIPs.
- The negative effect that soil erosion may have on both the quantity and quality of groundwater.
- The limited available borehole as well as spring monitoring data.
- The importance of a strategic management relationship between Geohydrological Provinces and catchment management areas.

**Strategic Approach**

There are five key priorities:

1. To compile a clear management view on the importance of groundwater for this ISP area.
2. To develop close co-operation and common purpose with existing studies and specialists in order to access and optimize the available knowledge base.
3. To initiate the planning of a GIS data and information base useful to local government, Departments of Land Affairs and Education, other DWAF Directorates, Aid Organisations, NGOs and the private sector.
4. To promote the integration of surface, groundwater and ecological monitoring/data collection, centralization of results and access at ROs and regular interpretation and use of the results as input into an accessible GIS based information system.
5. To compare groundwater supply in relation with the socio-economic context and identify needs in order to ensure sustainability of the resource.

**Management Actions**

The following actions are required:

- Continue to strengthen and promote the groundwater component of the water management institution.

- Investigate the introduction of Geohydrological Provinces in the formal water management areas.
- Quantify the strategic importance of the linear features that extend along WNW/ESE trends between King William's Town and East London.
- Continue to develop groundwater schemes in the ring structures as a strategic water resource in the WMA.
- Identify and protect areas that are susceptible to groundwater contamination.
- Engage in discussions with the Department of Agriculture concerning soil erosion and degradation of groundwater resources.
- Develop a proper monitoring network for both groundwater and springs.

**Responsibility**

DWAF Regional Office and Head Office Directorate : Information Programmes (Geohydrology).

**Priority**

Priority 1 – Very high and ongoing.

# 1.3 RECONCILIATION STRATEGY FOR BUFFALO CITY

**Management Objective**

To draw up a plan of action to ensure that the water requirements of this important area are always met at acceptable levels of assurance. This must be undertaken with the co-operation of all role players to ensure that buy-in is achieved.

In achieving this objective DWAF must ensure that all the existing water resources are being optimally used.

**Situation Assessment**

(Note : This strategy should be read in conjunction with Strategy Nos. 1.1 and 8.1)

Growth in raw water requirements in the BCM area due to expansion of urban and industrial demands is expected to exceed available supplies sometime around the year 2012 (for a 98% assurance of supply). The date will depend on measures adopted by the BCM, such as water conservation and demand management programmes and water re-use, as well as the growth in demand from the new East London Industrial Development Zone (ELIDZ).

Due to the importance of the area as a centre of economic activity and future economic growth for the region as a whole, the highest priority should be given to ensuring that a sufficient supply of raw water at a high level of assurance is always available. The estimated urban water requirement (ignoring WCDM programmes still to be initiated) for BCM of 79 million $m^3$/a by the year 2012 will be close to the maximum available yield of 80 million $m^3$/a (**Ref. 3, 4 and 5**). However, owing to changing growth patterns in the BCM area over the past six years, these demand figures need to be revisited and revised. The ecological Reserve estimates will also have to be revisited in order to determine more accurate yield estimates where necessary. The available yield also assumes transfer from the Wriggleswade Dam (18 million $m^3$/a), which is currently not being transferred to the Buffalo River due to several years of above average rainfall in the catchments. Time is of the essence as the development of raw water resources can take up to ten years.

Limited financial and skilled manpower resources within the local authorities and parastatal organisations are resulting in the breakdown of adequate service provision, a lack of effective operational and maintenance activities, and a lack of planning and provision of capital works to meet the needs of the region. The Water and Sewage division of the BCM is 35% understaffed at present, although the situation is far worse due to the loss of experienced personnel.

Groundwater is unlikely to play any significant role in water supplies to BCM, other than for rural villages and coastal resorts within the municipal area.

**Strategic Approach**

The main issue of **additional water supply for Buffalo City** first requires that the following sub-issues be addressed.

- Ownership, operation and maintenance of the Amatole Water Supply System is complex with at least four organizations being involved ie DWAF, the Amatola Water Board (AW), the Amatole District Municipality (ADM) and the BCM. Different organizational structures with different objectives, planning and management systems, tariff structures etc are leading to a breakdown of co-operative governance, disjointed planning and sub-optimal use of the available raw water supplies of the system. Reference should be made to Strategy No. 8.1 for additional details.
- High water losses are occurring in areas such as Mdantsane due to run-down, vandalised and poorly maintained water infrastructure as well as illegal connections.

- Limited re-use of treated effluent is currently taking place by industry and for irrigation of golf courses. Owing to their proximity to the coast some effluent treatment works discharge waste water either directly into the sea or into rivers below existing dams. This includes the new Hood Point sea outfall on the West Bank which will discharge large amounts of screened raw sewage.
- Large infestations of alien plants (silver and black wattle) in the upper Buffalo, Nahoon and Kubusi catchments are reducing the run-off in these rivers.
- Recent estimates undertaken by the Amatola Water Board (AW) of existing and future water requirements show a change since the last investigations were undertaken as part of the Amatole Systems Analysis (**Ref. 4**). This has come about as a result of the change in the municipal boundaries of the new BCM, the type of industries likely to be established in the new ELIDZ as well as the possible effect of HIV/AIDS. In addition, new methods for assessing the ecological Reserve requirements of the rivers have been developed and used. These estimates need to be accessed and incorporated in the next planning stages.

**Management Actions**

Before the issue of BCM's existing and future water supply problems can be adequately addressed, it is critical that co-operative governance be re-established. Refer to Strategy No. 8.1. This could be achieved by the formation of an Amatole System Liaison Committee or a System Authority with representatives from all parties in order to improve co-operative governance on an ongoing basis. Alternatively, sound agreements between all parties on all aspects of the operation and management of the Amatole Water Supply System need to be put in place. Once this has been achieved, the main issue and following sub-issues can be addressed in a co-ordinated manner.

1. Undertake the proposed DWAF study titled "Reconciliation Strategy for Large Bulk Water Supply Systems – Amatole Water Supply System (Buffalo City)" within the next two to three years.
2. Ensure that the system is operated according to the recommended operating rules. This should include the application of an equitable tariff structure in order to extract the maximum raw water from the system.
3. Implement a water conservation and demand management programme with a major focus on Mdantsane.
4. Investigate the economical use of treated eflluent especially by existing industries in BCM and by new industries in the ELIDZ.
5. While it is recognized that the use of treated effluent may not always be economical and that effluent returned to rivers does to some extent satisfy the ecological Reserve requirements, it is considered important that the feasible use of treated effluent by industries should be investigated and quantified before any major new raw water resources are developed. Management of the ELIDZ are favourably considering this at present and are conducting feasibility studies for the transfer of up to 6 million $m^3$/a (20 Ml/d) of reclaimed water from East London's East Bank WWTW to the ELIDZ site.
6. The Working for Water programme is active in the upper catchments of the system but needs to be expanded.
7. Investigate the harnessing of additional raw water resources from all possible sources including :

    - The Nahoon River
    - The Gqunube River
    - The Kwelera River
    - The Great Kei River
    - The upper Keiskamma River (Sandile and Binfield Park Dams)
    - The lower Keiskamma River

A concerted effort is required by all parties to retain, attract and train skilled water and sanitation personnel in the region. This task would be enhanced by, for example, the rationalization of water supply activities under a single Water Authority for the Amatole Water Supply System as recommended in Strategy No. 8.1.

**Responsibility**

DWAF Regional Office and National Directorates : Water Resource Planning and Options Analysis, together with the Buffalo City Municipality, Amatola Water Board and the Amatole District Municipality.

**Priority**

Priority 1 – Very high.

# 1.4 RECONCILIATION STRATEGY FOR QUEENSTOWN

**Management Objective**

To ensure that sufficient additional raw water resources are developed timeously and made available to the urban areas of Queenstown and Sada/Whittlesea at an acceptable level of assurance to meet the growing requirement for water. In achieving this objective DWAF must ensure that all the existing water resources and dams are being used optimally and that sufficient water is made available for the revitalisation of the irrigation schemes below Waterdown Dam.

**Situation Assessment**

Owing to the very important role that Queenstown plays in the inland region of this ISP area it is imperative that sufficient raw water and related infrastructure is always available to meet the town's requirements. Previous studies have indicated that additional raw water for domestic purposes would be required by the year 2000, but were based on the assumption that the full water allocation for irrigation was being used, which is not presently the case. Water restrictions were introduced in December 2003 in Queenstown due mainly to the fact that the main supply pipeline from Waterdown Dam could not deliver the peak water requirements and the fact that there was very little water available from the Bongola Dam.

The present allocation for domestic use from Waterdown Dam for Queenstown and Sada/Whittlesea is 8,25 and 4,2 million $m^3$/a respectively with a further allocation of 14,8 million $m^3$/a for irrigation. The actual yield of the dam (approximately 17,5 million $m^3$/a) is less than the sum of these allocations. Owing to the fact that some of the allocation for irrigation is not currently used and that which is used, is at a low level of assurance, no water shortages have yet been experienced. This will change as the irrigation rights are taken up with the revitalisation of the irrigation schemes in the Klipplaat Government Water Scheme/Shiloh area which accords to the provincial government's policy on food self sufficiency and poverty relief. Part of these irrigation allocations could be converted to domestic allocations if it is found that not all the irrigation allocations are needed.

Studies into the future raw water supply to Queenstown and the surrounding region are presently being undertaken by DWAF, the Chris Hani District Municipality and the Lukhanji Municipality. These studies will obtain more up to date information with respect to actual and future domestic and irrigation water supply requirements including ecological Reserve requirements and the yields from Waterdown, Shiloh and Oxkraal Dams and other available raw water resources in the region such as Xonxa Dam. In addition the limitations of existing infrastructure such as delivery pipelines will be investigated.

*The Main Issue :*

The water allocations from the Waterdown Dam for irrigation and for the urban areas of Queenstown and the Sada/Whittlesea urban complex presently exceed the yield of the of Waterdown Dam. Were it not for the fact that these allocations are not being fully used, the urban areas would be experiencing water shortages. Releases to meet the ecological Reserve will exacerbate the situation. Additional water must be sourced as the irrigation schemes are being revitalized and the urban requirements continue to increase.

**Strategic Approach**

Future augmentation options to meet the growing water requirements of the region should include investigations into the following:

- Water demand management
  Within Queenstown it is estimated that unaccounted for water/water losses are anything between 10 and 30%. Demand and conservation measures need to be put in place by the

Lukhanji Municipality. During the revitalizing of the irrigation schemes it is important that efficient irrigation systems are installed and that the infrastructure is suitably operated and maintained in order to minimize water losses.

- Industrial use of treated effluent
  Use of treated effluent for industry has been discussed in Strategy No. 1.6. Little opportunity is available in this regard as the effluent is presently used for irrigation on the town's golf course and for pastures below Queenstown while industry in the region is in decline.

- Improved supply system operational aspects
  In order to maximise the available yield from the system and increase water availability for domestic requirements, investigations should be undertaken into the optimal operation of the dams in the Oxkraal – Klipplaat system. Refer to Strategy No. 8.2.

- Water trading / buying out of irrigation rights
  Trading of irrigation rights is a possible viable future urban supply augmentation option.

- Supply from Xonxa Dam
  Previous studies (**Ref. 19 and 20**) identified spare capacity in this dam for possible augmentation to Queenstown. This aspect will be further investigated as part of the present study.

- New dams/weirs
  New dams or weirs on the Black Kei River were previously investigated and also the possibility of raising Waterdown Dam. These options are to be reviewed as part of the study.

**Management Actions**

Proceed with the proposed Queenstown Regional Water Supply Study (Phase 2) as a matter of urgency and undertake the recommendations of the study according to the recommended time frames through a project steering committee. As part of this initiative, the following needs to be undertaken:

1. Consider all social, environmental and economic impacts and costs in the comparison and selection of future augmentation options.
2. Investigate the current operation of Waterdown, Shiloh and Oxkraal Dams and the Waterdown Dam allocation and implement operational recommendations from the study.
3. Liaise with and assist the Lukhanji Municipality with the implementation of a water demand management and conservation programme.
4. Investigate the viability and possibility of trading/buying out unused irrigation rights from the Klipplaat Government Scheme.
5. Investigate the potential water supply from Xonxa Dam including undertaking a detailed cost-benefit analysis on any proposed scheme and the implication this scheme will have on future water tariffs for Queenstown.
6. Make recommendations on the future use of the Oxkraal Dam, the Thrift Dam, the Limietskloof Dam and the Bushmanskrantz Dam which are all presently underutilized.
7. In the planning of the augmentation scheme consideration should be given to supplying various rural villages from the scheme.
8. A study of the groundwater potential of the region is to be undertaken both as a possible source of water for urban supply and rural villages.

**Responsibility**

DWAF Directorate : Options Analysis is responsible for bulk water supply planning together with DWAF RO, Chris Hani DM and Lukhanji Municipality for water demand management and effluent re-use.

**Priority**

Priority 1 – Very high.

# 1.5 WATER SUPPLY TO IRRIGATION SCHEMES IN FORMER HOMELAND AREAS

**Management Objective**

To support the Eastern Cape Provincial Government's Growth and Development Strategy (PGDS), which has identified the high growth potential of the agricultural sector in the former homelands as a key component for addressing poverty eradication, household food security and the promotion of economic growth and employment opportunities. This will be achieved by ensuring an adequate supply of raw water at the necessary assurance for those irrigation schemes, which have been identified for rehabilitation and revitalization on a sustainable basis.

**Situation Assessment**

A large number of subsidized irrigation schemes with the necessary associated infrastructure were established under the former homeland governments in the Ciskei and Transkei. These schemes were largely managed by the homeland parastatal organizations, Ulimicor and Tracor. Large dams with funding from South Africa were constructed to ensure adequate supplies of raw water for these schemes. In the years leading up to 1994 and during the period thereafter while local government structures were being established, the parastatal subsidies were dramatically reduced, the parastatals disbanded and most of the schemes fell into disuse and disrepair. As a result the allocated water for these schemes is either not being used, only partially used, or is being used for domestic supply.

These schemes include the following (refer **Appendix B6**) :

- Tyume scheme
  This scheme is situated below Binfield Park Dam on the banks of the Tyume River, a tributary of the Keiskamma River. It was originally planted with citrus, which was predominantly exported to overseas markets. The scheduled area is 231 ha with an annual allocation of 0,7 million $m^3$. This scheme is presently being considered for full privatization or a Community Public Private Partnership (CPPP) arrangement. Binfield Park Dam also supplies water to Alice and surrounding rural villages.

- Zanyokwe scheme
  The scheme located downstream of Sandile Dam on the Keiskamma River consists of 471 ha of scheduled lands of which only approximately 90 ha is presently used mainly for maize and vegetables. The total water allocation for the scheme is 1 million $m^3$/a. Sandile Dam also supplies domestic water to Middledrift, Dimbaza and surrounding rural villages.

- Keiskammahoek scheme
  The Cata and Mnyameni Dams supply water to mainly dairy farming and support enterprises such as pasture lands and maize. Some 744 ha of the scheduled area of 854 ha are estimated to be used at present. The total water allocation for the scheme is 6 million $m^3$/a. The Mnyameni Dam also supplies domestic water to Keiskammahoek and surrounding rural villages.

- Klipplaat Government Water Scheme
  This scheme receives its water from Waterdown Dam. Water is released into the river channel to supply a scheduled irrigation area of 1905 ha along the Klipplaat River to its confluence with the Black Kei River, and along the Black Kei to its confluence with the White Kei River, a distance of some 150 km. There are considerable losses between the dam and lower irrigators. The Shiloh irrigation scheme, which is currently being rehabilitated forms part of this overall scheme. Lucerne, maize and pastures are the main crops grown. The existing allocations from the dam comprising 8,25 million $m^3$/a to Queenstown, 4,20 million $m^3$/a to Sada and 14,83 million $m^3$/a to irrigation cannot be supported at an acceptable level of assurance.

- Oxkraal scheme
  The Oxkraal and Shiloh Dams were constructed with the intention of irrigating 541 ha of land from Oxkraal Dam and 25 ha from Shiloh Dam for small-scale farmers. The lands were never developed and water from Oxkraal Dam is released for use on land scheduled under the Waterdown Dam. Shiloh Dam is unused at present.

- Nthabethemba scheme
  This scheme comprises a number of separate small schemes along the Upper Black Kei River upstream of its confluence with the Klipplaat River. The schemes draw water from the small dams of Tentergate, Mitford and Glenbrock. Although an area of 1200 ha was developed for irrigation much of this area has fallen into disuse due to the very low level of assurance of water supply from the dams. The situation with respect to an increased assurance of water supply by means of additional expensive dam(s) is unlikely to change in the short to medium term due to the uneconomical status of the irrigation schemes.

- Zweledinga scheme
  239 ha of scheduled land is currently supplied with water from the Bushmanskrantz Dam situated on the upper Oxkraal River. Maize is the main crop. The dam also supplies domestic water to a number of rural villages.

- Xonxa (Bilatye) scheme
  The Xonxa dam was constructed in 1972 with the intention of providing water for some 4900 ha of land along the White Kei River, although only some 3490 ha could be supplied at a 90% assurance. The yield of the dam is approximately 33 million $m^3$/a at 90% assurance. Only 1643 ha have been developed but much of this has fallen into disuse and until recently only some 60 ha was being irrigated. This scheme is regarded as having a high potential for revitalization although the expected full potential is only some 1000 ha due to the unsuitable soils. A portion of the surplus water from Xonxa Dam is being considered for use for Queenstown.

- Qamata scheme
  This scheme was established in 1966 to promote irrigation by small-scale farmers using water from the Lubisi Dam on the Indwe River. Water is released from the dam and abstracted 9 km downstream at the Lanti weir. Water is then conveyed to the irrigation lands via a 28 km long canal, two balancing dams and thirty four leidams. The scheduled area comprises 2600 ha but much of the infrastructure has fallen into disrepair and it is reported that less than 25% of the area is currently being used. This scheme is regarded as having a very high potential for revitalization and some effort is presently being undertaken in this regard.

- Ncora scheme
  Although this irrigation scheme in the Mbashe catchment does not fall within this ISP area, it was developed in 1978 using water transfer (20 million $m^3$/a) from Ncora Dam on the Tsomo River. Previous estimates show that the available water from the dam would support some 3000 ha of irrigation which was the area developed at the time. However, for various reasons this once very successful scheme has not prospered in recent years and it is estimated that less than 25% of the area is currently been used. Proposals for revitalizing this scheme and possibly extending it are presently being considered.

A feasibility study funded by DWAF has been commissioned by the Co-ordinating Committee for Small Scale Irrigation Farmers (CCSIS). This study is being managed by the Co-ordinating Committee for Agricultural Water (CCAW), formerly known as the Irrigation Action Committee. The study is investigating the viability of water supply for the possible extension of some of the above irrigation schemes to assist aspiring resource poor farmers (Zanyokwe and Ncora schemes).

The CCAW has commissioned studies into the revitalization of several schemes and on the basis of the study recommendations funds have been made available for upgrading. The Chris Hani DM is currently upgrading the Shiloh Irrigation Scheme.

**Strategic Approach**

The Eastern Cape Provincial Government has developed a "Strategy Framework for Growth and Development" in the province (**Ref. 27**). In addition to the manufacturing and tourism sectors, the document identifies the high potential in the agricultural sector for addressing poverty eradication through sustainable food supplies, employment and income generation in the rural areas where a majority of the population resides. It has been identified that the deep rural areas within the former homelands has some of the best natural resources in terms of available soils and abundant and developed water resources with an estimated 32,000 ha of potential irrigable land. The realization of this potential will be achieved by :

- Programmes to promote household food security by expanded small-holder production.
- Development of commercial agriculture through optimum use of high potential agricultural land in the former homelands.
- Focusing on land distribution and land tenure reform in order to release land for poor households and for new commercial farming enterprises.

The realisation of the objectives of this provincial strategy and the revitalization and expansion of viable and sustainable irrigation schemes depends to a large extent on the key support given by DWAF. To this end DWAF must provide technical knowledge and co-ordinated and timeous support to the relevant provincial government departments and District Municipalities involved in this initiative. The following committees all provide support to this initiative and have DWAF representation :

- The Co-ordinating Committee for Agricultural Water (CCAW)
- The Irrigation Programme Co-ordinating Committee (IPCC)
- The Co-ordinating Committee for Small Scale Irrigation Farmers (CCSIS).

**Management Actions**

The following management actions are required :

1. Assist in the establishment of plans, programmes and studies required for the revitalization of irrigation schemes based on an accurate assessment of the available raw water resources, the state of bulk infrastructure, its ability to deliver and due consideration of any vital alternative demands.
2. Assist with the co-ordination of bulk water supply infrastructure development and rehabilitation. This will require close co-operation between DWAF, the Provincial Department of Agriculture (PDoA) and District Municipalities.
3. Develop technical capacity within local government through the development of skills, the redeployment of staff and the allocation of sufficient financial resources (intergovernment fiscal transfers) to District Municipalities.
4. Complete the present study into the Resource Poor Farmers Irrigation Schemes Feasibility Study.
5. In all the above management actions, "people issues" must be at the forefront.

**Responsibility**

DWAF Regional Office together with the Directorates : National Water Resource Planning and Options Analysis, and the Provincial Department of Agriculture and the District Municipalities including the relevant joint committees.

**Priority**

Priority 1 – Very high.

# 1.6 RE-USE OF WATER

**Management Objective**

To optimize the re-use of water (treated effluent) for irrigation and industrial use as a water reconciliation option before new raw water augmentation schemes are considered.

**Situation Assessment**

Reference should be made to Strategy Nos. 1.1, 1.3 and 1.4.

The main potential for water re-use on a reasonable scale in the ISP area is within the Buffalo City Municipal (BCM) area and the Lukhanji (Queenstown) Municipal area, both of which will be requiring augmentation of their raw water supplies within the short to medium term. Outside of these areas, re-use will most likely be addressed at the local municipality level only once there is a shortage of water, which is not the case at present. Most local municipalities have adequate water supplies in the short to medium term and treated effluent will mostly be used for irrigation purposes (golf courses, sportsfields and/or vegetable irrigation) or discharged back into rivers.

Within the Queenstown area most of the treated effluent is presently used for irrigation of pastures on either side of the Klaas Smits River south of Queenstown and for irrigation of the golf course. There appears to be little scope for re-use of water for domestic or industrial purposes at this stage of development without reducing the supply of irrigation water, which may threaten the economic viability of the stock farms.

The use of treated effluent is one of the strategies identified by the BCM Water Service Development Plan (**Ref. 5**) to delay the need for augmenting its raw water supplies. Approximately 33 million $m^3$ of treated effluent is discharged annually from the WWTWs in the BCM area. At present treated effluent is only used for pasture irrigation and for the irrigation of golf courses. The majority of treated effluent is either returned to the upper/middle Buffalo River, resulting in an increase in mineralisation of the river especially during dry periods (closed circuit loop effect), or treated effluent is discharged into the sea or into a river near the mouth without the possibility of further use. In addition to this, untreated raw effluent is discharged into the surf zone on the West Bank at Hood Point. This is presently being replaced with a sea outfall pipeline, which will be used for the discharge of raw screened effluent from parts of East London and the new East London Industrial Development Zone (ELIDZ) area on the West Bank in East London.

With the development of the ELIDZ and the possibility of new wet industries, the viability of using treated effluent becomes more favourable. As a result, the ELIDZ developers have proposed the construction of a 12km long rising main from the East Bank Treatment and Reclamation Works to provide approximately 6 million $m^3$/a of treated effluent to new industries still to be established in the ELIDZ. The feasibility study for this pipeline has been complete and a decision is pending on the next phase of the project. Should the proposed industries for the ELIDZ accept this supply (indications are that some will) then the need for future raw water augmentation for BCM could be postponed. The situation with respect to this option is in a state of flux at present. Its resolution will have a bearing on BCM's future raw water needs and the implementation of supplementary sources.

**Strategic Approach**

DWAF is fully supportive and strongly encourages all initiatives to maximize the re-use of water. Departmental pricing policies for raw water use and waste water discharge also promote this approach. The licensing of new raw water supplies will be dependent on local authorities first maximizing these opportunities, particularly in areas where water is already a scarce commodity. This message should be conveyed in liaison meetings.

This strategy must have a high profile, as its successful implementation could delay the construction of major new raw water infrastructure for BCM by several years. A large amount of water in the form of treated effluent, which could potentially be used is presently discharged to sea. This will be a joint

strategy with BCM and the ELIDZ, and will have to be managed and implemented co-operatively. The role of DWAF will be to guide, assist and give direction.

**Management Actions**

1. DWAF together with the BCM should identify and assist further studies to maximize the re-use of water. Previous studies on the viability and feasibility of treating effluent to certain standards for industrial use, potable use, or irrigation, particularly for the BCM area should be considered.
2. The development of the ELIDZ provides an ideal opportunity for increased use of treated effluent in the BCM area. DWAF should engage with the BCM and ELIDZ officials to support all re-use initiatives and studies for the ELIDZ as a priority.
3. There is a need to ensure that the WSDPs of all local authorities adequately address the need for water re-use, notwithstanding the general surplus availability of water in the region at present.

**Responsibility**

DWAF together with BCM, the ELIDZ and local authorities are responsible.

**Priority**

Priority 1 – Very high for BCM and the East London IDZ.
Priority 3 – Medium for other local authorities. Implement over the medium term.

# STRATEGY NO. 2

# WATER RESOURCES PROTECTION

## Need for Water Resource Protection Strategies

The Water Resources Protection Strategy addresses the need for the protection of water resources to ensure their continuing availability for human use by leaving enough water of appropriate quality in rivers, streams and groundwater to maintain their ecological functioning. This will be achieved by:

- Classification of freshwater bodies and determination of their ecological Reserves.
- Setting resource quality objectives for freshwater bodies.
- Addressing water quality management, pollution control and sanitation.
- Addressing pollution sources.

Water required for socio-economic growth must be balanced with the availability of water that is fit for use by all users, including the protection of the aquatic ecosystem. The NWRS defines two complementary approaches for the protection of water resources. Resource Directed Measures focus on the character and condition of the in-stream and riparian habitat, whilst Source Directed Controls focus on the control of water use at the point of potential impact, through conditions attached to water use authorisations.

These strategies will aim to achieve adequate protection for surface and groundwater resources in order to reach a balance between protection and sustainable use.

## Relevant Identified Strategies

The following specific strategies have been developed further:

2.1 Water Quality Management
2.2 Reserve and Resource Quality Objectives
2.3 Water Quality in the Buffalo, Nahoon and small urban rivers in Buffalo City

# 2.1 WATER QUALITY MANAGEMENT

**Management Objective**

To control, manage and protect the water quality of all surface and groundwater resources thereby either maintaining water quality where it is acceptable or improving water quality where it is unacceptable.

This will be achieved by improving management and control of point sources of pollution, diffuse pollution and spills, including solid and toxic waste sites.

**Situation Assessment**

Reference should be made to Strategy No. 2.3 for specific and detailed aspects of the Buffalo, Nahoon and smaller rivers within the BCM. These are the most heavily impacted rivers in the ISP area with respect to water quality.

The aim of protecting water resources is to ensure their continuing availability for human use, by leaving enough water of appropriate quality in rivers and streams to maintain their ecological functioning. The Source Directed Controls approach is primarily designed to control water use activities at the source of impact, through tools such as standards and conditions in water use authorisations.

Source directed controls include:

- Best management practice measures that apply nationally.
- Special measures, derived from catchment management strategies and/or plans.
- Site specific measures, stemming from the authorisation process, taking account of considerations specific to the water use being evaluated.

The following issues and concerns have been identified :

- Assessing the extent of pollution of surface and groundwater resources is dependent on suitable monitoring which is not being adequately undertaken on any large scale in the Amatole – Kei ISP area due to a lack of manpower and financial resources.
- There is no clear and detailed action plan on what should be included in the rehabilitation of impacted water resources.
- The quality classification system for the Eastern Cape rivers is still under development, broadly focused on the Water Quality Guideline Document.
- It is unknown which WWTWs, if any, have adequate contingency plans to deal with power outages and spills which are known to frequently occur.
- Groundwater contamination in the area is unknown due to a lack of systematic monitoring. Diffuse and point source pollution from rural and coastal villages on groundwater is known to occur. As most of the coastal resort villages and many of the rural villages rely on groundwater, it is also likely that the sewage disposal (septic tanks, VIPs, bush toilets etc) is impacting on this resource.
- Pollution from villages without adequate sewage, or with solid waste disposal facilities that are located in close proximity to rivers, is generally an unknown factor due to a lack of monitoring but could be cause for concern. This is especially so in those pristine estuaries where septic tank effluent is causing possible pollution. There is a need to protect the identified pristine rivers and estuaries (refer **Appendix B15**).
- Pollution to the middle and lower reaches of the Buffalo, Nahoon and smaller rivers within the Buffalo City Municipal area (refer Strategy 2.3) has been studied and reported on (**Ref. 4**). The result of this pollution is to cause mineralisation, salinization and eutrophication in the rivers and dams, as well as pollution of the main recreational beaches. This impact is

exaggerated by the closed loop effect of water use from and returned to the Laing and Bridle Drift Dams. Eutrophication is resulting in occasional toxic cyanobacterial blooms and in the proliferation of water weeds in some of the main dams.

- Within the Keiskamma and Great Kei catchments poor land use practices on dispersive soils is resulting in erosion leading to highly turbid rivers and siltation of estuaries. Although not quantified this is also having an effect on the quality and quantity of groundwater resources.
- Rehabilitation of defunct irrigation schemes in the upper catchments of the Keiskamma and Great Kei Rivers and the use of fertilizers and poisons may be a future source of pollution if not adequately controlled and monitored.
- Serious pollution of the Gcuwa River, a tributary of the Great Kei River, which runs through Butterworth is occurring due to runoff from industries, urban areas and from the large unlicensed solid waste site, which is located on the river bank. There is an urgent need to close this solid waste site and develop a new licensed regional solid waste site.

**Strategic Approach**

Water quality needs to be managed with the same attention as quantity in the ISP area where in some instances the water quality issues are more urgent. Whilst there is an urgent need for monitoring, the serious water quality issues already identified must be given immediate attention.

DWAF regards the water quantity and water quality management issues in the Amatole – Kei area in a serious light and will take a strong hand in ensuring licence compliance by all facilities (notably solid waste sites and WWTWs) and will work co-operatively with Local Government Authorities to achieve these objectives.

The general strategic approach to promoting the water quality aspects of resource protection will be as follows:

- The prevention, reduction, recovery and treatment of waste will be encouraged by applying best management practice measures as part of source-directed controls.
- If the application of best management practice measures still results in a need for discharge of water containing waste or the disposal of waste, a minimum requirement or standard will apply.
- Until applicable waste standards are developed for implementation, the current General and Special Effluent Standards will apply.
- If the applicable minimum requirements or standards are not sufficient to ensure suitable water quality as required by resource quality objectives, requirements or standards stricter than the minimum requirements or standards will be applied.
- Deviation from minimum requirements or standards, or from special or site-specific source-directed controls, will receive consideration if enforcement of these measures could have significant negative social or economic impacts, which outweigh the ecological benefits.
- Reclassification of the water resource due to irreversible water resource impairment will be considered only under very special environmental value requirements.
- For other water uses that impact on water quality, such as impeding or diverting the flow of water in a watercourse, measures required to meet resource quality objectives will be stipulated by guidelines or directives.

**Management Actions**

The required actions to address specific and serious water quality management issues and concerns are as follows:

**a. Amatole sub-area** (refer Strategy No. 2.3)

- Address water quality management problems of the Buffalo, Nahoon and smaller urban rivers with the Buffalo City Municipality, the Amatola Water Board and the Amatole District Municipality with a view to establishing a water quality management and

monitoring plan. As part of this process investigate the adequacy of pollution control mechanisms of industries situated in the Buffalo and Nahoon River catchments.

- Together with WfW develop an action plan for the eradication of water weeds in the dams and river systems in this sub-area.
- Establish monitoring systems to gauge the extent of overuse and pollution of groundwater (salinity intrusion, septic tanks and solid waste sites) for those coastal and rural villages that rely on this source for water use. This action applies throughout the ISP area.

**b. Keiskamma sub-area**

- Address water quality management problems caused by poor land use practices and potential effects of revitalised irrigation schemes with the Provincial Department of Agriculture (PDoA). A comprehensive soil conservation programme needs to be initiated with the PDoA. This action applies throughout the ISP area.

