Makana Municipality
Local Environmental Action Plan

Environmental Audit Report:

Waste Management, Sanitation, Water Services and Industrial Environmental Management

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Executive summary

The current status of waste management, sanitation, water services and industrial environmental management in Makana Municipality has been investigated as part of the Local Environmental Action Plan (LEAP).

The most common observation are that littering and illegal dumping occur throughout urban areas in Makana Municipality. This not only affects urban areas themselves, in terms of health and aesthetics, but greatly affects property values and the quality of rivers and streams around the towns. This has a dramatic affect on the ability of rivers and streams to sustain biodiversity.

The municipal skips provided by the municipality serve to contain waste to be collected in limited areas, these however are often badly sited and waste spills out of skips due to animals and people searching for recyclables. These skips are also meant for garden refuse only but are used extensively for general refuse.

Three permitted landfill sites exist in Makana namely, Grahamstown, Alicedale and Riebeck East. Grahamstown landfill site is the largest and produces leachate which is controlled by two dams downstream of the site. The biggest issue at this site is the fact that there are people living on and around the site, some of which are permanent residents, others are reportedly 'hiding' and using the leachate water for domestic purposes. Alicedale and Riebeck East sites are very small and both burn waste as part of permit conditions. This is not the ideal means of disposal of waste due to release of greenhouse and other noxious gases during burning.

The municipality has recorded that approximately 39500 m^3 of vegetable waste is disposed of in the Grahamstown landfill site annually. A project has been started through the Centre for Entrepreneurship at Rhodes to turn this waste into compost.

Two recycling businesses operate in Grahamstown only, namely: Grahamstown Recycling and Eastern Cape Bottle Buyers (ECBB). These businesses are often marginal and need community and municipal support to remain viable.

Hazardous waste is of little 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 have been investigated and though in many cases the disposal methods were adequate, in a number of sites improper disposal methods were being undertaken. Noteworthy hazardous waste observed at the Grahamstown Landfill Site includes sewage sludge, animal carcasses and abattoir waste. There is currently no other means of disposal of such wastes.

In Makana Municipality not all households have the RDP sanitation standard according to Census 2001 figures. The municipality has embarked on a "bucket system eradication programme" which may take a number of years to complete. The major environmental problem that occurs with this system is when collections are late many people dispose of sewage on streets or in stormwater drains leading to health and environmental impacts.

In Makana Municipality there are two sewage treatment works in Grahamstown and one in Alicedale. Current disposal methods of hazardous sludge pose a major environmental hazard as there is a possibility that sewage sludge is getting back into the river systems after treatment. On average the Grahamstown Disposal Works has achieved the General Limits for most parameters tested over the last four years. Mayfield STW has a sludge drying system which leads to large volumes of hazardous sludge which presents disposal problems. It was found that there is no co-operation between the institutions which test the treated effluent and this has created a situation in which information is not shared and no coherent data base of treatment works function exists.

There is no database available on water resources for developments in Makana Municipality. According to Census 2001 10% of households in Makana Municipality fall below the RDP levels. Only 22% of people have water inside their houses. In Grahamstown the water is purified at the Waainek and Jan Kleinhans purifications works. In Alicedale, water is purified in a works close to the Bushman's River on the west side of town. Riebeck East's water is obtained from boreholes and is not treated.

Industrial Environmental Management practices were investigated. It was found that the larger corporately owned businesses and franchises often have environmental policies and codes of practice in place. The extent of compliance to these codes of practice is unknown.

The industries most in need of industrial environmental management are those which have hazardous waste and toxic waste waters, these include dry cleaners, tanneries, printing shops, garages and restaurants. All these industries require some level of training on appropriate waste handling and disposal methods. There is potential for co-operation between various businesses to have waste exchanges with existing waste recycling companies in Port Elizabeth or elsewhere. Many businesses also seem open to being audited for compliance to local and national environmental standards and legislation. Bylaws for trade effluents are currently being drafted. Bylaws on correct waste disposal practices should also be promulgated.

Air quality is not an issue currently but this will have to be monitored by the municipalities in future, especially to comply with updated legislation (not yet promulgated) and to take advantage of international protocols (Kyoto). To date no bylaws exist for the control of emissions which affect air quality or zonation of businesses which produce emissions.

