Makana Municipality

Local Environmental Action Plan

Preliminary Environmental Audit: Key Issues

Submitted 15 May 2004

Revised 13 July 2004

BRIEF

The audit is to provide an overview of the environmental issues currently being faced in the Makana area. This audit highlights any current gaps in information around local environment issues. A more detailed audit will be completed by September after further technical studies have been carried out.

This audit and the more detailed audit will follow a similar reporting framework to the Eastern Cape State of the Environment (ECSOE) report. This will make it easier to cross reference between issues highlighted in the LEAP and the ECSOE, so as to be able to compare the similarities and differences in the challenges faced in Makana and the wider Eastern Cape. The environmental issues to be reported on will be broken into the following themes: air quality, biodiversity, built environment, environmental management, freshwater and land. Although the socio-economic theme is not considered as a distinct theme, the relationship between socio-economic concerns and environmental issues will be considered under each theme where relevant.

EXECUTIVE SUMMARY

The key environmental issues audit provides an overview of the current state of the environment in the Makana Municipal area, as well as highlighting the main areas of concern of the public and other key stakeholders.

It was found that Air Quality is not regarded as a key area of concern, though it is felt that point sources of external air pollution need further investigation and that the (potentially serious) health impacts of indoor air pollution also warrant further investigation. There is also a need for better understanding of people's current energy usage in Makana.

Makana faces a number of challenges with regard to handling waste management. Illegal dumping and littering are common problems in or near most built up areas of Makana. It has been found that the current waste collection system seems overstretched in some areas, with some confusion around the usage of communal waste skips. The current landfill sites in Makana still have many more years of capacity, though there are concerns about access control, the control of hazardous waste and the practice of burning waste at landfill sites. Recycling in Grahamstown is mainly carried out by Grahamstown Recycling and Eastern Cape Bottle Buyers, who concentrate on recycling paper and glass. Feasibility studies are recommended to access the viability of improved recycling for the district.

Industrial Environmental Management is of much less concern in Makana than in more industrialised areas, though certain areas do warrant greater attention. Abandoned mines/quarries require rehabilitation, while consistent licensing is required for industries such as tanneries and abattoirs. Makana requires an integrated approach to Environmental Education and training, which is required across a range of sectors. The Rhodes University Environmental Education Unit is ascertaining the current Environmental Education requirements in Makana. Initial investigations have

shown that Makana is falling short with regard to several Environmental legal requirements, which require addressing.

The terrestrial resources of Makana need assessing to establish land use trends, their environmental costs and potential opportunities. Issues such as storm water drainage, tree planting and recreational needs have been raised as key challenges towards creating a healthy built environment in Makana. Challenges are still faced with regards to sanitation access and water supply, such as ensuring Sewage Treatment Works maintain sufficient capacity to handle waste as sanitation services are expanded. Many stakeholders view maintaining Biodiversity as being a key environmental challenge Makana faces, with threats being posed by the illegal harvesting of natural resources, as well as by agricultural and urban development. Urban Design and Landscape Planning issues have been raised by stakeholders from the eco-tourism industry. These stakeholders require stricter control over the policy for urban design and landscape planning, thereby ensuring the sustainability of the ecotourism ventures.

The aquatic ecosystem downstream of Grahamstown residential and industrial areas and the sewage treatment works is indeed in a poor state. This stakeholder concern is confirmed by the preliminary audit. Water quality analysis revealed that at various sites on the Boesmans and Kariega River, the water is too salty to irrigate or for humans and livestock to drink. A positive finding was that there appeared to be no serious nutrient enrichment at most of the DWAF sites (Bloukrans River sites still to be analysed). Indigenous vegetation removal and alien vegetation encroachment are being assessed at the biomonitoring sites and will be included in the final report. Water quality improved with increasing distance from Grahamstown and the sewerage treatment works.

Meetings with the public and other key stakeholders have highlighted the many and varied environmental issues and perspectives on those issues that are faced in Makana, which the LEAP process will seek to prioritise and develop into an Environmental Action Plan. The information gathered so far was obtained through numerous site visits and interviews by LEAP Project Team Members, reviewing municipal records and relevant external data, public input via City Hall meeting (6

April 2004) and key stakeholder interviews. Details of the dates, times, names of stakeholders and issues discussed are available on request.

ACKNOWLEDGEMENTS

This key issues audit has been compiled from a number of separate reports from the LEAP consortium's sector specialists, which have then been put together by Mr N. Hamer under the different themes. A separate section has been included for the stakeholder consultation undertaken thus far by the LEAP. Dr AR Palmer is the project leader and assisted in the editing process. The assistance by many officials at Makana Municipality is greatly appreciated, as are the contributions made by everyone at the public meeting of 6 April and all the other submissions we have received from stakeholders interested in the LEAP process.

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AIR QUALITY

	Theme summary	
Key Issues	**Key Indicators**	**Key Statistics**
External Pollution	Point sources	None available in Makana Municipality
Internal Pollution	Fuel usage	25% households use paraffin/candles for light
	Respiratory infections	70% child respiratory infections due to poor internal air quality in SA

All South Africans have the right to clean air. This means that the air we breathe must be free from contaminants such as carcinogens, dust and smoke. In South Africa primary air pollutants are caused by indoor wood fires and industrial activity. Air quality is regulated through the Atmospheric Pollution Prevention Act. Industries which have been identified as causing air pollution are required to register with the Chief Air Pollution Control Officer. In Makana Municipality the major sources of air pollution are indoor fires. Other sources include brick factories, coal burning, dry cleaners and refuse burning. A major consideration for air quality is the investigation into the possibility of carbon trading. This could mean that projects to reduce emissions could become more economically viable. Potential projects could include:

- Composting
- Landfill gas capture
- Biogas from sewage treatment works
- Use of integrated algal ponding for sewage treatment
- Reduction of burning of refuse in smaller towns

Air quality in Makana Municipality is not frequently mentioned as an environmental concern. However, ambient outdoor air quality has been linked to a variety of respiratory problems including asthma, emphysema, infections, and pneumonia. Air quality is typically affected by a variety of conditions including the location of sources, (fixed or mobile), the topography and prevailing weather patterns, the pollutants that are discharged and the location and make up of the exposed populations. The Department of Environmental Affairs and Tourism is responsible for maintaining and assessing air quality and routinely monitors air quality from fixed locations. However, with respect to the Makana Municipality, the nearest monitoring station is to the east of Port Elizabeth. Due to the conditions, listed above, it is

difficult to ascertain from this one, distant monitoring station the levels of airborne pollutants that residents may be exposed to and the conditions under which they are prevalent. Casual observation does not indicate that Makana is at considerable risk given the lack of intensive industrial facilities in the region and relatively small number of automobiles in a concentrated area. However, specific point sources of emissions and their pollutant concentrations do need to be identified as part of an overall environmental management strategy.

The methodology for the assessment of ambient air quality will be to assess the point sources through research of records, interviews and similar comparisons based on industry type. These records will be reviewed in conjunction with the recently enacted National Environmental Management Air Quality Bill. Recommendations will be provided as necessary to track and monitor ambient air quality standards for the municipality. According to Dr. Crispian Olver, Director-General of the Department of Environmental Affairs and Tourism (DEAT), "for too long many South African's have had to breathe air that gave them diseases and ill-health" (DEAT 2003).

Indoor air quality is beginning to receive more attention due to its specific health impacts and association with poverty. Indoor air quality can be affected by a variety of methods including the use of coal, paraffin, wood, and animal dung for heating and cooking or other energy needs. Women and children who typically have longer and more direct exposures particularly feel the build-up of particulate matter, carbon dioxide and other toxic or harmful substances. Recent studies have shown that over 70 percent of infants with severe respiratory infection have history of exposure to smoke from cooking and heating fires (Kosove, 1982). In addition, paraffin poisoning is a specific concern identified by the Municipality. In South Africa, it is estimated that over 50 percent of the population use wood and paraffin for cooking and other energy needs (Statistics South Africa, 2003). Within the Makana Municipality, records indicate that approximately 25 percent of the population uses paraffin or candles for lighting (no statistics are available for cooking). Given the significant level of poverty within the Eastern Cape, it is possible that a significantly higher number of households utilize paraffin and/or wood at least on an occasional basis.

The RU Environmental Science Department will be surveying households to more accurately determine the level of fuel usage and to assess if accommodations are being made to control indoor air quality. While no specific studies of indoor air quality are envisaged as part of the LEAP process, additional information will be brought to light on this topic. The continued electrification of those portions of the municipality not currently served will improve conditions in the future. However, continued intermittent use of alternative sources of fuel, as an economic necessity can only be reduced through poverty alleviation.

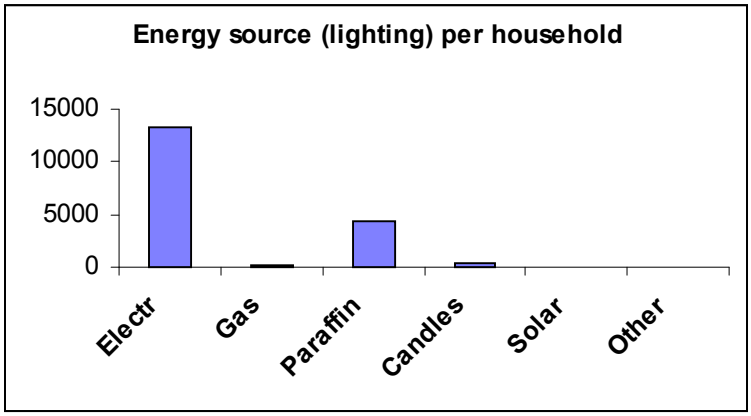


Figure 1: Lighting Energy Source for Makana Municipality (Statistics SA 2003)

BIODIVERSITY

	Theme summary	
Key Issues	**Key Indicators**	**Key Statistics**
Global importance of Succulent Thicket	Economic dependence	40% of global economy dependent on biodiversity
Local dependence	Livelihoods linked to biodiversity	Many residents collect indigenous plants for medicinal purposes in MM
Illegal harvesting	Loss in biodiversity	Over 136 endemic plant species are rare and threatened by exploitation
Agriculture (cultivation)	Loss in biodiversity	Cultivation of new lands continues to threaten unique succulent thicket plant communities.
Alien plant species	Loss in biodiversity	Alien invasive plant continue to increase
Industrial activity	Loss in biodiversity	There is limited new industrial activity

Development	Loss in biodiversity	There is limited new development

Introduction

The loss of biodiversity is of global concern. About 40% of the global economy is dependent on biological products and processes (Wolfson, 2003). Furthermore, most people in developing countries are dependent on biodiversity for their livelihoods. The issue of biodiversity was propelled to the international stage in 1992 at the Earth Summit in Rio de Janeiro where 152 nations ratified the Convention on Biological Diversity. A local environment action plan (LEAP) is an important tool for addressing the challenges of declining biodiversity to ensure sustainable development.

Although the term biodiversity means different things to people, the definition used here is that proposed by the Convention on Biodiversity (1992). Biodiversity is thus "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems". This definition is inadequate because it excludes important processes such as nutrient cycling, energy flow and water cycling (Noss, 1990). Noss (1990) has argued that the concept of biodiversity should include three attributes of elements in a collection at different levels of biological organisation. The three attributes are: (1) composition, (2) structure, and (3) function. He also identified four levels of biological organisation that are important to the concept of biodiversity. These are: (1) gene, (2) population, (3) ecosystem, and (4) landscape.

Biodiversity in Makana

Attributes of biodiversity and levels of biological organisation

Noss (1990) gives an excellent overview of the attributes of biodiversity. Briefly, composition deals with the identity and variety of elements in a collection and includes lists of species, and measures of species diversity and genetic diversity. Structure refers to the physical organisation or pattern of a system. Examples of structure are: (1) the diversity of habitats within communities, and (2) the pattern of

patches within a landscape. Function refers to ecological and evolutionary processes such as gene flow, nutrient cycling, primary production and disturbances.

Characterisation of biodiversity at different levels of organisation (e.g. gene, population, ecosystem, and landscape) is useful for management because it offers a conceptual framework for identifying specific and measurable indicators to monitor change and thus assess the overall status of biodiversity (Noss, 1990). Higher levels of organisation contain and influence the functioning of lower levels (Forman and Godron, 1986; Noss, 1990). No single level of organisation is fundamental and biodiversity should therefore be monitored at different levels of biological organisation (Noss, 1990). Furthermore, effects of disturbance will be expressed in different ways at different levels of biological organisation leading to unpredictable outcomes of disturbance. In assessing biodiversity, the attributes of the elements in a collection and the levels of biological organisation should always be considered.

Threats to biodiversity

Makana falls within the Albany Centre of endemism. The Albany Centre has 14 endemic genera of vascular plants and approximately 4000 species of vascular plants of which more than 600 are endemic (van Wyk and Smith, 2001). Victor and Dold (2003) identified the major threats to taxa in the Albany Centre (Figure 2). They found that harvesting (illegal commercial collection and medicinal plants) was the most important threat. Other major threats included agriculture, alien plants, industrial activities and development, and urban residential development.

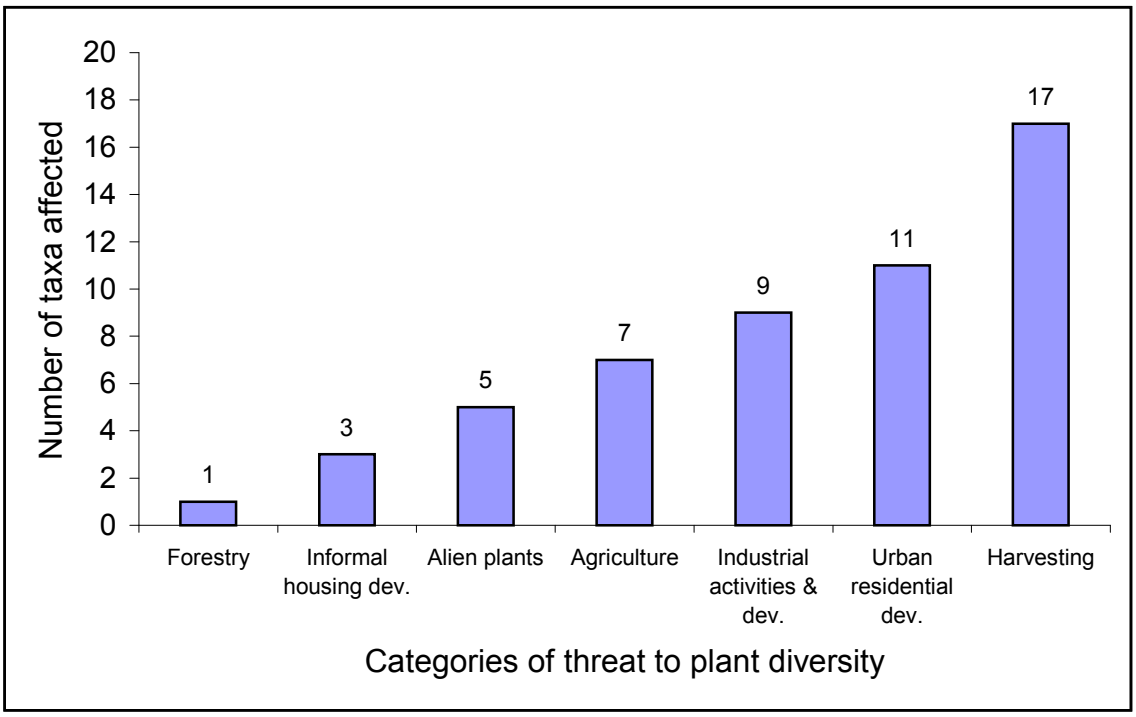


Figure 2. Categories of threat affecting taxa in the Albany Centre of endemism. (Adapted from Victor and Dold, 2003).

The stakeholders from the Makana Municipality identified several key issues concerning biodiversity during a public meeting on 6 April 2004. Written comments were also submitted at later dates. The issues of concern were:

- introduction and control of alien vegetation (nine comments);
- general protection of biodiversity (nine comments);
- land degradation through improper management and deforestation (eight comments);
- unregulated changes in land use practices and improper practices such as overgrazing and mining (four comments);
- introduction of alien fauna (three comments);
- improper collection of medicinal plants (three comments), and
- protection of rare and endangered wildlife species (one comment).

It should be noted, however, that some participants during the stakeholder meeting did not write down their comments. They stated that their comments had already been

written down on the flip charts. Thus, the number of comments on each of the concerns above should not be taken as indicative of the relative importance of each of the issues. The LEAP Stakeholder Group and further communication with key stakeholders will assist to prioritise and identify the issues.

Indicators of biodiversity

The Makana Municipality lies within the Albany Centre of endemism where at least five of White's (1983) phytochoria converge (Cape Region, Karoo-Namib Region, Maputaland-Pondoland Regional Mosaic, Afro-Montane Region and Kalahari Highveld Regional Transitional Zone) (Victor and Dold, 2003). There are increasing threats to biodiversity in this region of global importance. The choice of good indicators to monitor biodiversity is therefore crucial. Noss (1990) defined the characteristics of a good indicator. It should be:

1. sufficiently sensitive to provide an early warning of change;
2. distributed over a broad geographical area, or otherwise widely applicable;
3. capable of providing a continuous assessment over a wide range of stress;
4. relatively independent of sample size;
5. easy and cost-effective to measure, collect, assay, or calculate;
6. able to differentiate between natural cycles or trends and those induced by anthropogenic stress, and
7. relevant to ecologically significant phenomena.

The comprehensive audit will look at issues concerning the biodiversity of both fauna and flora. Detailed surveys will be carried out on: (1) use of energy (biomass and solar), (2) present state of endangered species within the Makana Municipality, (3) threats to species and ecosystems, e.g. alien species (lists of endangered species and maps showing areas with high concentrations of endemic species will be produced), (4) game farming and wildlife management, (5) hazardous waste, (6) water pollution, and (7) urban greenscape/green infrastructure. Gaps on key environmental issues will be identified.

THE BUILT ENVIRONMENT

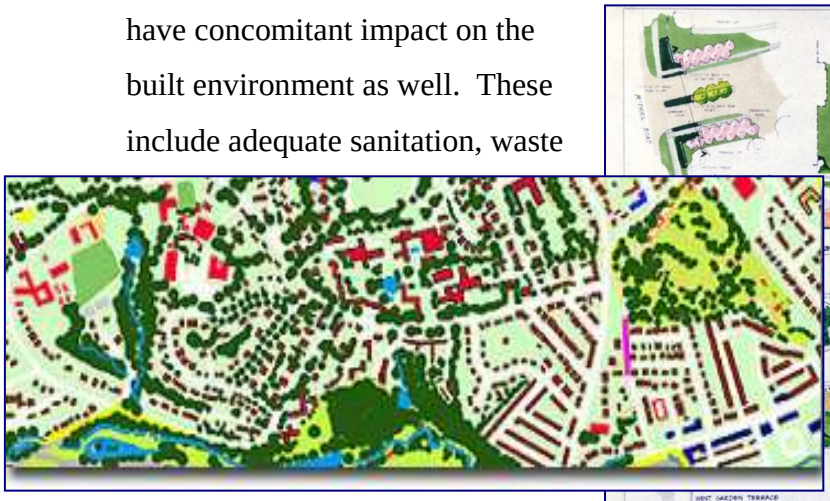
	Theme summary	
Key Issues	**Key Indicators**	**Key Statistics**
Illegal dumping of waste	Dumping on commonage	Abundant visual evidence
	Littering by area	Abundant visual evidence
	Garden skips	Some visual evidence of poor compliance
Landfill management	Lifespan	Data available for registered landfills
	Waste burning	Visual reports from Riebeek East and Alicedale
	Recycling	Two companies currently active
	Health of residents on landfill site	Survey household on site
	Access control	Poor at all sites
Recycling	Materials collected	Glass, paper and kraal manure
	Materials not collected	Tins, plastic and compost
Hazardous waste	Capacity to handle	Lack of capacity
Sanitation	RDP standard	55% below RDP standard in 2001 census
		Lack of treatment capacity in Alicedale
	Livestock in urban areas	Results of completed ECARP survey available to LEAP team
Water	RDP standard	10% below RDP standard in 2001 census
		22% households had in-house water in 2001 census
Energy needs	Household usage of energy	To be compiled

Introduction

The built-environment refers to all those areas which are occupied by urban areas, and includes the towns of Grahamstown, Alicedale and Riebeek East. In these areas, specific environmental issues arise which are linked directly to high density of human presence. Humans living in close proximity to one another have needs and impacts. These include the generation and concentration of waste, disturbance of the soil surface, increased storm water run-off due to reduced vegetation cover and paved surfaces, water provision and associated impacts, dwelling and road construction, and the creation of industries which produce associated waste. In urban environments there are also environmental impacts which impinge on people such as increased noise and disturbances from people, vehicles and animals; air pollution from open fires and burning refuse dumps, as well as noxious smells from animals and industry. In an effort to take note of all these impacts, the LEAP Team has surveyed the urban

environments in Makana to identify those issues which are of greatest concern to the residents of the municipality.