**c. Great Kei sub-areas**

- Apply pressure on the ADM to establish a regional solid waste site in Butterworth and close down the existing unlicensed site.

Implement water quality management actions in accordance with best management practice as follows :

1. Complete and distribute the water quality classification documentation.
2. Manage compliance to pollution related General Authorisations and review such authorisations and terms of actual management measures required.
3. Encourage WfW, along with District Municipalities, to compile business plans to address eradication of waterweeds in the EC Province under the invasive alien plant control strategy.
4. Keep point source pollution under control with regular visits.
5. Monitor storm water discharges and spillages from problem industries in co-operation with local municipalities.
6. Hold meetings in sensitive catchments to convey the importance of curtailing pollution.
7. Prepare for the implementation of discharge charges (polluter pays), as recommended in the National Water Quality Framework policy.
8. Through co-operative governance with local authorities, build capacity to ensure that operators of solid waste sites and WWTWs have established plans and procedures for emergency control of spillages, power failures and mechanical breakdowns.
9. Identify and address diffuse pollution from informal settlements through the Dense Settlements strategy.
10. Control diffuse pollution from irrigation schemes through co-operative governance with the PDoA.
11. Get buy-in from local authorities on solid waste site strategies and implement monitoring.
12. Implement the Department's Sanitation Policy and monitor through co-operative governance with local authorities,
13. Encourage local authorities to further develop and enforce bylaws, draft regulations etc to systematically deal with water quality problems with the long-term view of improving the water quality of riverine, marine and terrestrial environments.
14. Develop eutrophication management strategies and actions regarding toxic cyanobacterial blooms including an early warning system for domestic, agricultural and recreational users.

**Responsibility**

The RO is responsible for developing this regional strategy, assisted by D: WD&D.

**Priority**

Priority 1 – Very high. This is an ongoing strategy.

# 2.2 RESERVE AND RESOURCE QUALITY OBJECTIVES

**Management Objective**

To develop a regional strategy for the determination and implementation of management classes, Reserve requirements and resource quality objectives for surface freshwater bodies, estuaries and groundwater, within the requirements of the national classification framework. This will be done according to the prescribed methodologies by using applicable methods of determination.

**Situation Assessment**

The aim of protecting water resources is to ensure their continuing availability in order to sustain human use by leaving enough water of appropriate quantity and quality in rivers and streams to maintain their ecological functioning. Resource Directed Measures (RDM) focus on the quantity, quality and the overall health of water resources.

Resource Directed Measures include the following elements:

- Development of a National Classification System for rivers and groundwater.
- Determination of the class of the specific water resource.
- Determine the Reserve in accordance with the class of the resource
- Establish resource quality objectives.

The Directorate : RDM is currently streamlining the process to determine ecological Reserves. Until such time as a National Classification System is in place, a Preliminary Classification will be used to determine Preliminary Reserves. Licence applications are considered individually and decisions about the level of confidence and the method for the Reserve determination (if required) is then made. Intermediate ecological Reserve determinations have been conducted for the Nahoon, Kubusi, Buffalo and Upper Kei Rivers during various situation assessment studies.

*Classification*
A classification system, which allows for the formal classification of water resources is not yet available. A clear national DWAF policy for the implementation of Reserves and the calculation of allocatable resources is required. Water resources will be managed as far as possible within the boundaries of their management class.

*Determination of the Reserve and Resource Quality Objectives*
The Reserve comprises two components, namely basic human needs and ecological requirements. It has priority over all other water uses, and the requirements of the Reserve must be met before water can be allocated for other uses. However, where water is already allocated for other uses (existing lawful uses), the requirements of the ecological Reserve may be met progressively over time according to an implementation strategy which should be incorporated into the ISP and Catchment Management Strategy.

Resource quality objectives provide numerical or descriptive statements about the biological, chemical and physical attributes that characterise a resource for the level of protection defined by its class. They include:

- The quantity, pattern, timing, water level and assurance of instream flow.
- The water quality, including the physical, chemical, and biological characteristics of the water.
- The character and condition of the instream and riparian habitat.
- The characteristics and condition of the aquatic biota.
- Regulation and prohibition of in-stream or land-based activities, which may affect the quantity of water in or the quality of water of the resource.

- Other characteristics that stakeholders may wish to abide by.

Resource quality objectives need to be determined along with the setting of Reserves to be able to manage water resources adequately.

The ecological sensitivity of aquatic systems other than rivers has to date not been adequately assessed. The estuarine systems are generally not well studied with inadequate data available for accurate assessments. They are critically important from an ecological perspective and are sensitive to reduced flows and changes in water quality.

Water requirements for the ecological Reserve for most rivers in this ISP area will in general be high due to the relatively pristine nature of the rivers and their estuaries. Of the 40 rivers in the area, some 31 can be regarded as in good to excellent condition (refer **Appendix B15**).

As previously mentioned, a number of intermediate ecological Reserves have been determined on the more developed rivers in this ISP area.

There is a lack of groundwater monitoring data to support groundwater reserve determinations in this ISP area. This aspect of groundwater use and monitoring requires urgent attention and guidance from DWAF at a national level. Notwithstanding this, DWAF will continue to process licence applications for groundwater use until Reserve determinations protocols are established.

The status of Reserve determinations in the various sub-areas is as follows:

a) Amatole and Keiskamma Sub-area catchments

There are 40 rivers of varying size in this sub-area, the majority of which can be regarded as being in good to excellent condition (refer **Appendix B15**). The status of the larger "fair to poor condition" rivers is as follows :

- Keiskamma River : This river is in a fair condition, but with increasing abstraction in the headwaters of the catchment for basic use and irrigation, the river will become increasingly impacted. Only a rapid level Reserve determination has been performed as only water use licences for small woodlots have been received for this area.
- Buffalo River : This river is seriously degraded due to urban activities and the related pollution impacts. The river has the port of Buffalo City at its mouth and is not an estuary in the recognized sense of the word. Preliminary ecological Reserve determinations at intermediate level have been undertaken for the main reach of the Buffalo River and one of its main tributaries, the Yellowwoods River. Due to the serious water quality problems in the Buffalo River, resource quality objectives for all reaches of this river need to be established at a comprehensive level with a view to compulsory licensing in the near future.
- Nahoon River : The condition of this river is regarded as fair. But pollution from the urban areas of Buffalo City, irrigation in the catchment and peri-urban informal settlements are causing an increasing impact on the river and its estuary, which exits onto East London's main recreational beach. A Preliminary Reserve determination at intermediate level has been undertaken for the estuary, which showed that the Nahoon Dam is not releasing sufficient water to satisfy the estuarine ecological demands.

b) Great Kei River catchments

An intermediate Reserve determination has been conducted for the Upper Kei River as part of the Queenstown Water Supply Feasibility Study. A rapid reserve determination was also conducted in the lower Kei River. Due to poor land use practices in the catchment, both the riparian and estuarine ecology is being impacted by heavy siltation loads. It is expected that water from the large dams in the upper catchment, which has not been fully used in the past, will be taken up for use in revitalized irrigation schemes. This will increase the need for

Reserve releases to be determined and exercised. The estuary is highly rated in terms of its ecological importance.

**Strategic Approach**

In the absence of available resource classifications, Reserve determinations for water resources will continue to be done on an ad hoc basis as the need arises, depending on the availability of resources and information. The RO should keep up to date with the development of reserve methodologies for rivers, estuaries, wetlands and groundwater and ensure the timeous identification and initiation of such reserve studies where required.

Operational releases at dams must, where possible, be matched with releases for ecological requirements. There is a need to develop appropriate dam operating rules to achieve the aims of such releases once they have been determined. The issue of outlet structures at dams that cannot cope with required ecological releases is a serious one. The sizes of floods to be released must first be determined at an acceptable high confidence level before decisions are taken regarding the altering of outlet structures as this may prove to be an expensive operational and capital cost exercise.

Before any development of water resources is considered, a comprehensive study of the aquatic ecosystems in the area affected should be undertaken to ascertain the ecological impact of the development. This will depend on resources available to the Department.

In general DWAF's approach is as follows:

- Maintain the status and the present ecological state of the 31 rivers currently in a good to excellent condition.
- Set RQOs and ensuring compliance.
- Issue licences according to the current level of use and the availability of the water resources taking into account the needs of the Reserve.

**Management Actions**

In terms of this strategy, the following actions have been identified :

1. Request the allocation of additional manpower resources and funding for the RO for reserve determinations and setting of resource quality objectives according to a prioritized list to be compiled by the RO in consultation with the RDM Directorate.
2. The determination of the estuarine requirements of the Kei and Keiskamma Rivers should be a priority.
3. Develop the river classification at regional level once a formal classification framework becomes available.
4. Implementation of the ecological Reserves and auditing.

**Responsibility**

The RO, in consultation with the D: RDM, is responsible for implementing this strategy.

**Priority**

Priority 1: High – Buffalo, Nahoon and Keiskamma Rivers (Buffalo and Nahoon have been done and thus the implementation and auditing of the Reserve is a high priority)
Priority 2: Medium – Great Kei River (specifically the estuary)
Priority 3: Low – Other rivers.

This is a continuous programme that requires immediate and ongoing attention.

# 2.3 WATER QUALITY IN THE BUFFALO, NAHOON AND SMALL URBAN RIVERS IN BUFFALO CITY

**Management Objective**

To address the serious environmental impact and degradation that is occurring in the rivers and marine aquatic systems that are located within the Buffalo City Municipal (BCM) area due to high levels of pollution from point and non-point sources.

**Situation Assessment**

Refer to Strategy Nos. 1.3 and 8.1

Serious pollution of the river and marine environment is occurring within the Buffalo City Municipal area. This is resulting in degradation of the fauna, flora and recreational facilities with negative effects for the tourism industry and the local economy. This together with the health implications is a cause of dissatisfaction among residents of Buffalo City. This is especially so in the deprived areas of the City such as Duncan Village where pollution is further downgrading the already poor quality of life.

Most waste water treatment works in the catchments do have the necessary permits but do not always comply with the standards set. In some instances the capacities of the works are being exceeded. It should be noted that some of these effluent treatment facilities were owned by DWAF but have now been handed over to the BCM.

Most of the bulk sewerage infrastructure is also operating close to or above design capacity with resultant frequent sewage spills. These problems are exacerbated by inadequate maintenance of the infrastructure due to financial and manpower constraints within the BCM.

Additional pollution is caused by leachate from unlicensed solid waste sites, run off from informal settlements with inadequate sanitation facilities, from urban stormwater, from farm abattoirs and from illegal dipping tanks.

High water treatment costs are being incurred due to the high pollution loads and resultant mineralisation and eutrophication resulting in algal blooms, toxic cyanobacterial blooms and excessive water plants in the dams.

Future growth within the Buffalo City area will be hampered due to the unsatisfactory state of existing effluent treatment facilities and the urgent need for additional bulk treatment and bulk reticulation facilities.

The following issues have been identified.

- Inadequate existing effluent treatment and bulk sewerage reticulation capacity.
- Little development to meet future requirements for effluent treatment and bulk sewerage reticulation capacity. The sea outfall works for disposal of raw screened effluent has been stalled due to lack of finances.
- Inadequate skilled manpower and financial resources to address existing problems and planning and development of new facilities within the BCM.
- Inadequate knowledge of quantity and quality of pollution sources especially from industries.
- Lack of monitoring data for all rivers to establish a management plan.
- Need to identify the resource quality objectives (RQOs) and ecological Reserves for the rivers. This needs to be balanced with the capacity of the dam outlets to release water.
- Lack of a co-ordinated approach as different authorities were responsible for effluent treatment works and for addressing sources of pollution (DWAF sanitation programme).

There is also a lack of co-ordination and support within the BCM for addressing the problems due to conflicting demands on limited manpower and financial resources.

- This issue is linked to the required WCDM programme identified for BCM ie. reduce the water usage and the effluent will reduce (refer Strategy No. 4.1).

**Strategic Approach**

The situation as described above with regard to water quality in the Buffalo, Nahoon and other small rivers within BCM is unacceptable to the Department.

Whilst it is not possible to upgrade all facilities immediately, a programme which will lead to improved management practices, the allocation of appropriate funding for both management and upgrading of facilities, and an audited commitment to meet licensing standards as set down by DWAF must immediately be instituted by the BCM.

Any commercial offender failing to meet waste discharge requirements should institute immediate remedial action or be forced to halt operations until such time as such action has been taken. Where such management is the responsibility of the BCM and the BCM is failing to take due action, then DWAF should employ all its rights and responsibilities in ensuring compliance. DWAF will support the BCM in achieving responsible water quality management given the requisite commitment.

The above approach is adopted in the light of the urgent need for committed action.

The task of addressing the issues identified above would be simplified by the establishment of either a co-ordinating committee or single Water Authority as recommended in Strategy No. 8.1. This Authority would also have responsibility for water quality issues and could co-ordinate planning to ensure a balance between available water resources, water purification, water distribution and effluent treatment.

**Management Actions**

The following actions are required to address the above issues.

1. Establish a management plan for addressing the state of the rivers and dams. This would include :
   - Identifying all sources and quantities of pollution especially solid waste sites.
   - Establish RQOs and undertake ecological Reserve determinations for the rivers.
   - Identify areas of high pollution impact and embark on a programme with realistic time frames to upgrade the existing treatment facilities and develop new facilities. This will need to be undertaken together with BCM and should address the concerns being raised regarding the sea outfall project.
   - Progressively upgrade the existing and construct new sewerage treatment works and reticulation to meet the projected growth.
2. Assist in ensuring that adequate financial and skilled manpower resources are allocated to addressing the problems both within DWAF and the BCM by, for example, the secondment of staff, use of Amatola Water.

**Responsibility**

DWAF Regional Office together with the BCM, AW and the ADM.

**Priority**

Priority 1 – Very high.

# STRATEGY NO. 3

# WATER USE MANAGEMENT

## Need for Water Use Management Strategies

Chapter 4 of the NWA describes the provisions by which water use may be progressively adjusted to achieve the Act's principle objectives of equity of access to water, and sustainable and efficient use of water. Many of the Act's sustainability and efficiency related measures would be applied through conditions of use imposed when authorisations to use water are granted. Formal water use authorisations will also facilitate administrative control of water use by water management institutions, and will form the basis upon which charges for water use may be made, and provide for the collection of water related data and information.

If and when compulsory licensing is introduced, the existing water use control measures need to be strategically implemented to provide a means of reducing the number of authorisations that require processing under the existing arrangement. The protection of water resource must not be compromised through the modification of existing controls.

The Water Use Management Strategy is required to address:

- ⇨ Schedule 1 (basic) water use.
- ⇨ Management of water use in river basins shared with other countries.
- ⇨ Usage of General Authorisations to manage water use.
- ⇨ Validation of the water use registration and verification of the legality of existing water use.
- ⇨ Processing and issuing of new water use authorizations.
- ⇨ Control of invasive alien plants and weeds.

## Relevant Identified Strategies

The following specific strategies have been developed further for this ISP area:

3.1 Water Allocations and Licensing
3.2 Invasive Alien Plant Control

# 3.1 WATER ALLOCATIONS AND LICENSING

**Management Objective**

To ensure that the available water resources of the Amatole – Kei ISP area are allocated for existing and future requirements in an effective, efficient and beneficial manner in order to improve the social, economic and environmental conditions of the stakeholders while addressing equity considerations.

To achieve this DWAF will have to make decisions on the authorization of water use with the necessary conditions and within the context of the NWRS and ISP water management frameworks.

**Situation Assessment**

The surface water balance calculations indicate that the quaternary catchments in the ISP area vary from those with positive water balances to those that are approaching or are probably already in a stressed situation. These stressed catchments are mainly, but not only in the upper quaternaries where ecological water requirements (EWRs) rarely allow for any water allocations. It should be borne in mind that the information on which the water balances are calculated, such as the EWRs and existing use of water, requires additional investigation and refinement.

The situation in the sub-areas with respect to surface water resources is as follows:

a) Amatole Sub-area
All main river catchments with the potential to be a further source of raw water for the BCM area in this sub-area have been excluded from General Authorisations (refer **Appendix B14**). The yield of the rivers, including usable return flows of 18 million $m^3$/a, amounts to 80 million $m^3$/a. This yield can be augmented by the inter-catchment transfer of up to 18 million $m^3$/a of raw water from the Wriggleswade Dam on the Kubusi River in the adjacent catchment (S60), thereby giving a total yield of 98 million $m^3$/a. The total water requirement in the year 2000 was 82 million $m^3$/a.

- Buffalo and Nahoon River catchments (R20/R30E, F)
These catchments are the main source of water supply for Buffalo City Municipality with possible inter-basin transfer from Wriggleswade Dam.

  Without water transfer from Wriggleswade Dam, the water balance shows a deficit. This deficit is impacting on the ecological Reserve of the catchments, but this could be rectified by means of releases from Wriggleswade Dam.

  Allowing for water transfer from Wriggleswade Dam, the water balance shows a surplus. This surplus is reserved for, and is expected to be taken up by the growth in urban water demand from BCM by the year 2012. The actual time period will depend on the success of reconciliation interventions such as WCDM and treated effluent use and the rate of growth in demand, which will be dependent on the expansion of the formal housing sector and the success of the East London IDZ in attracting industries (wet or otherwise).

  Some 30 million $m^3$/a of treated effluent from WWTWs is presently discharged into the sea or into the Buffalo River near the river mouth. Use of this treated effluent may be possible and this aspect has been discussed in the Re-use of Water Strategy No 1.6.

  The upper Buffalo River which includes Rooikrantz and Maden Dams is in a stressed state due to an over-allocation and supply of water for King William's Town from the dams. Recent water supply infrastructure has been constructed to allow water from Laing Dam to be pumped back to the town. The cost and quality of Laing Dam water is not however attractive to the BCM in comparison with water from Rooikrantz Dam.

Based on the existing scenario where all spare water is reserved for the BCM, no further water allocations can be made from the Buffalo River catchment.

- Gqunube River catchment (R30C/D)
  This is the third largest river within the BCM area. There are no large dams on the river and no water is supplied for urban use. Only small farm dams and weirs in the catchment supply water for irrigation and stock farmers. It would be possible to increase the yield from the catchment with the development of a large dam(s) on the Gqunube River. However, because of the relatively pristine nature of the river and its estuary, a comprehensive reserve determination would be required in considering this catchment for additional water supplies. Verification of lawful use of water in the catchment will also be required. It should be noted that the transfer of water from Wriggleswade Dam can also be made into the upper catchment of the Gqunube River. This has already occurred for supply to irrigators during the 1993/94 drought period.

- Kwelera River catchment (R30B)
  The hydrology of the river is not well recorded and a flow recording station will be constructed in the near future. In addition the demands on the river are not well known. Based on the ISP water balance analysis, the Kwelera catchment appears to have a small surplus water balance. However, due to the relatively pristine nature of the river and estuary and the low confidence in available data, a comprehensive Reserve determination must be undertaken before further allocations can be considered from run-of-river. The concept of a dam and water supply to the peri-urban communities in the Kwelera and Mooiplaas areas has previously been proposed. Further analysis is required to ascertain the likely additional yield that could be generated by the construction of a dam(s).

- Kwenxura River catchment (R30A)
  This catchment consists of a number of small coastal catchments, which are in a relatively good condition. The catchment is in a deficit water balance if the ecological Reserve requirements are to be met. No further run-of-river allocations of surface water should be considered from these small rivers.

b) Keiskamma Sub-area

- Keiskamma River catchment (R10)
  Apart from the upper quaternary catchments of this river basin there is a water surplus in the middle to lower catchments which is available for allocation should the need arise. It should be borne in mind that revitalisation of the irrigation schemes with water allocations from Binfield Park, Sandile, Cata and Mnyameni Dams is presently underway and this will affect the water balance. The Keiskamma River with its under-utilised dams is also considered an important possible raw water resource for future supply to BCM. In view of the potential of this river with its storage dams in the upper catchment, further water allocations should be limited until the intended Reconciliation Strategy for the AWSS (BCM) has been drawn up.

- Bira/Mgwalana River catchments (R50)
  These catchments form part of the range of pristine coastal rivers, which have high ecological Reserve components. No significant run-of-river allocations should be considered from these rivers. Domestic water supplies are presently sourced from the Keiskamma River. Any increase in demand should be from the same source or from groundwater.

- Chalumna/Gulu River catchments (R40)
  These catchments also form part of the pristine range of coastal rivers, which have high ecological Reserve components. No significant run-of-river allocations should e considered from these rivers. Domestic water supplies are presently sourced from the Keiskamma and Buffalo Rivers. Any increase in demand should be from the same sources or from groundwater.

c) Upper Kei Basin Sub-area

Quaternary catchments S10A and S10E upstream of the Xonxa Dam, catchments S20A to S20C upstream of the Lubisi Dam, catchments S32A to C upstream of the Black Kei/Klipplaat confluence, catchments 32D and E upstream of Waterdown Dam and catchment S32F upstream of the Oxkraal Dam are all excluded from the General Authorisation in this sub-area (refer **Appendix B14**).

- White Kei River catchment (S10)
  If the ecological Reserve requirements are to be met, then the upper catchments above the Xonxa Dam are all in deficit with respect to water balance and no further run-of-river allocations from surface water should be considered. Future water supplies in the upper catchments should be sourced from groundwater. The catchments below Xonxa Dam have a large surplus of water. This surplus will be partly used during the rehabilitation of the Bilatye (Xonxa) irrigation scheme below the dam. In addition an allocation of water from the dam is being considered as a possible future supply for Queenstown (< 10 million $m^3$/a) and studies are presently underway in this regard. Other than the above, allocations of water can be considered in this catchment below Xonxa Dam should this be necessary, although it is known that there is currently little demand for water due to the steep topography and small rural population.

- Doring/Indwe River catchments (S20)
  The catchments are all in surplus with a large surplus generated below Lubisi Dam. This surplus will be partly used during the rehabilitation and possible expansion of the Qamata irrigation scheme below the dam.

- Klaas Smits/Heuningklip River catchments (S31)
  These rivers above Queenstown do not flow throughout the year. Currently opportunistic irrigation based on flood flows and alluvial groundwater is used.

  Below Queenstown the Klaas Smits River receives treated effluent from Queenstown, most of which is used for the irrigation of pastures.

- Black Kei/Klipplaat River catchments (S32)
  The upper quaternary catchments of the Black Kei river to the confluence with the Klaas Smits River are all in balance with no further surface water available for allocation. There is an over-allocation from Waterdown Dam compared to its available yield together with high water losses. This aspect together with the revitalisation of irrigation schemes at Shiloh is presently being investigated as part of the Queenstown augmentation study. Until the results of this study are complete, and due to the known good groundwater resources in the area, immediate future requirements should be sourced from the groundwater resources where possible.

d) Middle Kei Basin Sub-area

Quaternary catchments S50A to S50C upstream of the Ncora Dam and catchments S40A to C are all excluded from the General Authorisation in this sub-area (refer **Appendix B14**).

- Tsomo River catchment (S50)
  The subcatchments above Ncora Dam are in deficit. Below the Ncora Dam, the Tsomo river is joined by the Tsojana River with the Tsojana Dam in the upper catchment. This has the effect of creating a surplus below the confluence of the two rivers. Further allocations of water can be considered for domestic supplies from

  these two dams as the estimated requirements for this purpose form part of the Reserve and represent a very small percentage of the yield of the two dams. However, the current inter-basin allocation of water from Ncora Dam to the Mbashe

catchment for hydropower generation, revitalised irrigation projects and expansion of irrigation at the Ncora irrigation scheme is not accurately defined and is the subject of an existing study to ascertain the yield of the dam. Should it prove necessary, reallocation of water from Ncora Dam (hydropower) for local economic activities must be considered as a high priority in the future. The question of water supply to Eskom hydropower stations needs to be addressed at a national level.

- Thomas River catchment (S40A/B/C)
  The quaternary catchments are all in deficit due to the high use of water in run-of-river irrigation schemes and if the ecological water requirements are to be met. No further run-of-river abstractions should be allocated and existing lawful use and licences should be re-examined in this catchment.

- Great Kei River catchment (S40)
  There is minimal demand for water in this catchment down to the river mouth due to the nature of the deep gorge through which the river flows.

e) Lower Kei Basin Sub-area

- Gcuwa River catchment (S70)
  This catchment shows a surplus, with water released from Xilinxa Dam for abstraction downstream at Butterworth which has been on a negative growth curve since 1994. Further allocations for domestic requirements can be considered from this catchment below Xilinxa Dam but the available dam yield and environmental requirements need to be more accurately defined as demand increases. The catchments upstream of the Xilinxa dam in this sub-area are excluded from the General Authorisations.

- Kubusi River catchment (S60)
  The upper Kubusi catchment is considered a part of the Amatole System as the yield from the Wriggleswade Dam has been reserved for the BCM. The two upper quaternary catchments consist largely of forests (indigenous, formal and alien) with a water requirement for Stutterheim, rural villages and surrounding farms. The upper quaternary catchments would have a water deficit should the ecological Reserve be instituted. Without the removal of invasive alien plants in the catchment above Wriggleswade Dam, no further water allocations should be considered without a detailed water balance analysis.

- Great Kei River catchment
  This catchment shows a surplus water balance. The only large requirement for water abstraction from the lower Great Kei catchment that has been identified is for a proposed mining venture at Wavecrest. This project is currently on hold and it is unlikely to proceed due to major environmental opposition. However, should it or any other project requiring large water demands such as for BCM be considered in the future, a comprehensive ecological Reserve determination must be undertaken in view of the high importance of the ecostatus of the lower Kei River and its estuary.

While the groundwater potential of the Upper Kei Basin is believed to be good, groundwater resources in the ISP area are not well understood, with a lack of monitoring and information data from existing boreholes. Until such time as a more complete picture is gained, it is not possible to accurately determine water allocations or licensing criteria for this water resource. Notwithstanding this, further groundwater developments in the region are to be encouraged. In terms of the General Authorisations for groundwater, abstraction zones have been identified based on allowable extraction rates per hectare per annum (refer **Appendix B14**). These GAs need to be revised once a more detailed hydrocensus of the area has been undertaken during which all existing boreholes should be identified.

**Strategic Approach**

Allocations and issuing of water licences in those areas with a clear surplus of water should be done to encourage economic development. Where the water balance in a catchment is of low confidence and is approaching a balanced or deficit situation, further studies should be undertaken before allocations are made. In order to develop a comprehensive strategy for the allocation of water resources throughout the region and the licensing thereof, it is necessary that detailed and accurate information on the water resources is available and all existing lawful use has been quantified and verified. Until such time as this is in place, some water allocations and issuing of water licences may prove difficult. The main areas that require attention are as follows :

- A detailed and accurate knowledge base of existing groundwater resources and the use thereof needs to be established.
- Accurate information on lawful (and unlawful) water use including farm dams needs to be established in all catchments.
- Due to the pristine nature of many of the rivers and estuaries in the ISP area, the ecological Reserves need to be more accurately quantified. This will include studies on the hydrology of these rivers.
- For those catchments that are approaching a balanced state, specifically the Buffalo, Nahoon and Kubusi Rivers (the Amatole Water Supply System) previous studies need to be updated to include for changes in the water demand scenarios and the ecological Reserve should be factored-in on the availability side. No compulsory licensing is required before such an exercise has been completed.

Until such time as the above is in place, allocations and issuing of water licences should be done with care and only in those catchments where there is clearly a surplus of water available based on the latest water balance information. The future supplies of water to the Buffalo City Municipality and the Queenstown/Sada areas are priorities. Further allocations from possible supplementary water resources, which might be required in the future, should be limited until matters are clarified in the Reconciliation Strategy for the Amatole Water Supply System and strategies are refined based on current Queenstown studies.

**Management Actions**

General management actions include the following :

1. Implement available streamlining procedures to reduce the backlog of authorisation applications, which are delaying the implementation of projects.
2. Establish a central register of licence applications in the RO to ensure that the various offices issuing licences are aware of each other's activities so that a holistic licensing approach is followed.
3. Motivate for additional resources and budget for processing authorisations if necessary.
4. Evaluate and process water use licences only in those catchments or aquifers that clearly have surplus water.
5. Prioritise required Reserve determinations and motivate to the D: RDM.
6. Undertake comprehensive reserve determinations of the Buffalo, Nahoon and Kubusi Rivers and update the water balance situation in the Amatole Water Supply System.
7. Educate municipal policy makers and officials about the licencing process and the ISP to improve their planning for licence applications and to improve the quality of their WSDPs.

**Responsibility**

The RO in consultation with the Directorates WU, RDM, NWRM and Information Programmes (where applicable) is responsible for implementing this strategy.

**Priority**

Priority 1 – Very high.

# 3.2 INVASIVE ALIEN PLANT CONTROL

**Management Objective**

To protect the quality and quantity of the rainfall runoff to the groundwater and surface water resources and to protect the indigenous biodiversity of the environment through the control, harvesting and removal of invasive alien plants. This should be undertaken with due cognizance of the potential economic value of the invasive alien plants as well as the socio-economic conditions of the rural population who often rely on invasive alien plants for their requirements.

**Situation Assessment**

Widespread alien invasives in the ISP area largely comprise infestations of wattle species, which were originally introduced into the Stutterheim area in the late 1800s. The economic value of wattle grew with the development of the wattle bark industry in the 1950s for the production of tannin for use in the leather industry. With the demise of the tannin industry in the Eastern Cape, the lack of demand for the bark resulted in the abandonment of plantations. The original "plantations" were neither managed nor regulated and most were neglected or abandoned with the result that the seed from these wattle plantations spread throughout the Eastern Cape resulting in widespread and endemic wattle infestations on grazing lands and in riparian zones.

The establishment of plantations was not regulated until 1972, but by then infestations had been established throughout the area and adjacent to many watercourses. Government disincentives were only legislated once the problem had grown out of control, and then the regulations were never actively applied by government agencies, with the Department of Agriculture being particularly inept. In contrast, where landowners have managed their plantations, for example in KwaZulu-Natal, and where the demand for bark and timber products has existed, the cultivation of black wattle has been highly successful, resulting in a thriving tannin and timber export industry.

In a region where poverty is a major problem, the wattle timber is regarded by the local rural population as a critical resource and is used for building materials and fuelwood. The elimination of this resource without a suitable inexpensive replacement would further impoverish the populace who regard wattle as a superior resource to the indigenous species for their purposes. There are instances of communities requesting permission to grow wattle plantations due to its value to communities. The resource also has a commercial value in that it can be used for pulp, charcoal and laths. It can therefore play an important role in the economic development of the region if managed and controlled correctly.

The Conservation of Agriculture Resources Act provides for control over the use of the natural agricultural resources to promote the conservation of the soil, the water resources and vegetation and for the combating of weeds and invader plants. Benefits to be derived from the Working for Water (WfW) programme are the prevention of further invasions and protection of biodiversity, the creation of jobs and the improved availability of water.

WfW has its own approach and strategies and is a large, well-funded and important programme falling under the control of DWAF. The RO has an important interest in ensuring that the programme is carried out in a co-operative manner and takes account of objectives for the maximizing and good management of water resources in the ISP area.

Working for Water in the Eastern Cape is currently focusing on mainly state-owned and some private land through funding provided by the DWAF trading account. The main focus of the programme in the Amatole – Kei ISP area is in the upper reaches of the Buffalo, Nahoon and Kubusi catchments. This programme has not been entirely successful with unhappiness being expressed by the riparian landowners with claims that the riparian wattle previously formed a green fire belt against the spread of fires. With its removal run-away fires are more frequent and this has resulted in an increase in the

spread and germination of wattle seed. There are also widespread claims that while the wattles are being chopped down, they are not being removed. This has resulting in debris clogging up the rivers and the extraction pumps of farmers.

The situation within the ISP area is as follows :

**Amatole Water Supply System Area:**

It has been estimated that some 4000 ha of dense wattle infestation exists in the upper catchments of the Buffalo, Nahoon and Kubusi Rivers mainly on state and privately owned land. Of this, it is estimated that approximately 2600 ha should be cleared from wetlands, riparian zones and other watercourse areas. The remaining 1400ha could be managed as a high value resource or converted to forestry to produce equivalent products and meet economic needs.