Introduction

The current status of waste management, sanitation, water services and industrial environmental management in Makana Municipality has been investigated as part of the Local Environmental Action Plan (LEAP). The purpose is to develop a realistic picture of these aspects of environmental management in the municipal area. This will help with the formulation of action plans to address key issues but also create a record against which future developments in managing these issues can be measured. The information gathered during this phase was obtained by doing site visits and interviews as well as going through municipal records, 2001 Census data and getting the public's input via numerous stakeholder meetings. This report outlines the situation on the ground and identifies gaps in information which will require more detailed, full scale investigations beyond the scope of the LEAP.

Abbreviations

CBD – Central Business District
DME - Department of Minerals and Energy
DWAF – Department of Water Affairs and Forestry
EBRU – Environmental Biotechnology Research Unit
ECBB – Eastern Cape Bottle Buyers
GDW – Grahamstown Disposal Works
LDV – Light Delivery Vehicle
LEAP – Local Environmental Action Plan
MOP – Mayfield Oxidation Ponds
AEP – Alicedale Evaporation Ponds
RDP – Reconstruction and Development Plan
SET – Sustainable Environmental technologies
STW – Sewage treatment works
VIP – Ventilated Improved Pit Latrine

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 leads to environmental pollution, health hazards, flooding as well 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

Picture 1: Illegal dumping observed in and around Makana Municipality)

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

The Bloukrans River and its tributaries and storm drains in Grahamstown were choked with rubbish at numerous site visits throughout the year. This poses a high risk to the river health and biodiversity. This also causes 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 of this decreased efficiency. Resources are wasted as teams of municipal employees spend time after each rainstorm, unclogging rubbish choked drains. This time should be spent more productively maintaining infrastructure. Downstream water users are impacted upon by subsequent decreased water quality. Poor water quality affects irrigation of crops downstream and causes other clogging of pipes and pumps with litter, especially plastic.

Picture 2: Litter in drains and in the streams and rivers

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 (Bloukrans River), Matanyana River and eDakeni tributary. All of these areas are characterised by high poverty levels and refuse collection issues although weekly refuse collection reportedly does occur. 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 holes, adding to litter problems. People were observed scavenging in the skips for recoverables such as bottles while throwing non-valuable waste out of the skips in the process. Animal scavenging also adds to the spread of refuse out of the skips.

A number of skips are poorly positioned alongside watercourses, which leads to overflowing and windblown refuse in the streams. The worst example of such positioning was observed on the banks of the Kowie Ditch in Albany road near the taxi rank. A large amount of refuse is dumped in this area surrounding the skip and animals including donkeys, dogs and goats were observed scavenging in such skips. This further aggravates the spreading of the waste into the streets, stormwater drains and streams. Another poorly positioned skip is in Oatlands North right next to a wetland system which is home to birdlife and essential to 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. In general, it also has a negative visual impact on the entire area.

Picture 3: Litter and illegal dumping spoils the aesthetic of the commonage and green areas.

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. A major problem with the use of skips is that the high sides make disposal of large quantities or heavy items of garden or domestic refuse difficult unless the end doors are left open. However, as mentioned earlier, open doors allow animal scavengers

access to the waste which not only spreads litter, but is also bad for the health of the animals. An example of a good solution to this situation was observed in Somerset Heights where a ramp built along side the skip position allowed easy dumping into the skip while keeping large animals out. This solution would however be costly to implement throughout Makana.

Picture 4: 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

In the 2001 Census data, 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 unserviced. In Riebeek East, 30 out of 414 households remain unserviced 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.

Picture 5: 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. On interviewing members of the public on attitudes towards littering, it was found that many people are hoping the municipality will provide more jobs to clean up the litter. The large cost of cleaning up illegal dumping, unclogging drains and the social cost, money which could be used in uplifting of communities was most often not considered by the interviewees.

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 their impact on land, water resources, air and aesthetic aspects are minimised. 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 reportedly 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. Numerous site visits to the landfill were conducted and at no time was there any sign of leachate spraying for dust suppression as stipulated in the permit conditions and municipal records. It was difficult to determine whether cells are being constructed according to the guidelines.

A major concern is the people living on the dump site as well as squatting in the bush in the surrounding area near the dams constructed to catch and contain leachate draining from the landfill. These people access these leachate containment dams for their water needs and this is a cause for great concern due the strong possibility of the presence of heavy metals, carcinogens and bacteria meaning that the water in these dams is not fit for human use. Chronic health problems including cancers may result from the consumption of such leachate.