The built-environment encompasses a variety of landscapes and locations throughout the Makana Municipality. The largest urban area is Grahamstown with the largest percentage of the population. The Integrated Development Plan (IDP) and initial LEAP Stakeholder Group meetings have identified a variety of issues related to the built environment that will be addressed through the LEAP. These issues involve, stormwater management and drainage systems, urban landscaping and tree planting concerns, recreational needs (both passive and active), pedestrian friendly routes, dedicated bicycle lanes, cultural areas dedicated for local institutions, green belts, and vegetative buffers. In addition, numerous health related issues were identified that have concomitant impact on the built environment as well. These include adequate sanitation, waste disposal, water supply, electric supply, energy needs and transportation.



The built environment is closely related to the Integrated Development Plan and the local Land Use Plan. The development review process identifies those features of a development that are sustainable and consistent with the goals of the community. The public participation process is one area where

proposed development is tested against the community values and for consistency with the adopted policies of the municipality. As part of the LEAP, the Sustainable Development Framework will assess the consistency of the development review process to the identified standards imposed as part of the IDP process and the Local Agenda 21 Framework.

The benefits of Urban Greening

The improvement to the urban built environment provides for benefits to the community and the environment. For instance, the appropriate use of urban forestry and landscaping can reduce wind erosion, provide summer cooling through shade and permit passive solar radiation in the winter to help off set household and commercial energy needs. Urban forestry programs benefit the streetscape, add aesthetics to the community and also shade impervious surfaces during the summer. This lowers the surface temperature of pavement and reduces the thermal pollution of surface runoff water improving the local water quality. The multi-faceted benefits from a single intervention provide for a greater efficiency and overall improvement.

Waste management

Waste management is a broad term for a group of activities which involve dealing with waste produced by the general public and industries. Broadly waste management can be broken down into a number of elements namely:

- collection and transportation
- prevention
- minimisation
- treatment
- disposal

The National Waste Management Strategy has outlined the government's commitment to tackling issues surrounding waste management. Waste management is an issue that is currently being tackled all over the world, this is because poor waste management can lead to environmental pollution, health hazards, flooding and can lead to loss of resources which otherwise could be used to generate wealth.
Good waste management on the other hand can uplift communities by ensuring that people live in a healthy and clean environment. Good waste management can also

lead to job creation and business opportunities through recycling and resource recovery.

General waste management issues in Makana Municipality

Illegal Dumping, Disposal Issues and Littering

Figure 3: Illegal dumping observed in and around Makana Municipality

Littering and illegal dumping are common throughout urban areas in Makana Municipality. Site specific key issues within the area of littering and illegal dumping are described in detail below.

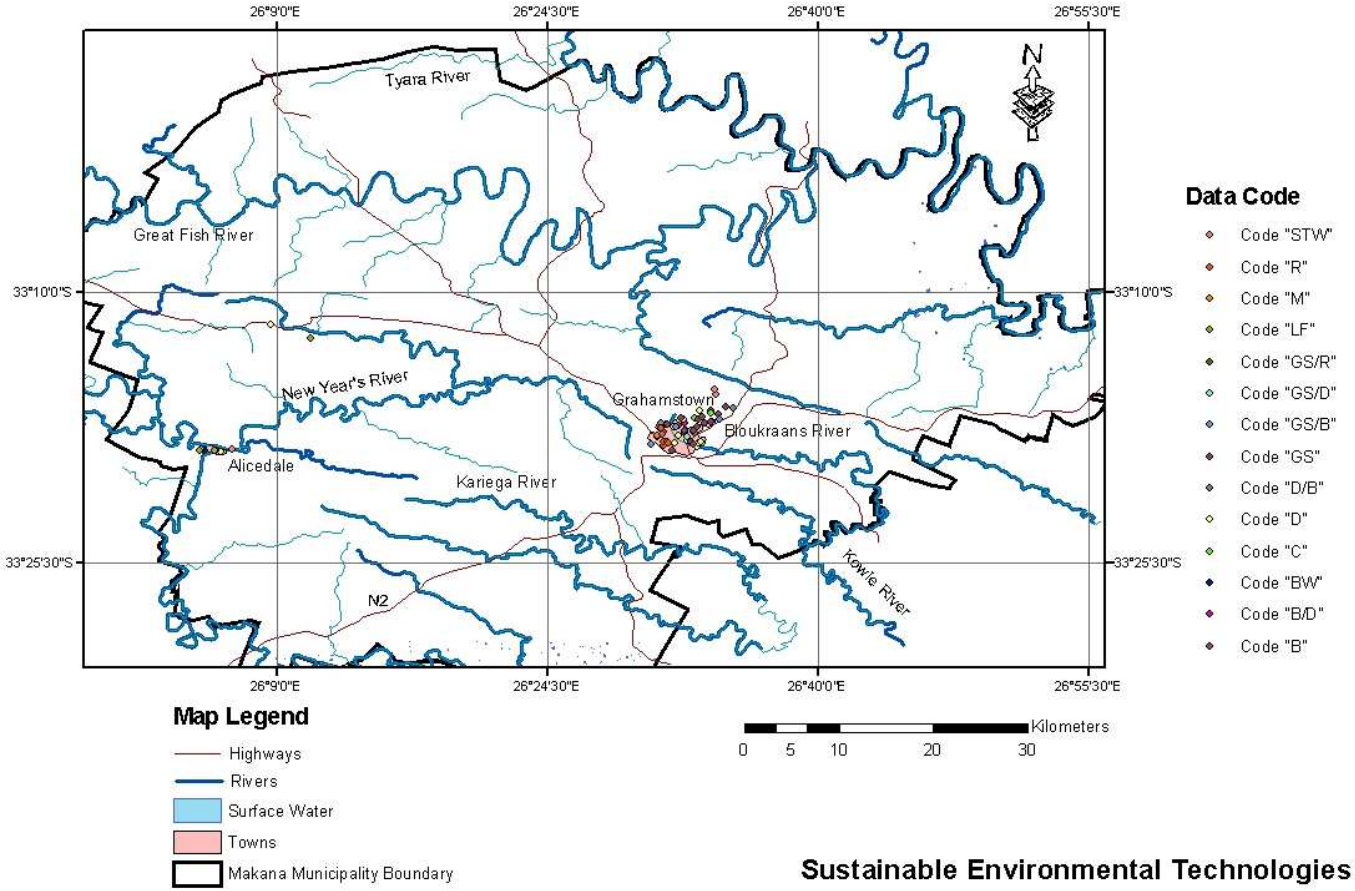
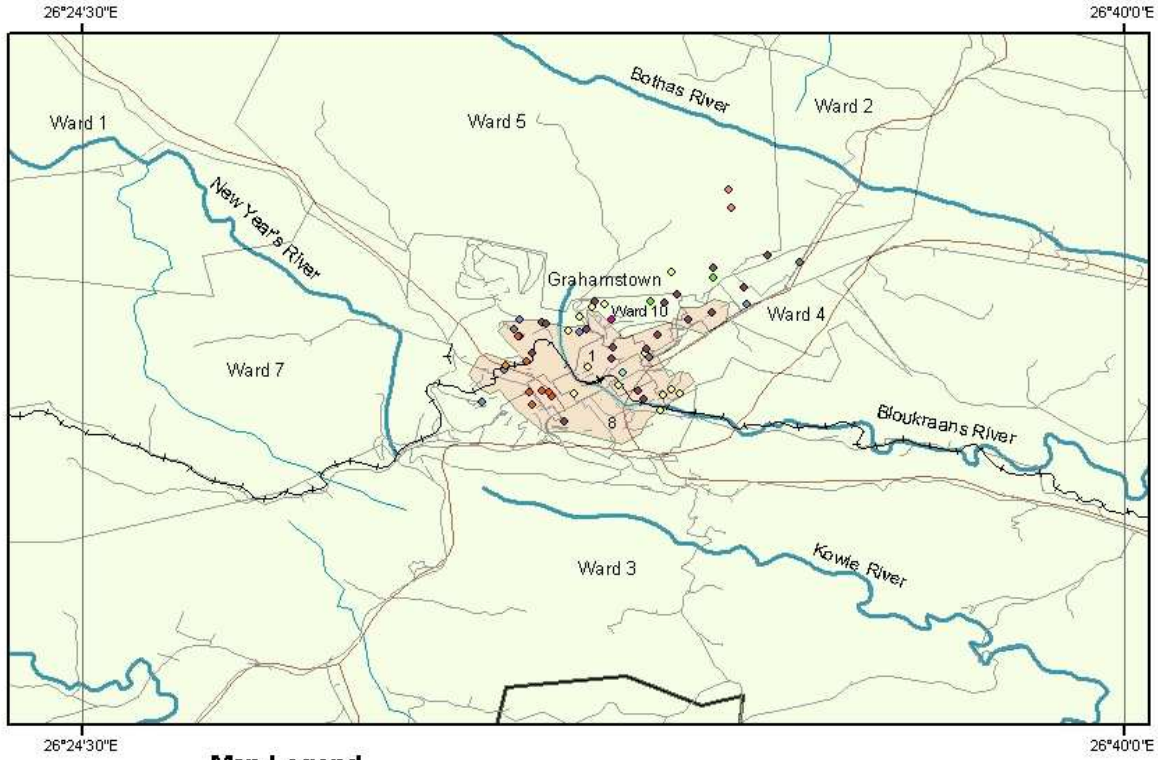


Figure 4. Location of waste (legal and illegal) sites in Makana D=Dumping, GS=Garden waste skip, B=Building rubble, C=Clean area, R=Recycling bin, M=Medical waste, LF=Landfill, STW=Sewage treatment works, BW=Bulk water treatment works.

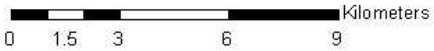


Data Code

- Code "STW"
- Code "R"
- Code "M"
- Code "LF"
- Code "GS/R"
- Code "GS/D"
- Code "GS/B"
- Code "GS"
- Code "D/B"
- Code "D"
- Code "C"
- Code "BW"
- Code "B/D"
- Code "B"

Map Legend

- Railways
- Local Roads
- Highways
- Rivers
- Surface Water
- Towns
- wards&profiles
- Makana Municipality Boundary



Sustainable Environmental Technologies

Figure 5. Location of waste (legal and illegal) sites in Grahamstown D=Dumping, GS=Garden waste skip, B=Building rubble, C=Clean area, R=Recycling bin, M=Medical waste, LF=Landfill, STW=Sewage treatment works, BW=Bulk water treatment works.

The Bloukrans River and its tributaries and storm drains in Grahamstown are choked with rubbish, which poses a high risk to the river health and biodiversity. This can also cause infrastructural problems such as clogging of drains and subsequent flooding, as well as impacting on the efficiency of sewage treatment works. The health of water users may then be affected by poorer water quality as a result. Downstream water users may be impacted upon such as due to the fact that water quality not suitable for their needs such as crop farming and other problems may include clogging of pipes with litter or algal growth.

Figure 6. Litter in drains and in the Bloukrans river

Illegal dumping and littering has been identified as an issue throughout Makana Municipality urban areas (Grahamstown, Alicedale, Riebeek East). The occurrence of illegal dumping is especially prominent in the Grahamstown areas of Sun City, Hoogenoeg, Scott's Farm and eDakeni as well as in the Kowie Ditch and eDakeni tributary. All of these areas are characterised by high poverty levels as well as being

characterised by minimal refuse collection. Many garden skips in these areas were being used for general waste. In addition, in Grahamstown many garden skips are in a poor state, rusted and with large wholes, adding to litter problems. In Oatlands North the position of one municipal skips is very close to a stream aggravating the problem of litter in streams and threatening river health.

Illegal dumping was observed on most Commonage areas. This decreases the value of the land for grazing and recreational uses as well as the surrounding properties as it has a negative visual impact on the area.

Figure 7. Litter and illegal dumping spoils the commonage for all.

Many skips were full or overflowing which suggests that the municipality may not have capacity for regular collection. A number of skips were not at designated sites resulting in illegal dumping at the sites.

Figure 8. Skips not properly managed and dumping sites without skips are unsightly and lead to wind blown litter. This also creates a situation in which illegal dumping becomes the typical backdrop

Access to waste collection services

Three levels of refuse collection are recorded, namely 'kerbside,' 'communal' and 'none'. There is some degree of overlap in municipal data, particularly between communal refuse collection and households classified as having no collection services. This is confusing and there is uncertainty as to what the municipality calls 'communal' versus 'none'.

According to municipal records provided, not all households within the three towns in Makana Municipality are provided with refuse collection services. In Alicedale, 17 households out of a total of 868 were shown to be un-serviced. In Riebeek East, 30 out of 414 households remain un-serviced and in Grahamstown, 6.4% of households are currently recorded as having no refuse collection. This equates to a total of 920 households with a further 1969 households on the communal refuse collection system.

Although approximately 10% of all households in Grahamstown, Riebeek East and Alicedale have access to 'community' refuse collection points, most skips seen were signposted as Garden Refuse skips. Separate skips for domestic refuse only were not apparent.

Figure 9. Skips are for garden refuse only but no alternative skips were apparent in most areas. This leads to the use of garden skips for all refuse.

Public dustbins are only located in the CBD areas as well as within Rhodes University campus. This leads to widespread littering, especially at busy areas such as taxi ranks, pick up/drop off points and along main thoroughfares and roads. Street sweepers currently operate only within CBD areas within Makana Municipality. All these factors contribute towards illegal dumping and wind blown litter and the associated environmental and health impacts.

Landfills and Dump Sites

Landfill sites and dump sites are places which municipalities use for disposing of waste. The planning and management of these sites is crucial for ensuring that land, water resources, air and aesthetics are impacted upon as little as possible. The Environmental Conservation Act stipulates that any site used for dumping or disposal of waste needs to be licensed. The government has published guidelines through the Department of Water Affairs and Forestry on the minimum requirements for licensing, commissioning and operation of such sites. These guidelines stipulate how to go about site selection, site construction as well as the operational requirements of landfill sites. As part of this report the guidelines will be used as the reference point for sound management of the three sites in Makana Municipality.

Grahamstown Landfill Site

Grahamstown Municipal Landfill site is classified as G: M: B+ meaning that it is permitted to handle General waste; is of Medium size and has significant leachate (runoff) production. Landfill operation must comply with minimum requirements as stipulated by DWAF. The landfill site is situated in an old kaolin quarry northwest of Grahamstown and has approximate lifespan of another 50 years at current disposal rates. For the year 2002 to 2003, 25 180 m^3 of domestic refuse, 38 580m^3 of garden refuse and 6190 m^3 of building rubble was dumped. Adequate cover material is available. The site has a leachate containment pond which is used to spray the landfill site to suppress dust. There are a number of issues surrounding the operation of the landfill site which are of key concern:

- There is no access control to the site which means that there is no control of what is dumped at the site. This results in the uncontrolled dumping of putrescibles (decayable matter other than garden refuse) and other hazardous waste without the knowledge or control of the site operator. This may also lead to an underestimation of current dumping rates and landfill lifespan. At the time of inspection there was no sign of leachate spraying for dust suppression as stipulated in the permit conditions and municipal records. It was difficult to determine at this stage whether cells are being constructed according to the guidelines. There is also a family living on the dump site which is a cause for concern due to health conditions of this environment. Poor or insufficient fencing results in significant amounts of windblown refuse littering surrounding sites. As yet this issue has not been raised by local landowners or businesses. No formal on-site salvagers operate although informal ‘picking’ does occur and is discouraged by site operators and Makana Municipality.
- There is no evidence of the methane gas recovery project which was started by Dr. la Trobe in 1990. This project consisted of a system of pipes to collect from the dump feeding a modified motor vehicle engine. This engine was attached to a generator for electricity. The revival of this project could be linked to carbon credit system of the Kyoto protocol. Further details of this will be expanded upon later, should a project of this nature be considered. Note that stricter management of landfill site cell construction and closure will have to take place for a gas recovery scheme to be successful.

Alicedale

Alicedale has a site G: S: B- (General: Small: insignificant leachate production) at the Western end of the town. The site is located in an old quarry. The site has a life span of 15 to 20 years at current disposal rates. This may decrease due to development plans. Burning of waste occurs once a week and no leachate problems were apparent. The burning of waste should be discouraged because this puts carbon dioxide as well as other greenhouse gases into the atmosphere. Alternatives to burning should be investigated as this is particularly important with respect to the Kyoto protocol and CO_2 emission reduction.

Figure 10. Alicedale disposes of its waste in a landfill situated in an old quarry near the station. Rubbish is burnt once a week and often continues to smoulder for long periods.

Issues of concern are again lack of access control; no cover material is available to bury nonflammables and though the burning of waste is a permit concession for this landfill, refuse continues to smoulder which causes air pollution in the form of carcinogens and could present a fire hazard. Current landfill operation will have to be reviewed in light recent development in the Alicedale and surrounds and the potential increase in quantities of refuse. No salvaging occurs at present although there are plans for recycling.

Riebeek East

The site is permitted as a G: C: B- (General: Community sized: insignificant leachate production) It is located outside town on the Eastern side and is surrounded by grazing land. Waste collection is done in a LDV (bakkie). No leachate is produced. Key issues identified for this site are: there is no access control and fences need improving to keep

out the animals from the surrounding area. Again, burning of waste is a permit concession for this landfill, but smouldering refuse could present a fire hazard to surrounding farmlands and burning refuse causes air pollution in the form of carcinogens. No salvaging occurs and there is a relatively large quantity of scrap metal in site which could be recovered and sold.

Waste Management and Recycling

Waste management and recycling go hand in hand. The more waste that can be recycled, the less waste has to be handled and disposed of in the landfill sites. Recycling is a growing business which has the potential to create jobs. As technology for recycling of materials improves, more and more waste types could be recycled and ultimately landfill sites will only be used for unrecyclable wastes. This will mean that waste management will cost the government very little and business opportunities will be maximised.

Recycling in Makana Municipality

Two recycling businesses operate in Grahamstown only, namely: Grahamstown Recycling (Sean Haydock) and Eastern Cape Bottle Buyers (ECBB). There are also a number of scrap dealers in Grahamstown. Grahamstown Recycling recycles paper and cardboard. ECBB recycle all glass except sheet glass and automotive glass. Recycling of these items occurs via recycling bins and collection by the recycling companies themselves.

Figure 11. There are numerous paper and bottle recycling bins around Grahamstown CBD and Grahamstown West suburbs.