**Remaining Sub-areas**

Surveys have shown that infestations of uncontrolled wattle exist throughout the ISP area from the coast to the upper reaches of the Kei River. The timber is regarded as a valuable resource by the rural population. The main threat throughout the ISP area is in the uncontrolled nature and spread of the wattle seed and its impact both on the biodiversity and water resources of the region.

**Strategic Approach**

DWAF and in particular the provincial DEAET would, ideally, like to see all invasive alien plants completely and permanently removed from the landscape for water and biodiversity reasons. Failing this, the minimum is to ensure that further spread is contained. However, it must be recognized that in the Amatole – Kei area there is considerable socio-economic dependence on the invasive black wattle as fuel wood and as a commercial resource. It is also recognized that the eradication of all jungle wattle is beyond the financial resources of the Working for Water programme. A three-pronged strategy should therefore be adopted:

- To prioritise all critical catchments and riparian zones and wetlands and to schedule the WfW programme for clearing of these areas, notably the catchments serving the BCM and Queenstown/Sada.
- To take up the opportunity offered by the so-called Water Use Exchange Guideline : allocating water use licences to areas cleared of IAPs (DWAF 2004 – in preparation at time of compiling this report). In this case the possible conversion of jungle wattle and/or IAPs either to formally managed wattle woodlots or to forestry plantations. This conversion would be the responsibility of the landowner (farmer or community) and the managed timber would have to licensed as forestry plantation. Advantages are that :
    a) All priority areas (riparian zones and wetlands) would have to be cleared,
    b) The waste stands would become commercially productive and licensed users of water.
    c) The cost would be borne by the landholder.
    d) Real co-operative partnerships could be developed with local communities thereby alleviating poverty.
- To provide incentives to landholders to clear their lands of invasive alien plants. These incentives could be offered through the WfW programme (eg free herbicides) or through DWAF (such as a rebate on water use or allowable conversions/exchanges via licences/General Authorisations).

**Management Actions**

The following actions are required to manage the control of invasive alien plants:

1. Complete invasive alien plants mapping initiatives and reconcile mapping with clearing data collected on an ongoing basis.
2. Categorise and license wattle plantations so that the wattle can be managed as a high

value resource. The DEAET would have to provide consent for this to occur. The PDoA does however allow demarcation of jungle wattle to become "managed" stands.

3. Identify opportunities for job creation through the use of the biomass. WfW has a Secondary Industry Programme and the benefits of job creation could be derived from this process.
4. Provide incentives to private landholders for clearing of invasive alien plants.
5. Develop clearing plans to optimise clearing and job creation within available budgets.
6. WfW will identify beneficiaries of clearing and do proportioning of clearing costs among those users.
7. Research the additional flow generated by eradication of aliens in the catchments.
8. Implement the national WfW Exit Strategy for handover to Maintenance when it becomes available.
9. Design a regional strategy of co-operation with the PDoA and DEAET to educate farmers on the importance of eradicating invasive alien plants.
10. Funding for WfW programmes should be constant. Five-year plans should be drawn up and monitored to avoid social problems following retrenchment.

**Responsibility**

DWAF Regional Office (WfW).

**Priority**

Priority 1 - Very high. Programme is ongoing.

# STRATEGY NO. 4

# WATER CONSERVATION AND DEMAND MANAGEMENT

## Need for Water Conservation and Demand Management Strategies

The options for further augmentation of water supplies by developing new physical infrastructure are becoming increasingly limited and expensive. As result more attention is being placed on managing the demand for water, encouraging its efficient and effective use, and reducing losses in water systems. This requires the creation of a culture of water conservation and demand management amongst individual users and within all water management and water services institutions.

The National Water Conservation and Demand Management Strategy is based on the premise that many water users can maintain their quality of life and achieve the desired outcomes from their water use, whilst using less water. Furthermore significant reductions in water use can be achieved by changes in behaviour and the adoption of water-saving technologies. DWAF will continue to encourage all water users to voluntarily comply with water conservation and demand management principles and strategies.

The Water Conservation and Demand Management Strategy is required to address the urban, agricultural and industrial sectors.

## Relevant Identified Strategies

The following strategies form part of this overall strategy:

4.1 Urban water conservation and demand management.
4.2 Agricultural water conservation and demand management.
4.3 Industrial water conservation and demand management.

# 4.1 URBAN WATER CONSERVATION AND DEMAND MANAGEMENT

**Management Objective**

To identify the priorities for urban water demand management measures in the ISP area and to use the opportunities created through legislation to promote implementation through co-operative governance, assistance, buy-in and capacity building.

**Situation Assessment**

DWAF is promoting and insisting on efficient water management and use. The principle of efficiency has been strongly emphasised in legislation. A national water conservation and demand management strategy is being developed. This strategy is aimed at the water supply industry and society at large and covers all water user sectors including agriculture, forestry, industry, recreation, the ecology, and water services.

The development and implementation of an urban water demand management strategy must be integrated into the water resource planning processes as a requirement before the planning of new infrastructure schemes. It should be regarded as the highest priority option before new augmentation options are considered.

There are a number of categories of water conservation and demand management measures and initiatives that can be implemented. The following categories are general for all water sectors and are according to the different components of the water supply chain:

- Water conservation measures in resource management.
- Water demand management in distribution of supply management.
- Water demand management measures of customer or end user.
- Water conservation measures for return flow management.

Water demand management is the responsibility of the user sectors. The District Municipalities are now responsible as Water Service Authorities/Providers for ensuring that WCDM plans are compiled and implemented by the various local municipalities. The RO still has a regulatory and advisory role.

Unaccounted for water consists of a combination of reticulation system leaks, unauthorised water connections, faulty water meters and domestic plumbing leaks. These factors, combined with the low levels of payment and institutional problems of local authorities, affect the sustainability of water services.

More efficient use of water will reduce the costs associated with purifying and distributing water to consumers, and with the subsequent treatment of wastewater. Proposed strategies include:

- Water Services Authorities will be required, as part of their WSDPs, to develop and implement a WCDM strategy in accordance with the model strategy prescribed by DWAF.
- Water Boards will be required to develop and implement their WCDM strategies according to the model strategy prescribed by the Department, and submit them as part of their business plans.

Urban demand for water in the ISP area is projected to increase. An evaluation of the supply and use of water indicates that up to 50% of the water supplied is unaccounted for in many of the urban areas within the Amatole – Kei area, eg Butterworth.

Most of the municipalities in the ISP area do not have the capacity, experience, knowledge and funds to implement water demand management strategies. At the present time only the larger municipalities have any capacity to implement a demand management programme, but even their resources are limited.

Stepped tariffs, a useful tool in discouraging excessive water use, are generally not in place in the smaller towns, except to accommodate the 6 kl per month free basic use. Demand management, if undertaken at all, is currently not addressed according to correctly identified priorities. Information is required to prioritise the required WCDM initiatives for each municipality. Establishment of a WDM plan for each town according to identified priorities in terms of the WCDM principles is required.

The WSDPs of the two largest urban consumers in the ISP area (BCM and Queenstown) have identified WCDM as the highest priority, but due to limited resources neither municipality has yet embarked on instituting any comprehensive programmes.

In summary therefore :

- Some towns have up to 50% unaccounted for water.
- Stepped tariffs are not in place throughout the area.
- Demand management is not pre-planned in all but the largest municipalities.
- BCM and Lukhanji LM have prioritised WCDM but lack technical resources.
- Capacity within all the municipalities is very low.

**Strategic Approach**

It is estimated that by 2012 the BCM raw water supply will need to be augmented. This period could be extended if comprehensive measures are adopted for water demand management and conservation leading to savings in existing water use. This strategy must receive the highest priority and immediate action is required. It is essential that regular liaison take place with the BCM, ADM and AW concerning a water demand management programme for the Amatole Water Supply System.

The implementation of further augmentation options that require infrastructural development will not be approved if serious and adequate steps have not been taken by BCM to ensure that water is not being wasted and unaccounted for water is at an acceptable level.

Queenstown is currently suffering from water restrictions due to the severe drought in the region and it is imperative that a comprehensive WCDM programme is implemented immediately.

Promotion of WCDM is essential, but if this is to succeed the DWAF head office and regional office, and/or the future CMAs will have to assist the municipalities until such time as they are capacitated by appointing specialists to do situation assessments and to develop water demand management strategies, guide them with the implementation thereof and do monitoring and evaluation. Otherwise it is unlikely that such measures will be implemented in many municipalities. Funds for such studies could be generated through water tariffs. Implementation of water demand management should be promoted and defined by need and within the constraints posed by resources at both DWAF and the municipalities.

**Management Actions**

Following this approach, implement an urban water conservation and demand management strategy as follows:

1. Facilitate the establishment of a water demand management plan for each local authority, according to priority, through co-operative governance. Assist municipalities to draw up detailed local urban conservation and demand management strategies where required, co-operatively with the responsible District Municipality.
2. Ensure that the WSDPs of local authorities highlight the need to implement local water conservation and demand management strategies prior to the development of new schemes.

WSDPs must also include plans for the use of water saved through demand management measures.

3. Review WSDPs submitted to ensure that water conservation and demand management objectives have been adequately addressed.
4. WCDM plans should include benchmarking. Set benchmark targets for water savings with local authorities through co-operative governance.
5. Build capacity in local authorities by providing appropriate support services where these are needed in local planning, development of new supply schemes or rehabilitation of existing schemes.
6. Use the water allocation process to promote the principles of water conservation and demand management.
7. Promote the principles of water conservation and demand management through forums and the media. Encourage the use of printed and electronic media to disseminate information to all stakeholders and contribute regular articles to relevant publications to promote the concepts of water conservation and demand management.
8. Directorate : Water Use Efficiency and the regional Water Use Efficiency division to assist local authorities with the implementation of WCDM to overcome the technical and financial barriers many municipalities face.
9. Assist the municipalities financially by appointing specialists to undertake situation assessments, to develop WCDM strategies and assist with the implementation thereof. The funds can be generated through Water Resource Management tariffs.
10. Set up regular liaison meetings with the BCM, ADM and AW officials to keep informed about their WCDM initiatives and progress within the Amatole Water Supply System.
11. Regularly liaise with responsible officials and if necessary politicians at the District Municipalities and Local Municipalities (more immediately Butterworth) where water demand management interventions are required and aggressively promote the implementation of demand management measures.

**Responsibility**

Water Service Providers are responsible for implementing urban water use demand management programmes that have been developed with the assistance of DWAF. The RO has a regulatory and advisory role but will continue its monitoring and mentoring role to build capacity and to promote the concept. D: WUE is responsible for a national framework and the development of standardised demand management methods and procedures. District Municipalities are responsible for ensuring that local WCDM plans are compiled and implemented.

**Priority**

Priority 1 – Very high.

# 4.2 AGRICULTURAL WATER CONSERVATION AND DEMAND MANAGEMENT

**Management Objective**

To promote the use of water conservation and demand management principles by the agricultural sector by ensuring the use of efficient and effective irrigation systems, and by ensuring that bulk irrigation systems are operated and maintained to conserve water and minimize losses

**Situation Assessment**

Irrigation requirements/allocations in the year 2000 accounted for an estimated 61% of total consumptive water requirements (i.e. excluding the ecological Reserve) in the Amatole – Kei ISP area. With the revitalization of irrigation schemes in the former Ciskei and Transkei homeland areas, the potential water losses within the irrigation sector due to dysfunctional and/or inefficient infrastructure could prove to be very large and could undermine the viability of these schemes. This is especially important below Waterdown Dam, which supplies the Klipplaat Irrigation Scheme and Queenstown/Sada. Water supply from the dam has been over-allocated with respect to the available yield and assurance, and water restrictions have been imposed on all users (also due to the present severe drought). Any savings through more efficient distribution systems and irrigation methods would assist the situation.

Irrigation losses are often very significant but have rarely been quantified for irrigation schemes in the area. The value of water seems largely unrecognised by many agricultural water users where flood irrigation and overhead sprinklers are widely used. Lining irrigation canals, and improving application efficiencies in areas where flood and sprinkler irrigation is practiced, will substantially reduce irrigation water losses.

Conveyance losses in canals (eg Lanti canal below Lubisi Dam to Qamata Irrigation scheme), and rivers (eg. Klipplaat River below Waterdown Dam) can be significant. There are also significant leakage losses in many distribution and irrigation systems. Whilst there are areas where water use is efficient, substantial improvements can be achieved, especially in those irrigation schemes located and being revitalized in the former Ciskei and Transkei areas.

Some irrigation system losses return to the river systems but this return water can be of reduced quality. Irrigation methods, irrigation scheduling, soil preparation, crop selection, crop yield targets and evaporation all affect the efficient use of water.

The development and implementation of an agricultural water demand management strategy, with specific targets, must be integrated into the overall water resource planning process.

To achieve the objectives in the agricultural sector, the Directorate : Water Use Efficiency has developed a suite of tools comprising Best Management Practices (BMPs), Water Audits, Benchmarks, Train the Trainer programme and a Training Manual. This suite of tools is being tested and refined in case studies.

**Strategic Approach**

The approach will be to promote water conservation and demand management through co-operative governance where the need is greatest.

Implement a regional agricultural water conservation and demand management strategy as follows:

- Use the water allocation process to promote and encourage water conservation and demand management principles.

- Losses in canals and distribution systems need to be identified, costed and repairs prioritized.
- Inherently inefficient and badly planned schemes should either be improved or dismantled.
- Set targets with the PDoA, DMs and WUAs (co-operative governance) for re-allocation of water saved. Procedures need to be in place to ensure that water, which is "freed up" is used appropriately elsewhere. This is of particular importance if the water saving has been achieved through incentives directed at farmers.
- Promote the use of more water efficient irrigation equipment in order to conserve water. Discourage the use of flood irrigation where laser levelling is not continually done to increase the efficiency. Likewise with overhead sprinkler irrigation methods.
- Provide appropriate support services where these are needed in planning, development of new irrigation schemes and rehabilitation of existing schemes.
- Encourage the use of the printed and electronic media to disseminate information to all stakeholders and contribute regular articles to local agricultural publications to promote the concepts of WCDM.
- Initiate awareness campaigns through workshops, discussion forums, and newsletters.

Water User Associations will implement the strategy through the drafting and submission of Water Management Plans. In a Water Management Plan, a WUA describes its current irrigation water use and conservation measures and sets out how it plans to implement Best Management Practices (BMPs) to improve its irrigation water supply services and to achieve water conservation and water demand management. Developing a Water Management Plan and reviewing it regularly is a major stimulus to efficiency, promotes co-ordinated action and facilitates negotiations with the CMA and other stakeholders. The process does not require expensive data gathering, but uses existing data for its initial implementation and then aims to improve the plan from year-to-year.

**Management Actions**

The following actions are required:

1. Ensuring that the WUAs and end users understand and appreciate the need to progressively modernise their water conveyance systems and irrigation equipment.
2. Ensuring that water allocations promote equitable and optimal utilisation of water by all sectors in a water management area.
3. Ensuring that preventative maintenance programmes are put in place to postpone major rehabilitation, replacement and reconstruction.
4. Ensuring that sufficient irrigation information is generated and accessible to all stakeholders.
5. Ensuring that the concepts of environmental awareness and protection are promoted and accepted by all stakeholders.
6. Ensuring that service providers implement audits from the water source to the end users and beyond.
7. Encouraging water services institutions and farmers to use the latest technology in irrigation methods and for their water release and distribution systems.

Study the results arising from the report on agricultural water demand management options in the Gamtoos GWS. Based on the results and experiences of this study, undertake or facilitate the implementation of water conservation and demand management plans for irrigation schemes in the Amatole – Kei ISP area as per the above strategic approach.

**Responsibility**

DMs, WUAs, Irrigation Boards and individual farmers are responsible for implementing agricultural water demand management programmes with the assistance of DWAF and the PDoA where necessary. The RO has a monitoring and mentoring responsibility to build capacity and to promote the principle. D: WUE is responsible for a national framework and the development of standardised agricultural demand management policy, methodology and procedures.

**Priority**

Priority 1 – Very high.

# 4.3 INDUSTRIAL WATER CONSERVATION AND DEMAND MANAGEMENT

**Management Objective**

To identify regional industrial water demand management measures and savings opportunities and to use the legislation now available to promote implementation through co-operative governance, buy-in and capacity building.

(It should be noted that in all cases in this ISP area, industrial water supply is currently supplied as part of urban supply and in general this strategy forms a part of the urban strategy. Only relevant and unique aspects relating to industrial supply are highlighted in this strategy.)

**Situation Assessment**

Limited industrial demand management initiatives and treated effluent use have so far been undertaken in the ISP area.

The development and implementation of an industrial water demand management strategy, with specific targets, must be integrated into the water resource planning process, not only as a potential alternative or augmentation option to increasingly expensive supply side management options, but as a requirement before the planning of new infrastructure schemes.

Water demand management is the responsibility of the user sectors. The well-being of this sector is crucial to South Africa's economic development, and it requires a high degree of certainty that its water needs will be satisfied. There is nevertheless scope for water use to become more efficient without adverse impacts on economic activity.

The manufacturing industry together with agriculture and tourism is expected to be the biggest contributor to future economic growth in the region. The industrial sector, which includes large industries mainly in the Buffalo City Municipal area, is projected to have the greatest growth in water requirements. Much of this growth is expected to occur in the new East London IDZ, specifically manufacturing and other industrial activities. It is imperative to have assured water supplies at a reasonable cost to support industrial development and for the industrial sector to improve its efficiency of water use and to minimise waste. The use of treated effluent (20 Ml/day) for appropriate industries in the East London IDZ is presently being investigated.

**Strategic Approach**

The implementation of a regional industrial water conservation and demand management strategy is dependent on co-operative governance, since all industries now fall under the jurisdiction of either district or local municipalities. Co-operative partnerships are therefore required with especially the BCM, but also with smaller municipalities to ensure that demand management is being undertaken by all large industrial users of water.

DWAF's strategic approach will be to provide an enabling legislative framework, assistance and incentives to the municipalities and in turn the relevant industries for the implementation of industrial water conservation and demand management measures.

**Management Actions**

Implement a regional industrial water conservation and demand management strategy as follows:

1. Promote the supply of treated effluent to industries by municipalities by providing an enabling legislative framework, assistance and incentives.

2. Promote the efficient use of water by industries through financial incentives or disincentives.
3. Identification of the largest water consuming industries.
4. Classification of those businesses that have the greatest impacts on the water resources in terms of water utilised, wastewater discharged and the efficiency and effectiveness thereof.
5. Develop regional and local levels of databases for the purposes of monitoring the water-related performance of businesses. There are too many businesses for all of them to be included in the databases, and only those businesses that have the greatest impacts on the water resources should be considered (i.e. the high priority categories).
6. Undertake performance auditing on identified industries. Determine whether the water is lost through leaks or bad maintenance or through the normal production process or business operation. Use best practice guidelines and manuals to provide guidance.
7. Ensure or facilitate the implementation of measures in industries where wastage is noted, such as fixing leaks to reduce further wastage.
8. Analyse the efficiency of production processes to understand how water is being utilized.
9. Design and implement communication, public awareness and education programmes as required.
10. Set up water conservation forums.
11. Identify and undertake pilot projects.
12. Manage non-conforming industries.

**Responsibility**

Water management institutions (Municipalities and water boards) and large individual water users are responsible for implementing urban and industrial water use demand management programmes. The RO has a monitoring and mentoring responsibility to build capacity and to promote the concept. D: WUE is responsible for a national framework and the development of standardised demand management methods and procedures.

**Priority**

Priority 2 – High.

# STRATEGY NO. 5

# INSTITUTIONAL DEVELOPMENT AND SUPPORT

## Need for Institutional Development and Support Strategies

There is a requirement that Local Authorities (LAs) and DWAF interact in the management of existing water supplies and in planning for new and additional water supplies in order for both parties to know and understand the opportunities and constraints of the available water resources. This interaction and sharing of knowledge should be reflected in the IDPs and WSDPs that are the responsibility of the Local Authorities. Due to the lack of skilled and experienced manpower within many of the LAs and their advisors, this has often not been the case. The result is that many IDPs and WSDPs that have been produced to date contain fundamentally wrong information and proposals that do not take account of the constraints and opportunities imposed by the available water resources. As a result these programmes, which are being adopted by the LAs, will in many instances not be successful resulting in much wasted effort and wasting of scarce resources. There is an urgent need for DWAF to pro-actively provide institutional support to the LAs in terms of closing the knowledge gap that presently exists thereby ensuring that LAs (councillors and officials) and their technical advisors know and understand the limitations to water supply in their areas.

At a national level this overall strategy includes support for the formation of Catchment Management Agencies (CMAs) and Water User Associations (WUAs). These are national functions with national strategies and policies in place. These national strategies and policies will need to be incorporated in an institutional development strategy still to be formulated relating to the establishment of Catchment Forums, WUAs and CMAs. Currently very little progress has been made on this issue.

This ISP strategy addresses institutional support for development of water supplies to Local Authorities.

## Relevant Identified Strategies

The following strategy forms a part of this overall strategy:

5.1 Supply to Local Authorities

# 5.1 SUPPLY TO LOCAL AUTHORITIES

**Management Objective**

To ensure that District and Local Municipal Authorities work together with DWAF to understand the available surface and groundwater resources in their areas in order to optimise the development and use of these resources.

IDPs, WSDPs, Water Sector Plans and water feasibility plans should reflect these opportunities and constraints.

**Situation Assessment**

The water supply situation in most of the towns in the ISP area is currently adequate with exceptions described under each key area below (refer **Appendix B13**).

Studies regarding water requirements and water supplies that could have a regional impact have to date been undertaken by DWAF Directorate : Project Planning (now Options Analysis). These studies include for water supply to BCM (**Ref. 3 and 4**) and augmentation of Queenstown's water supply (**Ref. 20**). Studies have also been undertaken by DWAF under the BoTT programme to implement water supplies to many rural villages and towns in the ISP area.

Since the establishment of District Municipalities as Water Service Authorities, investigations for additional or new water supplies to local authorities have been undertaken by the District and Local Municipalities using technical advisors (consulting engineers). In most cases the capacity and water management expertise in the DMs and LMs is insufficient. When requested, DWAF regional office has assisted municipal officials in compiling acceptable programmes and plans. However, in many cases this has not happened and unacceptable proposals for water supply options are often recommended for implementation by municipal officials where there are often insufficient raw water resources available or there are competing interests requiring the same source. This only becomes known when applications are made to DWAF for water licences. This gives the appearance that DWAF are delaying what are often seen as urgent and necessary water supply schemes and leads to misunderstanding and a breakdown in co-operative governance.

Local and District Municipalities are mostly unaware of provincial and national priorities when producing their IDPs and WSDPs. Until these documents are completed to an acceptable level of accuracy and detail, the information regarding the anticipated future water requirements and sources of supply for local authorities remains uncertain. Support requested and given by DWAF at the initial stages of compiling the WSDPs would overcome many of the problems encountered with the WSDPs to date. Often the fault lies with inexperienced consultants appointed by the LAs.

Many LAs obtain all or a portion of their water requirements from schemes which they own and operate. These LAs are often unaware that they must consult with DWAF, as the government department responsible for the management of the water resources, before making or approving recommendations regarding water supplies. In addition, there is often a general lack of capacity within many LAs to participate and to take responsibility for their mandate.

***Amatole and Keiskamma catchments:***

**Morgan Bay/Kei Mouth** obtains its water supply from a number of small surface water sources. Operation and maintenance is therefore problematic. The assurance of supply is also less than the required 98% especially during the peak holiday seasons. With the upgrading of the access road to Kei Mouth and a more permanent population, which is expected to grow rapidly in the short term, additional water resources will be required by 2008, probably sourced from the Kei River. Although a pre-feasibility study has been undertaken, no detailed studies for a future water supply have been

conducted. The most likely source of water would be from the Kei River which has a surplus water balance. However, due to the ecological Reserve requirements of the Kei River at different times of the year, it is most probable that off-channel storage will be required.

**East Coast Resorts,** which include some twenty villages along the coast to the east of East London rely on local dams, boreholes and rainwater tanks and all suffer from a low assurance of water supply. The resorts between Yellowsands and Cintsa should be considered for supply from Buffalo City notwithstanding their location within the Great Kei Municipal area. Plans for the extension of the bulk water supply from the BCM have been proposed but were put on hold pending the finalisation of the municipal boundary between the BCM and the Great Kei LM. It is likely that the construction of this pipeline to as far as Cintsa/Cefane will proceed within the next five years subject to the availability of funds and a sale agreement being concluded between the two municipalities. The few remaining resorts will continue to be dependent on local groundwater resources and/or small river schemes with off-channel storage for the foreseeable future. In the long term water will have to be sourced either from the BCM or from the Kei River. The Great Kei LM with the assistance of the ADM is presently undertaking a feasibility study to investigate the future water supplies to the region.

**West Coast Resorts**, which include some thirteen coastal villages to the west of East London down to Kaysers Beach all fall within the Buffalo City Municipal area. Most of these villages currently rely on boreholes and rainwater tanks. Plans have been developed and are gradually being implemented for water supply to these villages from the Buffalo City supply system (Amatole System). In time this will require the release of water from Wriggleswade Dam to supplement the raw water supplies in the Buffalo River, which is the identified source of raw water supply for these coastal resorts.

**Buffalo City Municipality,** which includes the towns of East London, King William's Town, Bisho, Zwelitsha, Mdantsane obtains its water from the Amatole Water Supply System. With the expected growth in this area, plans need to be advanced for the development of additional raw water sources by the year 2012, depending on the success of the East London IDZ. Due to the importance of this city in the region, a separate strategy has been developed for its future water supply (refer Strategy No. 1.3).

**Mooiplaas/Kwelera** are large peri-urban areas north east of East London. The communities currently rely on low yielding and poor water quality boreholes, which results in inadequate water supplies to these villages. Detailed feasibility studies are required to identify reliable future water sources for this area possibly from the Kwelera or Kei Rivers.

***Kei catchments:***

**Lady Frere** together with surrounding rural villages obtain water from the Cacadu Rural Water Supply Scheme with raw water from the Macubeni Dam. As a result of loss of capacity in the dam due to sedimentation as well as expansion of the rural components of the scheme, it is believed that the assurance of water supply is below 98%. The scheme and its possible augmentation and/or capacity constraints need investigation. Detailed groundwater investigations should form part of these investigations as the area has been identified as possessing good groundwater potential.

**Sterkstroom** obtains its water supply from boreholes. The assurance of the groundwater supply appears to be adequate for the foreseeable future.

**Queenstown/Ezibeleni,** together with Sada/Whittlesea obtains the bulk of its water from Waterdown Dam, which also supplies the Klipplaat River Government Water Scheme. The existing allocations from the dam cannot be supported at an acceptable level of assurance. Previous studies have been undertaken by DWAF and these studies are presently being revisited to confirm future water supply options for Queenstown (refer Strategy No. 1.4).

**Nqamakwe** currently obtains an inadequate water supply from boreholes. A study has been commissioned (Oct. 2003) by the ADM to undertake water supply feasibility investigations for the whole Nqamakwe region including that of the town.

**Hewu Groundwater Scheme** is currently being expanded to supply those rural villages that presently have inadequate supplies of water.

**Tsojana Water Supply Scheme** supplies the town of Cofimvaba and surrounding rural villages. Plans have been suggested for expanding this water supply from Tsojana Dam to additional rural villages between Cofimvaba and Tsomo and the Ncora Flats area. The yield of Tsojana Dam shows that there is a surplus of water to achieve a basic supply to these communities. However, the yield of the dam and demand need to be more accurately assessed before a firm recommendation in this regard can be made. This aspect should also be considered in conjunction with the studies to determine the yield from Ncora Dam as both dams are suitably situated for supplying the proposed rural villages. In addition, the groundwater resources of the region need to be more fully investigated.

The following issues and concerns have been identified for this ISP area:

- There is continued urbanisation in this ISP area. Water requirements are growing in most towns, even though overall populations are not increasing or are even declining in the rural areas. Services have been upgraded in most small towns under the CMIP programme.
- DWAF and the District and Local Municipalities do not have an adequate process of interaction, information sharing and co-operative governance.

**Strategic Approach**

The approach will be to work with and inform DMs and LMs, to promote up-front liaison and agreement between DWAF and LAs regarding proposed developments as mentioned in the WSDPs. Also to promote awareness within LAs of the need to inform DWAF of their plans and to consult before making recommendations. The WSDPs should more closely conform to the NWRS, ISP and Catchment Plans. WSDPs should highlight water conservation and demand measures proposed by the LAs in addition to current sources of supply and future anticipated sources of supply. Future planning should consider applicable social, environmental and economic impacts and costs.

DWAF RO will identify outstanding WSDPs and ensure that they are submitted timeously. They must review IDPs, WSDPs and Water Sector Plans and provide feedback to the relevant LAs to ensure that proposals conform to DWAF requirements. IDPs and WSDPs must become the documents that reflect the total municipal water strategies. The WSDPs should include water conservation and demand management measures and treated effluent use measures where appropriate.

LAs should be encouraged at every available forum, committee or other venues jointly attended by DWAF and the LAs to first pursue alternative augmentation options, such as water demand management, groundwater use, treated effluent use, water trading or eradication of alien plants in water stressed areas before applying for additional surface water developments. Where future water supplies have not been identified in the WSDPs, further feasibility studies must be undertaken by the LAs.

An approach and strategy for water supply must be developed for each town. The over-abstraction of coastal aquifers should be stopped as soon as possible.

There is a very real need to assist with building capacity in the water sector at District and Local Municipality level.

**Management Actions**

1. The RO must review the WSDPs and follow up with LAs in cases where submissions are incomplete or have not been submitted. The RO must pro-actively assist the LAs with regard to development of water supply schemes and water demand management investigations and implementation programmes.
2. Update the data of all municipal water sources, requirements, issues and future augmentation plans etc as contained in this Strategy (refer **Appendix B13**). Advise LAs and their technical advisors to interact upfront with DWAF before finalising water supply options.

3. Capacitating officials in District Municipalities is planned by the DWAF RO on an ongoing basis.
4. Request Directorate : Water Use Efficiency at DWAF Head Office and the regional WCDM division to assist LAs to overcome the technological barriers many of the local municipalities in the area face with the development and implementation of WCDM strategies.
5. Aquifer management plans are essential for groundwater supplies to the coastal villages to avoid over-abstraction and saline intrusion.
6. Aim to improve borehole monitoring and ensure that water management plans are compiled. Directorate: Information Programmes and RO Hydrological Information Sub-Directorate must investigate this and compile a strategy to deal with the situation.
7. Co-ordinate with the BCM, ADM and AW recording the need for further studies into future water supply options for the BCM (refer Strategy No. 1.3).
8. Similarly, co-ordinate with the Chris Hani DM and Lukhanji Municipality further studies into future water supply options for Queenstown (refer Strategy No. 1.4).

**Responsibility**

All Directorates in DWAF Regional Office.

**Priority**

Priority 1 – Very high.

# STRATEGY NO. 6

# SOCIAL AND ENVIRONMENTAL

## Need for Social and Environmental Strategies

Water for poverty eradication, for equity, and as a generator for economic growth is a major focus of both central and provincial government that will be pursued under this strategy. In addressing imbalances of the past, the provision of an equitable share of available water to previously disadvantaged communities is being addressed to improve the livelihoods of the poor. The establishment of resource poor emerging farmers, and the provision of water to areas in which land restitution is in progress, must be prioritised as one of the ways to reduce poverty. The water reconciliation for the ISP area has shown that water is available for allocation to emerging farmers especially in the former Ciskei and Transkei homeland areas where new and revitalized irrigation farms are being established. This strategy will support the Eastern Cape Provincial Government's Growth and Development Strategy.

## Relevant Identified Strategies

The following specific strategy has been developed further:

6.1 Poverty eradication, emerging farmers and revitalising of irrigation schemes.

# 6.1 POVERTY ERADICATION, EMERGING FARMERS AND REVITALISING OF IRRIGATION SCHEMES

**Management Objective**

To provide support to the Provincial Strategy Framework for Growth and Development (PGDP), which has identified poverty eradication as having the highest priority.

To optimize the allocation and use of water in the quest for equity and poverty eradication whilst at the same time recognizing the importance of the established agricultural sector and the need for resources to sustain urban and industrial growth and development in the long term.