Poor or insufficient fencing results in significant amounts of windblown refuse littering surrounding sites. This was a major concern raised by the neighbouring property owner of the riding school. The property value has not only been significantly decreased but the windblown litter also has a large negative impact on business and the safety of clients. Windblown litter causes horses to spook, sometimes bolting, throwing their riders and even running into traffic. This is a major concern with many of the riders being children. Windy conditions cause so much windblown litter in the area that riding events have to be cancelled. This results in loss of revenue not only to the riding school from provincial and national events, but also to other Grahamstown businesses. Further loss of revenue occurs when potential clients and horse owners are put off by the littered environment which riding school employees struggle to keep under control.

The dumping of ostrich offal results in strong odours to be blown across the properties surrounding the landfill site at times when this waste is left uncovered for a prolonged time such as over the weekends. Better site management and waste covering will go a long way to reduce wind blown litter as will regular removal of windblown refuse from the fences.

No formal on-site salvagers operate although informal ‘picking’ does occur by the people living on the surrounding land. This practice 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 biogas 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. At WasteCon 2004, run by the Institute of Waste Management of Southern Africa, experts recommended that municipalities should start to prepare for the ratification of the Kyoto protocol by planning projects. Projects to capture biogas from landfill and sewage treatment works as well as cleaner technologies which would decrease greenhouse gas emissions would be able to seek funding from first world countries interested in carbon trading. 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 G: S: B- site (General: Small: insignificant leachate production) at the Western end of the town. The site is located in an old stone quarry. The site has a life span of 15 to 20 years at current disposal rates. This life expectancy may decrease due to current development plans and increased disposal rates. Burning of waste occurs once a week and no leachate problems were apparent. The burning of waste should be discouraged because this puts carcinogens, 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.

Picture 6: 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 non-flammables and though the burning of waste is a DWAF permit concession for this landfill, refuse continues to smoulder which causes air pollution in the form of carcinogens, odours 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 future 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 and greenhouse gases. No salvaging occurs and there is a relatively large quantity of scrap metal on site which could be recovered and sold.

Waste Management and Recycling

Good 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 the unrecyclable wastes. This will mean that waste management will cost the municipality less 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. Although these are private enterprises, the continued and increased support by the community and the Municipality would allow the businesses to expand and create jobs. This is an area where responsible waste management practices at household and workplace level can uplift the community directly while contributing to creating a cleaner more sustainable environment in Makana. Some restaurants recycle cooking oil by giving it to Port Elizabeth-based paint and varnish companies which fetch the oil. Motor oil is also collected from some of the larger

garages and workshops by an oil recycling company which sends a truck from Port Elizabeth. Car batteries are collected by some scrap dealers for recycling.

Picture 7: 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 a more prominent 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 high enough 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. The Centre for Entrepreneurship at Rhodes University reviewed business plans for recycling, finding that recycling is often not a viable business. However, many municipalities country wide have successfully implemented recycling projects, were revenue from recycling subsidises general waste management as helps to create additional jobs.

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. A community group, Mzam'omhle Waste Collection Group, expressed interest in setting up a recycling initiative which would mainly focus on the collection of aluminium cans. Access to the markets, price and the baling and transport of the cans to the nearest transfer station in Port Elizabeth presented the major obstacle as the group currently do not have any way of accessing start-up capital for the project.

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 (motor and cooking)
- Car Batteries

Some of the wastes that are not recyclable are:

- Polystyrene packaging*
- Food packaging*
- Window pane glass

- Windshields
- Building rubble
- Some hazardous substances (e.g. cell phone and long life batteries)**

* Note: New technologies and developments revealed at WasteCon 2004 showed that the recycling of polystyrene and similar food packaging is now possible.

** Internationally, technologies for recycling electronic waste are being developed and this is being brought to South Africa by a company called Sky Africa, although there is no certainty as to what kinds of electronic waste will be recycled.

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 has been carried out in other municipalities, should be undertaken to gather the information required to increase recycling in Makana Municipality.

Hazardous waste

Hazardous waste consists of chemicals, chemicals containers and substances that have been identified as being somehow harmful to people and/or the environment. Examples are transformer fluid, oils, medical waste and sewage sludge. Some hazardous substances are used in our households, for example, certain electronic goods. Other hazardous substances are used in laboratories, factories and the motor industry for various purposes.