There is currently no recycling of tins, cans and plastics though there are markets for these items. There are many reasons why recycling is not bigger business in Makana Municipality. According to public opinion, there is not enough incentive for household participation in recycling or for informal collectors of recyclable goods. For goods such as paper and tins, cans etc. prices for recycled goods are not adequate for informal recyclers to make an adequate living. Although interest has been expressed by established recycling agencies in Grahamstown for larger scale recycling, as yet no feasibility studies have been undertaken to assess the viability of recycling of general waste. There are no facilities for recycling at Landfill Sites in Makana Municipality and there are too few recycling bins which are often used for general waste. There is currently no formal sector recycling in Grahamstown East.

The recyclable or recoverable waste observed in Makana Municipality is listed below. Not all of these are currently being recycled.

- Plastic

    - Bottles
    - Bags
    - General PVC packaging products
- Glass bottles
- Paper
- Metal scrap
- Green waste
- Kitchen waste
- Electronics parts
- Tyres
- Oils and greases
- Car Batteries

Some of the wastes that are not recyclable are:

- Polystyrene packaging
- Food packaging
- Wet paper
- Window pane glass
- Windshields
- Building rubble
- Some hazardous substances (e.g. cell phone and long life batteries)

Information Gaps in terms of recycling

To thoroughly identify and quantify the benefits that recycling can offer the following information must be obtained:

- The amount of material being recycled compared to the amounts of waste being produced.
- The markets for current recycled waste and the markets for other materials that are not being recycled at present.
- The transport costs for getting recycled goods to the nearest buyers.
- The estimated costs of collection of potential recyclable materials
- Assistance, funding or alternative arrangements that can make recycling easier or more economically viable.

An extensive feasibility study, similar to that which as been in other municipalities, should be undertaken to gather the information required to increase recycling in Makana Municipality.

Hazardous waste

Hazardous waste consists of chemicals or substances that have been identified as being harmful to people or the environment. An example of this is sewage sludge. Some hazardous substances are used in our households as part of electronic equipment (cell phone batteries, long-life batteries, re-chargeable batteries in electric razors, refrigerants) and should be disposed of in a responsible manner. Other hazardous substances are used in laboratories and factories for various purposes. Hazardous substances become hazardous wastes when they are discarded.

In South Africa there are very few hazardous waste sites. The government has developed guidelines on how to deal with various types of hazardous waste. Hazardous waste can be dealt with by treating it to make it less harmful or by disposing of it under controlled conditions.

Hazardous Waste in Makana Municipality

Hazardous waste is not of major concern in Makana Municipality due the lack of heavy industry, however, various types of hazardous waste are produced by industries and other institutions and the disposal methods of these substances need to be investigated and remedied where necessary.

The types of hazardous waste identified so far are the following:

- Putrescible waste for example carcasses from abattoirs end up at the municipal landfill sites which can lead to spread of disease and odours.
- Fuels, oils and greases from workshops and petrol station can end up in rivers, soils and ground water due to improper disposal, leaking tanks and lack of control measures for example bund walls, grease traps and oil drains.
- Medical waste must be incinerated due to its highly infectious nature. All clinics are required to transport their own waste to Settlers hospital for incineration.

Incorrect disposal poses a high risk to all people or animals that come into contact with the waste.

- Electronic waste may contain heavy metals and hazardous organic compounds. Small quantities will end up in the municipal landfill from domestic refuse; there is no other alternative at this stage.
- Transformer fluid is highly toxic and should be handled carefully. None of this should be disposed of anywhere in the municipality. All should be taken back to the supplier.
- Toxic waste water from abattoirs, tanneries and wash water from workshops and garages should go to the municipal sewage works. If it does not go into the sewage treatment works, it can enter rivers and streams from storm water, leaking pipes and run-off.
- Sewage sludge is classified as infectious waste because of bacterial content and high nutrient content. This can enter streams and rivers and cause eutrophication, the process by which a body of water becomes rich in dissolved nutrients, thereby encouraging the growth and decomposition of oxygen-depleting plant life and resulting in harm to other organisms. Sewage sludge also poses a hazard to people working at sewage plants and animals grazing within the area.
- Laboratory chemicals of varying toxicity can enter the ecosystem and cause damage if proper procedures for disposal are not followed.
- Fertilizer production and warehousing can cause eutrophication in the immediate surroundings and areas receiving runoff or wastewater. Further investigations will be done to establish a better understanding of the environmental impacts of the fertiliser industry in Makana.
- Expired pharmaceuticals should be returned to pharmacies to avoid misuse and avoid toxic chemicals such as antibiotics entering the ecosystem. Antibiotics can kill the useful bacteria in the environment and sewage treatment systems.

Some of these wastes were observed at the Grahamstown landfill site. Others have been identified by deduction from municipal records, interviews and from sewage treatment works visits. Many of these wastes occur in most municipalities country wide and as such are common issues in terms of hazardous waste. Though the DWAF guidelines do make provision for domestic hazardous waste, there is still a problem with safe disposal of

hazardous waste in Makana Municipality. In South Africa there are very few hazardous waste sites, in the Eastern Cape there is only one legal site which is in Port Elizabeth. This site is run by WasteTech which collect from limited sites in Makana Municipality.

Vegetable waste and compost

In Makana Municipality as in all other areas, large quantities of vegetable waste are produced every year. Vegetable wastes are any kind of waste which consists of plant material. The primary source of this waste is from gardens and farming. A good example is grass cuttings. Though this waste is disposed of in landfill sites it can used as a good source of material for compost making.

In Grahamstown the municipality has provided numerous garden skips all over town. It appears that many people use these for their garden waste. In many instances, however, the skips are being used for other waste that should be kept separate so that the garden waste can be used for composting.

Figure 12. Many garden skips in Makana Municipality are filled with mostly garden refuse, but virtually all are also being used for domestic refuse.

Composting in Makana Municipality

There is no formal compost making business in Makana Municipality, although some farmers sell kraal manure. The municipality has recorded that approximately 38 580m^3 (cubic metres) of vegetable waste is disposed of in the Grahamstown landfill site annually. This presents an opportunity for either composting business or a vermiculture business using the local giant earthworm species found in Makana District. (Vermiculture is the use of specially bred worms to convert organic matter into compost). Not only would this decrease quantities of waste to landfill but this would also be a good example

of utilising local biodiversity to solve what is currently a waste problem. If composting is to become a viable business opportunity in Grahamstown, separate skips need to be provided for communal refuse collection so as to keep refuse out of garden skips as well as an increased degree of awareness around the value of separating garden and domestic refuse.

Sanitation

Sanitation is the broad term for activity which involves removing, treating and containment of sewage. This includes pit latrines, night soils (bucket system) and flush toilets. Sanitation also includes treatment of sewage to make it less hazardous to humans and the environment.

General sanitation issues in Makana Municipality

Primary concerns raised at the public meeting were

- Eradication of the bucket system
- Access to public toilets
- Maintenance and paving of sewers and storm water drains
- Livestock kraals within residential areas

Access to sanitation

All South Africans have been granted the right to have adequate sanitation. This is defined as having a minimum of access to a ventilated pit latrine (VIP), according to RDP standards. Sanitation in South Africa can be divided into the following categories; flushing toilets to septic tanks, flushing toilets to sewers, ventilated pit latrines, pit latrines, chemical toilet, bucket latrines and no access. In Makana Municipality not all households have the RDP sanitation standard according to Census 2001 (Table 1). The census showed how many households have access to sanitation and at what level. In Makana Municipality 3% of households have no sanitation at all and approximately 25% use bucket latrines. In total 45% of households do not have sanitation at required levels. However, according to census 2001 this figure could be as high as 55% in Makana Municipality.

Table 1: Number of households in Makana (rural and non-rural) on the various types of sanitation systems showing the percentage of households below the RDP level of VIP (Source: Census 2001 Statistics SA 2004).

Toilet Type	**No. Households**	**% of total**
Flush toilet (connected to sewerage system)	6 155	34
Flush toilet (with septic tank)	502	3
Chemical toilet	30	0.2
Pit latrine with ventilation	1 425	8
Pit Latrine without ventilation	2 557	14
Bucket latrine	5 391	30
None	2 106	12
Total no. households below RDP levels	10 054	55

Sewage treatment works

Sewage treatment works (STW) are used to treat waterborne sewage, sludge from bowsers (Honey Sucker) and bucket latrines. This can be as simple as a ponding system or large treatment plants with highly technological systems. In Makana Municipality there are two sewage treatment works in Grahamstown and one in Alicedale. Riebeek East relies on septic tanks and pit latrines. The proper management of these sites is essential to ensure that sewage water does not impact negatively on rivers and downstream users. In the past poor sewage treatment or lack thereof has caused devastation to farming communities as well as river health. As part of the LEAP the sewage treatment works will be assessed to determine whether any interventions can improve the performance and hence improve the associated environmental and social impacts.

Grahamstown Sewage Treatment Works

A full sanitary analysis of each sewage works will be inserted into the full Environmental Audit Report. The Grahamstown STW is situated on the South East side of Grahamstown

in the Belmont valley. The STW is designed to treat 4 million litres everyday with the treated effluent flowing into the Bloukrans River. This STW consists of a trickle-filter and anaerobic digestion system. The biggest problem with this kind of system is the disposal of the dried sludge. Note that this is classified as hazardous waste. The municipal budget reflects the fact that more houses are to be connected to the waterborne sewage system that feeds this plant. This may require upgrading of the STW to handle additional loads.

Mayfield Ponds

The Mayfield STW is situated on the North East side of Grahamstown. A series of ponds receive sewage via sewers as well as buckets and bowsers (Honey Sucker). The effluent from this STW is used to irrigate the commonage below the ponds. The valley in which the STW is situated is in the Botha's River catchment. The effluent ends up in a dam which Makana Brick and Tile (Grahamstown Brick) uses. This STW has a sludge drying system which leads to large volumes of hazardous sludge which present disposal problems.

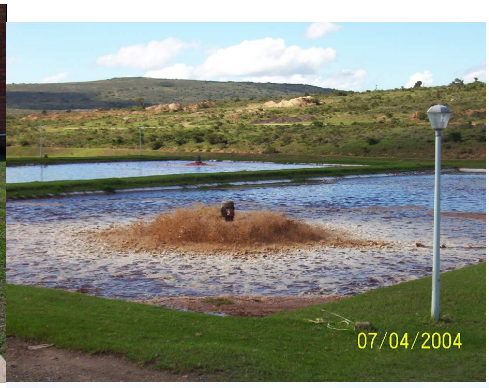


Figure 13. Mayfield STW showing ponds with aerators, sludge, buckets and inlet

Alicedale

Alicedale has a STW on the East end of town adjacent to the Bushman's River. This consists of a series of ponds and services Kwanonzwakazi, Transriviere and the Alicedale CBD by bowser (honey sucker). According to the unit manager this site is currently running overcapacity and must be upgraded if more houses are to be put on the system. At the time of the site visit the ponds were overflowing into a channel that leads to the Bushman's River. Since no data has been obtained on effluent quality at this stage no conclusions can be drawn as to the impact this effluent has on surrounding environments.

Figure 14. Alicedale STW showing clogging at inlet with refuse, poor performance of ponds, showing filling up of ponds with sludge and overflow to the Bushman's River.

Riebeek East

Currently all houses are either on septic tanks, soak aways or ventilated improved pit latrine (VIP), there are plans to introduce a waterborne sewage system if sufficient groundwater is found.

Livestock issues in residential areas

Some 1858 cattle and 1912 goats are kept by people living in residential areas in Grahamstown alone. These animals graze on the commonage by day and return to kraals next to owners houses in the evening. This not only poses a health hazard to residents, but also to the nearby streams and rivers as runoff carries nutrient-rich manure to these after rains. An associated issue is that nutrients are being removed (by grazing) and deposited in high concentrations in the kraals. This does not allow for a natural cycle of nutrients. This will ultimately cause soil infertility or soil depletion on the commonage.

Water services

By the constitution of South Africa all South Africans have the right to safe and clean water. The RDP level for water services is that everybody must be able to access a standpipe (water tap) within 200m of their dwelling. Water is also necessary for industries and thus development and growth of the town must take place within the context of water availability.

Access to Water in Makana Municipality

According to Census 2001 10% of households in Makana Municipality fall below the RDP levels. 10% have the minimum standard RDP requirement of a standpipe within 200m. Only 22% of people have water inside their houses. In Grahamstown the water is purified at the Waainek purifications works. This site is currently being upgraded, however, the details of this upgrade were not available at the time of preparing this report.

In Alicedale water is purified in a works close to the Bushman's River on the West side of town. Alicedale's water comes from the New Years Dam. A member of the public raised the concern that a landowner near the dam allows sewage to flow into the veld, which could enter the dam during rainy conditions.

Riebeek East obtains its water from boreholes. Currently there is a project to drill more bore holes to provide more water for the town. No information has been obtained on the quality of this water and no issues have been raised regarding water in Riebeek East.

Energy Needs

The energy needs of the community and the resultant sources of fuel will be assessed as part of the RU Environmental Science Department research. This will include community surveys and fuel wood surveys to estimate biomass usage and trends. The impact of alien clearing, species selection, accessibility and preferences will be considered during the study. This issue is closely related to indoor air quality and poverty alleviation. The requirements for a comprehensive approach to improving the conditions of poverty, resource use, energy consumption and environmental health will be reviewed.

Figure 25: Photo of child tending a fire, rural South Africa

Figure 16: Photo of child's burnt hand from open flame

ENVIRONMENTAL MANAGEMENT

	Theme Summary	
Key Issues	**Key Indicators**	**Key Statistics**
Industrial Environmental Management		
Mine/quarry rehabilitation	Number of mines rehabilitated	Needs to be determined
Tannery/taxidermist/ abattoir effluent disposal	Quality of effluent	Different standards for old and new businesses. Uncertainty prevails over disposal strategies e.g stormwater or STW
Laboratory effluent	Quality of effluent	Uncertainty prevails over disposal strategies e.g stormwater or STW
Petrol stations, garages and dairies		Uncertainty prevails over disposal strategies e.g stormwater or STW
Environmental Education		
Need for integrated approach		
Review of education and training	Number of Training Programmes in Makana by NGOs	Being determined by the review
Research on municipal worker needs	Number of Training Programmes in Makana Municipality	Being determined by the research
Legal		
Compliance	Level of compliance	Makana falling short
Considering relevant laws		
Enviro. Administration requirements		
Environmental liability		

Industrial Environmental Management

Industrial environmental management is the term used to describe how industries and businesses deal with their environmental impacts. Certain kinds of industries have in the past caused severe environmental impacts, many of which we are only being becoming aware of at the present. Industrial environmental management practices have been developed over the past couple of decades to help deal with these issues. One example of

industrial environmental management is the requirement that a mining company rehabilitate the mined area to a standard which is defined by the Inspector of Mines. This may involve replacing the soil and ensuring that vegetation returns to the site. In South Africa there are laws which companies must comply with to effectively manage their environmental impacts. Companies that are defined by the law as having impacts on the environment are required to monitor the impacts and take actions to prevent or reduce the impacts. Many large companies do this by implementing standardised management systems such as ISO 14000. The ISO 14000 is an International Standard to which company environmental management may comply. It is a voluntary standard and the full requirements are often expensive to apply. Smaller industries often do not have the resources to implement such systems and environmental management tends not to be a structured process but rather depends on the degree to which the management is committed to environmental management and has knowledge of environmental law as well as best practice.

Types of Industry in Makana Municipality with Significant Environmental Impacts

Mining and quarrying

There is a small amount of mining and quarrying in the Makana Municipality. Clay is mined for brick making and for industrial minerals. Quarrying for blocks or sand occurs sporadically. Presently the mining companies are required to complete Environmental Management Programme Reports before starting to mine. These reports detail how they intend to minimise environmental impacts and rehabilitate excavations. They must also secure finances to enable implementation of these reports.

Makana Municipality contains numerous disused kaolin mines and quarries. Many of these were established before the legal requirements were promulgated and as such, can only be rehabilitated by extensive outside funding (government, NGO etc).

Tanneries

There are about 5 tanneries in Makana Municipality and a number of taxidermists (number not known a t time of report writing). The environmental management of tanneries is limited to the treatment of wastewaters which may contain a whole host of hazardous chemicals used in the tanning process. Through the public meeting, it became

apparent that some tanneries are treating their wastewater before discharging to the sewers while others have no treatment system in place. Further investigations will have to be undertaken to ascertain environmental management practices undertaken by the tanneries and the licensing conditions under which tannery wastewaters are discharged. The following tanneries and taxidermists have been identified:

Ostrimark

Albany hides and Skins

Horne Tanning

Phillipe Exotic Leathers

Alicedale tannery– name not known at time of writing

Blaauwkrantz Taxidermy

Abattoirs

There are numerous abattoirs operating in Makana Municipality. Abattoirs have nitrogen rich wastewaters as well as petruscible solid waste both of which are classed as potentially hazardous. All abattoirs are required to be licensed by law. No information has been obtained at this stage on the environmental management practices of abattoirs. The following abattoirs and butcheries operate in Makana Municipality:

Fish River Abattoir

Grahamstown Ostrich Export Abattoir (GOA)

Rache (deboning)

Rosedale Abattoir and Butchery

Connock's Butchery

Nyamarama

Mark's Butchery

Ostimark Butchery

Ray's Butchery

Tiptop Butchery

Zukie Butchery

Bob's Chickens

Chan Henry Butchery

Gameston Butchery

Kekkle and Kraai

Grahamstown Meat Packers

Grahamstown Ostrich Export Co.
Castle Pork
A thorough investigation will be undertaken to ascertain whether these businesses take measures to ensure there waste waters and putrescibles are disposed off correctly.

Chemical industries and laboratories

In Makana Municipality there are a limited number of industries that fall into this category, however, the universities and educational institutions have laboratories that produce hazardous wastes. Part of a student project is the investigation of disposal practices of hazardous chemical substances at Rhodes University. This will be reported on later in the LEAP process. Investigations will also be done to determine what the best options are for these organisations for disposing of hazardous chemicals. The organisations that will be considered are:
Rhodes University
Laboratories at schools
Kynoch
Rayner Agencies
International School of Tanning Technologies
Makana Meadery

Petrol stations, garages and dairies

In Makana Municipality as in many other areas petrol stations and garages occur within the towns. Though these industries do not necessarily have any environmental impacts, petrol, oil and grease are hazardous substances and if allowed to move into the environment they can cause harm to aquatic organisms. For that reason it is important that they are included in environmental education and action plans for the district. Another important consideration of garages and dairies is the wash waters they produce. Garages which offer car washes produce soapy waters which must go into the municipal sewers and not into the storm water drains. Dairies produce hazardous wash waters as they use chemicals as disinfectants. This water should all go into municipal sewers and be treated at the sewage treatment works.

Miscellaneous

Other industries not listed above can also have environmental impacts. These industries include laundrettes, ceramic industries, farming and printing operations. These industries should be adequately informed of the nature and extent of their impacts and advised on how to ameliorate them.

Industrial Environmental Management issues identified within Makana Municipality

The following issues have been identified in consultation with members of the public as issues which need further attention as part of this LEAP:

Licensing or permit requirements for industries and the enforcement thereof

Environmental Management Programme Report compliance assessment

Funding of rehabilitation of old and abandoned quarries

Underground storage tank testing at petrol stations

Wash water treatment or disposal practices of dairies, abattoirs and tanneries

Oil, grease and wash water disposal practices at garages and other industries

General environmental management practices or lack thereof of industries in Makana Municipality

Formation of waste/environmental management clubs

Creating environmental ethic within industry

ENVIRONMENTAL EDUCATION AND TRAINING

Comprehensive audit and in-depth reports on the status of environmental education and training in the Makana District are not yet available. An analysis of environmental issues and risks facing the Makana District and its people indicates that an integrated approach to environmental education and training will be required, and that environmental education and training will be required in a range of sectors.