**Situation Assessment**

The provincial strategy framework for growth and development in the Eastern Cape highlights the fact that most of the constraints for improvement stem from the severe poverty that exists in the region especially in the rural areas. Amongst other factors, the underdevelopment of the agricultural potential of the province is both a cause and effect of the poverty that exists. At provincial level the sustainable development of the "abundant" natural resources of water and land has been identified as one of the main keys to poverty eradication. As such, food security has been prioritized and will be addressed through household food production programmes and increased support to black commercial farmers through credit and low interest loans, additional land etc (The Massive Food Production Programme and the Integrated Rural Development Programme).

DWAF is co-operating with other departments to ensure that the management of water resources can contribute to these programmes, with particular emphasis on interventions to reduce poverty and increase food supply.

Interventions under the Integrated Rural Development Programme include:

- Modifying water resource management programmes and priorities to align with the priority areas identified for the IRDP.
- Ensuring that rural development features strongly in catchment management strategies.
- Identifying rural water needs and opportunities, and making specific allowances for rural development and livelihoods in allocating water. In particular, identifying potential rural users, in addition to registered users, in calling for licence applications during licensing.
- Ensuring community representation on the management bodies of water management institutions.
- Ensuring that communications, awareness creation and education programmes are appropriate for rural communities.

The following mechanisms exist to alleviate poverty in terms of the broader Water for Equity approach:

- Assistance to resource poor emerging farmers.
- Assistance to small towns and rural settlements for general access to water.
- Creation of employment opportunities under the Working for Water and Working for Wetlands programmes.
- Assistance to farm workers.

The following national issues and concerns have been identified regarding resource poor farmers and rural settlements:

- The process to implement schemes for resource poor farmers is a lengthy one.
- DWAF provides access to water but land acquisition falls under other authorities (Department of Land Affairs and Department of Agriculture).

- DWAF can only subsidise farmers who are included in WUAs or other recognized water management institutions.
- Capital costs to acquire existing farms or to establish infrastructure on new land is expensive.

A number of initiatives have already been started by the Provincial Department of Agriculture (PDoA) and the District Municipalities. DWAF is assisting these initiatives through the CCAW by providing financial and resource support to these organizations. Most of these schemes are centred around irrigation projects and bulk water supply schemes and dams that were originally implemented under the former Ciskei and Transkei homeland governments. During the political transition period of the mid 1990s, most of these schemes fell into disuse with very little farming activity taking place. With the adoption of a new provincial strategy, which identifies poverty alleviation and self-sufficiency in food as one of its main goals, major emphasis is now being place on rehabilitating these schemes, either partially or wholly.

The following schemes have been identified for assistance by DWAF and an investigation study is presently underway:

- The Qumanco Scheme, which comprises a 2000 ha extension to the existing irrigation area supplied from Ncora Dam (scheduled water rights for 3000 ha). One of the main factors affecting the feasibility of the scheme will be the availability of water from the Ncora Dam. An updated yield analysis will be required taking account of the latest dam silt survey and water allocations required for domestic supply to rural communities.
- Ncora Scheme Extension, which consists of a further 1000 ha of irrigable land. The feasibility of the scheme depends on the water availability from Ncora Dam.
- Lower Wolf/Sandile Scheme, which is a new identified scheme of 15 ha with water to be pumped from Sandile Dam.
- Zanyokwe Scheme (Kama Furrow) entails rehabilitation and extension of an existing scheme to 60 ha with water from the Keiskamma River below Sandile Dam.
- Qamata Scheme (Extension 6) comprises phase 2 level development following on from centre pivot irrigation schemes implemented with assistance from Eskom. The scheme is a 642 ha extension to the existing scheduled area of 1959 ha with supply from the Lubisi Dam/Lanti weir and canal system.

In addition to the above, a number of schemes with existing scheduled water rights are in the process of being revitalised. These include the Xonxa/Bilatye scheme below Xonxa Dam (1643 ha), the Zanyokwe scheme below Sandile Dam (471 ha), the Keiskammahoek scheme below Cata and Mnyameni Dams (854 ha), and the Shiloh irrigation scheme, which forms part of the Klipplaat Government Water Scheme below Waterdown Dam (1905 ha).

**Strategic Approach**

DWAF has prioritized water for equity, but not at the expense of efficiency and beneficial use. DWAF supports the PDoA in providing water for resource poor farmers, provided the water is available and allocations have been prioritized. This requires close co-operation between DWAF and the PDoA.

DWAF will honour the allocations made to irrigation schemes and supports the revitalization of existing but defunct schemes. There are, however, four caveats :

- Alternatives to allocating and distributing this water to a wider spread of population for more effective poverty relief should be examined.
- The water must be available and new demands, notably the recently recognized requirements of the ecological Reserve, could mean some trimming of historical allocations.
- Where new demands (such as growth within the BCM and Queenstown areas) which are critical to the economy and affect the livelihoods of a very large number of people are identified, then defunct schemes should not be revitalized without detailed studies of all current and future water requirements.
- Irrigation schemes which will clearly never be viable and where water and investment will be wasted should not be revitalized.

**Management Actions**

The needs of prioritised resource poor farmers should be addressed through the CCAW, through co-operative governance between DWAF, the Department of Land Affairs, the Department of Agriculture, appropriate District Municipalities and DEAET as follows:

1. Identification of areas where it may be possible to develop and sustain resource poor farmers in the ISP area, especially those areas where bulk water supplies (and dams) are in place with existing water rights.
2. Identification and short-listing of schemes by the CCAW for further evaluation. The District Municipalities must be requested to provide information on potential small and large scale irrigation developments identified in their areas including the requirements for home gardens. DWAF will provide the water resource availability scenario to aid the identification process.
3. Evaluation of the short-listed and prioritised schemes through planning studies to determine the feasibility of the schemes.
4. Ways in which appropriate relevant information regarding water requirements and water availability can be effectively assessed in a structured way and transferred to the CCAW must be revisited. A protocol for a structured sharing and transfer of information, particularly between DWAF, the PDoA and the District Municipalities, regarding potential resource-poor farmer (and commercial) irrigation developments and required water resources must be implemented.
5. Ways in which the irrigation development needs of the PDoA in line with the provincial economic development strategy and various priority lists can be effectively communicated to the CCAW in a structured way must be revisited.
6. Ensuring the availability of staff and funds to undertake the planning studies by lobbying for such activities within DWAF and other Departments at a political level. The current serious shortage of manpower resources in the RO to implement this strategy must be addressed. To implement this strategy, staffing requirements must be clarified and adequate staff must be allocated.
7. Motivate for Reserve determinations where required to be able to allocate water licences where water is still available.
8. Attach a high priority to the forming of WUAs where the needs of resource poor farmers have been prioritised, once the schemes have been proven to be sustainable.
9. Arrange payment of a subsidy to the WUAs and assist with the sourcing of such funds if necessary according to the procedure for funding and construction of such schemes, as devised by D: WU.

**Responsibility**

The development of this strategy is the responsibility of the CCAW supported by the RO together with the PDoA, DLA, the DMs and the LMs.

**Priority**

Priority 1 – Very high.

# STRATEGY NO. 7

# INTEGRATION AND CO-OPERATIVE GOVERNANCE

## Need for Integration and Co-operative Governance Strategies

This strategy addresses co-operative data collection, information sharing, sharing of visions and plans, and co-operative making of joint decisions which are satisfactory or at least acceptable to all parties. The ISP strategies interface with those of other central and provincial government departments, local authorities and water service providers. Consequently, there is an inherent need for establishing co-operative relationships with such organisations. This is required to ensure that management and control of the water resources in the ISP area are integrated with the relevant strategies of other organisations, whilst meeting the requirements of particular legislation with which it must comply.

The Integration and Co-operative Governance Strategy is required to address:

- ⇨ Regional, local and sector-specific co-operative governance.

## Relevant Identified Strategies

The following specific strategy has been developed further:

7.1 Co-operative governance

# 7.1 CO-OPERATIVE GOVERNANCE

**Management Objective**

To improve co-operation and co-ordination between DWAF personnel and other authorities regarding information sharing and decision-making and thereby achieve improved management of the water resources in the Amatole – Kei ISP area.

**Situation Assessment**

Reference should be made to Strategy No. 8.1

Due to the integrated nature of water resource management, co-operative governance is linked to all of the strategies discussed in the ISP. Furthermore, land affairs issues, land use issues and marine issues are all related to water resources in one way or another. Consequently, the effective and efficient management of water resources requires co-operation between DWAF, other government departments and local authorities and parastatals such as Eskom and Water Boards.

In the spirit of good co-operative governance, the DWAF Regional Office has been involved with:

- Liaison with the Provincial Department of Economic Affairs, Environment and Tourism (DEAET), the Department of Agriculture (PDoA) and local authorities through the Stream Flow Reduction Activities Licence Assessment Advisory Committee (SFRALAAC).
- The existing Wetlands and Riparian Zone Delineation Policy Committee between DWAF and DEAET.
- The existing Provincial Liaison Committee (PLC) and its sub-committees, such as the Co-ordinating Committee for Agricultural Water (CCAW) involving DWAF, the PDoA, DEAET, the Department of Land Affairs (DLA), the Department of Local Government and Housing and the District Municipalities.
- The existing Integrated Water Services Management Forum.

The generic issues and concerns relating to co-operative governance requirements are identified as follows:

- The need for co-operative governance in the sharing of information and approval and licensing of all water related activities.
- Delays caused by the lack of capacity, finances or lack of knowledge on the part of officials within different government departments.
- There is a need to consolidate data information systems in the region and improve the sharing of water resource related information (and other information) between government departments, local authorities and institutions to avoid duplication of effort in an area with scarce skilled manpower and financial resources.
- The management and operation of purification and wastewater treatment works and solid waste sites by local authorities in order to meet the standards and requirements set by DWAF.
- Pollution of rivers and the marine environment due to inadequate and/or poorly maintained and operated infrastructure services under the control of local authorities.

The following issues and concerns relating to co-operative governance in the Amatole – Kei ISP area have been identified:

- The integrated nature, overall optimum management and future planning for augmentation of the Amatole Water Supply System requires significant co-operation between various organizations. This need for co-operation includes the deteriorating water quality of the Buffalo and Nahoon Rivers.

- Similarly, the need for co-operative governance related to the future water supply for Queenstown and it environs.
- The need for co-operative governance relating to pollution in the Gcuwa River due to illegal effluent discharges and the unlicensed solid waste site in Butterworth.
- Sedimentation of rivers and dams due to poor land use practices especially in the former Ciskei and Transkei components of the ISP area.
- The need for improved co-operation between DWAF, DLA, PDoA and DEAET for the management of wetlands, marine environments and estuaries, soil conservation and alien plant control programmes.
- The need for alignment between the Eastern Cape Provincial Growth and Development Strategy, the IDPs and WSDPs and the regional ISP perspectives.
- Need for groundwater representation on the CCAW because of unco-ordinated drilling often unknown to DWAF.

**Strategic Approach**

Promote the effective management and co-ordination of water resources in the ISP area through co-operation between DWAF, other government departments and local authorities and parastatals. Continue involvement in the various co-operative management bodies already established, and ensure active involvement in new liaison bodies that are being or will be established to contribute towards improved water management.

**Management Actions**

The following specific actions are required to address issues and concerns in the ISP area:

1. Study and provide feedback on the Provincial Situation Assessment and Provincial Strategy framework recently undertaken by the Eastern Cape Provincial Government.
2. Arrange a meeting between DWAF and DEAET to establish a permanent co-operative liaison body for improved co-ordination and information sharing regarding the management of wetlands, estuaries, marine environments and alien plant control programmes.
3. Arrange a meeting between DWAF and PDoA to initiate co-ordination regarding land use issues and soil conservation programmes.
4. Establish a co-operative initiative with local authorities and the Department of Housing and Local Government especially with respect to planning for future water needs and water conservation and demand management.
5. Develop and implement an action plan to ensure that all infrastructure planning processes that impact on water resources are aware of DWAF requirements.
6. Develop and implement an action plan to ensure DWAF input and requirements for IDPs and WSDPs during compilation.
7. Ensure groundwater representation on the CCAW.
8. Set up meetings with the BCM, the ADM and the AW to facilitate improved co-operative governance for optimum water management of the Amatole Water Supply System.
9. Report all co-operative governance issues to the PLC meetings as a regular agenda item.
10. Liaise with Eskom regarding their future plans for hydropower generation in the region.

**Responsibility**

Although the issues identified are at ISP level, the need for improved co-operative governance is a national and provincial requirement, with action from the RO on area specific matters.

**Priority**

Priority 1 – Very high.

# STRATEGY NO. 8

# WATERWORKS DEVELOPMENT AND MANAGEMENT

## Need for Waterworks Development and Management Strategies

Alternative options for the future ownership and management of major water resource infrastructure currently owned and operated by DWAF **(**refer **Appendix B9)** are being investigated at national level. In the interim, there is an ongoing need to economically and safely manage the existing water resource infrastructure at both national and regional level.

The Waterworks Development and Management Strategy is required to address:

- ⇨ Strategies for proposed augmentation and new regional schemes
- ⇨ Strategies for major infrastructure operational components
- ⇨ Disaster management planning

## Relevant Identified Strategies

The following strategies form part of this overall strategy:

8.1 Amatole System Management (refer also Strategy No.1.3)
8.2 Klipplaat Government Water Scheme (Queenstown)(refer also Strategy No. 1.4)
8.3 Public Health and Safety

# 8.1 AMATOLE SYSTEM MANAGEMENT

**Management Objective**

To ensure the effective and efficient operation and management of the dams and bulk infrastructure of the Amatole Water Supply System (AWSS) in order to meet the present requirements and to ensure that planning and implementation of new infrastructure is undertaken timeously in order to meet the anticipated growth in demand in the Buffalo City Municipal (BCM) area.

**Situation Assessment**

Reference should be made to Strategies No. 1.3 and 7.1.

The AWSS supplies the water requirements of the BCM area consisting of the East London/Mdantsane/Bisho/King William's Town urban complex, and the town of Stutterheim/Mlungisi and surrounding rural villages. The system is a complex one that has developed over many years from a number of separate water supply schemes, some of which have become interlinked as their supply areas have been extended.

The system consists of seven linked raw water storage dams, their associated water treatment works and distribution infrastructure. The dams are the Maden, Rooikrantz, Laing, and Bridle Drift dams on the Buffalo River, the Nahoon Dam on the Nahoon River, and the Gubu and Wriggleswade Dams on the Kubusi River (refer **Appendix B10**).

Most of the demand on the system is in the catchment of the Buffalo River and the adjacent coastal strip and is currently supplied from the dams on the Buffalo and Nahoon Rivers. With the expected growth in demand and/or drought conditions, water will be conveyed from Wriggleswade Dam on the Kubusi River to the Buffalo / Nahoon catchments by means of a canal and tunnel system. This inter-basin transfer scheme can also discharge water into the upper Nahoon and Gqunube catchments.

The AWSS can be divided into a number of sub-systems as follows. These systems are all linked in one way or another:

- The upper Buffalo system from Maden and Rooikrantz Dams supplying King William's Town and surrounding suburbs.
- The middle Buffalo system from Laing Dam supplying Bisho, Zwelitsha and surrounding peri-urban villages. This sub-system can also feed into the upper Buffalo System and the lower Buffalo system. An abstraction weir below the dam also supplies the large peri-urban area of Needs Camp.
- The lower Buffalo system from Bridle Drift Dam supplying Potsdam, Fort Jackson, Mdantsane, East London and the coastal strip.
- The Nahoon system from Nahoon Dam which feeds into the lower Buffalo system and also supplies the peri-urban areas of Newlands.
- The Kubusi system from Gubu and Wriggleswade Dams supplying Stutterheim/Mlungisi and surrounding rural villages. The primary purpose of Wriggleswade Dam is to feed raw water into the middle and lower Buffalo systems by means of an inter-basin transfer system.

The system of ownership, operation and maintenance of the AWSS infrastructure is complex with DWAF, the BCM, the Amatola Water Board (AW), the Amatole District Municipality (ADM) and the Amahlati Local Municipality all involved. The present arrangement is leading to problems with co-operative governance issues.

One example of this is the issue of different tariffs for the supply of raw and treated water in the AWSS. BCM owns Bridle Drift Dam, the associated Umzoniana Water Treatment Works and

distribution network in the lower Buffalo system, while DWAF owns Nahoon Dam and the associated treatment works, which are operated and maintained on DWAF's behalf by AW. Owing to different cost structures and overall customer base for each organisation the price of treated water supplied by the AW to BCM from the Nahoon system is greater than that supplied by BCM from its own Bridle Drift Dam and treatment works. The result of this is that the BCM uses as much water as it can from its own infrastructure whilst under-utilizing water from AW (a similar situation applies to water from Laing Dam to King William's Town). The AWSS is thus operated on a "tariff based system" and not on a system that optimises the yield nor takes into account the deteriorating water quality in the system. The consequences of this are many including :

- A breakdown of co-operative governance with arbitration methods being used to solve problems that arise.
- Necessary infrastructure being constructed by one organization but only being used (and paid for) during drought situations by another.
- Overall co-ordinated planning for additional infrastructure such as the need and location of additional water treatment works is not occurring.
- During a drought situation the yield of the system will be less than the optimum yield as each sub-system is presently being operated independently of the other sub-systems. This may create the apparent need for development of additional raw water resources, which could be delayed with optimum operation and management.
- The operation of the sub-systems currently makes no allowance for improving the serious water quality concerns in the system nor for environmental releases. This aspect could possibly be improved with the release of water from Wriggleswade Dam although studies (**Ref. 4**) show the impact to be minimal.
- Wriggleswade Dam, which was completed in the late 1980s has only being used a couple of times, once to provide farmers in the Gqunube catchment with water during the 1992/93 drought. For most of the past decade the dam has remained 100% full and has been used mainly for recreational purposes. There is a perception that the dam is a "white elephant" as it is not presently being used. Based on this perception, farmers in the Kubusi catchment are continually requesting water for additional irrigation and licences for forestry.

The following issues and concerns regarding the AWSS have been identified:

- The availability of water for future augmentation of the system.
- The need for a co-ordinated management and operational system for the AWSS. This may need to be undertaken by an organisation or forum involving all stakeholders such as a steering committee tasked with overseeing the management and operation of the system.
- The need for a uniform systems approach towards tariffing in the AWSS.
- The location and size of the existing bulk supply infrastructure (including water treatment works) limits supply options from the various sources. Major augmentation to this bulk infrastructure would be required in addition to the raw water resource development (dams).
- The need to transfer ownership of assets and redeployment of manpower according to DWAF policy.
- The need to address the current inadequate environmental releases.
- The need to define and implement clear operating rules based on drought conditions and accurate assessments of the ecological Reserves and releases.

**Strategic Approach**

A more integrated management approach must be led by DWAF. This could take the form of a new organization or steering committee with the authority to manage and operate the system to clear optimum guidelines, which would include setting of tariffs. Alternatively, it could be undertaken by agreements being drafted between the various parties for operation, maintenance and supply aspects of the system. The implementation of an overall universally agreed management plan and system tariff would be a logical extension of this approach. This system tariff should be compiled as part of a pricing strategy for the region where allocations and not only water use are paid for. It will be necessary to accurately evaluate the water allocations to achieve this.

**Management Actions**

The main actions include the following:

1. Establish liaison with the BCM, the AW and the ADM with the purpose of encouraging a co-operative governance approach to the management and operational problems of the AWSS.
2. Investigate the phasing in of a uniform systems tariff and how this will affect users.
3. Ensure that overall co-ordinated management and operational plans are put in place as soon as possible through co-operative governance.
4. Appoint specialists to undertake investigations to optimize the location of future water infrastructure such as water treatment works and bulk infrastructure pipelines. Previous studies into future raw water augmentation schemes need to be revisited in view of changing developments within the BCM, which may affect the growth in water requirements. More accurate information and assessments need to be made on the quantity of water required and the related time frames. Reference should be made to Strategy No. 1.3.
5. Address the requirements for environmental releases from all dams but especially from the Nahoon and Wriggleswade Dams.

Refer also to Reconciliation Strategy No. 1.3.

**Responsibility**

The DWAF Regional Office is responsible for developing this strategy in consultation with the Buffalo City Municipality, the Amatola Water Board and the Amatole District Municipality.

**Priority**

Priority 1 – Very high.

# 8.2 KLIPPLAAT GOVERNMENT WATER SCHEME (QUEENSTOWN)

**Management Objective**

To ensure the effective and efficient operation and management of the dams and bulk infrastructure of the Klipplaat Government Water Supply System which supplies Queenstown and Sada/Whittlesea and irrigation developments downstream of the dam.

To ensure that planning and implementation of new infrastructure is undertaken timeously in order to meet the anticipated growth in demand especially from Queenstown and the proposed revitalized irrigation developments in the former Ciskei homeland.

**Situation Assessment**

Due to the important role that Queenstown plays in the sub-area, it is imperative that sufficient raw water is always available to meet the town's requirements. Bulk raw water supply for Queenstown is currently supplied from the small Bongolo Dam (1,5 million $m^3$/a) just outside the town, but mainly from the Klipplaat Government Water Supply Scheme based on the Waterdown Dam some 40 km away on the Klipplaat River (8,25 million $m^3$/a). Water is supplied to Queenstown from Waterdown Dam by means of a 46 km long pipeline, which is over 35 years old. A booster pumpstation some 16 km from Queenstown increases the flow in the pipeline. An offtake from this pipeline supplies the expanding Sada/Whittlesea urban complex in the former Ciskei homeland.

The present allocation for urban use from Waterdown Dam for Queenstown and Sada/Whittlesea is 8,25 and 4,2 million $m^3$/a respectively, with a further allocation of 14,8 million $m^3$/a for irrigation. The actual yield of the dam (17,5 million $m^3$/a) is less than the sum of these allocations. Water from the Oxkraal Dam is used to supplement the irrigators in the lower parts of the scheme. Water use in Queenstown is close to its full allocation, but due to the fact that most of the allocation for irrigation is not currently used or used at a low level of assurance, no major water shortages have been experienced. This will change as the irrigation rights are taken up as part of the revitalization of the irrigation schemes around Shiloh, which forms part of the Government Supply Scheme.

A number of studies have been undertaken to investigate possible future raw water supplies for the town (**Ref. 19 and 20**). These studies indicated that additional raw water would be required by the year 2000 based on the assumption that the full water allocation for irrigation was being used and that the growth experienced in the town over the past decade (1986 –1996) would continue. This has not been the case as most of the potential irrigation development in the former Ciskei downstream of the dam did not occur with the result that the allocated irrigation water has been available for use by Queenstown and Sada subject only to the limitations of the pipelines and pump stations. In addition, the growth in the town especially of industries has slowed due to the removal of homeland border subsidy schemes. A number of alternative options were investigated during the study including optimizing the operations of the system. In addition to the very necessary requirement for optimizing the operations, the favoured infrastructure augmentation scheme consists of a new pump station and pipeline from the under-utilized Xonxa dam to Queenstown. This pipeline would also supply a number of rural villages along the pipeline route.

Due to the number of uncertainties and assumptions in the above studies, such as a lack of hydrology records, ecological Reserve requirements, actual growth patterns, revitalization of irrigation schemes etc, DWAF are currently assisting the Chris Hani District Municipality and the Lukhanji Local Municipality with updates to the previous Queenstown Regional Water Supply Feasibility Study (**Ref. 20)**.

The Chris Hani DM is placing increasing pressure on DWAF to give permission for the next stage of the Xonxa Dam supply option to proceed.

**Strategic Approach**

It is important that more accurate data and information is obtained regarding the assumptions made in the previous studies in order to substantiate the recommendation for proceeding with the Xonxa Pipeline option. Without this information a costly scheme could be undertaken with far reaching implications for future water tariffs for Queenstown. This information and the revised studies should be undertaken with the utmost urgency in order to ensure that neither the urban sector nor the irrigation sector is unduly affected. These studies should also include details for optimizing the operation of the dams in the Klipplaat catchments.

**Management Actions**

The main actions required include the following:

1. Until such time as a definitive recommendation can be made regarding Queenstown's future raw water supply augmentation, an operational plan for the dams in the Klipplaat system should be put in place in order to maximize the yield of the system. This will require close co-operative governance between DWAF, the Chris Hani DM and the Lukhanji LM. On the supply side, the yield of the Klipplaat system must be optimized through recommendations for the operational aspects of the dams including the Oxkraal Dam. This should include allowances for environmental releases, which must still be determined.
2. The overall yield information for the existing dams in the Klipplaat catchments and Xonxa Dam should be more accurately calculated using the latest hydrological information and setting of ecological Reserve requirements.
3. DWAF should proceed with the utmost urgency to finalise its studies and recommendations for the augmentation of Queenstown's water supply with time frames for its implementation. These studies should provide more accurate information on the existing and future water requirements of the town and region.

**Responsibility**

The DWAF Regional Office and Directorate : Options Analysis are responsible for developing this strategy in consultation with the Chris Hani DM and the Lukhanji Local Municipality.

**Priority**

Priority 1 – Very high.

# 8.3 PUBLIC HEALTH AND SAFETY

**Management Objective**

To ensure the effective and co-ordinated disaster management planning and implementation relating to floods, droughts, dam safety issues and pollution spills.

**Situation Assessment**

The Public Health and Safety strategy is addressed under the following headings:

- Disaster management planning
- Floods
- Droughts
- Dam safety
- Emergency pollution.

**a. Disaster Management Planning**

The National Disaster Management Act was promulgated in 2002. This Act establishes the National Disaster Management Centre as the national focal point for all disaster management activities. DWAF is investigating the establishment of a dedicated Public Safety Unit to deal with its water resources management, water services and forestry responsibilities relating to disasters and emergencies.

The following issues/concerns have been identified:

- An Eastern Cape Disaster Management Forum has been established.
- The need for each District Municipality to have a disaster management forum.
- Uncertainty about the existence of disaster plans for Bridle Drift Dam, which is owned and operated by BCM.

**b. Floods**

The National Disaster Management Centre has established several working groups, each of which will prepare a component of the National Disaster Management Framework. The Department will lead the working group to develop a national flood management policy.

The following issue/concern has been raised:

- The high risk of flooding to informal settlements located below flood levels especially within the Buffalo City Municipal area.

**c. Droughts**

The Department will co-operate with the National Department of Agriculture, which leads the Drought Working Group established by the National Disaster Management Centre, in developing prevention and mitigation measures for drought conditions.

The following issues /concerns have been raised:

- A method is required to co-operatively deal with supply to local authorities during times of drought.
- The level of sedimentation and its impact on the dead water storage in former Ciskei and Transkei dams is not well known.

**d. Dam Safety**

The Dam Safety Office within DWAF, administers the Act's provisions relating to the safety of all new and existing dams with a safety risk. The Department is preparing new regulations relating to the safety of dams. The drafting process was completed during 2002, after which the proposed regulations will be the subject of a public consultation process. There are no dams within the area that presently pose any major risks.

**e. Emergency Pollution of Water Resources**

In emergency situations, where harmful substances are accidentally or negligently discharged into water resources, the Act makes those who have caused the pollution responsible for remedying its effects. At present all pollution incidents must be reported to the Department, so that appropriate departmental responses can be co-ordinated with the relevant emergency services and disaster management centres.

Pollution from diffuse sources such as informal settlements is extremely difficult to control at source, and inadequate sanitation facilities in these areas can result in bacterial pollution of water resources, which may cause outbreaks of diseases such as cholera.

The National Disaster Management Centre has co-ordinated the development of an inter-departmental strategy to deal with cholera, which has become endemic in the Eastern Cape.

The following issue /concern has been raised:

- Vulnerability of rural and dense informal settlements to the outbreak of water borne diseases, especially cholera and dysentery.

**Strategic Approach**

DWAF will manage the water resources of the region to ensure that water is stored, managed and distributed to maximize health and minimize risk. This entails compiling a set of protocols that can be timeously implemented to mitigate the risks posed by floods, droughts, infrastructure failure and pollution of the water resources.

**Management Actions**

Until such time as the Public Safety Unit has been established, an interim strategy will be implemented as follows:

**a. Disaster Management Planning**

1. Procedures to supply water during times of emergency need to be documented. This includes procedures for repair work that may be required to specific infrastructural components.
2. Integrate any disaster management plans with the Disaster Management Act.
3. Emergency supply arrangements need to be developed for various durations of possible non-supply from the system or components for the various user groups.
4. Encourage the establishment of disaster management forums in all District Municipalities through the Water management institutional framework strategy.
5. Complete Emergency Preparedness Plans (EPPs) for all government dams in the ISP area and implement.
6. Encourage owners of Category 2 private dams to prepare EPPs for their dams.
7. Through the co-operative governance strategy, liaise with the BCM, other affected municipalities and the Department of Local Government and Housing to influence the fast tracking of the housing process to get people out of dangerously located informal settlements such as exist within the BCM area.

**b. Operation During Floods**

1. Draw up a management plan to operate government infrastructure during floods.

**c. Operation During Drought Periods**

1. Implement the recommendations on operating rules as contained in the Amatole Water Resources System Analysis Report (**Ref. 4 and 26**) in a drought period.
2. Draw up a drought management plan to operate all government infrastructure during droughts.
3. Draw up a drought management plan to co-operatively deal with supply to local authorities during times of drought.
4. Review and document procedures adopted during previous droughts.
5. Identify shortcomings in terms of operation during previous droughts.
6. Develop procedures for the implementation of restrictions in the agricultural sector.
7. Address both surface and groundwater resources in the above.

**d. Dam Safety**

1. Implement the requirement of the NWA regarding dam safety.
2. Process dam safety applications and issue authorisations as required.
3. Keep a regularly updated register of all dams with a safety risk.
4. Undertake dam safety inspections and reporting.
5. Take action against owners of illegal or unsafe dams.

**e. Emergency Spills and Pollution**

1. Request the polluter to remedy its effects.
2. Contact relevant emergency services and disaster management centres.
3. Ensure that measures are in place to address sporadic outbreaks of cholera in the region.

In addition to the above, the following specific management actions are required:

**a. Buffalo River / Bridle Drift Dam**

Liaise with BCM officials to establish the status of disaster management plans for the dam and encourage them to implement such plans if not already done so.

Consult with the BCM regarding the operation of their infrastructure during drought periods and ensure the implementation of the recommendations on operating rules as contained in the Amatole Water Resources System Analysis Report (**Ref. 4 and 26**).

**b. Nahoon River / Nahoon Dam**

Revisit and, if necessary, revise the Disaster Management Plan.

**Responsibility**

The RO is responsible for developing this strategy in consultation with the BCM, the AW, the Chris Hani DM and Amatole DM, the Provincial Department of Agriculture and the Department of Housing and Local Government.

**Priority**

Priority 2 – High.

# STRATEGY NO. 9

# MONITORING AND INFORMATION MANAGEMENT

## Need for Monitoring and Information Management Strategies

The National Water Act requires the Minister to establish monitoring systems for water resources to collect appropriate data and information. As part of the national Monitoring and Information Strategy which forms part of the NWRS, the Department is addressing the inadequacies and shortcomings of the current arrangements by amalgamating all existing and planned monitoring and assessment systems into a structured and coherent monitoring, assessment and information management system. This system and the data captured on water availability, water use and water quality is required for effective and efficient management of an increasingly scarce resource.

Monitoring at catchment level is required to ensure compliance with water authorisation conditions and licensing, to control all water use and also for billing and revenue collection.

The Monitoring and Information Management Strategy is required at a National, Water Management Area and Catchment Management level to:

- ⇨ Improve monitoring networks and data capturing for water use control (availability, allocations, licensing and revenue collection).
- ⇨ Obtain and capture accurate data on the physical, chemical and biological aspects relating to surface and groundwater resources (quality).
- ⇨ Improve on efficiencies in gathering of information, particularly through institutional co-operation in data acquisition, storage and management, information generation and dissemination.
- ⇨ Set and maintain standards for the acquisition/sampling, processing and management of accurate data leading to generation of information.
- ⇨ Ensure that information systems are easily accessible both within DWAF and to outside stakeholders without compromising data security.
- ⇨ To ensure roles/responsibilities (including providing key required resources) are clearly defined for different levels of monitoring. This will help avoid duplication while encouraging sharing of resources between WMAs.
- ⇨ Ensure co-ordinated long-term sustainability of existing monitoring networks and the emerging/new ones, eg. the Reserve Monitoring compliance.
- ⇨ Ensure that the WMA/local strategic monitoring framework is linked to the national framework.