In South Africa there are very few hazardous waste sites. Currently there are three sites in the Nelson Mandela Metropol area, namely Aloes 1, 2 and temporary. There is also one site in Uitenhage at Koedoeskloof.

The Department of Water Affairs and Forestry has developed guidelines on how to deal with various types of hazardous waste. These have categorised the various kinds of hazardous waste and outline the acceptable disposal methods for each category. Correct disposal practices of hazardous wastes are closely linked to effective industrial environmental management.

Hazardous Waste in Makana Municipality

Hazardous waste 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 further and remedied where necessary. The issues of highest concern surrounding disposal practices of hazardous waste materials and hazardous material containers is the lack of awareness of the very serious health and environmental consequences of incorrect disposal methods.

In a student study undertaken at Rhodes University, the following hazardous wastes were observed and associated the disposal practices notified:

- 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 stations 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. In some cases in Grahamstown, cooking oils are being sent to Port Elizabeth paint and varnish companies for recycling and many garages have systems for safe disposal of oil.
- 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 often contains 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 from high voltage electricity substations is highly toxic and should not be disposed anywhere in the municipality, but returned to the supplier. Containers used for transformer fluid should under no circumstances be used for other purposes, given away or disposed of in the landfill.
- Toxic wastewaters from abattoirs, tanneries and washwater from workshops and garages currently go to the municipal sewage works. This can enter rivers and streams from leaking, pipes storm water and run-off. Pre-treatment before release into municipal sewers should become standard practice for these wastewater streams according to individual and combined toxicities.
- Dry cleaning chemicals are highly toxic to humans and the environment but at the time of investigation no environmental disposal practices were in place. Empty chemicals containers were given away to use for water storage etc. Such dangerous practices must be stopped immediately and business owners made aware of the serious environmental and health implications of the chemicals with which they work.
- Sewage sludge is classified as infectious waste because of bacterial content and high concentration of nutrients. 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. In most cases these are being sent to WasteTech, however few industries wash hazardous chemicals down the drain, mostly because of lack of awareness and lack of alternative means of disposal.
- Fertilizer production and warehousing can cause eutrophication in the immediate surroundings and areas receiving runoff or wastewater. Fertilizer companies in Makana no longer manufacture fertilizers on site but have only distribution warehouses.
- 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.

The above wastes have been identified by deduction from municipal records, interviews and site 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 disposal in domestic landfill sites, there is still a problem with safe disposal in smaller municipalities.

Noteworthy hazardous waste observed at the Grahamstown Landfill Site includes sewage sludge, animal carcasses and abattoir waste. It is acknowledged that there is no simple and cost effective means of disposal of hazardous wastes in Makana Municipality and the use of the landfill site, though not ideal, is the only means of containing these wastes to minimise environmental exposure. Ideally specially designed skips could be purchased from WasteTech for hazardous wastes, which could be shipped to hazardous waste disposal sites.

Industries around Grahamstown were also investigated to determine how hazardous wastes are disposed of at source. Industries that were targeted were those which use hazardous chemicals in their processes and for cleaning. At many places hazardous chemicals are being washed down the drains, including recyclable waste such as oils and greases. Some of the larger petrol stations and workshops are required to recycle by their corporate environmental policies. Many are serviced by Oilkol, an oil recycling company, which periodically sends a truck from Port Elizabeth to collect used oil. Other office and workshop waste is also separated at source but, apart from paper which is collected by Grahamstown Recycling, all other waste ends up in the landfill. This constitutes wasted effort on the part of the company and wasted resources on the side of the municipality. The many smaller private garages and workshops do not have environmental practices surrounding oil disposal and most of this enters drains, polluting storm water. Soaps, cleaning fluids and any other substances entering sewers (apart from stormwater drains) will end up at the sewage works where these chemicals cause bacterial kills in the sewage works compromising performance.

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. Good examples are grass cuttings and hedge clippings. Though this waste is often disposed of in the landfill sites, it is potentially valuable as a good source of material for compost making.