There are currently a range of different environmental education and training programmes taking place in the Makana District, including:

Community education
Current projects include the Kowie Catchment Campaign and Umthathi training programmes.

Formal Education
Current initiatives include the school gardening programmes supported by Umthathi and the Makana schools programme. These support teachers who implement an environmental focus in the curriculum. The National Environmental Education Programme (NEEP), Makana Cluster, is another registered formal education initiative.

Higher Education
Formal qualifications in Environmental Sciences and Environmental Education and other disciplines are available at Rhodes University.

Adult Education
In this sector, environmental issues and concerns are integrated into ABET programmes offered through NGOs and other ABET training groups. The Department of Education has an active ABET programme which they aim to strengthen with environmental education and training.

Business education

There are currently few environmental training programmes available for the business sector in the Makana district.

Local Government

There are currently few environmental training programmes available for the local government sector.

Agriculture

There are some initiatives underway to support more sustainable agriculture, and support of extension workers, but to our knowledge there are no environmental education and training programmes available to this sector in the Makana District.

The process of auditing each of these sectors to gain a more detailed and in-depth perspective on the status of environmental education and training in these sectors is currently underway. A questionnaire survey is being used to ascertain what training programmes exist, how often they are run, how the training programmes are supported and resourced and what expertise exists in the Makana District to provide environmental education and training in response to the LEAP priorities and action plan. A research project is also underway to establish municipal workers' needs and organisational needs for environmental education and training within the Makana Municipality. These two studies will provide information which will inform the development of an environmental education and training strategy which will be responsive to LEAP priorities and action plans, and will provide a mechanism to support the implementation of the Makana LEAP. The institutions and groups involved in the survey are provided (Table 2).

NGO & CBO's	Tertiary Education Institutions	Government Departments	ABET Centres	Business Training	Unions
ECARP Masifunde Umthathi Kowie Catchment Campaign Millennium Tree Planting Project Wildlife and Environment Society of	Centre for Social Development Env. Science Env. Economics Rhodes University Environmental Education Unit ISER CADRE	Albany Museum Library Health Promoting Schools (Dept of Health and Dept of Education) Environmental Affairs Parks & Gardens Social Development Department of Water Affairs	Sample of schools List of ABET Centres LEAGUE	Sample of business association GCC SACOC SA Hawkers Grahamstown Recycling	NEHAWU SAMWU

South Africa Botanical Society Home Care President Awards Black Sash GADRA Scouts	Grahamstown Technical College Student organisations	and Forestry Working for Water Labour			

Table 2. Institutions being surveyed by the LEAP Environmental Education team.

LEGAL COMPLIANCE

Introduction

The objective of an environmental legal compliance audit is to determine the level of compliance with respect to general and specific environmental duties as well as environmental administrative requirements.

Environmental Responsibilities and Competencies

These encompasses a consideration of:

- National, provincial, local and, where applicable, international statutory environmental duties;
- Common law (delict, nuisance);
- Constitutional law.

These environmental law sources may be considered under the following identified headings having reference to Makana Municipality:

- *Land use and planning:* is the land correctly zoned; was an environmental impact assessment required, etc:
- *Soil:* soil salt concentration or soil conservation may be of relevance.
- *Water:* rights to use water; existing rights; water quality standards; pollution of water; trade effluents; stormwater, etc.
- *Air:* noxious or offensive gases; smoke; dust; noise; air quality standards, etc.
- *Waste:* solid; liquid or gaseous waste streams; historical disposal activities; current disposal methods; cradle-grave liability; waste transportation; handling and disposal; defining waste, etc.
- *Hazardous substances:* transportation; handling; disposal; storage; emergency incidents; employee health; safety and equipment; asbestos issues, etc.
- *Natural resource protection:* mining rights and restrictions; water conservation; protected areas; marine living resources; protection of biodiversity; protection of flora and fauna.

- *General environmental duties and standards:* entrenched environmental constitutional right; general environmental duty in the National Environmental Management Act 107 of 1998 (NEMA); environmental principles; Best Practicable Environmental Option Standard.

Environmental administrative requirements

The following are examples of areas which may need to be audited:

- *Land-use and development:* authorisations from relevant authorities may be required in terms of the environmental impact assessment or integrated environmental processes.
- *Water:* water licences; trade effluent permits, etc.
- *Air:* scheduled process certificates, smoke burning appliance licences/permits.
- *Waste:* waste disposal site permits; closure permits, etc.
- *Hazardous substances:* licensing issues regarding the sale of certain substances; underground storage tank registration and/or certification; major hazard installation notification; fire authority requirements; scheduled trade licensing requirements.

Environmental Liability

Environmental liability can arise in various ways. It is, therefore helpful to categorise environmental liability as follows:

- Criminal liability
- Civil liability
- Ecological liability

Criminal liability

Most legal systems categorise certain environmentally damaging activities as criminal. This may range from liability for violation of administrative law requirements such as operating a scheduled process without a registration certificate required in terms of section 9 of the Atmospheric Pollution Prevention Act 45 of 1965 or to violations of statutory duties, e.g. disposing of waste in an unlawful manner is an offence in terms of the Environment Conservation Act 73 of 1989.

Criminal liability can result in substantial cost to the offender, e.g. if a business operates without a scheduled process certificate this constitutes a criminal offence and the relevant authority (metropolitan and district municipalities) can shut down the process or business until such time that as it obtains a certificate. In terms of section 29 of the Environment Conservation Act, the unlawful disposing of waste can result in a conviction with a maximum fine of R100 000 or ten years imprisonment.

Criminal liability for environmental harm is not limited to the offending company. In terms of the National Environmental Management Act 107 of 1998 (NEMA), directors face personal liability where they fail to take reasonable steps to prevent the company from committing the offence. In addition directors can be ordered to pay fines, face imprisonment or be removed from the position of director by a court in terms of the Companies Act 61 of 1973.

Civil liability

In the context of environmental liability, two civil law remedies are applicable:

1. An application for an interdict either asking the court to compel the offender to do something or to refrain from doing something, e.g. an application may be made to top a company from discharging gases into the atmosphere because of the impact it is having on the health of the community living adjacent to it.

2. An action for damages (Aquilian action) where the defendant causes the plaintiff damage to his or her person or property. Examples of such environmental liability include:
    a. death or personal injury caused by an explosion at an industrial site;
    b. disease caused by exposure to a hazardous substance, such as asbestos;
    c. physical damage to property caused by hazardous chemicals leaking from a neighbour's industrial site.

Two other developments have increased the likelihood of civil action:

3. Legal standing (*locus standi)* has been improved entitling individuals or groups of individuals to seek judicial relief in respect of any breach of any provision of the National Environmental Management Act or any other statutory provision concerning the protection of the environment. Individuals may exercise this right:

- in their personal capacities;
- on behalf of another individual;
- in the interest of or on behalf of a group or class of persons;
- in the public interest; or
- in the interest of protecting the environment.

4. Access to environmental information has been made much easier. Both the Promotion of Information Act 2 of 2000 and the National Environmental Management Act 107 of 1998 set out instances in which environmentally relevant information must be made available to either government authorities or to the public at large.

Ecological liability

Ecological liability has features of criminal and civil liability, but arguably does not fit neatly under either. Criminal liability has as its principal features, the aim to punish and deter certain conduct. Civil liability covers injury to people and damage to personal property. Pollution and other environmental issues may, however, also result in deterioration of environmental quality, damage to ecosystems and loss of flora and fauna.

The potential shortcomings of traditional liability systems in addressing harm to the general environment have become increasingly apparent, internationally as well as locally and have lead to the introduction of specific statutory remedies to address clean-up and rehabilitation requirements. These are administrative remedies, ie procedures by which public authorities can compel or secure a clean-up and restoration of the affected environment.

The two most obvious examples of environmental liability are to be found in the National Environmental Management Act and the National Water Act 36 of 1998.

The former imposes a duty on every person who causes, has caused or may cause significant pollution or degradation of the environment, to take reasonable measures to prevent it from occurring, continuing or recurring, or when it cannot reasonably be avoided or stopped, to minimise and rectify it.

Although the Act does not define “reasonable measures” it does suggest that in appropriate circumstances this will include clean-up and rehabilitation of the environment. Where the responsible party fails to take these measures, an authority may do so and recover the costs from a list of what may be described as potentially responsible parties.

The Act describes this as the person who:

- was or is responsible for the pollution;
- directly or indirectly contributed to the pollution;
- was the owner of the land when the pollution occurred or the successor-in-title to such land;
- was in control of the land or had the right to use the land when the activity or process is or was undertaken, or the situation came about;
- was the party who negligently failed to prevent the activity or process being performed or the situation coming about ; or
- was a party who benefited from the lean-up measures.

Ecological liability in terms of the National Environmental Management Act and National Water Act, includes liability for historical pollution and not merely pollution which is caused today, This broadens the scope and costs significantly for potentially responsible parties.

LAND

	Theme Summary	
Key Issues	**Key Indicators**	**Key Statistics**
Environmental impacts		
	Population Density	18 people/km^2

	Rural land usage	To be determined in full audit
	Land use trends	Increase in private game reserves. Decrease in small stock farming activity.
Transparency needed in review and approval process		
Agriculture and soil erosion	Management plans	Limited dryland cropping
		Primary production mainly 2-4 tonnes/hectare
		Overgrazing evident in Great Fish River valley
Soils and geology		Mainly shale and mudstone or sandstone and quartzite

Introduction

Makana is a largely rural municipality and is imbued with abundant natural resources. These resources comprise the landscape, soils, geology, natural vegetation, natural fauna and climate. Using his skills at managing the landscape and its climate, humans have impacts on these natural resources. This activity include cultivation of land, fencing, grazing using both wild and domestic animals, construction of roads, villages, towns, construction of dams, and planting orchards and plantations. All these activities have impacts on the surrounding landscape, and may have impacts on water quality in the rivers, aesthetic beauty, soil and nutrient loss through erosion and the loss of unique biotic components.

Soil

The soils and geology

The geology of the area is comprised dominantly of shale and mudstone of the Beaufort and Ecca Groups and sandstone and quartzite of the Cape Supergroup. Basalt, breccia, tillite, conglomerate, tuff, silcrete and relict aeolianite occur to a lesser extent. Due to the resistant nature of the parent rock coupled with generally low rainfall, soils are not deeply weathered and are commonly very shallow, classified either as lithosols (topsoils on rock) or duplex (light textured topsoils abruptly overlying clay subsoils). Soils of higher potential are red apedal soils with a high base status which have weathered from old dune material found to occur in the south, in the vicinity of Sidbury Hill, Melville Park and

Spring Valley. An area of moderately high base status red structured soils occur in the north western portion of the municipality –Salisbury plains. Narrow bands of deep alluvial soils are found along parts of the Great Fish River. Many of the soils are low in nutrients such as nitrogen and phosphate, and have a low cation exchange base.

Termitaria or 'heuweltjies' are interesting phenomena which occur over much of the region. These termitaria provide localised sources of available nutrients due to the activity of termites. The termitaria support clumps of thicket, which play an important role in the local ecosystem.

Agriculture and soil erosion

Agricultural Potential

Due to the limiting nature of both soils and rainfall much of the area has a very low potential for dryland cropping. The region is best suited for conservation or grazing, and isolated areas, particularly along the Great Fish River, suitable for irrigation. Most productive farming enterprises occur in the south, where chicory and pineapples are grown as dryland crops.

In terms of primary production, which provides a general expression of the sustainable agricultural production expectation, the area has been rated as having a range from between 2 and 10 tons.ha^{-1}.season^{-1} (Schulze, 1997). Primary production for the whole country has been rated at between less than 0.5 and up to 12 tons.ha^{-1} . Most of the Makana municipality would have rates of between 2 and 4 tons.ha^{-1} with higher potential limited to areas of higher rainfall (>700mm) or under irrigation.

Soil erosion

The soils that occur throughout the area are highly susceptible to erosion. Soil erosion as a result of land clearing for intensive cropping has occurred to some extent, but has been monitored on an ongoing basis. Controls in chicory lands involves the use of regularly spaced windbreaks to minimize wind erosion on sandy soils, and grassed contour banks to minimize water erosion losses. In pineapple lands, where the raised beds are prone to

soil losses, particularly after harvesting and during re-establishment, well spaced contour banks have been established to minimize these soil losses.

Overgrazing, particularly by goats, has occurred on the hill slopes in the Great Fish River valley. Here, topsoil loss in the form of sheet erosion, and in places gulley erosion, is evident.

In the planning of future farming enterprises, it is necessary to incorporate measures that will facilitate sustainable ventures. It is imperative that future developments incorporate erosion controls such as contour ploughing, suitably spaced contour banks, and ley cropping.

Too often in the past have small scale farmers diligently started out well, only to have to abandon land after a year or two due to the lack of funding for appropriate annual fertilization. This land then becomes further degraded due to soil erosion losses.

Of all livestock, goats are reputed to be the most destructive but with careful planning and especially sound management of goat farming, overgrazing and consequently soil degradation can be avoided.

The *management plan* incorporates specific guidelines to minimise soil erosion losses. Essentially ***sustainable farming*** requires:

- Soil investigations to establish most suitable land for cropping
- Annual fertilisation and soil nutrient monitoring
- The use of mulching and the incorporation of organic fertilizers where possible to promote soil biological activity
- Contour ploughing and suitably spaced contour banks
- Well managed grazing

Viable irrigation schemes have been established on the banks of the Great Fish River. Potential exists for expansion, but in order to create a sustainable irrigation project, planning should incorporate the following factors:

- Soil suitability for irrigation– guidelines are provided in the management plan
- Analyses and monitoring of water quality – Salinisation of soils through the use of injudicious water application, or irrigation of unsuitable soils has occurred in various parts of the Eastern Cape.

TERRESTRIAL RESOURCES

The Makana Municipality is located within the Eastern Cape Province of South Africa and is bordered by the Blue Crane Route Municipality (EC102) to the northwest, the Nxuba (EC 128) to the north, the Nkonkobe (EC127) to the northeast, the Nqgushwa (EC 126) to the east, the Ndlambe (EC 105) to the south and the Sunday's River Valley (Ec106) to the west. The Makana, Blue Crane Route, Ndlambe and Sunday's River Valley municipalities are within the Cacadu District Council (DC 10) and the remaining are in the Amatole District Council (DC 12). The northern and eastern boundary of Makana is the Groot-Vis River (Great Fish River) and the municipality also contains the Boesman, New Years, Bothas, Klein, Tyara and Soso river systems. The topography of the region is generally comprised of northwest to southeast oriented ridges and valleys with elevations ranging from approximately 800 to 900 meters above sea level in the Swartwatersberg range to less than 200 meters above sea level within the Great Fish River valley.

The Makana Municipality comprises an area of 4222 square kilometres with an overall population of 76182 (2001 Census). This yields an average density of 18 persons per square kilometre. However, Grahamstown is the largest population centre. With the exception of Alicedale and Riebeek East, the remainder of the Municipality has a very low population density. Outside the urbanised areas, land uses are dominated by pasture, wildlife preserves, game farms and cultivated lands. Urban settlements are concentrated around Grahamstown, Riebeek East and Alicedale.

The method of assessment for a determination of the terrestrial resources will be dependent upon the specific component to be addressed. For example, development patterns associated with land uses will be based on the Eastern Cape Spatial Development Framework and the Integrated Development Plan (IDP) for Makana. A series of land use trends for the Municipality will be developed and the long term environmental cost and opportunities of the land use trends will be assessed. Where appropriate, recommendations will be made to reduce anticipated environmental impacts as a result of

land use decisions and to ensure a more transparent and inclusive review and approval process.

WATER RESOURCES

	Theme summary	
Key Issues	**Key Indicators**	**Key Statistics**
Sewage toxicity	Hydrology monitoring, Toxicity tests	Bloukrans, poor ecosystem health downstream of Grahamstown STW
Water chemistry	Water chemistry monitoring	Bushmans/Kariega too salty to irrigate or drink
Ecosystem health	Biomonitoring and ecosystem guidelines	No serious nutrient enrichment at any DWAF site

Introduction

Makana comprises two important water resource regions, and each has a distinctive water quality and supply. In the southern parts of Makana, rainfall is higher than in the northern, semi-arid portion. The Zuurberg range, which runs east-west across Makana, provides a natural barrier to the rain-bearing clouds which come from the south west. The highest rainfall areas are those located along the Zuurberge, and run-off provides input to the rivers (Assegaai, Kowie, Kariega, Bushmans) and dams (Howieson's Poort, Settlers Dam) of the southern portions. These mountains, which comprise Witteberg quartzites, also have a positive influence on water quality, as the run-off from these rocks is low in dissolved salts and is regarded as "sweet". In contrast, the northern parts of Makana consist of rocks from the Karoo system, which are high in nutrients and salts. Run-off from these rocks results in an increase in salt levels in the river (Great Fish River). When combined with the lower rainfall, these salts contribute to poor water quality. The LEAP Project Team determined all those factors which impinge on water quality issues within Makana. They have not attempted to deal with the quantity of water required for growth within Makana.

Stakeholder Issues

At the Stakeholder Meeting on 6 April 2004 the following categories of issues were raised:

Human Health

- Cholera risk: Concern was expressed about the safety of river water. This was in respect to the direct drinking of river water as well as indirect contact.
- Municipal water purification standards: Concern was voiced that the purification standards of the municipal water may be inadequate.

Water Services

- Improved access to safe drinking water: A call was made for the provision of taps to new areas.
- Lack of sanitation infrastructure in townships: The effect of poor structure on human and ecosystem health was highlighted.
- Poor water drainage system in townships: Concern regarding its effect on erosion of the landscape and resultant sedimentation in rivers was recorded.
- The need for increased education regarding water conservation was also recorded.

Ecosystem Health

- Pollution of the Bloukrans River: Concern was voiced over the impact of the sewage treatment works, and the dumping of rubbish in or near the river.
- Indigenous vegetation removal: Concern over the impact of this on the riverine ecosystem.
- Alien vegetation: The increase in Alien vegetation in the riparian zone was seen as a threat to the ecosystem.

Alignment of Stakeholder issues with the Preliminary Status Audit.

Stakeholder issues categorized under Human Health are not addressed in this preliminary audit. However, a desktop risk assessment of the cholera hazards will be undertaken for the Comprehensive Report.

Stakeholder issues categorized under Water Services are not dealt with in this Audit but are addressed instead in the Sustainable Development Framework.

Preliminary Audit results in terms of the Ecosystem Health issues raised by stakeholders are as follows:

- The aquatic ecosystem downstream of Grahamstown residential and industrial areas and the sewage treatment works is indeed in a poor state. This main stakeholder concern is confirmed by this preliminary audit.
- Water quality analysis revealed that at various sites on the Boesmans and Kariega River the water is too salty to irrigate or for humans and livestock to drink (see the Preliminary document that follows for details)
- A positive finding was that there appeared to be no serious nutrient enrichment at any of the DWAF sites (Bloukrans River sites still to be analysed).
- Issues of indigenous vegetation removal and alien vegetation encroachment are being monitored at the biomonitoring sites and will be included in the final report.

Preliminary Water Resource Status Audit

General introduction

The purpose of this report is to summarise the condition of water resources in the Makana Municipality, based on a preliminary analysis of selected variables. This preliminary analysis examines water quality by looking at Ecological factors, and Physico-chemical factors.

Based on a variety of variables from the above factors, rivers may be classified according to their health (Table 3). To classify the ecological state of rivers in a region, a technique called biomonitoring is used. Data collected in this way provides information about the

vertebrate and invertebrate fauna living in the water. For this report the integrity of the invertebrate fauna was assessed.