## Relevant Identified Strategies

The following specific strategies have been developed further:

9.1 Monitoring networks and data capture
9.2 Information management

# 9.1 MONITORING NETWORKS AND DATA CAPTURE

**Management Objective**

The installation of effective national and regional monitoring networks and the accurate population of databases to ensure sustainable water use (monitor the balance between availability and requirements), to ensure the control and billing of water use, and to ensure the protection of surface water resources and groundwater (water quality).

**Situation Assessment**

The National Water Act requires the Minister to establish national and regional monitoring systems for water resources to collect appropriate data and information necessary to assess the following:

- The quantity, quality and use from and effluent return to surface and groundwater resources
- The rehabilitation of water resources
- Compliance with resource quality objectives
- The health of aquatic ecosystems
- Atmospheric conditions which may influence water resources
- Other data necessary for the management of water resources such as billing and tariff calculations

To meet the requirement for detailed integrated information, DWAF is currently reviewing and revising at a national level, all data-acquisition, monitoring and information systems.

In addition to national networks required for assessing water availability and use, the following national water quality monitoring networks are required.

- National Chemical Water Quality Monitoring Network
- National Microbial Monitoring Network
- National Eutrophication Monitoring Programme
- National Aquatic Ecosystem Biomonitoring Programme (River Health Programme)
- National Toxic Monitoring Programme
- National Radioactivity Monitoring Programme is being tested
- National Estuarine Monitoring Programme is planned

Monitoring networks and data capture on **water use** aspects within the Amatole – Kei catchments are far below optimal, especially in the former Ciskei and Transkei areas, due to under resourcing (refer **Appendix B11**). Very little monitoring by DWAF of water use from surface water resources to small towns is done in the region. Monitoring is mainly undertaken for those supplies from DWAF owned dams or those for regional water supply schemes originally funded by DWAF. These include supplies to the Buffalo City Municipality and Queenstown.

The location and status of monitoring boreholes of small towns and coastal villages is poorly documented. Actual groundwater abstraction information is also generally not available from these towns and villages. In most instances officials responsible for these schemes do not have the technical expertise or capacity to do groundwater monitoring over an extended period and DWAF lacks the capacity to adequately undertake such monitoring on their behalf.

While agriculture is the largest user of water in the area, most of the irrigable areas fall within the former Ciskei and Transkei homelands where monitoring equipment and data capture is seriously lacking and prone to vandalism.

**Flows** in rivers are monitored at national monitoring stations. The number of operational flow monitoring sites, where flow is measured at reservoirs, at transfer schemes, at major irrigation schemes and at estuaries needs to be greatly expanded. This need is currently being addressed with proposals for flow gauging stations in the Kwelera River, below the Laing Dam in the Buffalo River and below the Binfield Park Dam in the Tyume River. These efforts need to be increased and facilities constructed in rivers such as the Kei River (estuary).

Within the former RSA component of the area, the regional hydrological data capture systems and databases are generally regarded as being the minimum acceptable to regional DWAF staff (monitoring and capturing of rainfall, evaporation, surface water, ground water and water quality). The available information and monitoring systems and resources to capture data are, however, not acceptable. Previous attempts at establishing sustainable GIS capacity in the region have failed. There is a lack of skilled personnel within DWAF and within the municipalities to undertake adequate monitoring, together with a lack of funds to increase monitoring points at an acceptable rate. This situation is worse for the former Ciskei and Transkei areas. An example is that of water quality samples, which are taken monthly by DWAF and not every two weeks due to a lack of manpower.

**Water quality monitoring** is sparse and sporadic throughout the area due to a lack of skilled manpower resources, both at the regional (DWAF) level and at the local (municipal) level. The near to pristine nature of many of the rivers and estuaries in the area and their important role in the region with regards to biodiversity, fish breeding and recreational activities and tourism requires that improved and expanded monitoring systems be formulated. As the overall responsible authority for the water quality of the rivers, it is incumbent on DWAF to ensure that all rivers are adequately monitored either by DWAF personnel or by local municipal authorities.

The urban rivers in and around East London are heavily impacted. After classification, these rivers require a detailed monitoring and data collection programme in order to identify the impacts and institute steps to improve the health of the rivers. Buffalo City Municipality is also presently undertaking a sea outfall for raw screened sewage and effluent, which will require monitoring by DWAF.

Both national and regional monitoring systems are spatially inadequate and operate largely in isolation of each other. Whilst DWAF is actively working to structure its systems into a single “Monitoring, Assessment and Information System (MAIS)”, this strategy will need to address networks and funding, staff capacity, and co-operative relationships with other organizations.

The current resources in the RO to implement this strategy are inadequate. This results in monitoring only of perceived critical data at intervals that are too long.

**Strategic Approach**

DWAF recognizes that the monitoring of water resources, both quantity and quality, is seriously deficient within the Amatole – Kei area and particularly within the former Ciskei and Transkei regions. Manpower and financial resources are severely limited and the Department will have to invest heavily in monitoring if it is to fulfill its requirements as mandated under the NWA.

The implementation of an adequate monitoring programme will require the installation of significant new equipment and infrastructure eg. weirs etc, a major increase in staff capacity, and the bringing of all water quality monitoring up to standards, with an emphasis on potential crisis areas.

Many different organizations are involved in monitoring and the first step for DWAF will be to co-ordinate these disparate organizations. At the same time this will require DWAF to share data and information.

**Management Actions**

Develop a detailed regional strategy that is compatible with the national information system for the monitoring needs of the ISP area by undertaking the following generic actions:

1. Establish a regional task team and review or identify all aspects that need to be monitored. Group all monitoring needs into logical systems with common goals according to functional areas, which are then divided further into sub-systems. This will include but not be limited to:

    - Hydrology (rainfall, climate and streamflow)
    - Geohydrology (groundwater)
    - Inflows and outflows (transfers)
    - Abstractions (water users, dam levels, operational releases, losses etc)
    - Water quality (surface and groundwater)
    - Return flows
    - Waste water outflows
    - River health
    - Sedimentation
    - Small farm dams (numbers, capacity and use)
    - Land use changes (agricultural cropping, forestry, alien invasives)
    - Wetlands

2. Develop a detailed information requirement and monitoring needs assessment for the various systems, which are grouped by functional areas.
3. Prepare a set of standards for monitoring and data capture which must cover accuracy, completeness, time scales and time frames, information sharing etc.
4. Identify and motivate for additional monitoring points or functions required for the ISP area in a phased implementation manner based on priorities.
5. Amalgamation of the identified existing and planned monitoring and assessment systems needs into a coherent and structured monitoring, assessment and information system.
6. Review staff resources required for adequate monitoring of surface and groundwater and employ, develop and train additional staff where identified.
7. Motivation for the regional share of the national monitoring budget.
8. Develop regional co-operative, collaborative relationships between DWAF and other organisations that have relevant data or operate water-related monitoring, assessment and information systems. This should include a plan for storage and sharing of mutually useful information.
9. Regularly review and update the regional monitoring strategy.

*Surface water monitoring:* Continue existing monitoring and data capture systems and identify the need to install additional rainfall, flow and estuarine recorders.

*Groundwater monitoring*: Build capacity, especially at local authority level. Additional staff are also urgently required in the RO.

*Water quality monitoring*: This was largely addressed in the *Water Quality Management Strategy*, which also dealt with water quality monitoring needs.

*Coastal and marine monitoring (estuaries and effluent discharges to sea outfalls)* is required and assistance should be obtained from the Coastal and Marine Research Institute of Port Elizabeth and the South African Institute for Aquatic Biodiversity in Grahamstown. These two organizations could be part of a co-operative governance effort.

**Responsibility**

The development of this strategy is the responsibility of the RO in consultation with the RDM office and the Directorates of Information Programmes, Waste Discharge and Disposal and the RQS. Co-operative governance liaison should be developed with the provincial departments of Local Government, Health, the District Municipalities and Buffalo City Municipality.

**Priority**

Priority 2 – High. Implement over the short to medium term.

# 9.2 INFORMATION MANAGEMENT

**Management Objective**

Facilitate improved storage, manipulation, backup, archiving, dissemination, access to and sharing of information within the ISP area and WMA.

**Situation Assessment**

National systems will be designed so that CMAs, once established, can take responsibility for information management in their Water Management Areas, as well as have access to information from adjacent areas. The national information system for water services required by the Water Services Act will be linked to information systems for water resources. The Act requires any person, at the request of the Minister, to provide data and information to facilitate the management and protection of water resources. Regulations may be written in this respect. The Minister is required by the NWA to establish the following national information systems:

**a. Surface Water Hydrology**
The Department's existing mainframe-based *Hydrological Information System*, and several related systems are being replaced with a new server-based commercial system (Hydstra). It is expected to be operational at all DWAF Regional Offices by the end of 2004.

**b. Water Quality**
The Department is developing the *Water Management System* for the operational management of water quality monitoring systems, and storing, processing and disseminating the results arising from monitoring. The *Water Management System* is currently functional and operational in the Department's National Office and some Regional Offices. The system is expected to be fully operational throughout the Department in 2007.

**c. Groundwater**
The present mainframe-based national groundwater database is to be replaced with a server-based, web-enabled *National Groundwater Archive*. The development of the system and transfer of all data are expected to be completed by the end of 2004. The Archive will be linked to a proprietary system that provides management information by modelling groundwater recharge, the impacts of abstraction, and the impacts of aquifer contamination. The system was installed in the Department's National Office and three Regional Offices by the end of 2002, and will be fully operational in all Regions by the end of 2004.

**d. Water Use Registration and Authorisation**
The *Water Use Authorisation and Registration Management System* (WARMS) is a comprehensive system designed to manage the process of registering water use and the authorisation of water use (by licensing), as well as manage administrative components of the water charge system. The registration component of the system has been in use since 2000. The cost recovery functions became operational early in 2002, with the licensing capabilities to follow in 2003. Links with national databases operated by other departments should be established by the end of 2004.

**e. State of Rivers Reporting**
The *National River Health Programme* intends to produce *Ecological State of the Rivers Reports* for all major river systems in the country by 2008. The reports will indicate the present state of the rivers, whether conditions are stable, deteriorating or improving, what is causing the state of the river to change, and what management interventions are required. This will depend on the availability of physical and chemical data.

The following monitoring strategy issues and concerns were identified in the Amatole – Kei :

- The need to share information, responsibilities, databases and other related issues and actions.
- Inability of the *Water Use Authorisation and Registration Management System* (WARMS) to handle water use queries per catchment area.
- The *Water Quality and Quantity Water Management System* (WMS) will supersede the *Pollution Monitoring and Capture System* (POLMON).

The following information management related issues and concerns were identified:

- There is ongoing capturing according to priority in the registration process. Data of some water users and solid waste sites have not yet been captured.
- There is an ongoing mapping project that captures data on alien invasive species.
- There was a loss of captured solid waste site data in the RO due to inadequate backup facilities. Only 20 % of solid waste sites are now populated in the *Waste Manager* programme (waste permit information).
- There is an urgent requirement for adequate data storage, backup and archiving systems for captured Eastern Cape data.
- The availability and retention of suitably trained and qualified staff is a problem.

The current resources in the RO to implement this strategy are inadequate. Skilled IT and GIS staff, funds to buy and properly manage the software and databases and technical staff to evaluate, manage and improve the systems and databases and to liaise with other information managers are required. The available staff is very stretched and address issues according to priorities (reactive and crisis management). The most important activity is thus to increase skilled manpower resources. Restructuring is currently under way in the RO, which is a difficult time to increase resources, but is also an opportune time to divert appropriate resources to information management, which in the past generally seemed to be undervalued in importance.

**Strategic Approach**

Data is valuable and expensive, and adequate systems and staff must be provided to ensure the accurate capture and storage, retrieval processing and dissemination. In the case of potentially harmful events, the RO should have the necessary plans and information in place to warn all relevant stakeholders. The Department recognizes the inadequacies of the current monitoring and information systems and proposes that an Information Management Plan be instituted through this ISP.

**Management Actions**

Compile an ISP area Information Management Plan as follows:

1. Identify what information the Departmental information managers require.
2. Determine GIS specific requirements such as hardware for storage.
3. Identify information requirements from other departments, provincial and local government and other organizations.
4. Compile an information sharing policy with other departments, provincial and local government and other organisations and identify the following:
    - What information should be shared?
    - Who should have access to it?
    - What is the integrity of the information to be shared?
    - With whom is sharing of information beneficial?
5. Implement the information sharing policy through co-operative governance with other departments, local authorities and institutions through various formal and informal committees or other forms of effective co-operation.
6. Re-capture waste related permit information in Waste Manager.
7. Install adequate storage, backup and archiving facilities and library systems in all the Eastern Cape Offices.
8. Formulate an approach to deal with available WARMS information.

**Responsibility**

A new Chief Directorate Scientific Services will be created to take overall responsibility. The development of the regional strategy is the responsibility of the RO in collaboration with HO NWRS so as to avoid conflicting ideas.

**Priority**

Priority 2 – High. Implement over the medium term.

# STRATEGY NO. 10

# IMPLEMENTATION

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## Need for an Implementation Strategy

The Implementation Strategy is required to address:

- ⇨ An Implementation programme for the ISP
- ⇨ Resources to implement the ISP
- ⇨ Delegation of responsibility
- ⇨ Budgeting priorities

## Relevant Identified Strategies

The following specific strategy has been developed further:

10.1 Implementation

# 10.1 IMPLEMENTATION

**Management Objective**

To ensure that the approaches put forward by the Department through this ISP are adopted and implemented in the Amatole – Kei catchments of the Mzimvubu to Keiskamma WMA 12. This will require willpower, funding and capacity.

**Situation Assessment**

The ISP is an internal document, developed almost exclusively by and on behalf of the Department of Water Affairs and Forestry. The ISP sets out the approach which the Department is taking towards water management in the Amatole – Kei catchments of the Mzimvubu to Keiskamma WMA 12, and lists suggested actions towards achieving good management of the water resource.

The wider public has had no direct input into this ISP. However, it is recognised that the approaches adopted have a significant impact on the populace of the Amatole – Kei area. Whilst the approach to date in developing this ISP may seem non-participatory, it must be remembered that this is not a Catchment Management Strategy, but DWAF setting out how DWAF itself sees the situation, and the steps which DWAF views as most appropriate in dealing with the situation. Years of interaction with the public have had an important influence.

The ISP is not a closed document, but is to be made available to the wider public for comment and input. This makes the ISP an inherently transparent document, exposing the thinking and planning of the Department in a way that has never been done before. Although DWAF makes no commitment to adopt every comment made, these will be taken seriously and the ISP will be updated and improved as newer and better perspectives are formed. Once the Catchment Management Agency has been established, it will be required to develop a Catchment Management Strategy, and this will require full public participation. It is to be hoped that the ISP will be taken as useful baseline information and, indeed, that the approaches adopted here are found to be acceptable to, and adaptable by, the new dispensation.

**Strategic Approach**

The ISP is subject to the approach set out in the NWRS and details this approach for the Amatole – Kei catchments of the Mzimvubu to Keiskamma WMA 12. It carries significant weight in expressing how water resource planning and management will be carried out in the WMA. It is not, however, an inflexible document, nor is it without its flaws. As such the ISP may be adjusted and adapted when new and better ideas are presented. Despite this, the approaches and requirements of this ISP may not be ignored.

The implementation of the ISP is an enormous task. Never before have all the hopes and expectations of the Department been gathered together into one document. Much of what is in this document describes the day-to-day functions of the Department. But there are many new tasks, functions, and actions set out in response to DWAF's visions for the future.

It is recognised that it is quite impossible to immediately launch into, and achieve, all that is required by this ISP. Funds and capacity are, and will always be obstacles that must be surmounted. The approach is to take the ISP and to use it as instruction, guidance, and motivation in the development of yet clearer management and action plans. These must be built into Departmental Business Plans, and budgeted for as part of Departmental operating costs. This will necessarily be in a phased manner as dictated by available resources, but it is important that the ISP be used to leverage maximum funds, maximum capacity, and to bring optimum management to the WMA

A major focus in the Amatole – Kei catchments in the short to medium term will be on the following :

- Planning for the provision of additional water for the Buffalo City Municipal area (and the East London IDZ).
- Ensuring that intervention measures are applied to the deteriorating water quality situation in the Buffalo, Nahoon and small urban rivers within the BCM area.
- Applying co-operative governance measures to optimize the management and operation of the Amatole Water Supply System.
- Supporting the Eastern Cape government's growth and development plan for the revitalisation of the agricultural sector by means of the rehabilitation of irrigation schemes in the former Ciskei and Transkei homelands. This support will include institutional development (WUAs) to enhance the process.
- Planning for the provision of additional water for Queenstown in the short term.
- Interacting with the Provincial Department of Agriculture in order to address the increasing soil erosion problems in the region.

This will be achieved through the implementation of the identified strategies, which must complement each other.

**Management Actions**

The following actions are required:

1. Publish the ISP in hard-copy, on CD, and perhaps even on the Web, for public input and comment. Copies will only be presented to key stakeholders, and on request. It is not the intention to have a major drive for public input, but merely to create accessibility for input.
2. There are many actions in the ISP which do require public involvement – and it is important that the thinking with regard to, for example, the use of groundwater, and the importance of WCDM, are taken out forcefully both to local authorities, other direct water users such as agriculture, and the wider public.
3. Collate comment and consider this in revising and improving the ISP.
4. The ISP should, in any event, be open to continuous improvement, with possible updating on an annual basis.
5. All DWAF Regional staff, Working for Water, and other major stakeholders should have access to, or copies of, the ISP.
6. Approaches set out in the ISP need to be accepted and adopted by both national and regional staff. Where there is resistance to ideas then this needs to be resolved in an open climate of debate and understanding. Modification of the ISP is not ruled out.
7. The practicalities of implementation demands must always be considered.
8. Most actions in this ISP have been assigned to the Region. It is critically important that the tasks outlined are prioritised, budgeted for, and built into regional and national business plans and budgets.

**Responsibility**

The DWAF Regional Office is responsible for managing the implementation of this ISP.

**Priority**

Priority 1 – Very high.

The implementation is to be ongoing until the establishment of a fully functional CMA in the Mzimvubu to Keiskamma WMA and the ISP is superseded by a CMS.

# APPENDICES

# AMATOLE – KEI INTERNAL STRATEGIC PERSPECTIVE

# APPENDICES

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# APPENDIX A

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**APPENDIX A1**

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| 27. | Myburgh JA | Pump testing evaluation of existing boreholes Sterkstroom Eastern Cape province | May 2002 |
| 28. | Myburgh JA | Rehabilitation of borehole EC/042/SB - Tentergate | June 2002 |
| 29. | Myburgh JA | Groundwater source development for the village Thika located in the Mnquma local municipality of the Amatole district Eastern Cape province | December 2002 |

# APPENDIX B

# ISP RELATED INFORMATION

**APPENDIX B1**

# AMATOLE – KEI ISP

## RIVERS, DAMS AND TOWNS IN THE ISP AREA

| QUATS | RIVERS/RIVER REACHES | DAMS | TOWNS/SUBURBS |
|---|---|---|---|
| **Amatole Catchments** | | | |
| R10A | Keiskamma | | |
| R10B | Keiskamma<br>Cata<br>Wolf | Sandile<br>Cata<br>Mnyameni | Keiskammahoek |
| R10C | Keiskamma<br>Rabula | | |
| R10D | Keiskamma | | |
| R10E | Keiskamma<br>Debe | Debe | Middledrift |
| R10F | Tyume | | |
| R10G | Tyume | Binfield Park<br>Pleasant View | |
| R10H | Tyume | | Alice |
| R10J | Keiskamma | | |
| R10K | Keiskamma<br>Zalara | Dimbaza | Dimbaza |
| R10L | Keiskamma | | |
| R10M | Keiskamma | | Hamburg |
| | | | |
| R20A | Buffalo<br>Cwengcwe | Rooikrantz, Maden | |
| R20B | Buffalo<br>Zele | | |
| R20C | Mgqakwebe | | |
| R20D | Buffalo<br>Ngqokweni | | King William's Town |
| R20E | Buffalo<br>Yellowwoods | Laing | Bisho |
| R20F | Buffalo | | Mdantsane |
| R20G | Buffalo<br>Amalinda<br>Mzonyana | Bridle Drift<br>Amalinda<br>Umzoniana | East London |
| | | | |
| R30A | Kwenxura | | Morgan Bay |
| R30B | Kwelera<br>Kwamehlwenyoka | Amberdene<br>Bideford<br>Sun Rise, Magazo Park | Cintsa East |
| R30C | Gqunube<br><br>Tanga<br><br>Ngculu | Windmill, The Lake, Queens Court Big Fairview Farm, Sunnyside Irrigation Kentbury | Sunrise-on-Sea |
| R30D | Gqunube | | Gonubie |
| R30E | Nahoon<br>Nkobongo<br>Qoqongwane<br>Xolo | Partners Valley<br>Lyndhurst<br>Conrad Swart<br>Ossie, Lillystone | |
| R30F | Nahoon | Nahoon | East London/Beacon Bay |

| QUATS | RIVERS/RIVER REACHES | DAMS | TOWNS/SUBURBS |
|---|---|---|---|
| R40A | Gxulu | Rockcliff | East London, Kidd's Beach |
| R40B | Tyolomnqa | | |
| R40C | Tyolomnqa | | Kayser's Beach |
| | | | |
| R50A | Bira | | Bira, Wesley |
| R50B | Magwalana<br>Mtati<br>Mpekweni | | |
| **White Kei Catchments** | | | |
| S10A | Grootvleispruit<br>Kleinvlei | Glen Wallace<br>Kleinvlei B, Park, Kleinvlei T | |
| S10B | White Kei<br><br>Sidwadwa<br>Birds | Rietfontein,<br>Above Huts<br><br>Birds River | |
| S10C | White Kei<br>Lemoenfontein | | |
| S10D | White Kei<br>Qoqodala | | |
| S10E | White Kei | Xonxa | |
| S10F | Cacadu<br>Hol | Macubeni<br>Glen Doris | |
| S10G | Cacadu | | Lady Frere |
| S10H | White Kei | | |
| S10J | White Kei | | |
| | | | |
| S20A | Doring | Blaauwkrantz | Indwe |
| S20B | Doring<br>Indwe | Doring River,<br>Rustdal, Redlands | |
| S20C | Indwe | Lubisi | |
| S20D | Indwe | | Qamata |
| **Black Kei Catchments** | | | |
| S31A | Hex | Lismore | Sterkstroom |
| S31B | Klaas Smits | | |
| S31C | Heuningklip | Varkenskuilen, Spes Bona L,<br>Lekkerlag, Glen Torret | |
| S31D | Lesseyton | Vaalkrantz | |
| S31E | Klaas Smits<br>Bonkolo | Skietfontein<br>Oakleigh | |
| S31F | Bonkolo | Bongolo | Queenstown, Ezibeleni |
| S31G | Klaas Smits<br><br>Bonkolo<br>Komani | Western Essex Prospect<br><br>Rathwick | |
| | | | |
| S32A | Black Kei | Thrift<br>Limietskloof | |
| S32B | Black Kei | Tentergate,<br>McEwan | |

| QUATS | RIVERS/RIVER REACHES | DAMS | TOWNS/SUBURBS |
|---|---|---|---|
| S32C | Black Kei<br>Bulhoekspruit<br>KuZitungu | Sherwood Forest<br><br>Mitford, Glenbrook | Thornhill, Mitford |
| S32D | Klipplaat | Winston | |
| S32E | Klipplaat<br>Krom | Waterdown, Lowestoffe | |
| S32F | Oxkraal | Oxkraal, Bushmanskranz | |
| S32G | Klipplaat<br>Oxkraal | <br><br>Shiloh | Sada, Whittlesea |
| S32H | Black Kei<br>Klipplaat | | |
| S32J | Imvani | | Ilinge |
| S32K | Black Kei | | |
| S32L | Waqu | | |
| S32M | Black Kei | | |
| **<u>Great Kei Catchments (</u>downstream of confluence of White and Black Kei Rivers)** | | | |
| S40A | Thorn | Sam Meyer, Meentgrond<br>Cathcart Koch | Cathcart |
| S40B | Thomas<br>Little Thomas | Reigate<br>Ailsa Farm Irrigation | |
| S40C | Thomas | | |
| S40D | Kei | | |
| S40E | Kei<br>Qwanti | | |
| S40F | Kei | | |
| | | | |
| S50A | Tsomo | | |
| S50B | Xentu | | |
| S50C | Tsomo<br>Mbokotwa<br>Mzwazwa | <br><br>Crossmaloof | |
| S50D | Tsomo | | Cala |
| S50E | Tsomo | Ncora | |
| S50F | Tsojana<br>Ncuncuzo | Tsojana | |
| S50G | Tsomo<br>Tsojana | | |
| S50H | Ngcongcolora | | Cofimvaba |
| S50J | Tsomo | | Tsomo |
| | | | |
| S60A | Gubu<br>Ndakana<br>Kubusi | Gubu<br>Waterfall | Stutterheim, Mlungisi |
| S60B | Kubusi<br>Kubusi<br>Gqunube | Wriggleswade, Leonard's Valley<br>Big Red, Deemies | |
| S60C | Gqolonci<br>Toise | | |
| S60D | Gqolonci<br>Mgwali | <br>Boord | |
| S60E | Kubusi | | |
| S70A | Kei | | Komga |

| QUATS | RIVERS/RIVER REACHES | DAMS | TOWNS/SUBURBS |
|---|---|---|---|
| S70B | Kei<br>Toleni | Toleni | |
| S70C | Gcuwa<br>Xilinxa | Xilinxa | |
| S70D | Gcuwa<br>Mtwa | | Nqamakwe |
| S70E | Gcuwa<br>Cegcuwana | Gcuwa | Butterworth |
| S70F | Kei<br>Tyityaba | | Kei Mouth |

# AMATOLE - KEI ISP
## WATER AND WASTE WATER TREATMENT WORKS IN THE AMATOLE SYSTEM

### WATER TREATMENT WORKS (Ref. 5 and 24)

| TREATMENT WORKS | | | RAW WATER SOURCE* | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 1 in 50 YEAR YIELD** | | | |
| NAME | CAPACITY (Ml/d) | OWNER/ OPERATOR | NAME | (million $m^3$/a) | (Ml/d) | ADDITIONAL YIELD ALLOCATED TO OTHER USERS (million $m^3$/a) | OWNER/ OPERATOR |
| Rooikrantz<br>King William's Town | 1,2<br>7,0 | DWAF/AW<br>BCM | Rooikrantz Dam<br>Rooikrantz and Maden Dams | 3,10 | 8,5 | None | DWAF/AW<br>DWAF/AW/ BCM |
| Laing Dam | 27,3 | DWAF/AW | Laing Dam | 14,90 | 45,0 | None | DWAF/AW |
| Umzoniana | 120,0 | BCM | Bridle Drift Dam | 30,70 | 79,0 | None | BCM |
| Nahoon | 33,0 | DWAF/AW | Nahoon Dam | 5,60 | 15,0 | 1,3 Irrigation<br>0,9 Environmental | DWAF/AW |
| Stutterheim | 2,5 | Amahlati LM | Gubu Dam<br>Kubusi River Boreholes | 2,27 | 6,3 | 0,63 Irrigation | DWAF/AW |
| Kei Road | 0,3 | Amahlati LM | Wriggleswade Dam | 0,10 | 0,3 | 16,8 Future urban<br>3,0 Irrigation<br>5,5 Environmental | DWAF/AW |
| Needs Camp | 0,8 | BCM | Buffalo River | *** | *** | None | BCM |
| | 192,1 | | | 56,67 | 154,1 | 28,13 | |

* Includes effluent return flows for expected level of development in the year 2010.
** Yields from individual dams vary depending on how the system is operated.
*** Included in firm yield of Laing Dam.