Picture 8: 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

The municipality has recorded that approximately 39500 m^3 of vegetable waste is disposed of in the Grahamstown landfill site annually. This presented an opportunity for either a 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. In recognition of the opportunity and value that garden waste presents, a composting project has recently been set up through the Rhodes University Centre for Entrepreneurship, Mzam'omhle Waste Collection Group and Sustainable Environmental Technologies, with funding from the Carl and Emily Fuch's Foundation and the support of Makana Municipality. All garden waste can now be taken to the composting site located near the dump site. The project also receives municipal skips which do not have excessive domestic waste mixed into the garden refuse. In Grahamstown the municipality has provided numerous garden skips all over town. It appears that many people use these for their garden waste. In most instances, however, the skips are also being used for other waste that should be kept separate so that the garden waste can be used for composting, and time and capacity is not wasted separating out the domestic refuse. To help ensure the viability and success of the Mzam'omhle Composting Project 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 and community commitment around the value of separating garden and domestic refuse.

Picture 9: Mzam'Omhle community group has started turning garden refuse into compost.

Apart from this initiative, some farmers also sell kraal manure and the Grahamstown Riding School sell horse manure to gardeners.

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 encompasses treatment of sewage to make it less hazardous to humans and the environment.

General sanitation issues in Makana Municipality

Primary concerns raised at public meetings were

- Eradication of the bucket system
- Access to public toilets
- Quality of water leaving sewage works (effluent quality)
- Maintenance and paving of sewers and storm water drains
- Disposal of sewage sludge
- Livestock kraals within residential areas

Sewage treatment works are situated in the Bloukrans valley, in Mayfield and Alicedale.

Access to sanitation

All South Africans have 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 figures. 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. Makana Municipality dispute these figures as exaggerated and outdated but no other statistics were available at the time of publication. A major problem with VIP toilets in Grahamstown is the unsuitability of the underlying geology. High clay content in the soil means that excess liquids cannot percolate through the soils as per the VIP design. This leads to poor functioning of the toilets, odours and rapid filling. Many alternative more suitable technologies exist which should be thoroughly investigated before mass installation of flush toilets or VIPs

Table 1: Number of households on the various types of sanitation systems showing the percentage of households below the RDP level of VIP

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	10 054	55

below RDP levels		

Sewage treatment works

Sewage treatment works (STW) are used to treat waterborne sewage, black water from bowsers (honey suckers) and bucket latrines. This can be as simple as a ponding system or large treatment plants with highly technical 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. The entire citrus farming community downstream of Grahamstown was decimated due to the poor water quality in the past. As part of the LEAP the sewage treatment works have been assessed to determine whether treatment is adequate and if any interventions can improve the performance and hence improve the associated environmental and social impacts.

Certain aspects or parameters of the sewage water must be monitored according to the size and daily flow rate of the sewage treatment works. The monitoring requirements are laid out in Section 21 (f) and (h) of the National Water Act (Act 36 of 1998). These parameters are given limits, known as General Limits, which must be achieved before finally releasing the treated effluent into a water course (see Table 2). A more detailed outline of the monitoring of the sewage treatment works is outlined in the LEAP Monitoring Framework.

Grahamstown Disposal Works

The Grahamstown STW is situated on the south east side of Grahamstown in the Belmont valley. The STW is designed to treat 4Ml ($4000m^3$) per day 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 as it is infectious waste. Current disposal methods are to simply throw the dried sludge over the side of the drying beds where it has the potential to re-enter the Bloukrans River during heavy rains. This would then counteract the treating of the sewage as the sludge contains high nutrient levels, harmful bacteria (*E. coli*) and possibly

even heavy metals. Current disposal methods of this hazardous sludge pose a major environmental and social impact.
Correct disposal methods for sludge must be investigated and implemented or at the very least the sludge must be disposed of in an area where it cannot enter watercourses or ground water.

Effluent quality is tested monthly by Department of Water Affairs and Forestry and analysis done at an accredited laboratory in Port Elizabeth. The results are however difficult to come by and not always consistent in the parameters that are tested. The following information was obtained from DWAF for the Grahamstown Disposal Works for the last four years.