With regard to the physico-chemical state of Makana Municipality's water resources, two variables were selected for this first report. Other variables will be included in the final audit report. Phosphate (PO_4) and Electrical Conductivity (EC) were selected as they provide information on two major aspects of water quality – salinity and nutrient status.

Table 3. River health classification

River Health	River Class
Natural River: Healthy, hardly changed at all, excellent ecosystem health	Excellent/Natural
Little changed from natural, good ecosystem health	Good
Changed a lot from natural, fair ecosystem health.	Fair
Changed so much that many natural plants, animals and processes have disappeared, poor ecosystem health.	Poor

Ecological State Assessment - Biomonitoring

Introduction

Biomonitoring is the systematic use of biological responses to evaluate changes in the environment with the aim of monitoring water quality. The great diversity of aquatic macroinvertebrates and the selective tolerance ranges of different species to prevailing environmental conditions, the presence or absence of certain species, decrease in species richness, or proliferation of a particular species provides a reflection of environmental change (De Moor *et al*. 2002). Therefore, resident invertebrate communities provide a long-term picture of water quality and quantity, habitat quality and other environmental conditions within an aquatic ecosystem. They are suitable for use as bioindicators, reflecting the current state of the environment in which they live, and are extensively used in aquatic biological monitoring in many parts of the world.

Methodology

Sampling sites

In November 2002 and September 2003, the Kowie Catchment Campaign, represented by Dr Ferdi de Moor and Ms Helen Barber-James (Departments of Freshwater Invertebrates) and Dr Jim Cambray (Department of Ichthyology), all of the Makana Biodiversity Centre, Albany Museum, Grahamstown, undertook biomonitoring on the Bloukrans River. Seven sites were chosen for invertebrate biomonitoring in 2004 (See Table 4 for site descriptions and Figure 17 for map of sites). Results were produced in the form of two reports, submitted to Makana Municipality for perusal. Under the current study these same sites will be further sampled. The original Sites 1, 3, 4 and 5 were re-sampled in March 2004 for aquatic macroinvertebrates, using the SASS5 (South African Scoring System version5) technique. Sites 6 and 7 were dry; but additional samples will be taken through the year to assess seasonal variability.

In addition, one site at the confluence of the Berg and Palmiet Rivers, and one site on the Great Fish River were also identified for sampling (See Table 4 for site descriptions). Sampling occurred in March 2004 and additional sampling will be undertaken throughout the year to assess seasonal variability.

Biomonitoring method

The SASS5 methods are clearly recorded in de Moor *et* al (2002). Briefly, groups of macroinvertebrates were identified to family level; and different scores were assigned to each group according to their tolerance and sensitivity to water quality conditions. The total SASS Score and Average Score Per Taxon (ASPT) were used as the measures of ecosystem health.

According to Chutter's guidelines for interpreting SASS scores in non-acidic waters (ph>6) (Table 5), the following combination of Total SASS scores and ASPT provide a good idea of present ecological state in terms of water quality.

Table 4. Description of sites where biomonitoring was undertaken

Sampling site code	**Site description**

Bloukrans River: Has its head waters near Grahamstown, after which the river flows in a south-easterly direction and later joins the Kowie River.	
B1	Section of non-canalized river below small road-bridge near Fort England Hospital. 33°18’46”S 26°32’29” E.
B2	Stream flowing out of the sewage farm (treated sewage effluent) into the Bloukrans River (Fig. 3). 33°18’56”S 26°33’36” E. Only water chemistry recorded.
B3	Section of river below farm-road bridge close to N2 highway bridge. 33°19’04”S 26°34’05” E.
B4	Section of river below Railroad bridge and immediately below road bridge. 33°19’26”S 26°36’00” E.
B5	Section of river below road on Mr. Duncan’s farm. 33°19’40”S 26°38’35” E.
Confluence of Palmiet and Berg Rivers: In Thomas Baines Nature Reserve	
B8	At confluence of the two rivers, 33°22’18”S 26°28’35” E
Great Fish River: Forms part of the north-eastern boundary of the Makana Municipality. It is one of the larger rivers in the region. One site was chosen for sampling	
B9	The Double Drift causeway, 33°05’18”S 26°46’51” E.
***Other sites**: to be chosen once rains have commenced*	

Analysis of water samples

Water samples were taken from each site and sent for full inorganic and metal analyses to the Department of Water Affairs and Forestry. Analyses will take approximately three months from time of sampling and thus results will be included in the Comprehensive Report to be submitted as part of the LEAP at the end of the 2004.

Table 5. Chutter's guidelines for interpreting SASS4 scores in non-acidic waters (ph>6).

Total score	ASPT	Water Quality
>100	>6	water quality natural, biotope diversity high
<100	>6	water quality natural, biotope diversity reduced
>100	<6	borderline case between water quality natural and some deterioration in water quality, interpretation should be based on the extent by which Total Score exceeds 100 and ASPT < 6
50-100	<6	some deterioration in water quality
<50	Variable	major deterioration in water quality

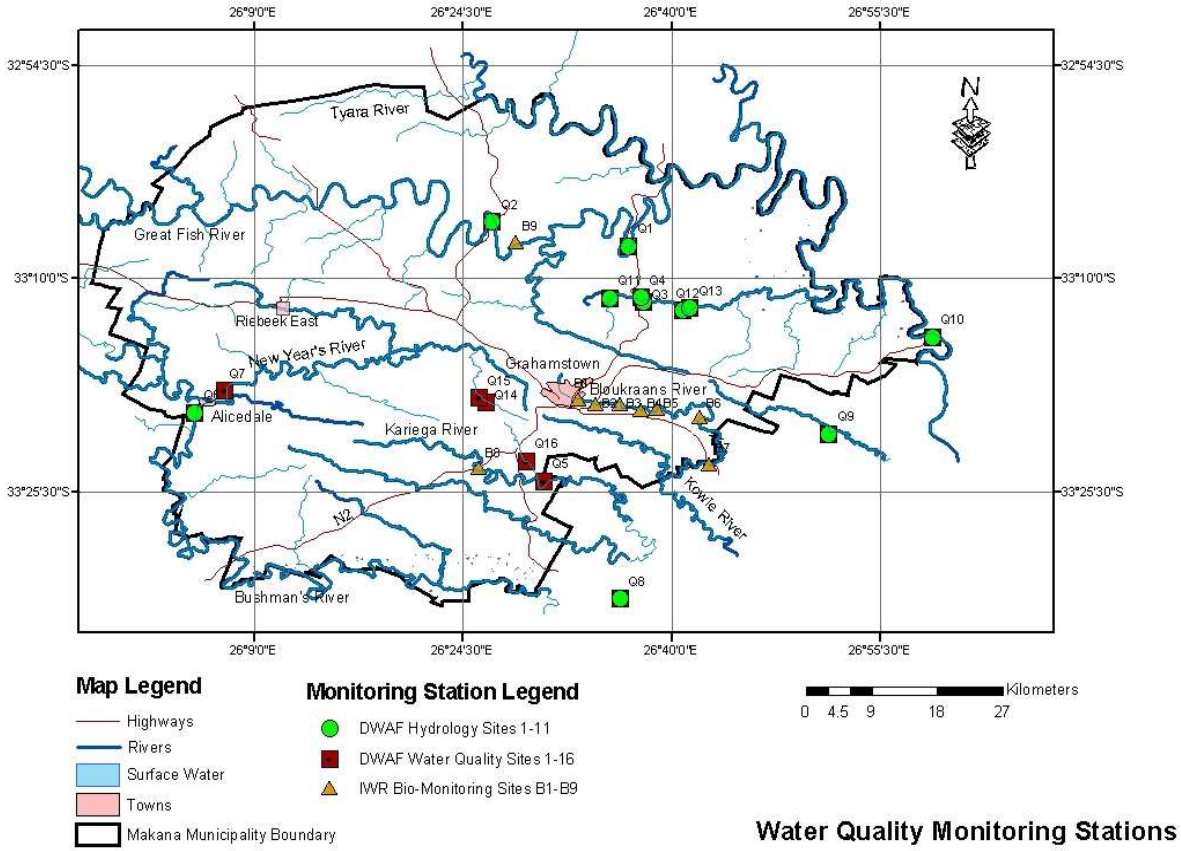


Figure 17 Map of the water quality monitoring stations within the Makana Municipality

Results

The total SASS scores for all four sites on the Bloukrans River were below 100 with Site B1 below 50, and ASPT scores were all less than six (Figures 18 and 19). The total SASS scores increased from upstream to downstream; *i.e.* water quality improved with increasing distance from Grahamstown and the sewerage treatment works. According to Table 5, Site B1 (closest to Grahamstown) showed major deterioration in water quality and remaining three sites some deterioration in water quality.

At Site B8 at the confluence of the Palmiet and Berg all habitats for the SASS5 scoring system were sampled (Figures 18 and 19). The ASPT score was low, and the total SASS score of 89 suggests some deterioration in water quality.

At Site B9 on the Great Fish River biomonitoring was undertaken in Marginal Vegetation only. The remaining habitats of Stones and Gravel, Sand and Mud were unsuitable for biomonitoring as the river was at high flow. The vegetation provides some idea of the ecological state of the river (Figures 18 and 19) and suggests the site shows some deterioration in water quality.

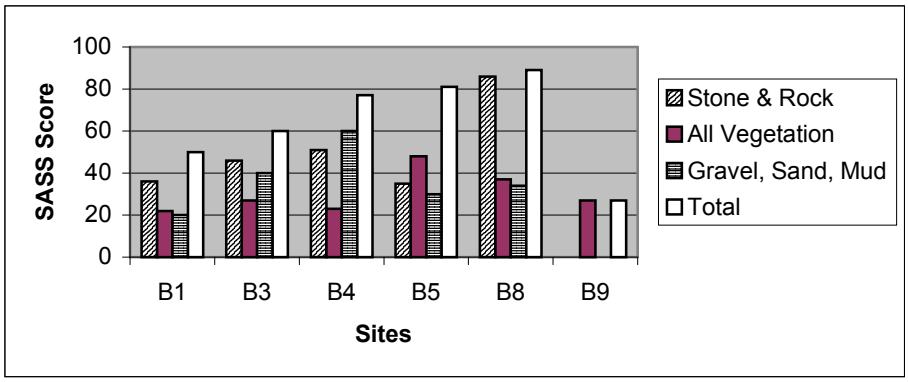


Figure 18. SASS scores for each biotope (stone and rock; all vegetation; and gravel, mud and sand) and total SASS score for each site.

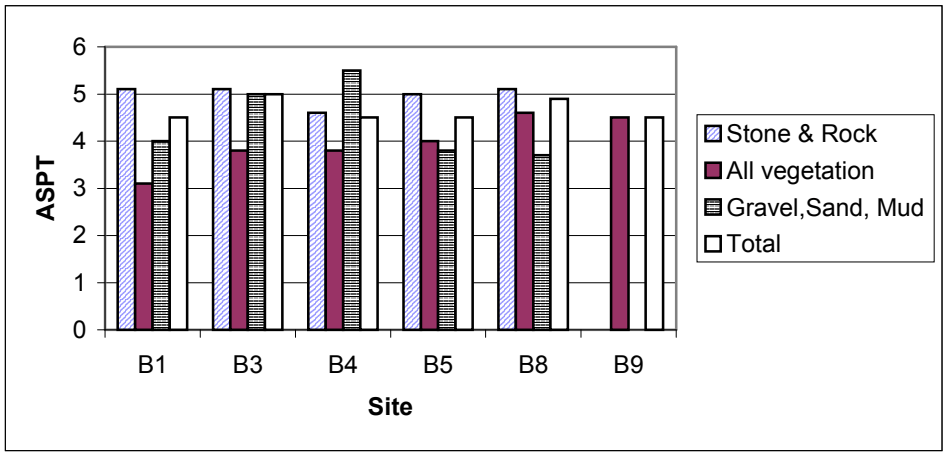


Figure 19. Average Score Per Taxon (ASPT) for each biotope (stone and rock; all vegetation; and gravel, mud and sand) and total ASPT for each site.

Physico-Chemical Assessment

Introduction

Water chemistry is reported in terms of three water user groups (domestic, agriculture, and livestock), and in terms of the river ecosystem itself. Electrical Conductivity (EC) and Phosphate (PO_4) were selected as the variables to be assessed as they provide information on two major aspects of water quality – salinity and nutrient status.

Methodology

Electrical Conductivity and Phosphate water quality data were obtained from the Department of Water Affairs and Forestry (DWAF) database. A list of the DWAF water quality monitoring points used are detailed in Table 6 and also appear in Figure 17. The EC and PO_4 data from each water quality site were then compared to the DWAF Water Quality Guidelines (1996).

Table 6 Department of Water Affairs and Forestry water quality monitoring sites utilized in this study

Site code	DWAF site number	Location	Latitude : longitude
Q1	Q9H001	Great Fish River	33.127778 : 26.613889
Q2	Q9H012	Great Fish River	33.098333 : 26.445556
Q10	Q9H018	Great Fish River	33.237778 : 26.990278
Q6	P1H003	Boesmans River	33.329167 : 26.0775
Q16	P3R001	Howisonpoort Dam	33.387778 : 26.4875
Q14	P1R001	Jameson Dam	33.316667 : 26.4375
Q9	Q9H013	Kap River	33.355278 : 26.861944
Q8	P3H001	Kariega River	33.554444 : 26.603611
Q15	P1R002	Milner Dam	33.311111 : 26.428889
Q7	P1R003	New Years Dam	33.303056 : 26.113889
Q5	P3R002	Settlers Dam	33.412222 : 26.509167
Q3	Q9H022	Brak River	33.195 : 26.632222
Q4	Q9H023	Brak River	33.189722 : 26.629444
Q11	Q9H024	Brak River	33.190556 : 26.590833
Q12	Q9H021	Brak River	33.205833 : 26.681667
Q13	Q9H020	Brak River	33.202778 : 26.690278

Results

Site Q1 (Great Fish River)

Electrical conductivity

Domestic

EC values at this site on the Great Fish River are mostly between 100 and 250mS/m (Figure 20). The water is thus likely to have a marked salty taste and would probably not be used due to its appearance. It is not likely to produce any adverse health effects in the short term.

Agriculture

Moderately salt sensitive crops could be maintained using this water for irrigation.

Livestock

With EC values such as those recorded for this site, no significant adverse effects on livestock are foreseen, although there could be an initial reluctance to drink.

Ecological

The Electrical Conductivity EC values are too high to use EC as an assessment criterion and individual salts will need to be assessed in the final report.

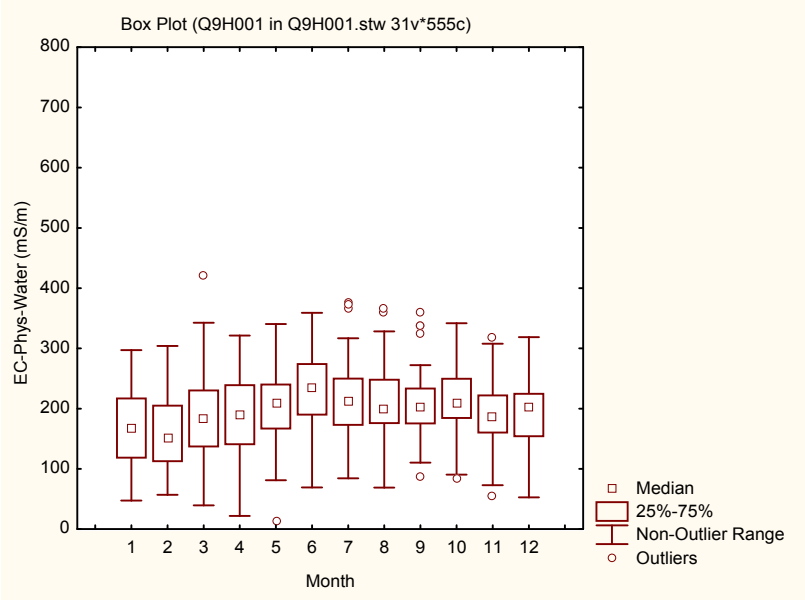


Figure 20 EC values for Site Q1 on the Great Fish River

Phosphate

The site is located in the middle reaches of the Great Fish River. Phosphate levels are generally high in this part of the river, probably due to the phosphate-rich sedimentary rocks of the catchment, although land-use that may have negative impacts on the environment. Phosphate concentrations are generally higher during summer months, but drop from July to September (Figure 21). This can be attributed to increased runoff during summer months. Therefore the river is in a 'good' condition in winter, as compared to 'fair' condition in summer.

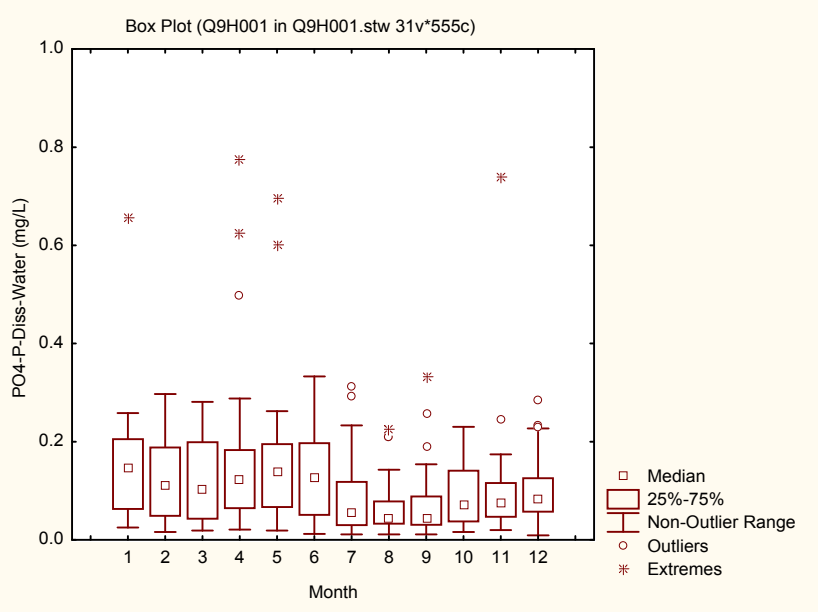


Figure 21 Phosphate values for Site Q1 on the Great Fish River.

Site Q2 (Great Fish River)

No electrical conductivity data

Phosphate

The site is also located in the middle reaches of the Great Fish River. Phosphate levels are generally high in this part of the river, probably due to the phosphate-rich sedimentary rocks of the catchment, although land-use that may have negative impacts on the environment. The river can be considered in a 'fair' condition (Figure 22).