## WASTE WATER TREATMENT WORKS (Ref. 5)

| SCHEME NAME | SOURCE | TYPE OF TREATMENT | DESIGN CAPACITY Ml/d | UTILISATION | EFFLUENT DISPOSAL | QUATS | COMPLIANCE | POTENTIAL IMPACT TO RESOURCES |
|---|---|---|---|---|---|---|---|---|
| Bisho STW | Domestic sewage | Oxidation ponds | 1.75 | 200% | Irrigation storage dam for pasture | R20E | Not compliant with General Standard or Special Phosphate Standard | Overflows directly into Yellowwoods River |
| Stutterheim STW | Domestic sewage | Activated sludge reactor & a clarifier, Maturation ponds | 0,7 | Unknown | Cumakala River | S60C | Compliant with General Standard | Effluent from the abattoir affects the quality of the final effluent. Overflow if tanker is not available. |
| Mdantsane STW | Domestic sewage & industrial from chicken abattoir | Biofilters | 24.0 | 122% | Buffalo River downstream of East London WTW offtake | R20F | 60% compliant | Requires upgrading |
| Potsdam STW | Potsdam & Mdantsane West (Domestic and industrial) | Trickling Filters | 9.24 | 73% | Buffalo River downstream of East London WTW offtake | R20F | Compliant with General Standard | Works has additional capacity to divert Mdantsane sewage |
| King Tanning Company | Industrial (Tanning factory) | Closed | 1,8 | N/A | Irrigation of kikuyu pasture at Bidhli Farm | R20D | Not operational | High salinity runoff from the irrigation lands during high rainfall |
| King William's Town STW | Domestic and industrial effluent | 60% by Activated sludge, & 40% Biofilter | 4, 8 | 108% | 80% into Buffalo River, 20% for irrigation purposes and golf | R20D | 70% compliant | |
| Da Gama Textiles (Zwelitsha) | Industrial Effluent | | | | Infiltration, and irrigation | R20D | 95% compliant | Area for irrigation cannot cope with volume – Plans for recycling |

| SCHEME NAME | SOURCE | TYPE OF TREATMENT | DESIGN CAPACITY Ml/d | UTILISATION | EFFLUENT DISPOSAL | QUATS | COMPLIANCE | POTENTIAL IMPACT TO RESOURCES |
|---|---|---|---|---|---|---|---|---|
| Zwelitsha STW | Domestic sewage & some industrial wastewater | Trickling filter | 7.7 | 76% | Buffalo River | R20D | 95% compliant | Works is immediately upstream of Laing Dam – Eutrophication taking place in the dam. |
| East Bank STW | Domestic & some industrial effluent | Activated sludge modules & clarifiers | 40 | 75% | Irrigation at East London Golf Club, sea outfall and sludge discharge into sea at Hood Point | R30F | 85% compliance (not phosphates) | Potential for industrial use |
| Central (Amalinda) STW | 65% industrial effluent & 35% domestic sewage | Biofilters & maturation ponds | 5.0 | 90% | Buffalo River via Umzoniana stream | R30F | 60% compliance | Overloaded resulting in overflow of sewage into the Buffalo River |
| Gonubie STW | Domestic from Beacon Bay & Gonubie | Activated sludge & clarifiers | 5.0 (12) | 140% | Klokha River & irrigation at Gonubie Golf Course | R30D | 90% compliance | Drip irrigation system for tomato farming |
| Breidbach STW | Domestic sewage | Oxidation Ponds | 0,8 | N/A | Irrigation of kikuyu pastures | R20E | Unknown | Periodic overflows. Seepage from the ponds into Yellowwoods River |

# AMATOLE – KEI ISP

## SOLID WASTE DISPOSAL SITES

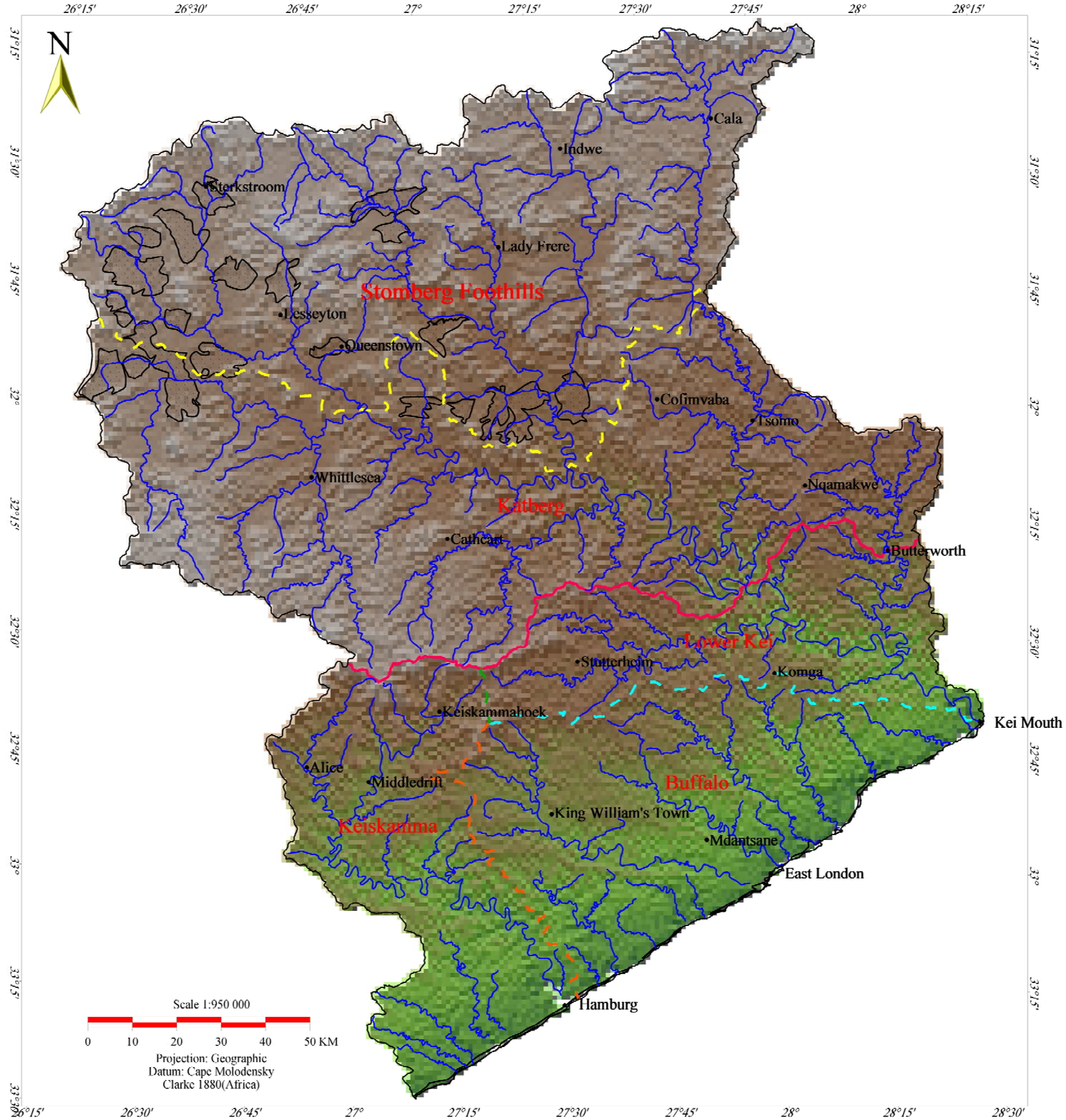
| SOLID WASTE SITE | SIZE | STATUS OF APPLICATION | OWNERSHIP | COMMENTS |
|---|---|---|---|---|
| East London Regional | L | PERMITS ISSUED | Local Municipality | G:L:B+ |
| King William's Town | M | Processing | Local Municipality | Well managed |
| Second Creek | M | To be closed | Local Municipality | To be rehabilitated |
| Gonubie | C | To be closed | Local Municipality | To establish transfer station |
| Mdantsane | S | To be closed | Local Municipality | To be rehabilitated |
| Ducats B/Bay | S | CLOSED DOWN | Local Municipality | To be rehabilitated |
| Dimbaza | S | CLOSED DOWN | Local Municipality | To be rehabilitated |
| Butterworth | S | Not Permitted | Local Municipality | New Regional Site being studied |
| Idutywa | S | Not Permitted | Local Municipality | Will link in with the above Reg Site |
| Nqamakwe | C | Not Permitted | Local Municipality | Will link in with the above Reg Site |
| Tsomo | C | Not Permitted | Local Municipality | Will link in with the above Reg Site |
| Willowvale | C | Not Permitted | Local Municipality | Will link in with the above Reg Site |
| Kentani | C | Not Permitted | Local Municipality | Will link in with the above Reg Site |
| Queenstown | S | New site identified | Local Municipality | Municipality to close & rehab existing site |
| Whittlesea | C | Not Permitted | Local Municipality | Consultants appointed |
| Lady Frere | C | Not Permitted | Local Municipality | |
| Cofimvaba | C | Not Permitted | Local Municipality | Poor management |
| Alice | C | Permit issued | Local Municipality | |
| Middledrift | C | Permit issued | Local Municipality | |
| Seymour | C | Not permitted | Local Municipality | Will link in with Queenstown -proposed regional site |

| SOLID WASTE SITE | SIZE | STATUS OF APPLICATION | OWNERSHIP | COMMENTS |
|---|---|---|---|---|
| Cala | C | Permit issued | Local Municipality | Poorly managed |
| Cathcart | C | Not permitted | Local Municipality | To issue directions |
| Stutterheim | GSB+ | Consultants appointed | Local Municipality | Consultants investigating |
| Keiskammahoek | C | Permit issue | Local Municipality | Permit issued |
| Cintsa West | C | | Private | |
| Cosy Corner | C | | Private | |
| Fish River Sun | C | To be closed | Private | Will link with the Peddie Regional Site |
| Haga Haga | C | | Private | |
| Hamburg Transfer Station | C | Processing Direction | Local Municipality | With final disposal at Peddie regional solid waste site |
| Peddie | C | Proposed regional site | Local Municipality | To be a regional site for Ngqushwa Municipality |
| Indwe | C | Not permitted | Local Municipality | To issue directions |
| Kayser's Beach | C | Closed | ADM/BCM | All waste taken by ADM to Second Creek |
| Kei Mouth | C | Not Permitted | Local Municipality | Poor State - need to identify new site |
| Morgan Bay | C | Not permitted | Local Municipality | |
| Kidds Beach | C | To be closed | ADM/BCM | To be rehabilitated |
| Komga | C | Not permitted | Local Municipality | Poor state - need to identify new site |
| Macleantown | C | Not permitted | ADM | |
| Seavale | C | To issue directions | Private | |
| Sterkstroom | C | Processing Direction | Local Municipality | Construction to start soon |
| Christmas Rock | C | Processing | Private | Well managed |

**Total No of sites = 42**
**Permitted = 5**
**Processing = 3**
**Sites to Close(d) = 14**

# APPENDIX B4

# GROUNDWATER MAPS




## LEGEND

- Towns
- High level alluvial deposits

Proposed Hydrogeological Provinces

- Southern boundary of Stormberg Foothills
- Southern boundary of Katberg
- Keiskamma - Buffalo
- Keiskamma - Lower Kei
- Lower Kei - Buffalo

Elevation

2479

0 metres

PROJECT NAME

INTERNAL STRATEGIC PERSPECTIVE (AMATOLE-KEI)

CLIENT

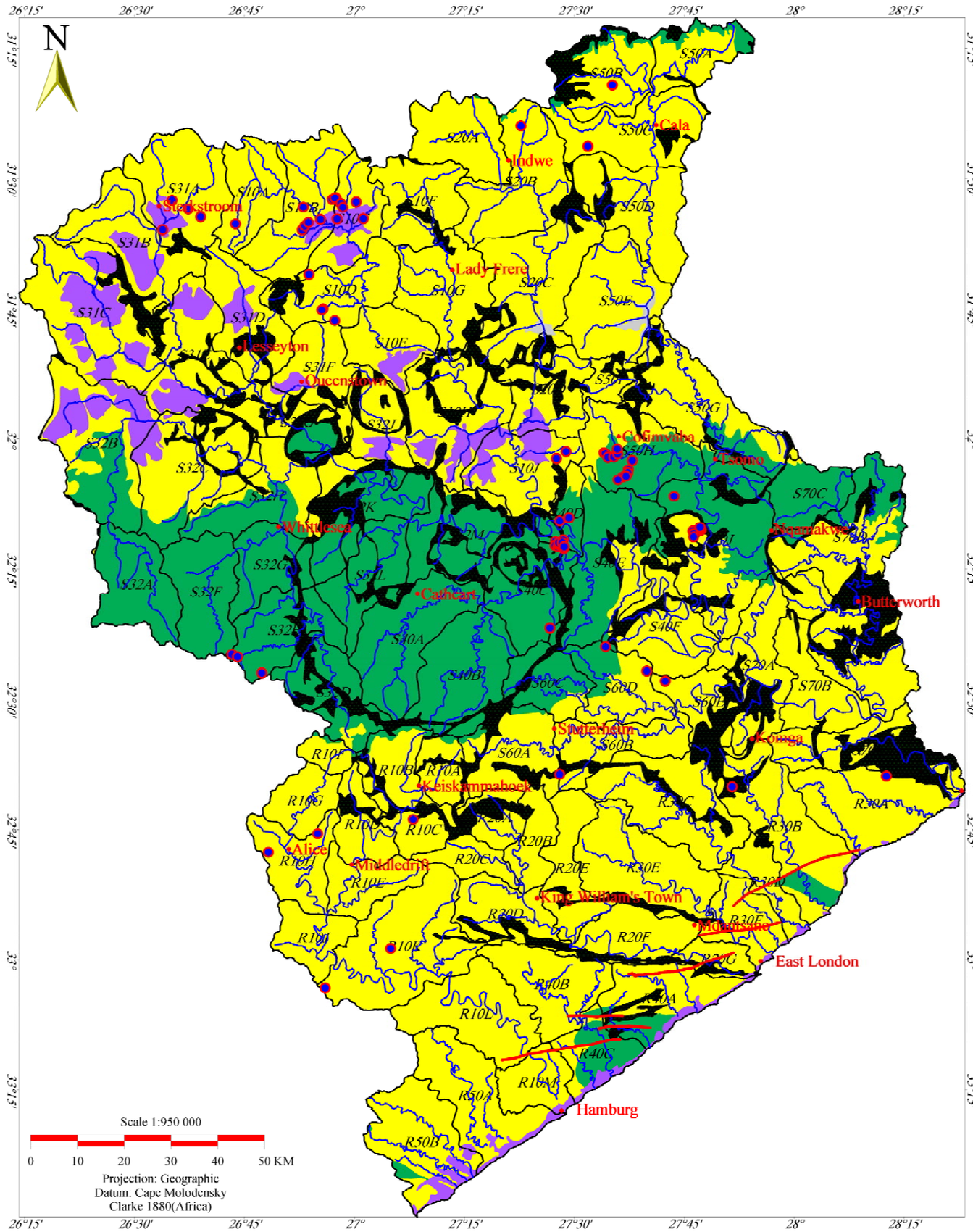
CONSULTANT

UMVOTO

TITLE

STUDY AREA AND TOPOGRAPHY

FIGURE B4.1




LEGEND

PROJECT NAME

INTERNAL STRATEGIC PERSPECTIVE (AMATOLE-KEI)

CLIENT

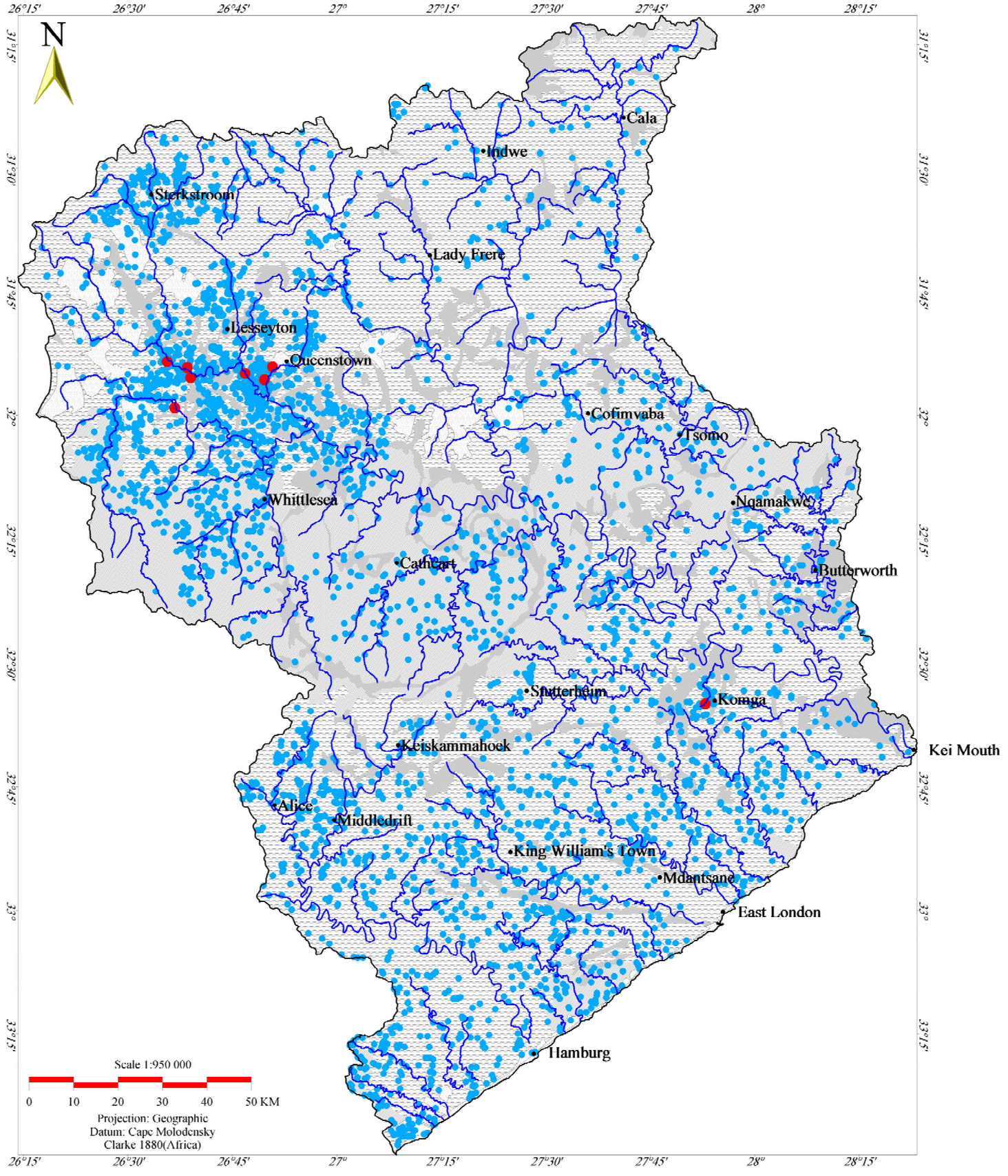
CONSULTANT

UMVOTO

TITLE

AQUIFER TYPE (REVISED)

FIGURE B4.2




LEGEND

- Towns
- National Geohydrological Database (NGDB) boreholes
- DWAF Geohydro-Monitoring Sites
- Rivers

Aquifer Types (revised)

- Intergranular
- Fractured
- Fractured (dolerite)
- Intergranular (weatherd) & fractured

PROJECT NAME

INTERNAL STRATEGIC PERSPECTIVE (AMATOLE-KEI)

CLIENT

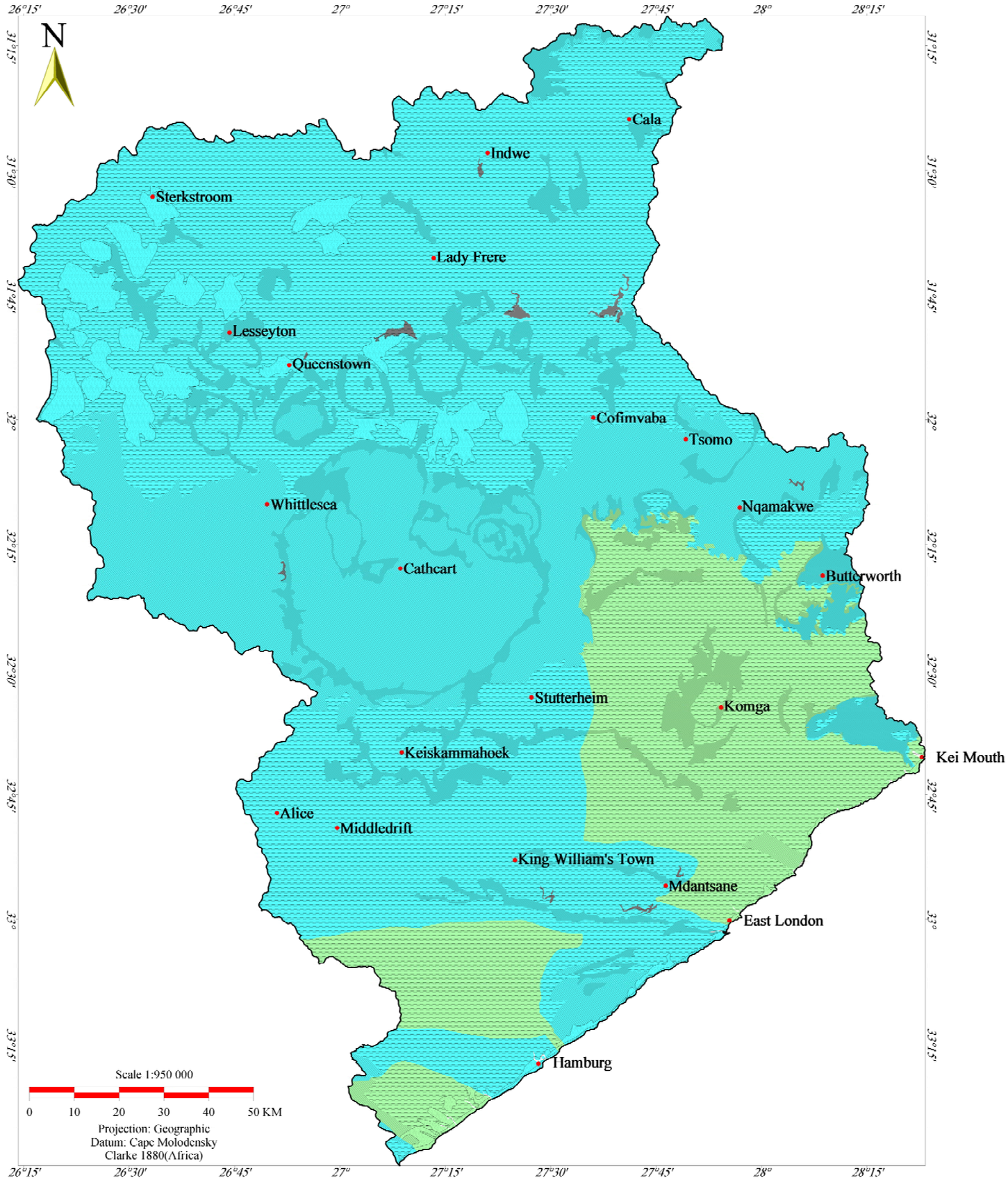
CONSULTANT

UMVOTO

TITLE

NGDB BOREHOLES AND DWAF MONITORING SITES

FIGURE B4.3




LEGEND

Towns

Intergranular

Fractured

Fractured (dolerite)

Intergranular (weatherd) & fractured

Yield (median l/s)

0.1 - 0.5

0.5 - 2.0

PROJECT NAME

INTERNAL STRATEGIC PERSPECTIVE (AMATOLE-KEI)

CLIENT

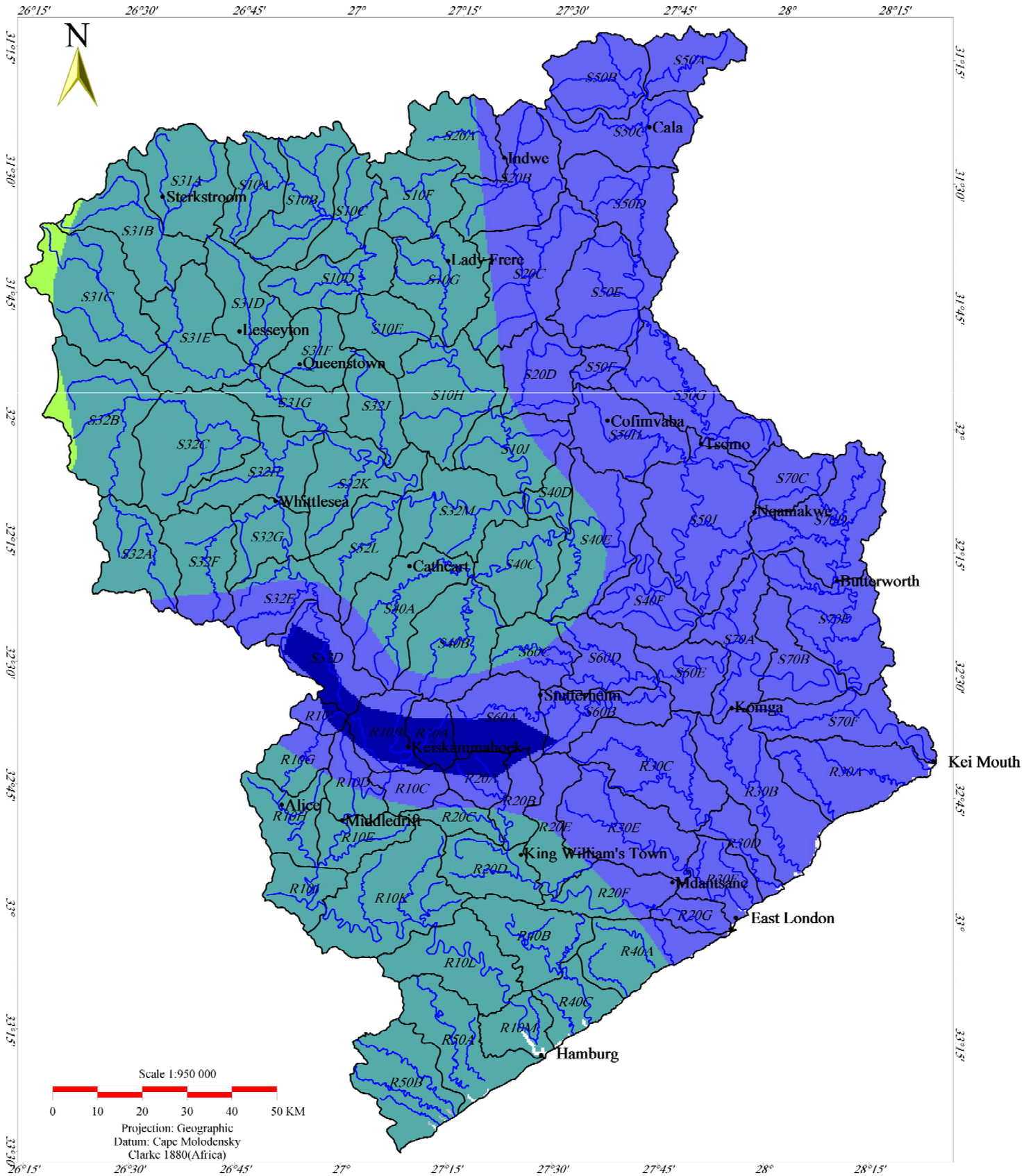
CONSULTANT

UMVOTO

TITLE

GROUNDWATER OCCURRENCE AND MEDIAN YIELD

FIGURE B4.4




LEGEND

- Towns
- Rivers
- Quaternary Catchments

Rate of recharge (mm per annum)

- 10 - 25
- 25 - 37
- 37 - 50
- 50 - 75

PROJECT NAME

INTERNAL STRATEGIC PERSPECTIVE (AMATOLE-KEI)

CLIENT

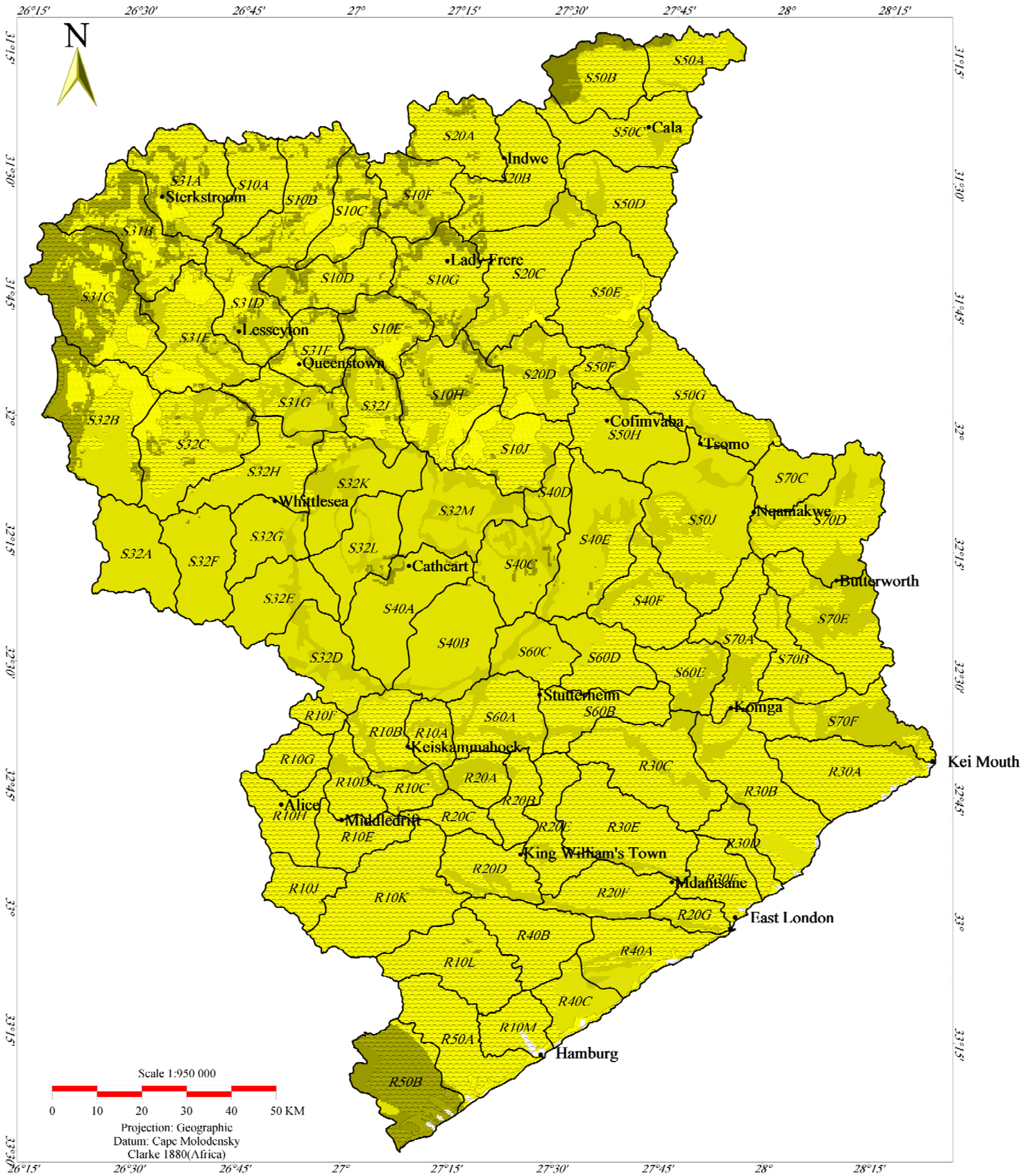
CONSULTANT

UMVOTO

TITLE

RECHARGE TO GROUNDWATER

FIGURE B4.5




## LEGEND

- Towns

Aquifer Types (revised)

- Intergranular
- Fractured
- Fractured (dolerite)
- Intergranular (weatherd) & fractured

Aquifer Vulnerability

- Least
- Moderate

PROJECT NAME

INTERNAL STRATEGIC PERSPECTIVE (AMATOLE-KEI)

CLIENT

CONSULTANT

UMVOTO

TITLE

AQUIFER VULNERABILITY

FIGURE B4.6

## AMATOLE - KEI ISP

## DWAF TARIFF TABLE FOR RAW WATER USE CHARGES FOR GOVERNMENT WATER SCHEMES FOR 2003-2004 (excl. VAT)

| Government Water Scheme / Irrigation District | Region | WMA (see | Charges for irrigation purposes | | | | | Charges for domestic and industrial use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $m^3$ quota per ha | Cent per $m^3$ | | Total tariff cent per $m^3$ | Payment dates | Cent per $m^3$ | | | | Total tariff Cent per $m^3$ |
| | | | | O & M | Deprec'n | | | O & M | ROA | Deprec'n | Input cost | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| AMATOLA (WRIGGLESWADE DAM) | EC | 12 | | | | | | | | | | |
| (a) From the Dam and Kubusi River | | | | | | | | | | | | 53.99 |
| (b) From Yellowwoods & Nahoon Rivers & from Wriggleswade canal | | | | | | | | | | | | 95.62 |
| BINFIELD PARK DAM | EC | 12 | 6 100 | 2.46 | 1.00 | 3.46 | 31/07<br>31/01 | | | | | 60.19 |
| BUSHMANSKRANTZ DAM (Zweledinga) | EC | 12 | | | | | | | | | | 67.40 |
| DEBE DAM | EC | 12 | | | | | | | | | | 67.40 |
| DORING RIVER (DORING RIVER DAM) | EC | 12 | 6 100 | 13.50 | 1.00 | 14.50 | 31/07<br>31/01 | | | | | 40.81 |
| KEISKAMMAHOEK (CATA DAM) | EC | 12 | 6 100 | 5.08 | 1.00 | 6.08 | 31/07<br>31/01 | | | | | |
| KEISKAMMAHOEK (MNYAMENI DAM) | EC | 12 | 6 100 | 4.86 | 1.00 | 5.86 | 31/07<br>31/01 | | | | | 67.40 |
| KLIPPLAAT RIVER (WATERDOWN DAM) | EC | 12 | 6 100 | 2.33 | 1.00 | 3.33 | 31/07<br>31/01 | | | | | 10.54 |
| Raw water from the dam | | | | | | | | | | | | |
| KUBUSI RIVER (GUBU DAM) | EC | 12 | | | | | | | | | | 23.19 |
| LAING DAM | EC | 12 | | | | | | | | | | 30.80 |
| MACUBENI DAM | EC | 12 | | | | | | | | | | 67.40 |
| NAHOON RIVER (NAHOON DAM) | EC | 12 | | | | | | | | | | 107.99 |
| NCORA GWS | EC | 15 | | 2.11 | 1.00 | 3.11 | 31/07<br>31/01 | | | | | 44.01 |
| PLEASANT VIEW DAM | EC | 12 | | | | | | | | | | 38.45 |
| QAMATA (Lanti Weir) | EC | 12 | 6 100 | 7.52 | 1.00 | 8.52 | 31/07<br>31/01 | | | | | |
| ROOIKRANTZ DAM | EC | 12 | 6 100 | 5.19 | 1.00 | 6.19 | 31/07<br>31/01 | | | | | 35.68 |
| TOLENI (TOLENI DAM) | EC | 12 | | | | | | | | | | 48.39 |
| TSOJANA DAM | EC | 12 | | | | | 31/07 | | | | | |
| Raw water from the dam | | | 6 100 | 7.82 | 1.00 | 8.82 | 31/01 | | | | | 36.77 |
| XILINXA DAM (and Gcuwa weir) | EC | 12 | | | | | | | | | | 27.69 |
| From weir | | | | | | | | | | | | 40.36 |
| XONXA GWS | EC | 12 | 6 100 | 0.65 | 0.85 | 1.50 | | | | | | |
| ZANYOKWE (SANDILE DAM) | EC | 12 | | | | | 31/07 | | | | | |
| From the dam and the main pipeline | | | 6 100 | 2.24 | 1.00 | 3.24 | 31/01 | | | | | 67.40 |

NB: VAT SHOULD BE ADDED TO CHARGES

Ref : DWAF

# AMATOLE - KEI ISP

## CONTROLLED AND MAJOR IRRIGATION SCHEMES (1995)

**(Ref. 24)**

| SCHEME NAME | SCHEDULED IRRIGATION (Ha) | IRRIGATED AREA IN 1995 (Ha) | CROPS IRRIGATED | SUPPLY SOURCE | QUATS | WATER USE* ($\times 10^6$/a) | ALLOCATION ($\times 10^6$/a) | AVAILABLE WATER @ 90% ASSURANCE ($\times 10^6$/a) |
|---|---|---|---|---|---|---|---|---|
| Klipplaat Government Water Scheme | 2 060 (Section 63) | 1820 | Lucerne, maize and pastures | Waterdown Dam | S32G, H S31G S32K, M | 18,0 | 14,83 | 7,2 |
| Oxkraal Irrigation Scheme | 0 | 0 | Land has not been developed | Shiloh Dam Oxkraal Dam | S32G | 1,7 | 6,18** | 0,4 7,9 |
| Nthabethemba Irrigation Scheme | 1 200 | 720 | Maize and mixed vegetables | Thrift, Limietskloof Tentergate, Mitford Glenbrock dams & Black Kei | S32A, S32B, S32C | Unknown | | 2,52 |
| Zweledinga Irrigation Scheme | 239 | 239 | Maize | Bushmanskrantz Dam | S32F | Unknown | | 2,26 |
| Doring River | 513 (Section 63) | 180 | Lucerne, maize and pastures | Doring River Dam | S20B | 1,8 | 3,13 | 1,8 |
| Qamata Irrigation Scheme | 2 600 | 650 | Lucerne, maize and pastures | Lubisi Dam | S20D | Unknown | | 30,5 |
| Xonxa Irrigation Scheme | 1 643 | 60 | Lucerne, maize and pastures | Xonxa Dam | S10H | Unknown | | 33,0 |
| Zanyokwe Irrigation Scheme | 47 | 90 | Mixed vegetables | Sandile Dam | R10C, D | 1,0 | | 5,18 |
| Keiskammahoek Irrigation Scheme | 854 | 744 | Dairy Farming | Mnyameni & Cata Dams | R10G, H | 6,02 | | 9,86 |
| Tyume Irrigation Scheme | 231 | 114 | Citrus | Binfield Park Dam | R10G | 0,7 | | 17,36 |
| Ncora Irrigation Scheme | 2 600 | 750 | Dairy, vegetables and maize | Ncora Dam | T12C, D | Unknown | | 35,0 |
| Rooikrantz | | | | Rooikrantz Dam | R20A | | | |

* Field edge water requirements (no water losses taken into account).
** 566 ha planned under the Oxkraal Scheme but not developed. The dam releases water for irrigators under the Klipplaat Government Water Scheme.