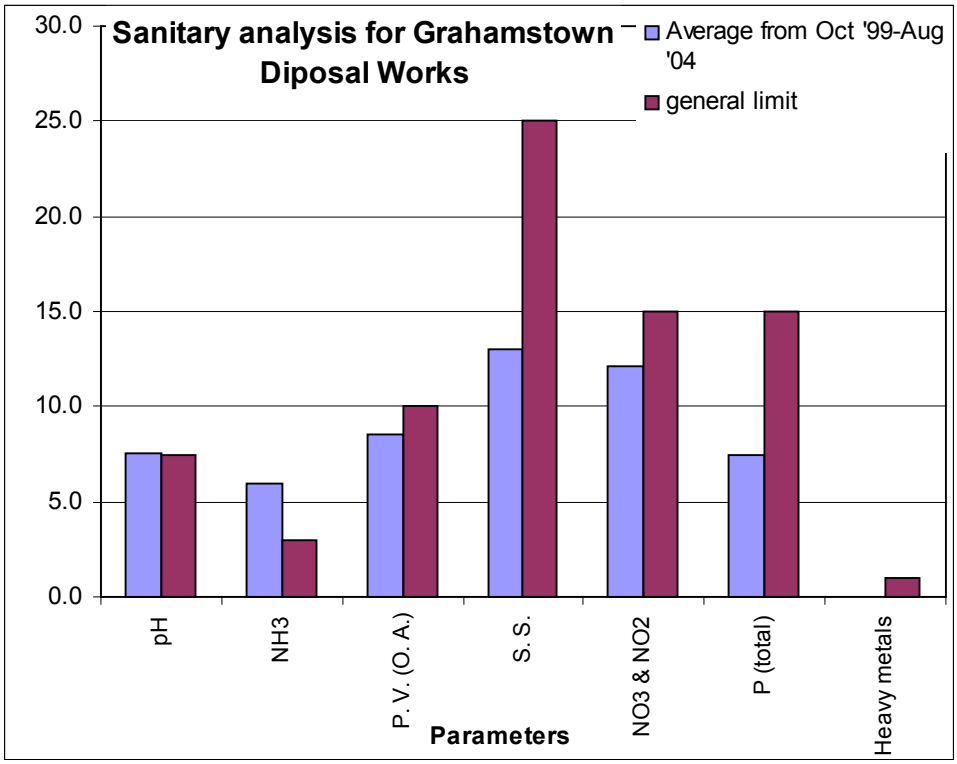
Table 2: Over the last four years the Grahamstown Disposal Works (GDW) has on average achieved compliance to the General Limits for most parameters.

Parameter	**GDW average**	**General Limit**
pH	7.5	5.5-9.5
Chemical Oxygen Demand (C.O.D.)	78.3	75
P. V. (O. A.)	8.5	10
Suspended Solids	13	25
Electrical Conductivity	165.39	250
Sodium (Na)	190.7	90
Nitrate (NO_3) & Nitrite (NO_2) as Nitrogen (N)	12.1	15
Ammonia ($NH_{3)}$	6	3
Phosphorus (total)	7.5	15
Fecal coliforms	25032.1	1000
Heavy metals	0.0431	1

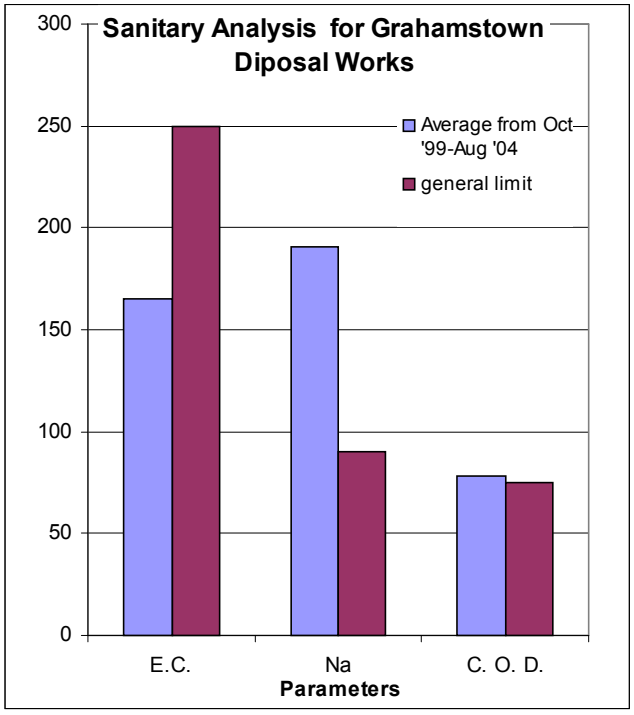
On average the Grahamstown Disposal Works has achieved the General Limits for most parameters tested. The three notable exceptions are Chemical Oxygen Demand, sodium (salt) concentration. These can all have devastating effects both in-stream and on water users. High chemical oxygen demand causes low oxygen availability to river fauna causing decreased biodiversity and river health which has a knock on effect to the riparian (surrounding) ecosystems. Sodium is particular concern to farmers using the water for irrigation as salt build up in the soil decreases soil quality and productivity. The general standards for faecal

coliforms are for 10km downstream of the treatment works which means that a count of 25 032 below the GDW is excellent as counts are often in the millions at the outlet of STWs.