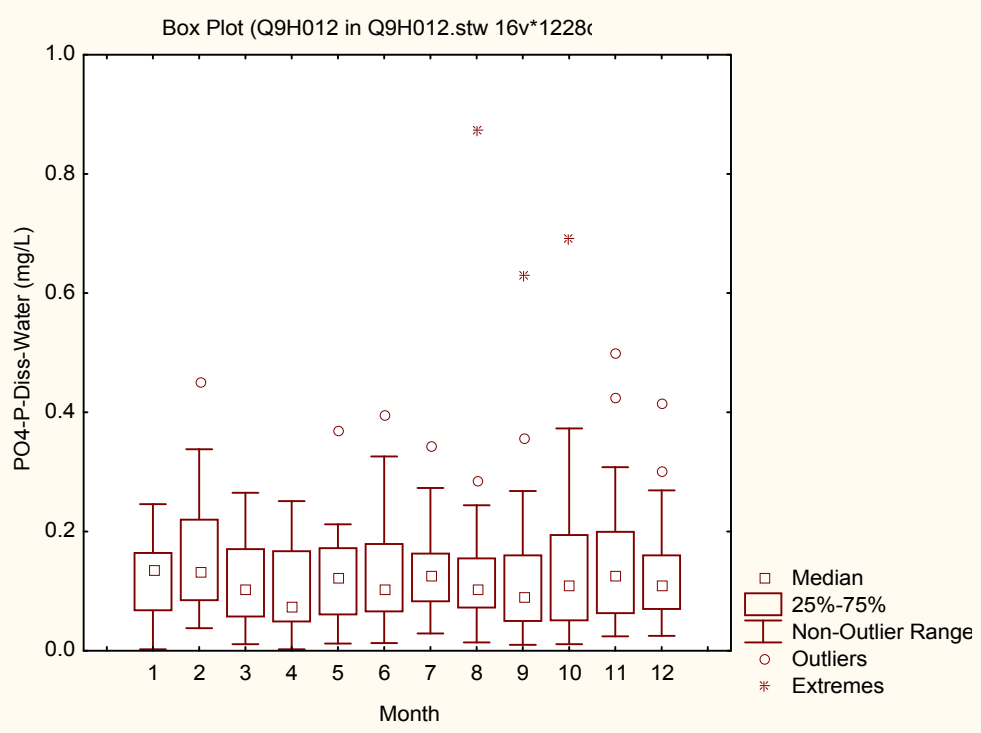


Figure 22. Phosphate values for Site Q2 on the Great Fish River.

Site Q10 (Great Fish River)

Electrical Conductivity

Domestic

Like Site Q1, also on the Great Fish River, the 25th – 75th percentile EC values range from approximately 90 to 250mS/m (Figure 23). Thus water quality does not seem to have changed significantly between the two sites. Adverse health effects as a result of consumption of this water are not likely.

Agriculture

Moderately salt tolerant crops could be maintained under irrigation using this water.

Livestock

No significant adverse effects on livestock are foreseen.

Ecological

As EC values are higher than 85, study into individual salts will be necessary.

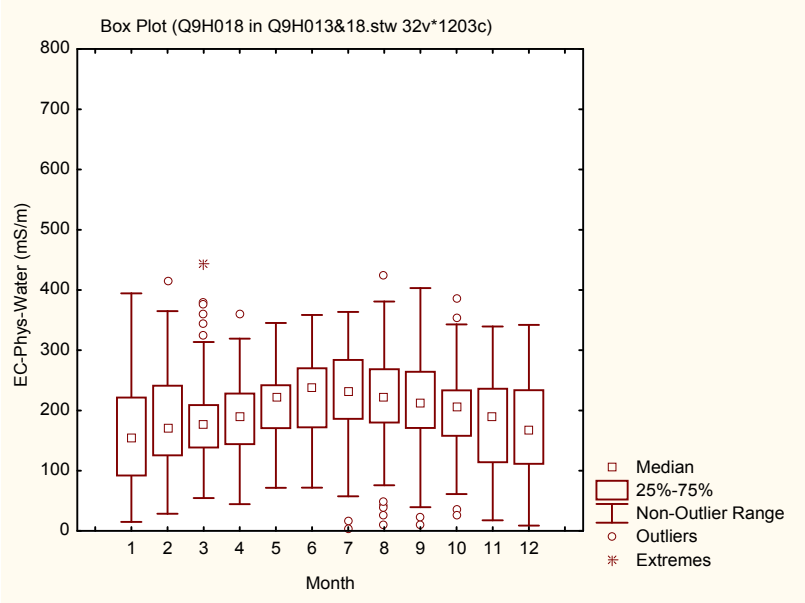


Figure 23. EC values for Site Q10 on the Great Fish River.

Phosphate

Phosphate concentrations are generally higher during summer months, but drop from July to September (Figure 24). This can be attributed to increased runoff during summer months. The river can be considered in a 'good' condition, with medians below 0.2 mg/l.

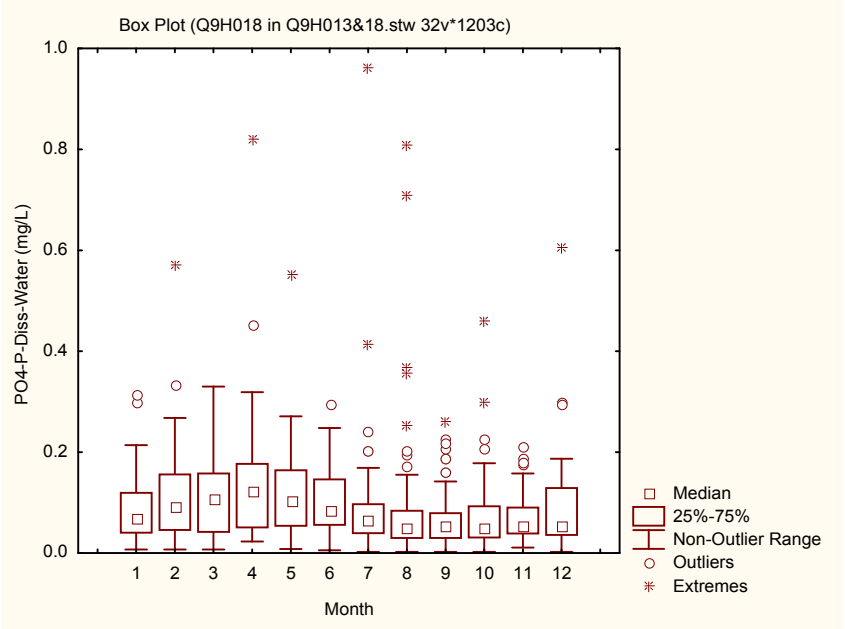


Figure 24. Phosphate values for Site Q10 on the Great Fish River.

Site Q6 (Boesmans River)

Electrical Conductivity

Domestic

The EC values at this site can be seen to be much higher than those recorded for most other sites. At any time of year maximum EC values were never below 400mS/m (Figure 25). In terms of domestic use, short-term consumption may be tolerated, although disturbance of the body's salt balance is likely. At concentrations higher that 450mS/m (seen for most months of the year), effects such as corrosion or scaling increase and noticeable short term health effects should be expected.

Agriculture

Use of this water for irrigation of selected crops is still possible, although yield decreases will occur and management and soil requirements are likely to become restrictive.

Livestock

With such high EC values, use of this water for livestock watering (especially of pigs and/or poultry), a significant decline in production is likely. Exposure to such water should be kept to a minimum.

Ecological

The majority of EC values were well above 85mS/m (Figure 25). An in-depth study of individual salts is needed to properly determine the ecological impact.

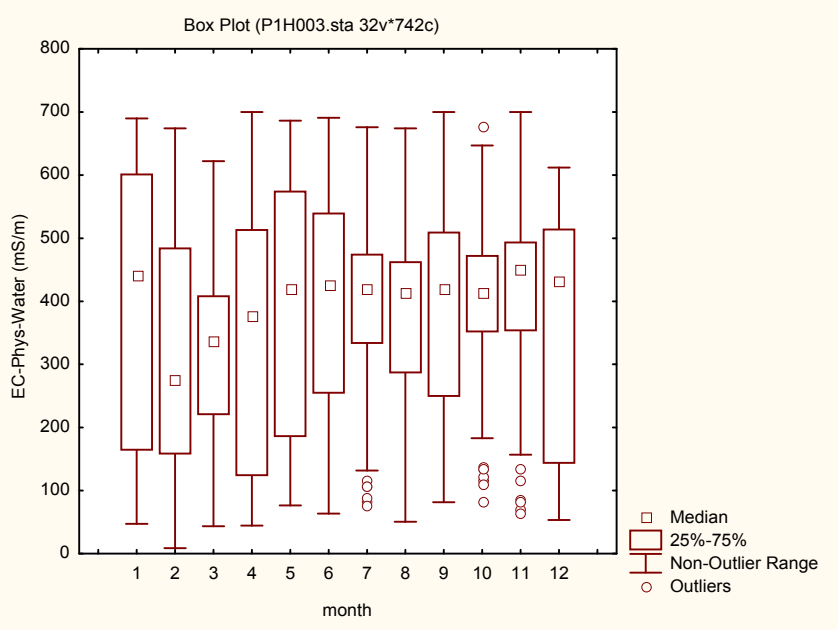


Figure 25. EC values for Site Q6 on the Boesmans River.

Phosphorous

The site is located in the middle reaches of the Boesmans River closer to Alicedale. Generally the phosphate levels were low (median fluctuating below 0.04)(Figure 26), suggesting that river was in 'good' condition.

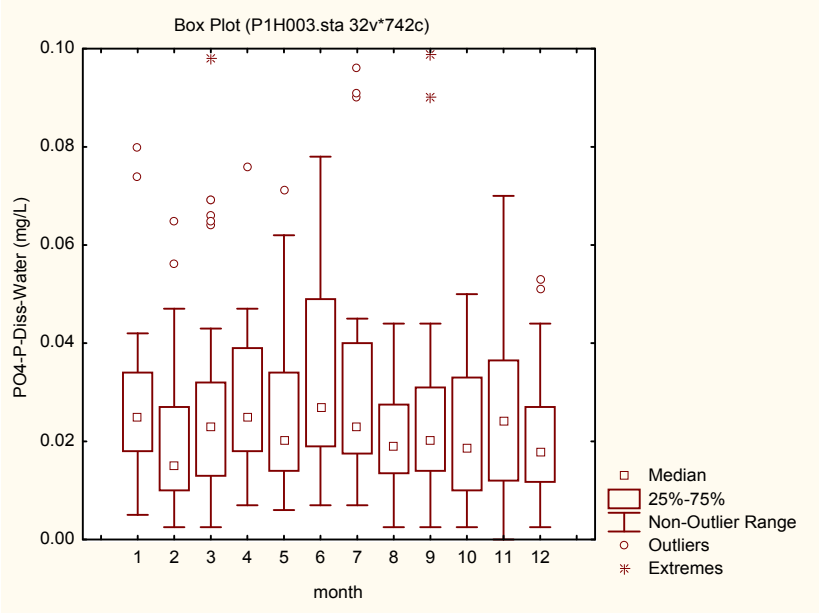


Figure 26. Phosphate values at Site Q6 on the Boesmans River.

Site Q16 (Howisonpoort Dam)

Electrical Conductivity

Domestic

The EC values for water at this site lie between 10 and 90mS/m, and for most months values are well below 70mS/m (Figure 27). This water is therefore within DWAF target range for domestic use.

Livestock

With such values, the use of water from this site will be suitable for livestock watering purposes.

Agriculture

Although wetting of salt sensitive crops with this water should be avoided, moderately salt sensitive crops could be sustained using a low- frequency irrigation system.

Ecological

In ecological terms the water quality at this site may on the whole, be classified as being in good condition although for the month of August EC values were higher than 55mS/m meaning that the water for this period should be classified as ‘fair’.

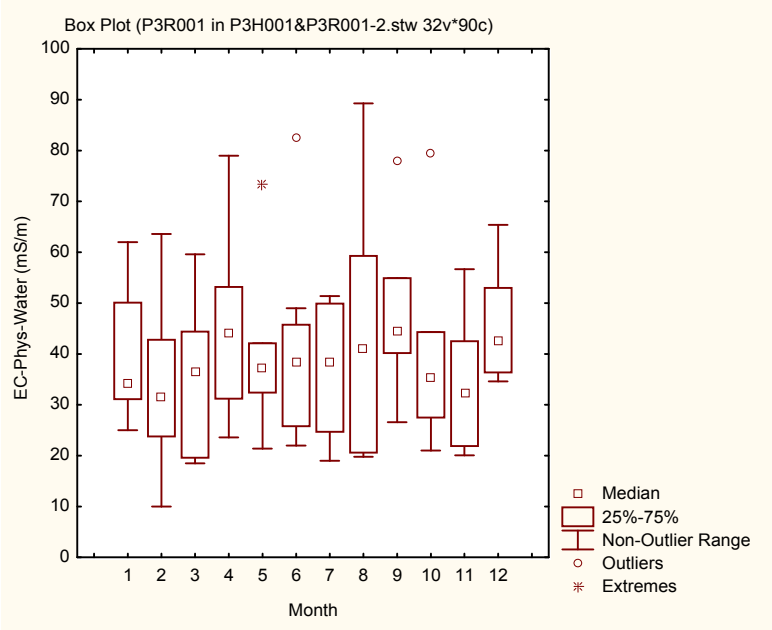


Figure 27. EC values for Site Q16 at the Howisonpoort Dam

Phosphate

Howisonpoort Dam is on the Kariega River. It is characterised by very low concentration of phosphates and therefore little nutrient enrichment (Figure 28). The site is in a 'good' condition.

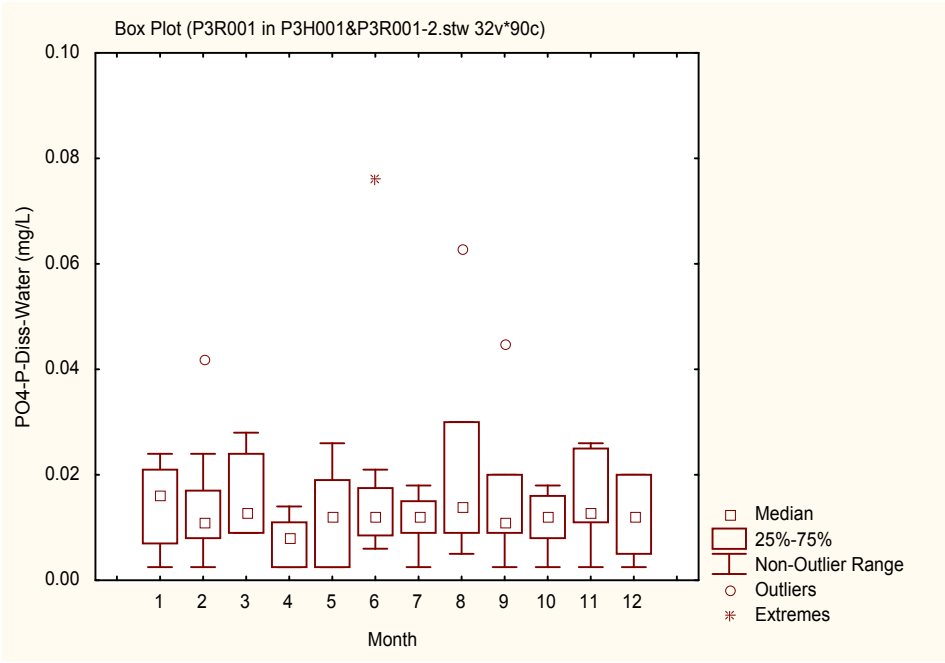


Figure 28. Phosphate values at Site Q16 at Howisonpoort Dam.

Site Q14 (Jameson Dam)

Electrical Conductivity

Domestic

For much of the year, the EC range is well within the DWAF guideline Target Water Quality Range for domestic use of 0 to 40mS/m. For January, November and December however, EC values were much higher. As these values did not exceed 150mS/m no health effects are likely (Figure 29).

Agriculture

Similarly for agricultural purposes, it is only the EC values above 90mS/m such as seen in November that are of real concern. Irrigation of salt sensitive crops with such water should be avoided.

Livestock

As far as livestock watering is concerned, these EC values are well within acceptable limits.

Ecological

Since for most of the year, EC values are less than 30mS/m, the water may be considered to be in a natural state.

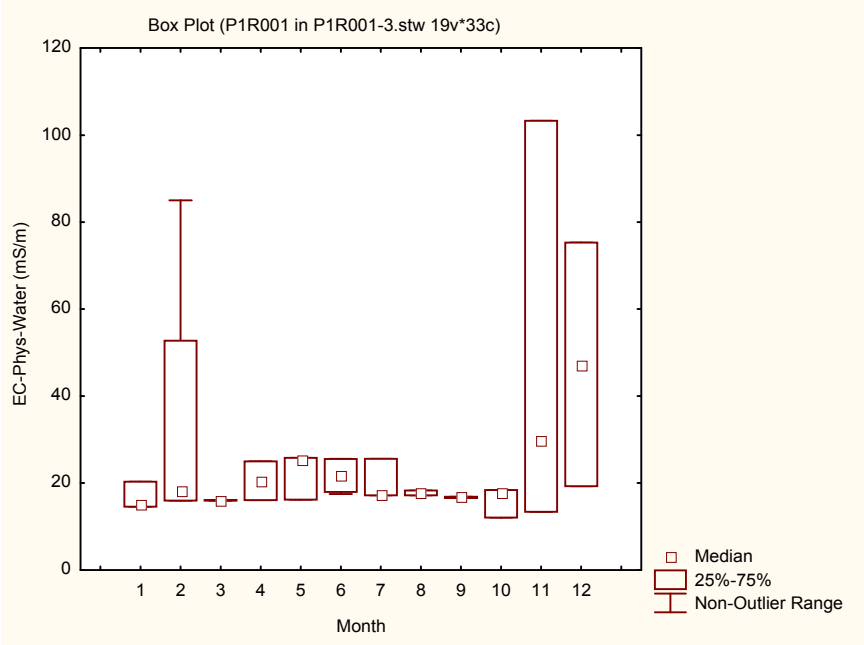


Figure: 29. EC values for Site Q14 at Jameson Dam.

Phosphate

The Jameson dam is also located in the New Years River in the upper reaches. Phosphate concentration is small, especially in March, July and October (Figure 30). The site is in a 'good' condition.

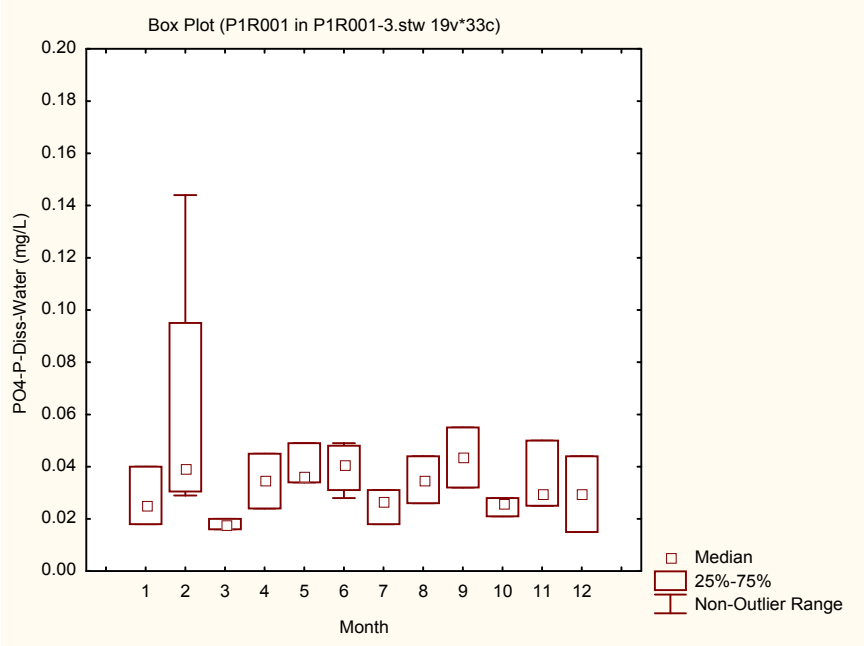


Figure 30. Phosphate values for Q14 at Jameson Dam.

Site Q9 (Kap River)

Electrical Conductivity

Domestic

The EC data for this site is relatively variable. For the first three months of the year, EC values can be seen to fluctuate between approximately 50mS/m to close to 200mS/m (Figure 31). This means that at its worst the water will be likely to have a salty taste and possibly have some effects on plumbing and appliances such as increased corrosion. The water should be safe to drink.

Agriculture

Moderately salt tolerant crops could be maintained using a low-frequency application of this water without significant yield decreases.