**APPENDIX B7**

# AMATOLE - KEI ISP

## WATER MANAGEMENT INSTITUTIONS

| ORGANISATION | RESPONSIBILITY | AREA | COMMENT |
|---|---|---|---|
| Department of Water Affairs and Forestry | Overall responsibility for and authority over the nation's water resources and their use | Entire ISP Area | At present DWAF is filling the role of Water Services Authority and Provider in certain instances until hand over of assets to the District Municipalities and establishment of CMA's |
| Amatole District Municipality | Water Service Authority (WSA) for ensuring an equitable supply of water to all consumers within its boundary | Amatole District Municipal area | |
| Chris Hani District Municipality | Water Service Authority for ensuring an equitable supply of water to all consumers within its boundary | Chris Hani District Municipal area | |
| Buffalo City Municipality | Water Service Provider (WSP) for ensuring and delivering an equitable supply of water to all consumers within its boundary | Buffalo City Municipal area | Exact role of the BCM needs to be clarified. Should the BCM become a Metropolitan it will then become a WSA. |
| Local Municipalities<br>▪ Great Kei<br>▪ Amahlati<br>▪ Nkonkobe<br>▪ Ngqushwa<br>▪ Mnquma<br>▪ Lukanji<br>▪ Inkwanca<br>▪ Intsika Yethu<br>▪ Emalahleni | Water Service Provider responsible for delivering an equitable supply of water to all consumers within the local municipality boundary | Local Municipal boundary areas | This role is to change for some municipalities due to a lack of resources. To be handed to DM's. |
| Amatola Water Board | Water Service Provider. Provides a service to DWAF and the WSA's where the Local Municipalities cannot fulfill role of WSP | | Contracts with the relevant Water Services Authority, DWAF or the relevant Local Municipality |
| Kubusi Irrigation Board | | | |
| Village Water Committees | Water Service Provider responsible for delivering an equitable supply of water to all consumers within the village boundary | Rural villages throughout the ISP area | |
| Forums | Unknown | | |

**APPENDIX B8**

# AMATOLE – KEI ISP AREA

## MUNICIPALITIES (refer Appendix C2 for map)

| Old Transitional Local Council Name | New Local Municipality Name | New District Municipality Name |
|---|---|---|
| East London / Mdantsane / Gonubie / Beacon Bay | Buffalo City (moving towards becoming a Metropole) | Amatole District Municipality |
| King William's Town / Bisho / Dimbaza / Zwelitsha | | |
| Amatola Coastal Local Council | | |
| Komga | Great Kei | |
| Kei Mouth | | |
| Amatola Coastal Local Council | | |
| Stutterheim | Amahlati | |
| Keiskammahoek | | |
| Kei Road | | |
| Cathcart | | |
| Alice | Nkonkobe | |
| Middledrift | | |
| Hamburg | Ngqushwa | |
| Butterworth | Mnquma | |
| Nqamakwe | | |
| Queenstown / Ezibeleni / Ilinge | Lukanji | Chris Hani District Municipality |
| Whittlesea / Sada | | |
| Sterkstroom | Inkwanca | |
| Tsomo | Intsika Yethu | |
| Cofimvaba | | |
| Lady Frere | Emalahleni | |
| Indwe | | |

**APPENDIX B9**

# AMATOLE - KEI ISP

## POSSIBLE FUTURE BULK WATER SUPPLY SCHEMES

| ISP AREA | CATCHMENT | SCHEME | ESTIMATED YIELD |
|---|---|---|---|
| AMATOLE | R10 | Extension of rural water supply schemes. Possible future raw water supply from Keiskamma River to Buffalo River (Buffalo City). Potential = 37 million $m^3$/a | |
| | R20 | Mainly rehabilitation and upgrading of existing infrastructure to balance demand. Extension of rural water supply schemes. Extensions of supply to coastal resorts both east and west of East London. | |
| | R30 | Extension of rural water supply schemes. Future potential raw water supplies to Buffalo City from the Nahoon, Gqunube and Kwelera Rivers | |
| | R40 | Extension of urban supply from Buffalo City to coastal resorts | |
| | R50 | Extension of rural water supply schemes from existing Peddie RWSS. Source from Keiskamma River. | |
| KEI | S10 | Extension of rural water supply schemes. Possible future bulk supply from Xonxa Dam to Queenstown (8 million $m^3$/a) | |
| | S20 | Extension of rural water supply schemes | |
| | S31 | Bulk supply from Xonxa Dam to Queenstown | Requirement = 8 million $m^3$/a |
| | S32 | Extension of rural water supply schemes | |
| | S40 | Extension of rural water supply schemes | |
| | S50 | Extension of rural water supply schemes | |
| | S70 | Extension of rural water supply schemes. Possible supply from Great Kei River to Wavecrest for mining purposes (project on hold) | |

# AMATOLE - KEI ISP

## MAJOR DAMS (Ref. 24)

| Name | Live Storage Capacity (million $m^3$) | Yield* (million $m^3/a$) | Purpose | Catchment | Owner/operator |
|---|---|---|---|---|---|
| Maden | 0,22 | 3,1 | Domestic water use | R20A | BCM |
| Rooikrantz Dam | 4,9 | | Irrigation | R20A | DWAF/AW |
| Laing Dam | 21,0 | 14.9 | Domestic water use | R20E | DWAF/AW |
| Bridle Drift Dam | 101,7 | 30,7 | Domestic water use | R20F | BCM |
| Nahoon Dam | 20,7 | 7,8 | Domestic water use, irrigation | R30E | DWAF/AW |
| Gubu Dam | 8,8 | 2,9 | Domestic water use, irrigation | S60A | DWAF/AW |
| Wriggleswade Dam | 91,2 | 25,4 | Domestic water use, irrigation | S60B | DWAF/AW |
| Sandile Dam | 30,9 | 18,0 | Irrigation/ Domestic | R10B | DWAF/AW |
| Binfield Park Dam | 36,8 | 16,5 | Irrigation/ Domestic | R10G | DWAF/AW |
| Pleasant View Dam | 2,0 | 1,5 | Irrigation | R10G | DWAF |
| Debe Dam | 6,0 | 2,2 | Domestic water use | R10E | DWAF |
| Mnyameni Dam | 2,0 | 2,3 | Domestic water use | R10B | DWAF/AW |
| Cata Dam | 12,1 | 6,2 | Irrigation | R10B | DWAF/AW |
| Waterdown Dam | 36,6 | 16,5 | Domestic supply & irrigation | S32E | DWAF |
| Bongolo Dam | 6,95 | 0,7 | Domestic Queenstown | S31F | Lukhanji LM |

| Name | Live Storage Capacity (million $m^3$) | Yield* (million $m^3/a$) | Purpose | Catchment | Owner/operator |
|---|---|---|---|---|---|
| Bushmanskrantz Dam | 4,62 | 2,1 | Irrigation | S32F | DWAF |
| Oxkraal Dam | 17,8 | 6,2 | Irrigation | S32G | DWAF |
| Shiloh Dam | 0,52 | 0,3 | Irrigation | S32G | DWAF |
| Thrift Dam | 2,6 | 0,6 | Irrigation | S32A | DWAF |
| Limietskloof | 0,78 | 0,1 | Irrigation | S32A | DWAF |
| Tentergate Dam | 1,72 | 0,3 | Irrigation | S32B | DWAF |
| Mitford Dam | 0,89 | 0,1 | Irrigation | S32C | DWAF |
| Glenbrock Dam | 0,41 | 0,1 | Irrigation | S32C | DWAF |
| Macubeni | 1,85 | 1,5 | Domestic | S10F | DWAF |
| Xonxa Dam | 126,0 | 27,6 | Irrigation | S10E | DWAF |
| Doring River Dam | 17,84 | 3,4 | Domestic water use, irrigation | S20A | DWAF |
| Lubisi Dam | 135,0 | 28,5 | Irrigation | S20C | DWAF |
| Ncora Dam | 120,0 | 98,0 | Hydropower Irrigation Small Domestic | S50E | DWAF |
| Tsojana | 9,35 | 3,2 | Domestic | S50F | DWAF |
| Sam Meyer Dam | 0.608 | | Domestic/ Leisure | S40A | Amahlati LM |
| Xilinxa Dam | 14.5 | 9.4 | Domestic Water Use | S70C | DWAF |

* Yields are at a reliability of 1 in 50 years (98% assurance).

**APPENDIX B11**

# AMATOLE - KEI ISP

## LIST OF FLOW GAUGING STATIONS

Data Types

E = Electronic Data
C = Chart (Week Gear)
Cm = Chart (Month Gear)
R = Return
WQ = Water Quality Sample (analysed at IWQS)
DC = Data Collector

| Station no. | Station Name | Data collected | Data processed | Data collector | Latitude | Longitude |
|---|---|---|---|---|---|---|
| R1H014 -A01 | Tyume at Khayaletu - Yantola's Location | C+E+R+Q | C | Cradock DC | 32°38'24" | 26°56'10" |
| R 1H015 -A01 | Keiskamma at Farm no.7 | Cm + E +Q | E | Cradock DC | 33°11'09" | 27°23'27" |
| R 1H017 -A01 | Keiskamma at Sandile Dam | C+ E + Q | C | Cradock DC | 32°43'06" | 27°05'56" |
| R 1H019 - M01 | Pipeline from Sandile Dam | R | R | Sandile Dam | 32°43'07" | 27°06'24" |
| R 1H020 - M01 | Pipeline from Binfield Park Dam | R | None | Cradock DC | 32°41'13" | 26°53'59" |
| R 1R001 - A01 | Sandile Dam | C + E + R | C | Cradock DC | 32°43'05" | 27°06'23" |
| R 1R003 - A01 | Binfield Park Dam | C + E + Q | C | Cradock DC | 32°40'47" | 26°54'13" |
| R 2H001 - A01 | Buffels at Pirie Main Bos Res. | C + E + Q | C | Cradock DC | 34°43'55" | 27°17'37" |
| R 2H005 - A01 | Buffels at King William's Town | C + E + Q | E | Cradock DC | 32°52'30" | 27°22'59" |
| R 2H006 - A06 | Mqqakwebe at Msenge Ridge | C + E + Q | C | Cradock DC | 32°51'24" | 27°22'35" |
| R 2H008 - A01 | Quencwe at Braunschweig (Edendale) | C + E + Q | C | Cradock DC | 32°46'05" | 27°22'27" |
| R 2H009 - A01 | Mqqokweni at Sheshegu (Nqqokweni Loc) | C + E + Q | C | Cradock DC | 32°55'00" | 27°22'23" |
| R 2H010 - A01 | Buffels at 135 K.W.T.Q. (Macintyre Bridge) | C + E + Q | E | Cradock DC | 32°56'26" | 27°27'41" |
| R 2H015 - A01 | Yellowwoods at Fort Murray | C + E + Q | C | Cradock DC | 32°55'54" | 27°28'21" |
| R 2H016 - A01 | Zwelitsha sloot at Malakalaka | C + E + Q | E | Cradock DC | 32°56'05" | 27°28"45" |
| R 2H017 - M01 | Pipeline to purification works (Laing Dam) | R + Q | R | Laing Dam | 32°58'04" | 27°29'33" |

| Station no. | Station Name | Data collected | Data processed | Data collector | Latitude | Longitude |
|---|---|---|---|---|---|---|
| R 2H020 -M01 | Main pipeline from Rooikrantz Dam - right | R | R | Rooikrantz Dam | 32°45'19" | 27°19'41" |
| R 2H024 -M01 | Pipeline to Trout Farm at Rooikrantz Dam | R | R | Rooikrantz Dam | 32°45'19" | 27°19'32" |
| R 2H025 -A01 | Canal before Yellowwoods (Wriggleswade Dam) | C + E | C | Wriggleswade Dam | 32°42'52" | 27°33'15" |
| R 2H 027 -A01 | Buffels at Bridledrift | Cm + E + Q | E | Cradock DC | 32°59'37" | 27°38'24" |
| R 2H029 -A01 | Buffalo at Bridledrift Dam | E | E | Cradock IT | 32°59'29" | 27°43'45" |
| R 2R001 - A01 | Laing Dam | C + E + R + Q | C | Cradock DC | 32°58'05" | 27°29'39" |
| R 2R001 - K01 | River outlet from Laing Dam | R | R | Laing Dam | 32°58'05" | 27°29'39" |
| R 2R001 - K02 | River outlet from Laing Dam | R | R | Laing Dam | 32°58'05" | 27°29'39" |
| R 2R002 - A01 | Rooikrantz Dam | C + E + R + Q | C | Cradock DC | 32°45'19" | 27°19'41" |
| R 2R003 - A01 | Bridle Drift Dam | E + R + Q | E | Bridledrift Dam | 32°59'24" | 27°43'57" |
| R 3H001 - A01 | Gqunube at Outspan | Cm + E + Q | E | Cradock DC | 32°48'07" | 27°51'21" |
| R 3H003 - A01 | Nahoon River at Farm 305 (Nahoon Dam) | C + E + Q | C | Nahoon Dam | 32°45'34" | 27°48'41" |
| R 3H004 - M01 | Pipeline to purification works Nahoon Dam | R + Q | R | Nahoon Dam | 32°45'34" | 27°48'41" |
| R 3H005 - A01 | Canal from Wriggleswade Dam before Nahoon outlet | C + E | C | Wriggleswade Dam | 32°41'55" | 27°33'54" |
| R 3H006 - A06 | Tunnel from Wriggleswade Dam | C + E + Q | C | Wriggleswade Dam | 32°38'43" | 27°34'54" |
| R 3R001 - A01 | Nahoon Dam | C + E + R + Q | C | Nahoon Dam | 32°54'35" | 27°48'41" |
| | | | | | | |
| S 1R001 - A01 | Xonxa Dam | R + E + Q | E | Cradock DC | 31°50'17" | 27°10'03" |
| S 2H005 -A01 | Indwe at Mote Farm (Lubisi Dam) | C + E + R + Q | C | Dept. Observer | 31°47'45" | 27°25'52" |
| S 2H006 - A01 | Doring River Dam at Indwe (Doring River Dam) | C + E + Q | C | Doring River Dam | 31°30'47" | 27°20'05" |
| S 2H007 - M01 | Pipeline to Indwe at Doring River Dam | R | R | Doring River Dam | 31°30'47" | 27°20'05" |
| S 2H008 - M01 | Pipeline to dam terrain at Doring River Dam | R | R | Doring River Dam | 31°30'47" | 27°20'05" |
| S 2R001 - A01 | Lubisi Dam | C + E + R + Q | C | Dept. Observer | 31°47'45" | 27°25'52" |
| S 2R002 - A01 | Doring River Dam | C + R + Q | C | Doring River Dam | 31°30'47" | 27°20'05" |
| S 3H002 - Q01 | Klaas Smits at Weltevreden (Grobbelaar) | Q | None | Cradock DC | 31°44'39" | 26°35'04" |

| Station no. | Station Name | Data collected | Data processed | Data collector | Latitude | Longitude |
|---|---|---|---|---|---|---|
| S 3H003 - Q01 | Black Kei at Doornkraal | Q | None | Cradock DC | 32°12'00" | 26°29'00" |
| S 3H004 - A01 | Black Kei Cathcarts Gift (Endwell) | C + E + Q | C | Cradock DC | 32°03'00" | 26°47'23" |
| S 3H005 -A01 | Oxkraal at Whittlesea | Q | - | Cradock DC | 32°10'52" | 26°49'15" |
| S 3H006 - A06 | Klaas Smits at Weltevreden (Queenstown) | C + E + Q | C | Cradock DC | 31°55'24" | 26°47'11" |
| S 3H008 -Q01 | Black Kei at Doornkraal | Q | None | Cradock DC | 32°12'00" | 28°29'00" |
| S 3H010 - A01 | Klipplaat River at Waterdown Dam | C + E + Q | C | Cradock DC | 32°17'06" | 24°51'37" |
| S 3H011 - M03 | Pipeline from Waterdown Dam | R | R | Waterdown Dam | 32°17'06" | 26°51'37" |
| S 3H011 - M04 | Pipeline from Waterdown Dam | R | R | Waterdam Dam | 32°17'16" | 26°51'37" |
| S 3H012 - A01 | Oxkraal at Oxkraal Dam | C + E +Q | C | Cradock DC | 32°12'37" | 26°44'02" |
| S 3R001 - A01 | Waterdown Dam | C + E +R + Q | C | Waterdown Dam | 32°17'06" | 26°51'37" |
| S 3R003 - A01 | Oxkraal Dam | C + E + Q | C | Cradock DC | 32°12'20" | 26°45'31" |
| S 5H002 - A02 | Tsomo at Wyk Maduma | E + R + Q | E | Dept. Observer | 32°02'36" | 27°49'22" |
| S 5H004 - A01 | Tsomo at Famini Loc. (Ncora Dam) | C + E + R +Q | C | Dept. Observer | 31°47'37" | 27°41'12" |
| S 5R001 - A01 | Ncora Dam | E + R + Q | R | Dept. Observer | 31°47'15" | 27°40'45" |
| S 6H001 - A01 | Kubusi at Stutterheim | C + E + Q | C | Cradock DC | 32°34'45" | 27°22'00" |
| S 6H003 - A01 | Toise at Forkroad | Cm + E + Q | E | Cradock DC | 32°30'58" | 27°31'25" |
| S 6H004 - A01 | Gubu at Farm 253 (Gubu Dam) | C + E +Q | C | Gubu Dam | 32°34'37" | 27°16'46" |
| S 6H005 - A01 | Kubusi at Wriggleswade | C + E + Q | C | Wriggleswade Dam | 32°34'34" | 27°33'57" |
| S 6H005 - B01 | Kubusi at Wriggleswade Dam | C + E | C | Wriggleswade Dam | 32°34'34" | 27°35'57" |
| S R6R001 - A01 | Gubu Dam | C + E + R + Q | C | Gubu Dam | 32°34'37" | 27°16'46" |
| S 6R002 - A01 | Wriggleswade Dam | C + E +R + Q | C | Wriggleswade Dam | 32°34'44" | 27°33'40" |
| S7H00? -M01 | Pipeline to purification Works at Butterworth (Gcuwa Dam) | R | R | Dept. observer | 32°34'44" | 27°33'40" |
| S 7H001 - A01 | Gcuwa at Butterworth | E + R + Q | E | Dept observer | 32°19'39" | 28°08'41" |
| S 7R001 - A01 | Gcuwa Dam | R + Q | R | Dept. Observer | 32°19'26" | 28°08'26" |
| S 7R002 - A01 | Xilinxa Dam (to be closed) | R | None | Dept. Observer | 32°08'23" | 28°05'53" |
| S 7H004 - A01 | Groot Kei at Springs B | Cm +E +Q | E | Cradock DC | 32°31'00" | 28°01'07" |
| S 7H004 - B01 | Groot Kei Springs at B | Cm + E | Cm | Cradock DC | 32°31'00" | 28°01'07" |

# AMATOLE KEI ISP
# MAJOR INFRASTRUCTURE AND TRANSFER SCHEMES

## WATER TREATMENT WORKS (Ref. 5 and 24)

| ISP AREA | QUATS | NAME | OWNER/OPERATOR | CAPACITY (Ml/d) |
|---|---|---|---|---|
| **AMATOLE** | | | | |
| | R10B | Keiskammahoek | Amatole DM / Amatole Water | 2.2 |
| | R10C | Sandile RWSS | DWAF / Amatola Water | 18 |
| | R10E | Debe | Amatole DM | 1.5 |
| | R10G | Alice<br>Binfield Park Dam<br>Pleasant View | Amatole DM<br>DWAF / Amatola Water<br>Amatole DM | 3.8<br>4.8<br>0.75 |
| | R10L | Peddie RWSS | Amatole DM / Amatola Water | 6.6 |
| | | | | |
| | R20A | Rooikrantz | DWAF / Amatola Water | 1.2 |
| | R20B | King William's Town | DWAF / Amatola Water/Buffalo City Municipality | 7.0/13? |
| | R20E | Laing Dam | DWAF / Amatola Water | 27.3 |
| | R20F | Ncera Coastal / Needs Camp | Amatole DM ? | 0.8 |
| | R20G | Umzoniana | Buffalo City Municipality | 120 |
| | | | | |
| | R30B | Cintsa | Amatole DM | 0.48 |
| | R30E | Kei Road | DWAF / Amatola Water | 0.30 |
| | R30F | Nahoon | DWAF / Amatola Water | 33.7 |
| | | | | |
| | R50A | Wesley | Amatole DM | 3.8 |

| ISP AREA | QUATS | NAME | OWNER/OPERATOR | CAPACITY (Ml/d) |
|---|---|---|---|---|
| **KEI** | | | | |
| | S10F/G | Cacadu | DWAF (?) | 3.5 |
| | | | | |
| | S20A | Indwe | Lukhanji LM | ? |
| | | | | |
| | S31F | Queenstown | Chris Hani DM / Lukanji Municipality | 40 |
| | S32G | Sada | Chris Hani DM / Lukanji Municipality | 11.25 |
| | | | | |
| | S40A | Cathcart | Amatole DM / Amahlati Municipality | ? |
| | | | | |
| | S50C | Cala | Sakhisizwe Municipality | 1.8 |
| | S50E | Ncora | DWAF (?) | ? |
| | S50F | Tsojana | DWAF/ Intsika Yethu (?) | 0.47 |
| | S50J | Tsomo | Chris Hani / Intsika Yethu | 0.50 |
| | | | | |
| | S60A | Stutterheim | Amahlati LM | 2.5 |
| | | | | |
| | S70A | Kei River (Komga) | Amatole DM / Great Kei Municipality | 1.2 |
| | S70C | Xilinxa | Amatole DM / Mnquma Municipality | ? |
| | S70E | Butterworth | Amatole DM / Mnquma Municipality | 18 |

## BOREHOLE SUPPLIES

| ISP AREA | QUATS | SCHEME NAME | TOWN |
|---|---|---|---|
| **AMATOLE** | | | |
| | R10M | Hamburg | Hamburg |
| | R30A/B/D | East Coast Resorts | Between Gonubie & Cefane |
| | R30A/B | Mooiplaas | 15 Rural villages |
| | R30B/D | Kwelera | 7 Rural villages |
| | R30E | Macleantown | Macleantown |
| | R40A | West Coast Resorts | Between Cove Rock & Gxulu River |
| **KEI** | | | |
| | S31A | Sterkstroom | Sterkstroom |
| | S32B/C/F/H | Hewu | 48 Rural villages |
| | S32J | Ilinge | Ilinge and rural villages |
| | S60C | Wartburg | 6 Rural villages |
| | S60D | Mgwali Heckel | 6 Rural villages |
| | S70D/S50J | Nqamakwe | Nqamakwe |

## TRANSFER SCHEMES (Raw Water)

| ISP AREA | QUATS | SOURCE TO SUPPLY END |
|---|---|---|
| **AMATOLE** | | |
| | R10L to R50A | Keiskamma River to Birha River (Wesley Scheme now replaced by Peddie RWSS) |
| **KEI** | | |
| | S32E to S31F | Waterdown Dam to Queenstown |
| | S50E | Ncora Dam to Mbashe Catchment (Eskom) |
| | S50F to S50H | Tsojana Dam to Cofimvaba |
| | S60B to R20B | Wriggleswade Dam to Buffalo River (or Nahoon River) |

## PIPELINES

Waterdown Dam to Queenstown. Pumped line with a present capacity of 0,265$m^3$/s (23Ml/d).

## CANALS

| ISP AREA | QUATERNARY | SOURCE TO SUPPLY END |
|---|---|---|
| **AMATOLE** | | |
| **KEI** | | |
| | S20D | Lubisi Dam – Qamata Irrigation Scheme<br>28.5 km long canal from Lanti weir |
| | S60B to R20B | Wriggleswade Canal |

## POTABLE WATER SUPPLY SCHEMES (1995) (Ref. 24)

| SCHEME NAME | RAW WATER SOURCE | POPULATION SUPPLIED | SCHEME CAPACITY | | | CATCHMENT No. |
|---|---|---|---|---|---|---|
| | | | (million $m^3/a$) | (l/c/d) | Limiting Factor | |
| Amatole System | Bridle Drift, Nahoon, Laing, Rooikrantz, Maden, Gubu, Wriggleswade | 725 000 | 57,0 | 215 | Treatment capacity | R20A, B, C, D, E, F, G<br>R30D, E, F |
| Komga | Boreholes, Kei River | 5 100 | 0,50 | 268 | Treatment capacity | S70A |
| Butterworth | Xilinxa Dam | 36 450 | 5,45 | 188 | Treatment capacity | S70E |
| Tsomo | Tsomo River | 2 050 | 0,12 | 160 | Treatment capacity | S50J |
| Nqamakwe | Boreholes | 2 050 | 0,05 | 66 | Source | S50J |
| Cathcart | Sam Meyer Dam | 8 000 | 0,50 | 172 | Source | S40A |
| Mgwali Heckel Scheme | Boreholes | 4 500 | 0,42 | 255 | Source | S60D |
| Wartburg Scheme | Boreholes | 5 000 | 0,27 | 148 | Source | S60C |
| Kwelera Scheme | Boreholes | 18 000 | 0,88 | 133 | Source | R30B, D |
| Mooiplaas Scheme | Boreholes | 30 000 | 0,60 | 55 | Source | R30A, B |
| Alice (Tyume Valley Scheme) | Binfield Park Dam | 15 300 | 1,1 | 195 | Treatment capacity | R10H |
| Debe Regional Water Supply Scheme | Debe Dam | 29 000 | 0,45 | 43 | Treatment capacity | R10E, J ,K |
| Keiskammahoek Water Supply Scheme | Mnyameni Dam | 12 000 | 0,88 | 200 | Treatment capacity | R10B |
| Wesley Regional Water Supply Scheme | Keiskamma River | 700 | 1,15 | N/A | Treatment capacity | R10M<br>R50A, B |
| Sandile Regional Water Supply Scheme | Sandile Dam | 104 000 | 5,4 | 142 | Treatment capacity | R10D, E, K<br>R20C, D |
| Hamburg | Boreholes | 1 700 | Unknown | | | R10M |
| Indwe | Doring River Dam | 6 350 | 0,35 | 151 | Treatment capacity | S20A |
| Cala | Tsomo River, Boreholes | 13 350 | 0,55 | 111 | Treatment capacity | S50A |
| Queenstown | Waterdown Dam, | 50 450 | 8,9 | 483 | Source | S31F |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Bongolo Dam | | | | | |
| Sada/Whittlesea | Waterdown Dam | 50 400 | 3,4 | 185 | Treatment capacity | S32G, H |
| Yonda, Mbekweni | Bushmanskrantz Dam | 9 200 | 0,10 | 30 | Treatment capacity | S32F, G |
| Cacadu Rural Water Supply Scheme | Macubeni Dam | 64 000 | 1,06 | 45 | Source and Treatment capacity | S20A S10F, G |
| Hewu Groundwater Scheme | Boreholes and springs | 48 000 | 0,53 | 30 | Source | S32C, F |
| Ilinge Scheme | Boreholes | 13 000 | 1,3 | 274 | Source | S32J |
| Tsojana Scheme | Tsojana Dam | 5 000 | 0,14 | 79 | Treatment capacity | S50H |

