

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 m³/a water from the Wriggleswade Dam on the Kubusi River (S60), a tributary of the Great Kei River, to the Buffalo and Nahoon Rivers.

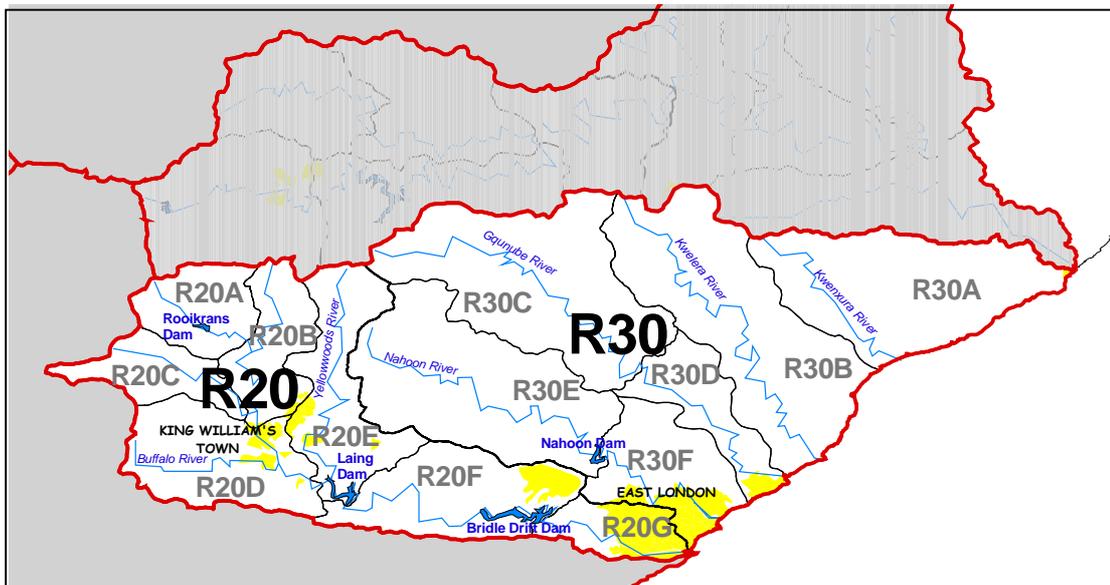


Figure 3.1 The Amatole Sub-area

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 (GDP) 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 Laing Bridle Drift	DWAF DWAF 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 unknown.

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 m³/a. This excludes the 10 million m³/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 m³/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 m³/a)
- Middle Buffalo System : Augment Laing treatment works and/or new works adjacent to the Yellowwoods River or at Kei Road (10 million m³/a)
- Lower Buffalo System : Augment the Umzoniana WTW at Bridle Drift Dam (20 million m³/a) and Nahoon WTW (6 million m³/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 m³/a in the year 2005 increasing to 79 million m³/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 m³/a in the year 2000 to 79 million m³/a by the year 2012, ie an increase of 20 million m³/a compared to the available surplus of 16 million m³/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.