Livestock

This water should be completely safe for livestock watering, apart from a possible initial reluctance to drink in the case of poultry and/or pigs.

Ecological

As the median EC values were mostly between 55 and 85mS/m, for example in the months: April, May, June; the ecological condition of site should be fair. However, the presence of values larger than 85mS/m at other times during the year does call for investigation of individual salts.

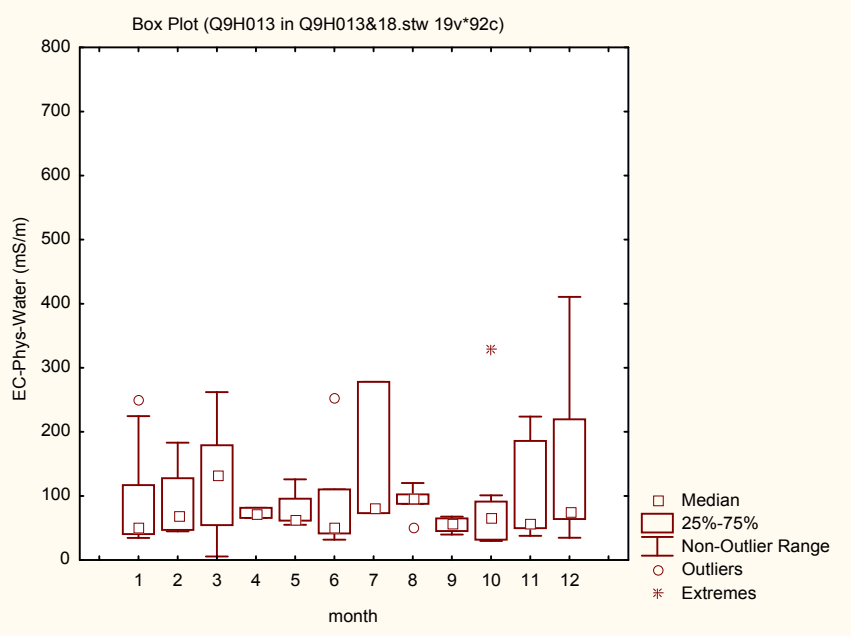


Figure 31. EC values for Site Q9 on the Kap River

Phosphate

The site is located in one of the tributaries of the Great Fish River. As the river's mean phosphate concentration was about 0.02 (Figure 32), it can therefore be considered as being in a 'good' condition.

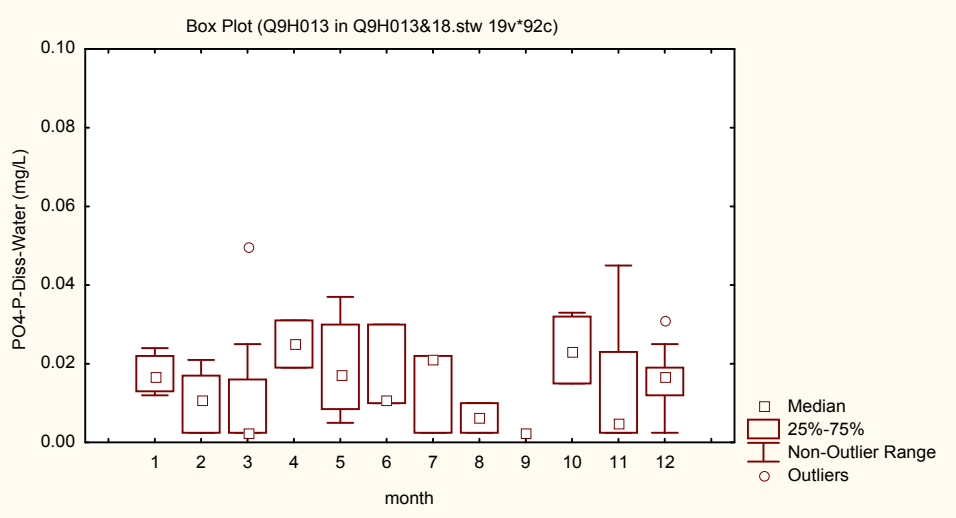


Figure 32. Phosphate values for Site Q9 on the Kap River.

Site Q8 (Kariega River)

Electrical Conductivity

Domestic

As with the Boesmans River, EC values are elevated relative to DAWF target water quality ranges. This water will have an extremely salty taste and noticeable short-term health effects are likely. Alternative sources of water should be used for drinking.

Agriculture

As the EC values for this site are mostly between 200 and 600mS/m (Figure 33), the likelihood of sustainable irrigation being possible is not high.

Livestock

Care should be taken when allowing stock to access these waters, particularly in the early part of the year. With EC values of 450mS/m and 600mS/m, poultry, pig production will in all likelihood decline.

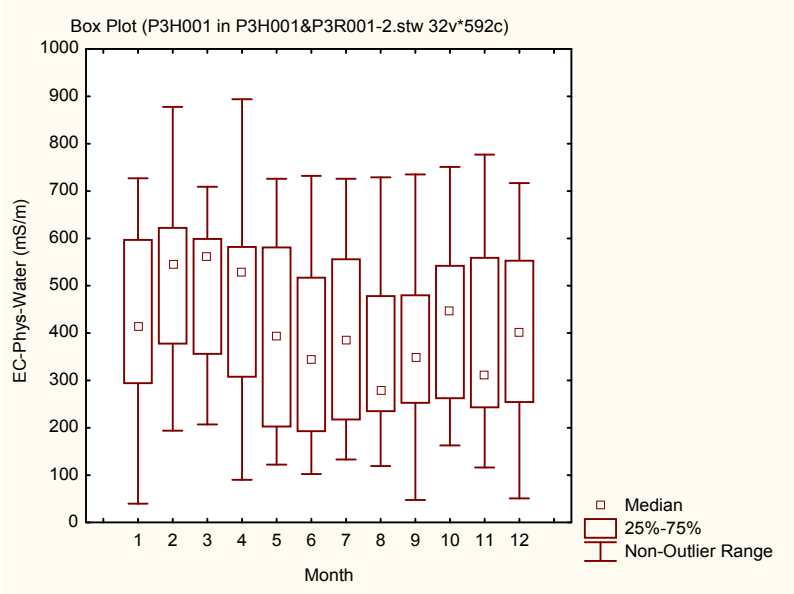


Figure 33. EC values for Site Q8 on the Kariega River

Phosphate

This site is located in the lower reaches of the Kariega River. The phosphate concentration was very low throughout the year fluctuating around 0.04 mg/l (Figure 34). The site is in a 'good' ecological state.

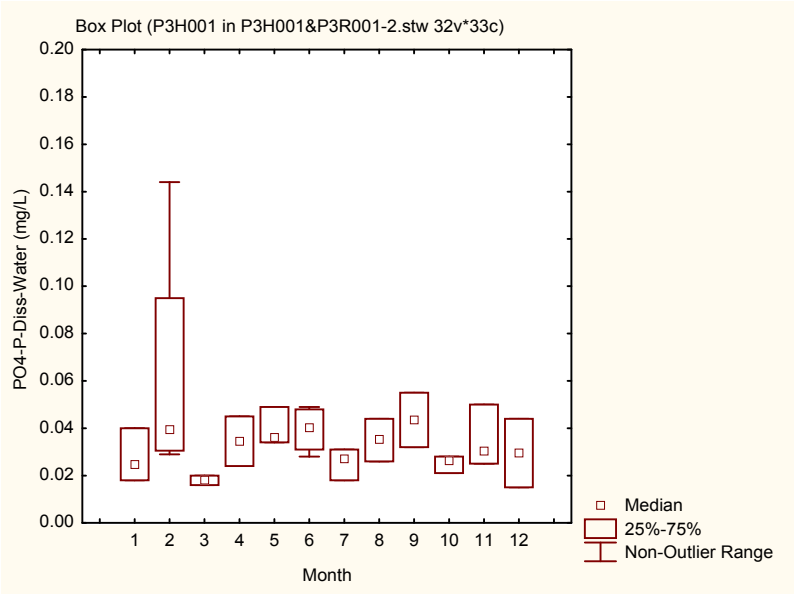


Figure 34. Phosphate values for Site Q8 on the Kariega River

Site Q15 (Milner Dam)

Electrical conductivity

Domestic

The EC values (Figure 35) at this site are low and with the exception of August, fall within target quality range for domestic use, this being less than 70mS/m.

Agriculture

Water from this site is also suitable for agricultural purposes (irrigation) as EC values of less than 40mS/m should ensure that salt sensitive crops can be grown without yield decreases.

Livestock

Since EC values are all below 150mS/m this water would be completely safe for livestock watering purposes.

Ecological

With EC value

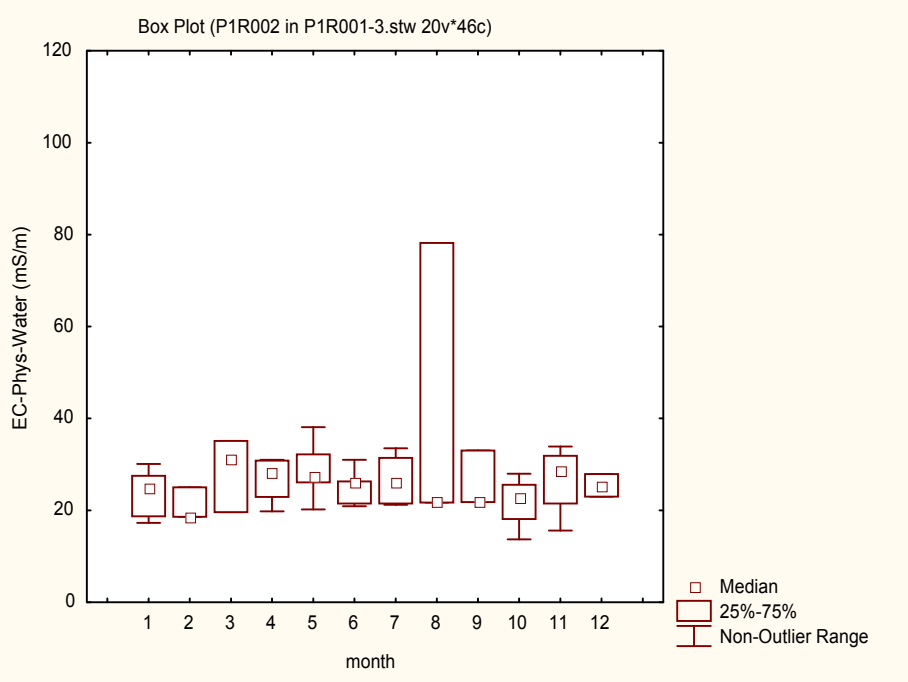


Figure 35. EC values for Site Q15 at Milner Dam

Phosphate

The Milner Dam is also situated in the New Years River in the upper reaches. The phosphate levels fluctuate around 0.02 mg/l (Figure 36). The site can be considered in a 'fair' condition, despite higher levels in July.

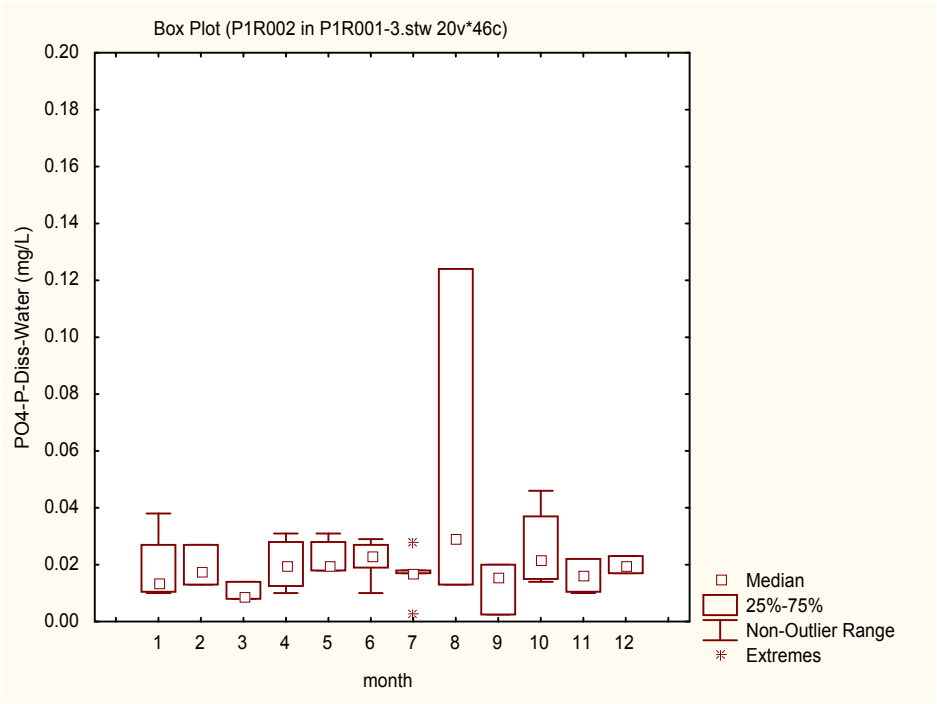


Figure 36. Phosphate values at Site Q15 at Milner Dam.

Site Q7 (New Years Dam)

Electrical Conductivity

Domestic

This site is located on the New Years River, close to the south-western boundary of the Municipality. The EC plot below (Figure 37), shows that for the most part, EC values were 50mS/m and 100mS/m. According to DWAF guidelines, this water should not be likely to have any adverse health effects in the context of domestic use as EC values between 0 and 70mS/m form the target water quality range.

Agriculture

For agricultural use, EC values of less than or equal to 40mS/M are the DWAF target water quality range, at this for which values are higher than this, a 95% relative yield of moderately salt-sensitive crop could be grown.

Livestock

For livestock, any EC value less than 450mS/s is acceptable, except for pigs and poultry for which there may be a slight temporary decline in production.

Ecological

Since the median EC values are all between 55 and 85mS/m, ecologically the site may be classified as fair. As there are maximum EC values higher than 85mS/m, individual salts will need to be studied.

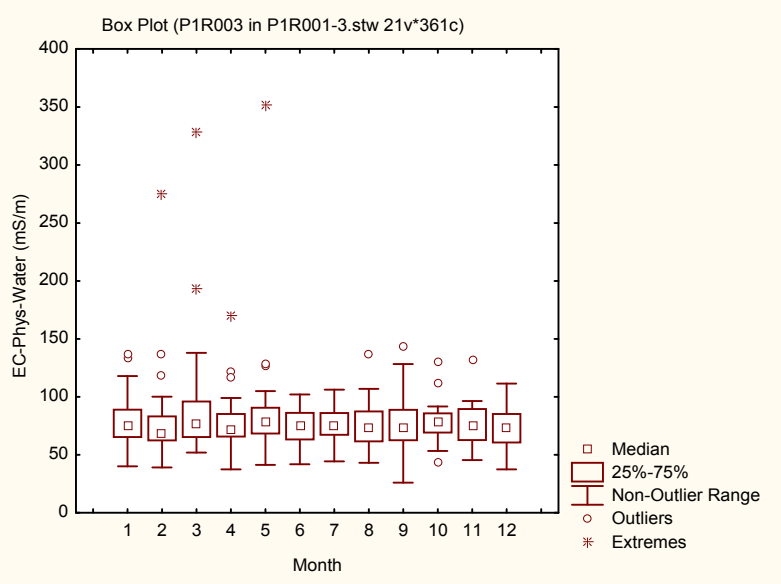


Figure 37. EC values at Site Q7 at New Years Dam.

Phosphate

The New Years dam is located in the lower reaches of the New Years River, just before this river joins Boesmans River. The concentration of phosphates is very low throughout the year (less than 0.2mg/l)(Figure38). For this reason the river on this site can be considered as 'fair'. However, there are extremes where phosphate levels increase, especially during wet seasons. This may be due to phosphates washed towards the river during runoff.

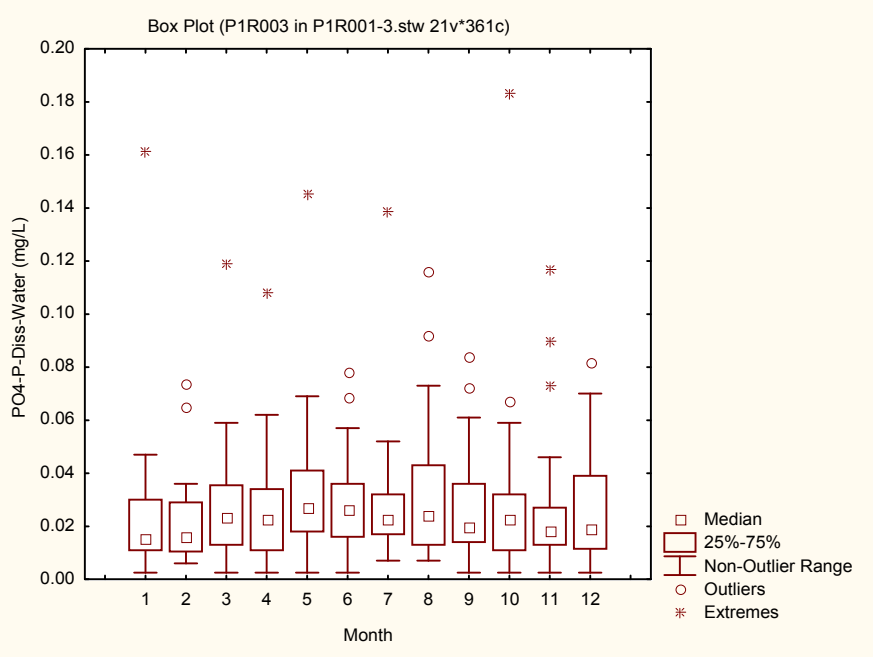


Figure 38. Phosphate values for Site Q7 at New Years Dam.

Site Q5 (Settlers Dam)

Electrical Conductivity

Domestic

The EC values (Figure 39) are much the same as those of the New Years Dam, with most of the values lying between approximately 50 and 100mS/m. The water at this site is thus safe for domestic use.

Agriculture

Most values are higher than 40mS/m meaning that the success of salt-sensitive crops cant be ensured. However, moderately salt-sensitive crops could be grown while using this water for irrigation.

Livestock

Having EC values lower than 100mS/m, no significant adverse effects should be expected.

Ecological

This site may be classed as being fair I for those periods when the EC values were between 55 and 85mS/m, but as the EC values exceeded 85 for much of the year individual salt concentrations will have to be taken into account.

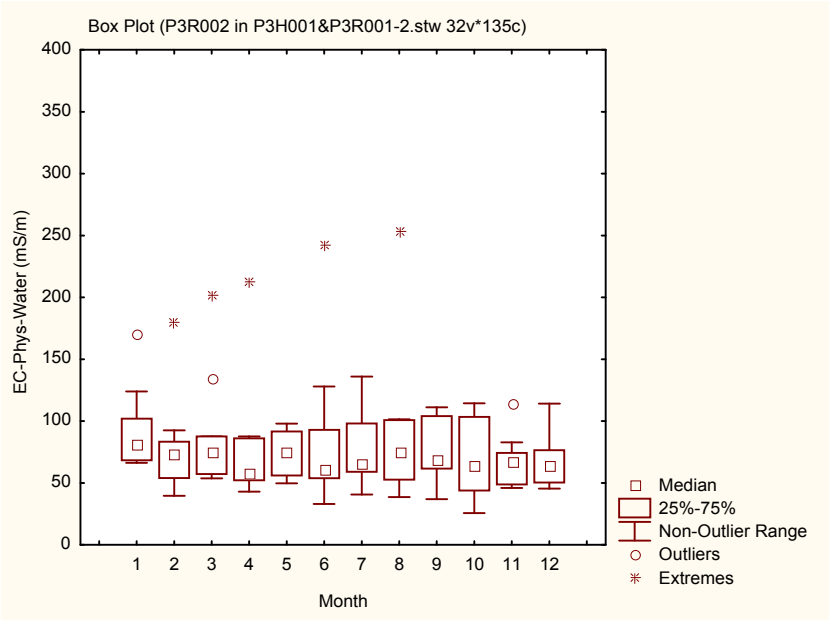


Figure 39. EC values Site Q7 at Settlers Dam

Phosphate

The Setters dam was constructed in the Kariega River. Phosphate levels are very low (Figure 40), probably because the site is located in an area with low negative land-use impacts. The river at this site can be classified as being in good condition.