# AMATOLE- KEI ISP

## URBAN WATER USE/ESTIMATED DEMAND AND SOURCES

**(Ref. 2, 5 and 24)**

| Towns | Water Consumption or *Estimated Demand 2003 (million $m^3$/a)* | Assurance of Water Supply or Reliability of the Water Source | Current Supply Source | Problems with Current Supply | Need to Augment Current Supply | Comment on Demand Management Initiatives and its Results | Planned Water Schemes or Studies |
|---|---|---|---|---|---|---|---|
| Keiskammahoek | *0.20* | 98% | Mnyameni Dam | Unknown | No. OK until 2015+. | Unknown | No |
| Dimbaza | | Adequate | Refer Sandile Regional | | No | Unknown | No |
| Middledrift | | Adequate | Refer Sandile Regional | | No | Unknown | No |
| Alice | | Adequate | Refer Tyume Valley WSS | | No | Unknown | No |
| Hamburg | *0.090* | Unknown | Boreholes | Unknown | Unknown | Unknown | Unknown |
| Peddie (outside catchment) | *0,30* | 98% | Keiskamma river. Peddie RWSS. | None | No | Unknown | No |
| Kei Road | *0.075* | 98% | Wriggleswade canal & dam | None | No. OK until 2015+. | Unknown | No |
| Macleantown | *0.010* | Unknown | Nahoon WTW (?) | None | No | Unknown | No |
| Morgan Bay/Kei Mouth | *0,24 (Year 2003) 0,32 (year 2008)* | Assurance < 98% (peak holiday season) | Cwili & Ntshala Rivers and small dams, springs and dune supply | Many small sources. Difficult and expensive to operate and maintain | Yes, by the year 2008 | Water restrictions coinciding with peak holiday season | Prefeasibility proposals - Augmentation from the Kei River |
| West Coast Resorts<br>- Rock-Clyffe-on-Sea<br>- Winterstrand<br>- Lekkeroord<br>- Roeberts<br>- Aqualea/Magula<br>-<br>- Igoda Mouth<br>- Gulu Mouth<br>- Kidd's Beach<br>- Palm Springs<br>- Cosy Corner<br>- Christmas Rock<br>- Sea Vale<br>- Kayser's Beach<br>-<br>- Bira<br>- Mtata<br>- Mpekweni | *Combined 0.080*<br><br>*Combined 0.25* | <br>Inadequate<br>Good<br>Inadequate<br>Inadequate<br>Good<br><br><br><br>Inadequate quantity & quality | <br>Borehole/raintanks<br>Boreholes<br>Borehole/raintanks<br>Borehole/raintanks<br>Borehole<br><br><br><br>Borehole/raintanks<br><br><br><br>Ncera RWSS<br><br>Refer Wesley Regional WSS | <br>Inadequate/saline<br><br>Inadequate/saline<br>Inadequate/saline<br><br><br><br>Inadequate/saline | <br>Yes<br>No<br>Yes<br>Yes<br>Yes<br><br><br><br>Yes | | Proposed West Coast Water Supply Scheme from Buffalo City (information on development lacking)<br><br><br><br>Ncera Coastal Water Supply Scheme (information on development lacking) |

| Towns | Water Consumption or *Estimated Demand 2003 (million $m^3$/a)* | Assurance of Water Supply or Reliability of the Water Source | Current Supply Source | Problems with Current Supply | Need to Augment Current Supply | Comment on Demand Management Initiatives and its Results | Planned Water Schemes or Studies |
|---|---|---|---|---|---|---|---|
| Buffalo City<br>- King Williams Town<br>- Bisho<br>- Zwelitsha<br>- Mdantsane<br>- East London<br>- Gonubie | *73,2* | 98%<br>System yield = 79 $Mm^3$/a | Maden Dam<br>Rooikrantz Dam<br>Laing Dam<br>Bridle Drift Dam<br>Nahoon Dam<br>Wriggleswade Dam | Adequate but needs internal rebalancing of supply and increased treatment capacity | Adequate until Year 2012 if demand management programme implemented | Still to be undertaken | Future bulk supply from Kei / Keiskamma / Nahoon / Gqunube and Kwelera Rivers |
| East Coast Resorts | | | | | | | |
| - Rainbow Valley | *0,008* | Adequate | Buffalo City Supply | | No | | East Coast Bulk Water Supply Scheme from Gonubie to Cintsa West (information on development lacking) |
| - Sunrise-on-sea | *0,10* | Inadequate | Buffalo City Supply | | No | | |
| - Kwelera | *0,050* | Inadequate | Borehole/raintanks | | Yes | | |
| - Club Areena | *0,02* | Adequate | Dam | | Yes | | |
| - Yellow Sands | *0,017* | Adequate | Dam/borehole/raintanks | | Yes | | |
| - Glengariff | *0,017* | Inadequate | Dam/borehole/raintanks | | Yes | | |
| - Glen Eden | *0,020* | Adequate | Dam/borehole/raintanks | | Yes | | |
| - Glen Navar | *0,014* | Adequate | Boreholes | | Yes | | |
| - Queensberry Bay | *0,015* | Inadequate | Dam/borehole/raintanks | | Yes | | |
| - Four Seasons | *0,014* | Inadequate | Dam/borehole/raintanks | | Yes | | |
| - Glen Muir | *0,015* | Inadequate | Dam/borehole/raintanks | | Yes | | |
| - Cintsa Bay | *0,008* | Inadequate | Boreholes/raintanks | | Yes | | |
| - Cintsa West | *0,025* | Adequate | Boreholes/raintanks | | Yes | | |
| - Buccaneers | *0,004* | Adequate | Raintanks/borehole | | Yes | | |
| - Cintsa East | *0,10* | Inadequate | Cintsa River dam | Yes | Yes | | |
| - Cefane | *0,004* | Adequate | Raintanks/borehole | | Yes | | |
| - Bosbokstrand<br>- Haga Haga<br>- Marshstrand | *0,050* | Good | Borehole<br>Haga Haga River and boreholes | No | No | No | |
| - Double Mouth | *0,002* | Runs dry during droughts | Spring supply | Unreliable | Yes | No | Connect to Morgan Bay Supply |
| Rural Villages | | | | | | | |
| - Mooiplaas (15) | *0,70* | Not good | Boreholes | Inadequate/poor quality | Yes | | Dam on Kwenxura River |
| - Kwelera (7) | *0,45* | Not good | Boreholes | Inadequate/poor quality | Yes | | ? |
| - Newlands | *0,47* | Adequate | Nahoon Dam & WTW | | No | | Details required |
| - Needs Camp<br>- Ncera | *0,65 (?)*<br>*0,43 (?)* | Unknown<br>Unknown | From Buffalo River u/s of Bridle Drift Dam | | | | Ncera Coastal Water Supply Scheme (information on development lacking) |
| - Debe Regional | *0,38* | Adequate | Debe Dam | Adequate | No | | No |

| Towns | Water Consumption or *Estimated Demand 2003 (million $m^3$/a)* | Assurance of Water Supply or Reliability of the Water Source | Current Supply Source | Problems with Current Supply | Need to Augment Current Supply | Comment on Demand Management Initiatives and its Results | Planned Water Schemes or Studies |
|---|---|---|---|---|---|---|---|
| - Sandile Regional (incl. Middledrift, Dimbaza and some 50 villages) | *6,60* | Adequate | Sandile Dam | Adequate | No | Unknown | No |
| - Tyume Valley (inc. Alice and rural villages) | *1,30* | Adequate | Binfield Park Dam | Adequate | No | Unknown | No |
| - Wesley Regional | *1,01* | Adequate (allocation not fixed) | Bulk water from Peddie RWSS | Adequate | No | Unknown | No |
| - Tqolomna Regional | *?* | | Bulk water from Peddie RWSS | Problems with commissioning | | | No |
| Lady Frere (Cacadu) | *0,92* | Dam siltation reducing yield | Macubeni Dam | Adequate | Yes | | No |
| Indwe | *0,40* | Adequate | Doring River Dam | Unknown | No | | No |
| Sterkstroom | *0,06* | Inadequate | Boreholes/springs | Unknown | Yes | | Unknown |
| Queenstown | *8,50* | Inadequate | Waterdown Dam (8,25 $Mm^3$/a)<br>Bongolo Dam (0,6 $Mm^3$/a) | Inadequate bulk supply | Yes | Yes (?) | Feasibility Study 1997 |
| Sada/Whittlesea | *1,97* | Adequate | Waterdown Dam | None | No | Unknown | Ditto |
| Cathcart | *0,78* | Unknown | Sam Meyer Dam | Unknown | Dam recently raised | Unknown | Unknown |
| Cala (outside area) | *0,11* | Adequate | Tsomo River | None (silt) | No | Unknown | No |
| Cofimvaba | ? | ? | Tsojana Dam | Unknown | No | Unkown | Unknown |
| Ncora | *0,80* | Adequate | Ncora Dam | Unknown | No | Unknown | Unknown |
| Tsomo | *0,0164* | Unknown | Tsomo River | Unknown | Unknown | Unknown | Unknown |
| Stutterheim | *1,38* | Adequate | Gubu Dam and River | None | No | Unknown | Proposed pipeline directly from Gubu Dam |
| Nqamakwe | *0,14* | Inadequate | Boreholes | Inadequate | Yes | Unknown | Proposed regional study 2004 |
| Butterworth | *7,40* | Adequate | Xilinxa and Gcuwa Dams | Siltation of Gcuwa Dam | No. Adequate until year 2009 | Unknown | Unknown |

| Towns | Water Consumption or *Estimated Demand 2003 (million $m^3/a$)* | Assurance of Water Supply or Reliability of the Water Source | Current Supply Source | Problems with Current Supply | Need to Augment Current Supply | Comment on Demand Management Initiatives and its Results | Planned Water Schemes or Studies |
|---|---|---|---|---|---|---|---|
| Komga | *0,34 -0,50* | Adequate | Kei River Boreholes/spring | B/h & spring high nitrates | No | Unknown | No |
| Rural Villages | | | | | | | |
| - Mgwali/Heckel (7) | *0,054* | Adequate | Boreholes | None | No | Unknown | No |
| - Wartburg | *0,092* | Adequate | Boreholes | None | No | Unknown | No |
| - Xilinxa | | | | | | | |
| - Hewu | *0,94* | Unknown | Boreholes | Unknown | Unknown | Unknown | Unknown |
| - Ilinge | *0,68* | Adequate | Boreholes | None | No | Unknown | No |

# AMATOLE - KEI ISP

## GENERAL AUTHORISATIONS (SURFACE/GROUNDWATER)

**Purpose of General Authorisation:**

The purpose of general authorisation is the need to replace the necessity for a water user to apply for a licence in terms of the National Water Act for the abstraction or storage of water from a water resource, provided that the abstraction or storage is within the limits and conditions set out in this authorisation. The tables below indicate the areas in the Amatole - Kei catchments permitted in terms of Government Gazette No: 20626 of 8 October 1999.

**TABLE 1.1 Areas excluded from General Authorization for surface water abstraction**

| Primary | Secondary/Tertiary/ Quaternary drainage | Description of main river in drainage region |
|---|---|---|
| R | R20 | Buffalo River |
| | R30A, B, C & D | Kwenxura, Kwelera, Gonubie Rivers |
| | R30E & F | Nahoon River |
| S | S10 A & E | White Kei River upstream of the Xonxa Dam |
| | S20A to C | Indwe River upstream of the Lubisi Dam |
| | S32A to C | Black Kei River upstream of the Klipplaat confluence |
| | S32D & E | Klipplaat River upstream of Waterdown Dam |
| | S32F | Oxkraal River upstream of Oxkraal Dam |
| | S40A, B & C | Thorn, Thomas Rivers |
| | S50A, B & C | Tsomo, Kwa-Qokwama and Mbokotwa Rivers |
| | S60A & B | Kubusi River upstream of Wriggleswade Dam |
| | S60C & D | Toise River |
| | S70C | Xilinxa River upstream of the Xilinxa Dam |

**TABLE 1.2 Groundwater Abstraction Zones: Tertiary and Quaternary Drainage Regions**

| ZONE A<br>No water may be abstracted from these drainage regions except as set out under Schedule 1 | ZONE B<br>45m$^3$ per hectare per annum may be abstracted from these drainage regions | ZONE C<br>75m$^3$ per hectare per annum may be abstracted from these drainage regions |
|---|---|---|
| | R10A, B &F | R10C-E, G, H, J-M |
| | R20A & C | R20B, D-G |
| | | R30A-F |
| | | R40A-C |
| | R50B | R50A-H, J |
| | | |
| | S20A | S20B, D-G |
| | S31B, C & E | S31A, D, F, G |
| | S32D & E | S32A-C, F-H, J-M |
| | | S40A-F |
| | S50D | S50A-C, E-H, J |
| | S60A & B | S60C-E |
| | | S70A-F |

**TABLE 1.3: Wastewater limit values applicable to discharge of wastewater into a water resource**

| SUBSTANCE/PARAMETER | GENERAL LIMIT | SPECIAL LIMIT |
|---|---|---|
| Faecal Coliforms (per 100ml) | 1000 | 0 |
| Chemical Oxygen Demand (mg/l) | 75* | 30* |
| pH | 5,5-9,5 | 5,5-7,5 |
| Ammonia (ionised and un-ionised) as Nitrogen (mg/l) | 3 | 2 |
| Nitrate/nitrite as Nitrogen (mg/l) | 15 | 1.5 |
| Chlorine as Free Chlorine (mg/l) | 0.25 | 0 |
| Suspended Solids (mg/l) | 25 | 10 |
| Electrical Conductivity (mS/m) | 70mS/m above intake to a maximum of 150mS/m | 50 mS/m above background receiving water, to a maximum of 100mS/m |
| Ortho-Phospate as phosphorous (mg/l) | 10 | 1(median) and 2,5 (maximum) |
| Fluoride (mg/l) | 1 | 1 |
| Soap, oil or grease (mg/l) | 2.5 | 0 |
| Dissolved Arsenic (mg/l) | 0.02 | 0.01 |
| Dissolve Cadium (mg/l) | 0.005 | 0.001 |
| Dissolved Chromium (VI) (mg/l) | 0.05 | 0.02 |
| Dissolved Copper (mg/l) | 0.01 | 0.002 |
| Dissolved Cyanide (mg/l) | 0.02 | 0.01 |
| Dissolved Iron (mg/l) | 0.3 | 0.3 |
| Dissolved Lead (mg/l) | 0.01 | 0.006 |
| Dissolved Manganese (mg/l) | 0.1 | 0.1 |
| Mercury and its components (mg/l) | 0.005 | 0.001 |
| Dissolved Selenium (mg/l) | 0.02 | 0.02 |
| Dissolved Zinc (mg/l) | 0.1 | 0.04 |
| Boron (mg/l) | 1 | 0.5 |

**TABLE 1.4: Listed water resource**

| | |
|---|---|
| 14 | Buffalo River from its source to where it enters the municipal area |
| 15 | Klipplaat River from its source to Waterdown Dam |
| 16 | Black Kei River to its confluence with the Klipplaat River |
| 18 | Bongola River to Bongola Dam |
| 19 | Kubusi River to Stutterheim municipal boundary |
| 22 | Little Tsomo River |

# AMATOLE - KEI ISP

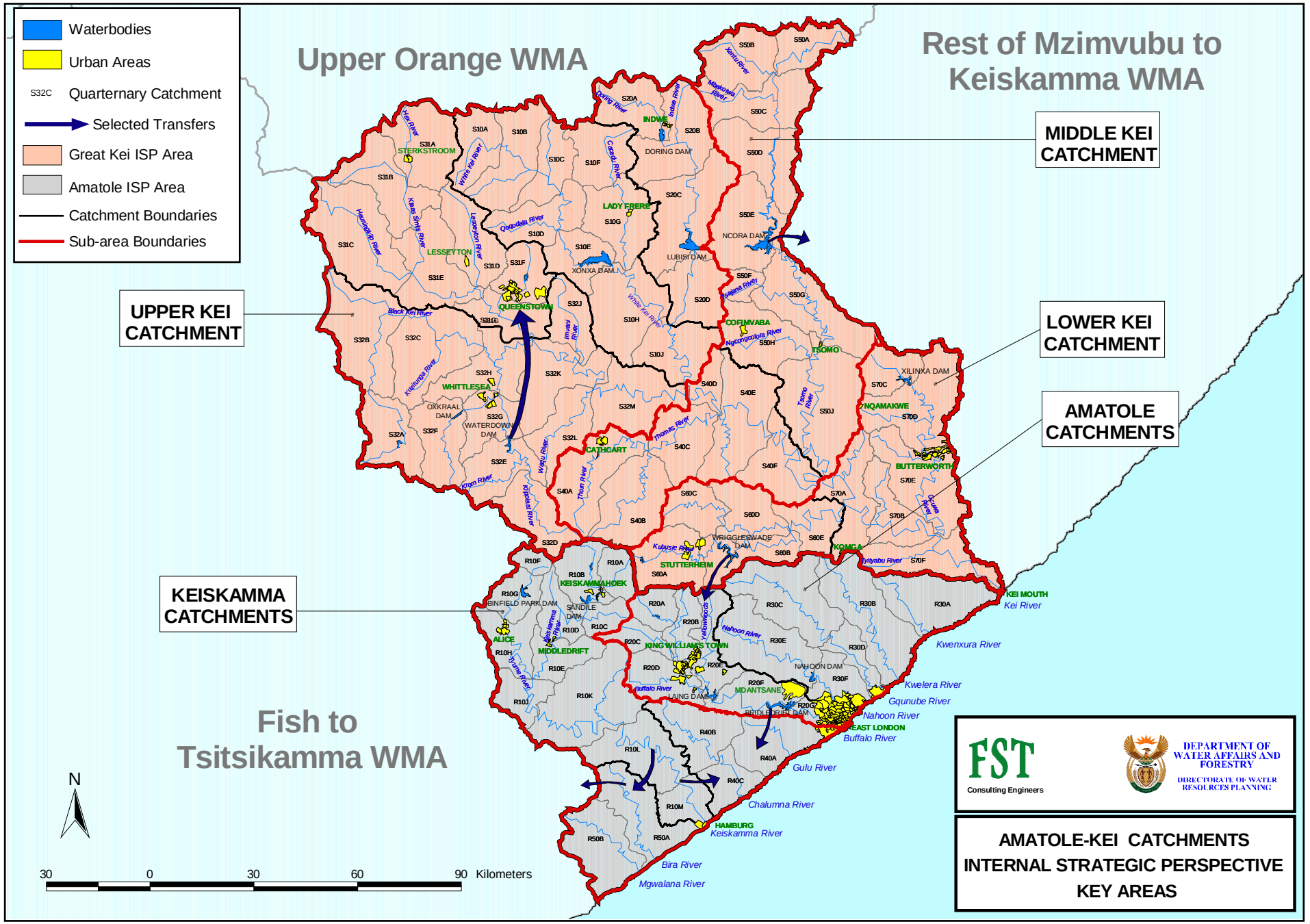
## ESTUARIES (Ref. 18 and 28)

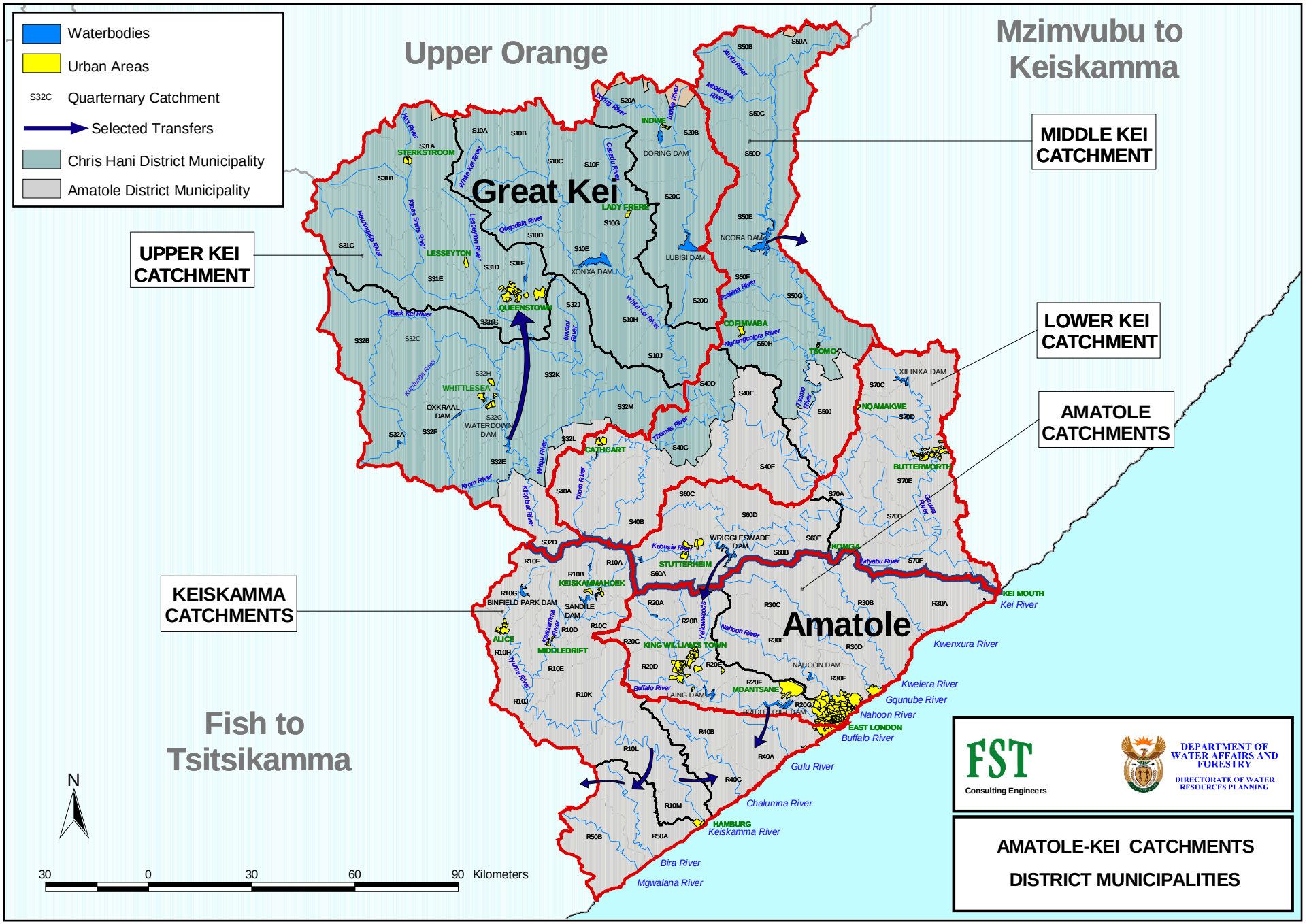
| ESTUARY NAME | CONDITION | CLASSIFICATION | INFORMATION | COMMENTS |
|---|---|---|---|---|
| Mpekweni | Good | Temp. open / closed | Poor | Hotel manipulates estuary |
| Mtati | Excellent | Temp. open / closed | Poor | New resort development at mouth |
| Mgwalana | Excellent | Temp. open / closed | Poor | Small resort near mouth |
| Bira | Excellent | Temp. open / closed | Poor | Northern bank artificially stabilized |
| Gqutywa | Excellent | Temp. open / closed | Poor | Declared conservation area |
| Ngculura | Good | Temp. open / closed | Poor | Catchment degradation |
| Mtana | Excellent | Temp. open / closed | Poor | Vehicle access on estuary bank |
| Keiskamma | Fair | Permanently open | Moderate | Increasing fresh water abstraction and human impacts in catchment |
| Ngqinisa | Excellent | Temp. open / closed | Poor | Undeveloped |
| Kiwane | Excellent | Temp. open / closed | Poor | Undeveloped |
| Tyolomnqa | Good | Temp. open / closed | Poor | State forest reserve on western bank |
| Shelbertsstroom | Fair | Temp. open / closed | Poor | Floodplain disturbed by construction of car park |
| Lilyvale | Good | Temp. open / closed | Poor | Resort development to east at Christmas Rock |
| Ross' Creek | Good | Temp. open / closed | Poor | Farmlands and resort development to east |
| Ncera | Excellent | Temp. open / closed | Poor | Weir at head of estuary |
| Mlele | Good | Temp. open / closed | Poor | Weir at head of estuary |
| Mcantsi | Good | Temp. open / closed | Poor | Kidd's Beach on south bank |
| Gxulu | Fair | Temp. open / closed | Poor | Resort on floodplain |
| Goda | Excellent | Temp. open / closed | Poor | Resort on northern bank |
| Hlozi | Good | Temp. open / closed | Poor | Farmlands in catchment |
| Hickmans | Fair | Temp. open / closed | Poor | Causeway and resort development in floodplain |
| Buffalo | Poor | Permanently open | Poor | Urban and rural pollution |
| Blind | Poor | Temp. open / closed | Poor | Serious urban pollution |
| Hlaze | Poor | Temp. open / closed | Poor | Serious urban pollution |
| Nahoon | Fair | Permanently open | Moderate | NB environmental asset and recreation |

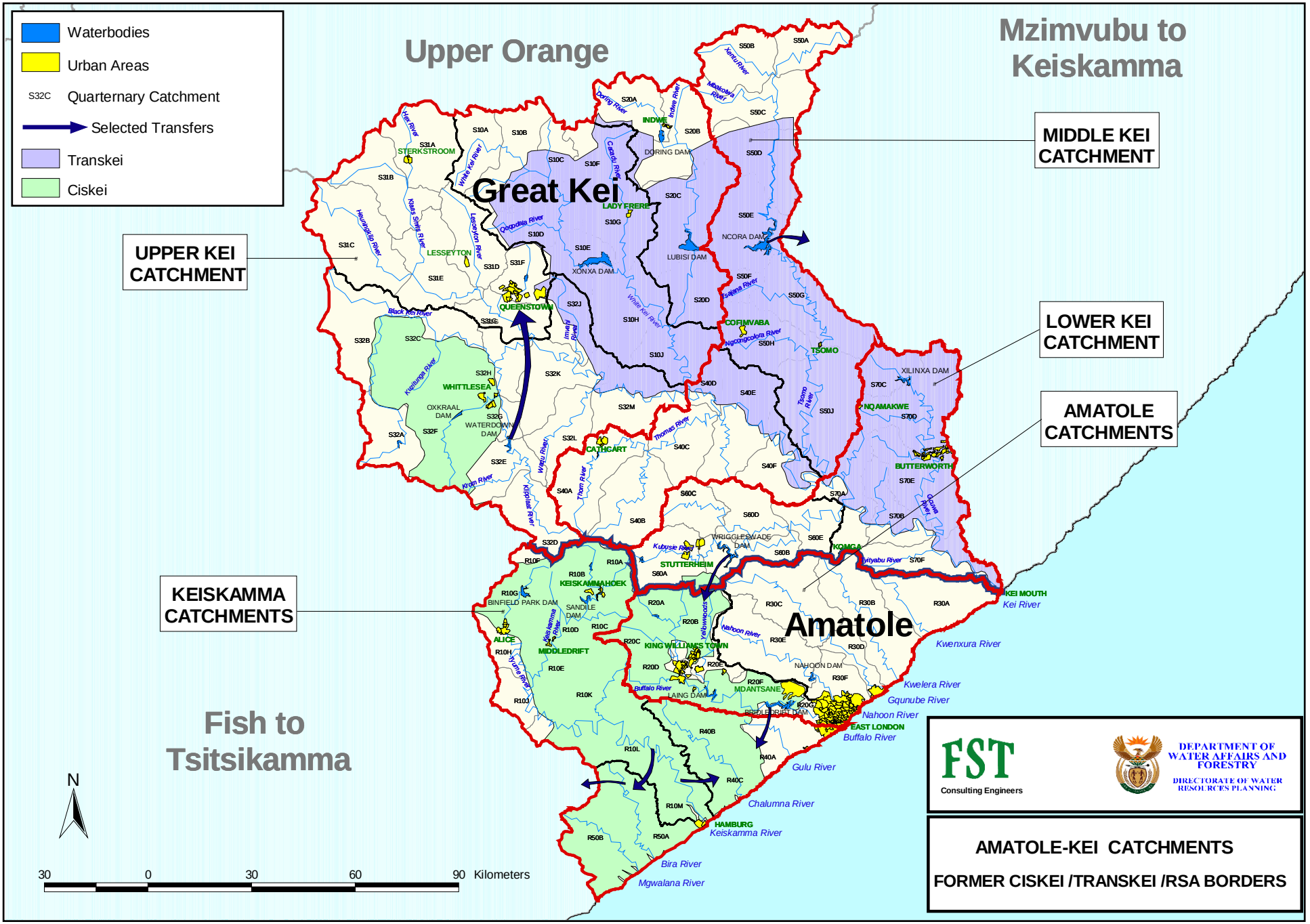
| ESTUARY NAME | CONDITION | CLASSIFICATION | INFORMATION | COMMENTS |
|---|---|---|---|---|
| Quinera | Good | Temp. open / closed | Poor | NB environmental asset and recreation |
| Gqunube | Good | Permanently open | Poor | NB environmental asset and recreation |
| Kwelera | Good | Permanently open | Poor | Resorts on north bank |
| Bulura | Good | Temp. open / closed | Poor | Resorts on north bank |
| Cunge | Good | Temp. open / closed | Poor | Low Oxygen levels in bottom waters |
| Cintsa | Good | Temp. open / closed | Poor | Extensive resort development |
| Cefane | Excellent | Temp. open / closed | Poor | Possible coastal reserve |
| Kwenxura | Excellent | Temp. open / closed | Poor | Possible coastal reserve |
| Nyara | Excellent | Temp. open / closed | Poor | Possible coastal reserve |
| Haga Haga | Excellent | Temp. open / closed | Poor | Increased freshwater extraction for resort |
| Mtendwe | Excellent | Temp. open / closed | Poor | Catchment and estuary in excellent condition |
| Quko | Excellent | Temp. open / closed | Poor | Conservation area |
| Morgan | Good | Temp. open / closed | Poor | Increased freshwater extraction for resort |
| Cwili | Good | Temp. open / closed | Poor | Old bridge in estuary |
| Great Kei | Fair | Permanently open | Moderate | Heavy siltation due to catchment degradation |

# APPENDIX C

# STUDY AREA MAPS


Waterbodies
Urban Areas
S32C Quarternary Catchment
Selected Transfers
Great Kei ISP Area
Amatole ISP Area
Catchment Boundaries
Sub-area Boundaries
Upper Orange WMA
Rest of Mzimvubu to Keiskamma WMA
Fish to Tsitsikamma WMA
MIDDLE KEI CATCHMENT
UPPER KEI CATCHMENT
LOWER KEI CATCHMENT
AMATOLE CATCHMENTS
KEISKAMMA CATCHMENTS
STERKSTROOM
LESSEYTON
QUEENSTOWN
WHITTLESEA
OXKRAAL DAM
WATERDOWN DAM
CATHCART
STUTTERHEIM
KEISKAMMAHOEK
BINFIELD PARK DAM
SANDILE DAM
ALICE
MIDDLEDRIFT
KING WILLIAMS TOWN
LAING DAM
HAMBURG
INDWE
DORING DAM
LADY FRERE
XONXA DAM
LUBISI DAM
NCORA DAM
COFIMVABA
TSOMO
XILINXA DAM
NQAMAKWE
BUTTERWORTH
KOMGA
WRIGGLESWADE DAM
MDANTSANE
NAHOON DAM
BRIDLEDRIFT DAM
EAST LONDON
KEI MOUTH
Kei River
Kwenxura River
Kwelera River
Gqunube River
Nahoon River
Buffalo River
Gulu River
Chalumna River
Keiskamma River
Bira River
Mgwalana River
N
30 0 30 60 90 Kilometers
FST Consulting Engineers
DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE OF WATER RESOURCES PLANNING
AMATOLE-KEI CATCHMENTS
INTERNAL STRATEGIC PERSPECTIVE
KEY AREAS
APPENDIX C1


Waterbodies
Urban Areas
S32C Quarternary Catchment
Selected Transfers
Chris Hani District Municipality
Amatole District Municipality
Upper Orange
Mzimvubu to Keiskamma
Great Kei
Amatole
Fish to Tsitsikamma
UPPER KEI CATCHMENT
MIDDLE KEI CATCHMENT
LOWER KEI CATCHMENT
AMATOLE CATCHMENTS
KEISKAMMA CATCHMENTS
INDWE
STERKSTROOM
LESSEYTON
LADY FRERE
QUEENSTOWN
WHITTLESEA
OXKRAAL DAM
WATERDOWN DAM
CATHCART
STUTTERHEIM
KEISKAMMAHOEK
BINFIELD PARK DAM
SANDILE DAM
ALICE
MIDDLEDRIFT
KING WILLIAMS TOWN
MDANTSANE
BRIDLEDRIFT DAM
EAST LONDON
HAMBURG
DORING DAM
XONXA DAM
LUBISI DAM
NCORA DAM
CORTMVABA
TSOMO
XILINXA DAM
NQAMAKWE
BUTTERWORTH
KOMGA
WRIGGLESWADE DAM
NAHOON DAM
LAING DAM
KEI MOUTH
Kei River
Kwenxura River
Kwelera River
Gqunube River
Nahoon River
Buffalo River
Gulu River
Chalumna River
Keiskamma River
Bira River
Mgwalana River
N
30 0 30 60 90 Kilometers
FST
Consulting Engineers
DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE OF WATER RESOURCES PLANNING
AMATOLE-KEI CATCHMENTS
DISTRICT MUNICIPALITIES
APPENDIX C2


Waterbodies
Urban Areas
S32C Quarternary Catchment
Selected Transfers
Transkei
Ciskei
Upper Orange
Mzimvubu to Keiskamma
Fish to Tsitsikamma
Great Kei
Amatole
UPPER KEI CATCHMENT
MIDDLE KEI CATCHMENT
LOWER KEI CATCHMENT
AMATOLE CATCHMENTS
KEISKAMMA CATCHMENTS
QUEENSTOWN
LESSEYTON
STERKSTROOM
WHITTLESEA
CATHCART
STUTTERHEIM
KEISKAMMAHOEK
ALICE
MIDDLEDRIFT
KING WILLIAMS TOWN
BUTTERWORTH
NQAMAKWE
TSOMO
COFIMVABA
LADY FREREE
INDWE
HAMBURG
EAST LONDON
KEI MOUTH
DORING DAM
XONXA DAM
LUBISI DAM
NCORA DAM
XILINXA DAM
OXKRAAL DAM
WATERDOWN DAM
BINFIELD PARK DAM
SANDILE DAM
WRIGGLESWADE DAM
NAHOON DAM
LAING DAM
RIPPLE DRIFT DAM
MDANTSANE
Kei River
Kwenxura River
Kwelera River
Gqunube River
Nahoon River
Buffalo River
Gulu River
Chalumna River
Keiskamma River
Bira River
Mgwalana River
N
30 0 30 60 90 Kilometers
FST Consulting Engineers
DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE OF WATER RESOURCES PLANNING
AMATOLE-KEI CATCHMENTS
FORMER CISKEI /TRANSKEI /RSA BORDERS

APPENDIX C3