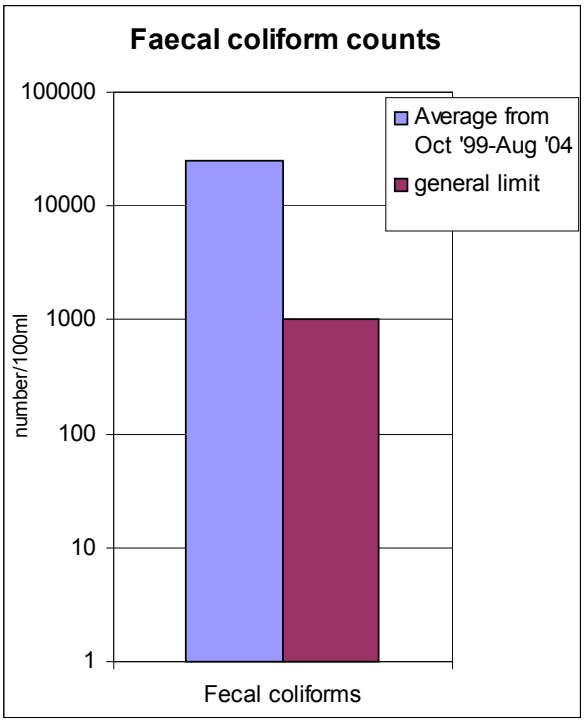
Graph 1: Average performance of the Grahamstown Disposal Works over the past 4 years.



Graph 2: Average performance of the Grahamstown Disposal Works over the past 4 years.



Graph 3: Average faecal coliform count in the final effluent of the Grahamstown Disposal Works over the past 4 years.



An outline of the quarterly testing done by the Nelson Mandela Municipal Metropol's Water Reclamation Officer is also presented. This gives an indication of the points at which samples are taken along the process and provides a comparison of raw sewage to final effluent quality which enters the Bloukrans River. The full Certificate of Analysis has been attached as Appendix 1. Note that these figures are the results of a single quarterly test. Testing for phosphorus and coliforms was not done, although legally these tests are required.

Table 3: Quarterly analysis of the Grahamstown Disposal works to monitor performance.

Sample Identification	Raw Sewage	Final Effluent	Final filtered	General Limit
pH	6.9	7.3	-	5.5-9.5
Conductivity at 25°C (mS/m)	-	137	-	-
Total dissolved solids @ 180°C	-	906	-	-
Chloride as Cl	221	-	251	-
Nitrate + Nitrite as N		0.8		15

Ammonia as N	61	14	-	3
Chemical Oxygen Demand	973	79	78	75
Permanganate value (4hr)	53	12	12	
Total solids (%)				
Suspended solids	440	34	-	25
Volatile matter				

The municipal budget reflects 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 Oxidation Ponds

The Mayfield Oxidation Ponds are situated on the north east side of Grahamstown in the Mayfield area. 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 runoff from this irrigated area 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.

Picture 9: Mayfield STW showing ponds with aerators, sludge, buckets and inlet

Although DWAF does sample the final effluent which is used for irrigation, these figures were not available at the time of writing this report. Municipal records of testing were unobtainable. The main hazard of irrigating with effluent is the spread of diseases to humans and animals that eat the plants in the irrigated area. If this water is to be used for growing vegetables, strict regulation of water quality must be maintained. There is currently no cultivation of crops in the irrigated area but it is used for grazing. It is not known whether medicinal plants are harvested from the area. The problem of sludge disposal is not as severe as with the Grahamstown Disposal Works, but the implications are the same. Before additional housing and waterborne sewerage added to the Mayfield ponds, the Makana's City Engineers should take into account the current handling capacity of the system and plan for an upgrade in anticipation of increased flow rates.