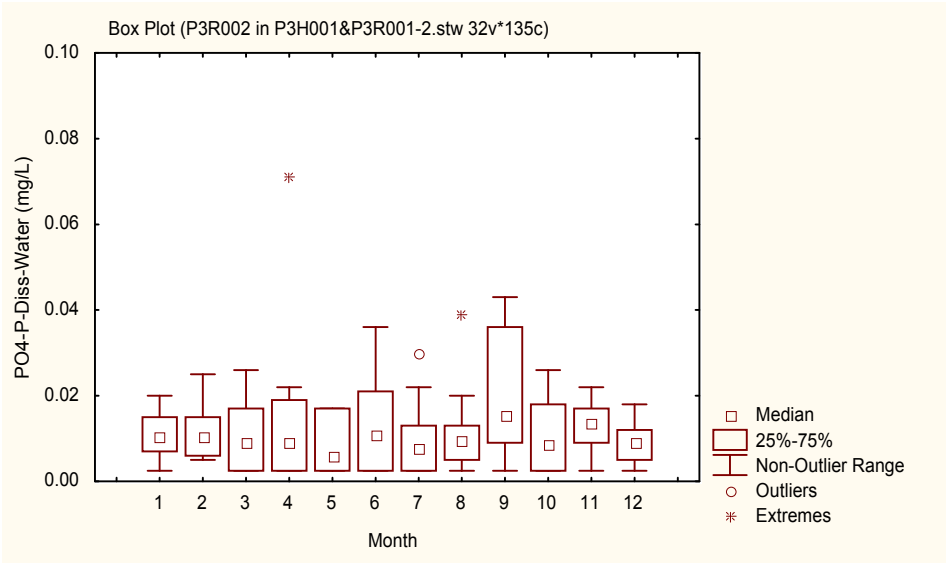


Figure 40. Phosphate values at Site Q5 at Settlers Dam.

STAKEHOLDER CONSULTATION

Leap Issues Summary

This section provides a summary of the issues raised at the LEAP public meeting of 6 April 2004. Residents of Makana, their representatives, NGOs, business and any other interested parties, were invited to attend this meeting. During the meeting the project team described the objectives of the LEAP. Opportunity was given for the public to describe the key environmental issues faced within the Makana Municipal area and to bring these to the attention of the project team.

The issues raised have been categorised under the different 'station' themes provided for at the meeting. The themes are broken down into the main issues raised at the meeting and then the problems/opportunities associated with each issue. During the remainder of the LEAP process these identified issues will be prioritised with the assistance of the LEAP Stakeholder Group and through further communication with key stakeholders. The full list of comments is available on request.

Station 1. Biodiversity and Ecosystems

<u>Promotion of indigenous plants</u>

- Maintaining biodiversity leaves a good impression with tourists
- Loss of biodiversity limits local opportunities
- In riparian corridor, enables clean water and EE opportunities
- Wetlands being drained, overgrazed and overexploited

<u>Promoting indigenous fish and fauna</u>

- Threatened via land degradation
- Threatened via alien species, so they need removing
- Endangered species being lost

<u>Eradication of alien invasives</u>

- Can have negative impact on environment
- Cutting, poisoning, re-cutting cycle seems like a waste of time and funds

- Dumping garden refuse exacerbates the problem
- Proliferation in private gardens
- Valley bushveld needs clearing
- Roads and railways act as seed beds
- Reduces fire risk

Extraction of medicinal plants

- Unregulated
- Over harvesting
- Can be conserved through urban greening

Preserving linkages between ecosystems

- Need healthy trees in urban areas retained
- Blaukrantz/Ecca need preserving and better management by MM
- S. Commonage conservancy needs forming

Management of private game reserves/farms

- Unregulated
- Non indigenous fauna stocked
- Natural environment overtaken by private interests, excludes the populace

Deforestation and land degradation

- Including natural bush
-

Station 2. Land and Livestock

Inappropriate irrigation

- Salty soil, useless land and erosion

Overgrazing

- Generally in rural Makana
- On commonage

Land shortage for small farmers and cultural use

- Access commonage for cultural use needed
- More land required for communal grazing, to allow rotation and resting of fields
- No visible land reform in Makana

- Stray animals in urban areas
- Stray animals need removing

Technical support and skills support for small farmers needed

Fencing required to keep livestock off roads

- All roads effected, urban and rural
- Uncontrolled grazing on verges
- Danger and tourism loss

Need for land-use planning

- Especially with conversion to game farming

Knowing carrying capacity of land

- Need to promote quality and not quantity

Knowing carrying capacity of market and supporting infrastructure

- Need sustainable veld management practices

Station 3. Waste, Industry and job creation

Recycling needs boosting

- By municipality
- Need to separate at source (like Knysna)
- Timber could be separated
- Bottles can now be recycled in Makana

Jobs need creating

- Attention to transport from residential areas required
- Poor roads damage economy
- Should be a general and LEAP priority
- Promote international flights to PE
- Promote charter flights to Grahamstown
- LEAP should promote labour intensive emphasis

Waste management

- Landfill site
- More skips required

- Toxic waste needs addressing
- Littering

Better networking across agencies needed

Mines need rehabilitation

- Financial assistance needed for all Kaolin mines

LEAP should promote LED

Station 4. Water quality

Access to water

- Need to consider rainwater harvesting. Tension between cost and access
- Health hazard vs. water purification
- Needs extension
- Effect of boreholes in urban areas
- Over use leads to a lack of basic access

Water conservation

- Rainwater harvesting
- Cars, swimming pools etc. wasteful
- Recycling of grey water
- Restrictions on water tanks in urban areas need lifting
- Awareness needs raising
- Need to determine existing capacity
- Irrigation overuses resources and makes salty soil
- Makes access issue easier

Access to sanitation

- Lack of sewage system
- Need (managed) public toilets
- Poor sanitation systems in townships

Unsafe tap water

- Is it purified/safe?

Sewage treatment

- Poor

Dams as recreation facility

- Settlers dam

Drainage

- Poor system, especially in townships

River pollution

- Through erosion from alien plants
- Incidents need action (tar into Howison's Poort)
- Rubbish dumped in rivers
- Skips too near rivers
- Clean up of Kowie and tributaries required
- Control of diffuse runoff required
- Cattle in township
- Effluent management double standards, some manage at great expense, while others dump
- Discharge standards inadequate

Station 5. General

Heritage conservation

- Required
- Historic sites and landscapes
- Need a well designed and integrated signage system
- Cultural/historical sites need identifying
- Municipal sites need maintenance (e.g. Grey dam, bible monument etc.)
- Historic core needs preservation
- Cultural/custom area required close to down
- Aesthetic building standards need maintaining
- To promote tourism
- To promote community cohesion
- Sense of pride and place

HIV/AIDS

- Support for sufferers required
- Safe havens needed for orphans

Wide stakeholder involvement required for LEAP

Animal problems

- Poorly cared for
- Limits/home required for dogs
- Prevalence of disease
- Veterinary services required for poor areas
- Livestock need removing from suburbs
- Dangerous dogs let loose

Environmental Education support required for plans

- To ensure support for plans
- Current lack of awareness
- Resources overused

Suburb planning

- Potential for poorly planned suburbs due to housing shortage
- Greening needs rectifying (25% have 75% of green areas)
- Green belts need protection
- Green areas/trees needed in new housing developments
- Greening provides shade, wind breaks, recreational space, erosion control
- Need to incorporate social and environmental sustainability
- New township areas badly laid out

Economic realities need understanding

- Economic overlay of LEAP required
- Issues need integrating into socio-economic context
- Many 'sustainable' interventions ignore economic realities and fail

Energy efficiency/conservation needs promoting

- Green building emphasis needed
- Efficient use of water, energy etc. (insulation, water tanks etc.)

Poverty and unemployment

- Food security through urban greening

- Encourage home food production
- Hunger, disease and poor living conditions

Noise nuisance

- Dogs barking
- Students
- Digs need controlling

Environmental regulations

- Need understanding
- Need enforcing

Population control/in-migration

Urban cohesion (between different populations) needs promoting

- Transport
- Urban design

Transport

- Vehicle maintenance required
- Roads poorly maintained

STAKEHOLDER MEETINGS

Since the beginning of the LEAP process Nick Hamer has consulted with various key stakeholders, including formal meetings held with Bulie Madlavu (Makana, Director, Corporate and Social Services), Kevin Bates, (Makana, Parks and Recreation, Melikhaya Tshungu (Makana, Director, Technical Services and Infrastructural), ECARP, Masifunde and Sean Haydock (Grahamstown recycling). The following summarises the issues that were highlighted in these discussion. Most of the issues were also brought up during the LEAP public meeting. The discussion serves as a starting point to understanding some of the challenges around issues that have been identified and how the LEAP process may help prioritise these concerns and take them forward.

Land

Various challenges relating to land management are seen as a key challenge faced in Makana.

Urban greening

The need for urban greening is well recognised, but currently faces difficulties, due to factors such as the number of cattle in urban areas. Urban greening can't occur without the cattle issue being resolved. There is concern that if such issues are not tackled there is an increased likelihood of worsening social issues, a 'clean and green' environment is seen as physically and socially better to live in. The construction and placement of parks and playgrounds and woodlot management could also improve the urban environment.

Rural development

There is a perceived lack of expertise and delivery at Makana Municipality on rural development. MM see their role as to engage with DLA and other agents, but are not mandated to get involved with private sales, so just aim to facilitate processes.

Fort Brown is an exception, where bulk water infrastructure is being provided, tourism/crafts projects developed as well as plans for an agri-village. The aim is to provide for viable rural communities near ex-farms and prevent in-migration.

Stock farming

An ongoing issue is the shortage of grazing land for small stock owners and/or some stockowners owning too many cattle, resulting in a lack of rotational grazing and over-grazing in many areas. So far branding of animals has not yet occurred, which makes commonage management difficult to monitor. There also is a perceived male gender bias around commonage management. There is also the issue of different expectations around land-use, with many promoting commercial stock farming, while communities may wish to keep cattle for primarily cultural reasons. This does impact on what stock density is seen as appropriate.

Concern was raised that LEAP must not bypass farm workers and farm dweller concerns in discussions about land use. Evictions of farm workers have secondary impacts that can be overlooked, such as leading to additional cattle on the commonage. It was suggested that the department of agriculture must also be involved in the comprehensive audit on land issues.

Emerging farming challenges

Many interventions to support emerging farmers have faced serious challenges, as farming is seen as a way to generate income and create food security in rural areas. Poultry, pig and crop farming projects have been subsidised by government in terms of infrastructure but many have struggled to become viable businesses. A major difficulty has been in sustaining farming infrastructure such as dipping tanks, electricity, water etc.

Various projects are running where free-range chickens/pigs are kept and organic vegetables grown, as well as in ‘conventional’ agriculture. There may be scope for an initiative to be developed that could help emerging farmers access local markets. One suggestion being that perhaps a pilot organic market could be facilitated via LEAP

Game Reserves

There is still a lack of clarity on the actual number of jobs created by game reserves (especially for local communities), though the Alicaedale initiative does seem to have had a major impact. There tends to be an emphasis on stock/crop farming for 'emerging' farmers, though there is interest (but a lack of skills) in game farming. There is some concern that the social programmes of private game reserves are mainly to create a positive image. There has been a lot of discussion around this initiative within Makana Municipality, including a perception that there has not been transparency around Environmental Impact Assessment.

Veld fires

There is some concern that they seem to be increasing on an annual basis, so a conscious effort is required to minimise these fires.

Alien vegetation

Is another major issue that needs managing and an effective programme to control it is required.

Waste and recycling

Waste is seen as a huge issue, with there being a total disregard of the environment (littering and illegal dumping). There is a need to change the mindset of people re. the environment. Since democracy came, there has been an expectation from people that the government will deliver and so delivery is waited for. Urban greening is also required, with more trees and flowers etc. required.

It is felt there has been a lack of progress in developing recycling together with Makana Municipality, though several positive developments have occurred Grahamstown Recycling now employs 15 people, up from 5 three years ago and there is plenty of scope for far more employment and greater recycling levels. This could be achieved by better

collection of materials such as paper and looking into how other materials might be collected and recycled in Makana, such as plastic bottles and tins.

Rhodes University should soon be expanding its paper recycling efforts together with Grahamstown Recycling. It is estimated this would generate a saving to Rhodes of at least R10 000/annum, as well as creating new jobs and reducing waste.

The recent hospital oil spill shows some of the shortcomings of the municipality, in that there was not an awareness of this as being a potential issue. Different municipal departments are not seen as well integrated with each other in this regard. Planning at the moment tends to be quite reactive, with issues being tackled as they arise.
At the moment environmental issues can get pushed aside as the pressure to increase service delivery increases. A problem here is that there is a lack of controlling bodies to enforce environmental management. A lack of media awareness on environmental issues is also seen environmental issues being overlooked.

Energy

Energy usage (especially electricity and paraffin) needs to be looked at. A great deal of progress has been made with regard to access to electricity, though it needs to be recognised that access and usage are not the same. Makana is simply not able to afford the free electricity it is supposed to provide. There is a need to consider how better access to energy can be achieved within financial constraints and to consider how this could help boost the local economy.

Food security

Nutrition is another major challenge, with many different components. There is a lack of food available for many people in Makana (food insecurity), a lack of local food production and an expectation of jobs for in-migrants and not for home food production. On the other hand institutions in Makana (schools, restaurants etc.) and wealthier individuals are seen as been wasteful, with fresh food being dumped at the landfill site. It was felt that excess food could perhaps be provided to shelters or feeding schemes.

Sanitation

Priority no. 1 is to eliminate the bucket system from Makana, R30 million has been earmarked to achieve this by 2006. VIP is not seen as practical in Grahamstown, due to clay soils and no reason is seen not to have a flush system. Tenders are now out to provide water borne sanitation in parts of Grahamstown, Alicedale and Riebeck East. In farming areas VIP/basic systems have to relied upon and the municipality is not enable to enforce solutions in these areas and so remains a challenge to be addressed.

Housing

Eliminating informal settlements and ensuring water access are also priorities. Some informal areas have been identified for development. The aim is for new development to occur close to town.

Other

HIV/AIDS

This is clearly a major issue that cuts across all sectors

LEAP process

Aside from issues per se several recommendations were made on how the LEAP process might be strengthened. These suggestions are summarised below:

- LEAP should consider some of the key issues raised by the Provincial Growth and Development Plan, particularly as some felt that it does not adequately address soft environmental issues.

- LEAP should 1st pilot programmes in Grahamstown, then widen the net after lessons have been learned.

- LEAP needs to look at what it may be able to afford for implementation, so that the stakeholder group (and stakeholders generally) have an idea of a budget that can be worked with.

- LEAP needs to learn from mistakes of other well-meaning initiatives that have failed here due to a lack of funding, commitment and capacity. It is key to avoid over-raising expectations and starting a talk shop. Starting small is seen as a good approach

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Appendix 1. Key issues identified in the Eastern Cape State of the Environment Report

Air quality

Climate change

Cumulative impacts of several polluting sources in a specific area

Growth in air traffic demand

Health impacts associated with exposure to pollution

Inadequate disposal of waste

Incineration and disposal of medical waste

Increasing development

Need for strategic planning

Poor air quality

Proximity of residential areas to sources of pollution

Sources of pollution – industrial, forestry, burning of waste, tanneries, brick works, household energy use, construction activities, heavy vehicle use

Waste minimisation (industrial ecology – the waste of one industry provides the raw material for another)

Biodiversity

Afforestation

Biological control of alien organisms

Bio-prospecting

Desertification and climate change

Habitat change

Habitat fragmentation

Habitat loss

Increasing industrialisation

Introduction of exotic flora and fauna

Loss of biodiversity

Biodiversity

Policy implications of loss of biodiversity
Resource value
Spread of alien/invasive species
Strategic conservation of biodiversity
Trade in endangered species
Unsustainable resource use
Veld fires

Built Environment
Disposal of sewage effluent (of questionable quality) into rivers
Inadequate collection of waste
Inadequate management of waste disposal sites
Inadequate road maintenance
Inadequate waste minimisation (e.g. recycling)
Increasing industrialisation and pollution
Informal housing developments
Majority of the population is currently living in the rural areas of the province
Promotion of alternative energy technologies
Provision of infrastructure – telecommunications, transport, housing

Environmental Management
Provision of services – waste management, water, sanitation, energy
Alignment of environmental legislations in various departments for the function of environmental management
Alignment of IDP's from District and Local authorities
Alignment of local, provincial and regional tourism plans
Appropriate allocation of funding – applies to all themes
Crime and corruption – applied to all themes
Education, awareness & communication – applies to all themes
Enforcement of legislation – applies to all themes
Inadequate waste minimisation

Increasing industrialisation and development
Institutional capacity – applies to all themes
Integrated Environmental Management
ISO certification of local authorities

Freshwater
Joint initiatives between DEAET and other stakeholders
Declining resource quality
Eutrophication
Habitat change
Implementation of Catchment Management Agencies
Loss of biodiversity
Non-compliance of sewage works
Over-abstraction of surface and groundwater
Pollution from various sources into surface and groundwater
Resource use and exploitation

Land
Agricultural encroachment vs. increasing development pressures on land
Complex problems related to land tenure, access to land and jurisdiction over land
Conflicts over land use
Decreasing natural vegetation
Desertification (and climate change)
Illegal use of land (and land invasions)
Land degradation
Land reform process
Land use change
Mining and its impacts
Overgrazing and overstocking
Soil erosion and soil quality
The use of herbicides and pesticides

Uncoordinated land use planning
Unsustainable development

Marine and Coastal
Change in land use
Development pressures
Ineffective community involvement
Lack of strategic planning
Loss of biodiversity
Marine pollution (overuse of septic tanks, beach & estuary pollution, poorly sited landfills, agricultural run-off, ineffective sewage treatment, shipping & fishing pollution, storm water run-off)
Resource use and exploitation
Ribbon development along the coast
Threats to the marine & coastal environment

Socio-Economic
Access to natural resources, particularly for subsistence
Current backlog in educational infrastructure and teaching capacity
Discrepancies in information between former homeland areas & RSA, as well as rural and urban areas
Inadequate expenditure of the annual health budget, particularly for HIV/AIDS
Increasing HIV infection in the population
Increasing urbanisation and decline in rural populations
Just under half of rural households are classified as ‘very poor’
Lack of formal housing for more than 1/3 of the population
Low levels of formal education
Low literacy rate
Majority of the population lives in the rural areas of the province
Migration of population to other provinces
More than 20% of population under 34 years is HIV positive

More than half the population in the province is unemployed
Nutrition related diseases
Population growth of 2.1%
Predominantly young population (48% below 19 years)
Skew distribution of economic activities in the province, perpetuated by IDZ's
Skew representation of historical statistics, former homelands were not accounted for in previous Census years.
The economy is strong and diverse, manufacturing is the largest sector
The province has the lowest average monthly expenditure
The province has the second lowest HDI in the country, well below the national mean
The province has the second lowest personal income per capita
Water borne diseases, particularly in the former Transkei area

(Eastern Cape Province State of the Environment Report 2003, Eastern Cape Key Environmental Indicators, Background Information, September 2003).