Alicedale Evaporation Ponds

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 over capacity 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. The STW was designed to perform as evaporation ponds with no effluent. The increase in number of households on waterborne sewerage without a corresponding increase in handling capacity at the ponds has caused a potentially environmentally disastrous situation as sewage with high nutrient loading, bacterial counts, salts and chemical oxygen demand may be entering the Bushman's River. The polluting of the river with low quality effluent causes eutrophication, algal blooming, death of sensitive fish and invertebrate species and general destruction of the ecosystem. The upgrading of the STW at Alicedale is vital to improving the surrounding environment and decrease odours especially in light of the new developments which will add additional loading to an already overloaded system. The Alicedale ponds were designed as evaporation ponds and it was only due to the LEAP investigation that the DWAF became aware that these ponds were beyond capacity and releasing effluent into the environment. There is, therefore, no monitoring data for this STW and the extent of impacts on the environment cannot be determined from this study.

Picture 10: 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

The issues of livestock in Makana are largely dealt with in the section on livestock. However, wastes of these livestock and the consequences of over 3 000 stock units kept in residential areas in Grahamstown alone must be mentioned here. These animals graze on the commonage by day and return to kraals next to owners houses in the evening. This not only causes odours and flies and poses a health hazard to residents, but also is a threat 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. Kraal manure, however, also presents an underutilised resource. Umthathi Training Programme is running an ongoing education programme on how to make compost using kraal manure and garden waste.

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. In terms of the LEAP this section deals with source directed controls and does not address water quality and quantity in rivers, groundwater and dams. These aspects are addressed under the section by the IWR.

Water Supply

Currently there is no data on water resources available for developments in Makana Municipality. This is alarming considering the rate of development in Grahamstown and

Alicedale as well as the expanded IDP programmes to put more houses on water borne sewage in Grahamstown.

It is vital that an assessment of water quantity available for development, including a study of hydrogeological conditions be completed so that new developments can be planned in line with water available. This will help prevent a potentially disastrous situation in which developments are approved and water cannot be supplied and further more water resources are stressed beyond their natural limits, more detail is expanded on this topic in the IWR section.

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 of a standpipe within 200m. Only 22% of people have water inside their houses. In Grahamstown the water is purified at the Waainek and Jan Kleinhans purifications works. The Waainek site is currently being upgraded; however, the details of this upgrade were not available at the time of preparing this report. A detailed outline of the monitoring of the water quality is outlined in the LEAP Monitoring Framework.

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. It has been reported that water quality is variable; however no issues have been raised by the public regarding water in Riebeek East.

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 becoming aware of now. Industrial environmental management practices have been developed over the past couple of decades to

help deal with these issues. An example of industrial environmental management is a mining company which replaces the soil and vegetation after mining has ceased in a particular area. In South Africa there are laws with which companies must comply 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. 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.

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:

- 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 and grease 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

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 currently 7 known tanneries and taxidermists operating in Makana Municipality. The environmental management of tanneries is aimed at limiting odours and 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. Although all tanneries were invited to a meeting to discuss current practice and effective environmental practices, there was some reluctance and representatives of only two tanneries attended. Little accurate information could thus be obtained regarding the environmental practices of the other tanneries in Makana. A later visit to one of the tanneries revealed that although there is no environmental policy, limited environmental training is carried out for employees working in the effluent treatment section.

Abattoirs

There are numerous abattoirs operating in Makana Municipality. Abattoirs have nitrogen-rich wastewaters as well as petruscible solid waste, both of which can be hazardous in significant concentrations. All abattoirs are required to be licensed by law. Although invited to a meeting held for industries to discuss environmental management, no one from the sector attended and no information was obtained on the environmental management practices of abattoirs. Waste from one abattoir is removed by the Municipality and thus becomes the responsibility of the Municipality to dispose of it correctly. The are currently 18 abattoirs and butcheries operate in Makana Municipality.

Chemical industries and laboratories

In Makana Municipality there are a limited number of industries that fall into this category. The universities and educational institutions have laboratories that will produce hazardous wastes. Fertilizer companies in Makana no longer manufacture fertilizer and only have distribution warehouses where there is little waste. Rhodes University has a number of departments have laboratories which produce hazardous wastes. These make use of the services of WasteTech to remove hazardous materials. Biological waste and glass ware is incinerated. The University is currently developing a more comprehensive waste management plan to deal particularly with hazardous waste streams and recyclables.

Petrol stations, garages and dairies

In Makana Municipality, as in many other areas, numerous petrol stations, workshops and garages occur within the towns. If environmental impacts are not managed correctly, these industries can cause severe damage to the environment if petrol, oil and grease, classed as hazardous substances, are allowed to move into the environment where they can pollute rivers, soil, groundwater and cause harm to humans, fauna and flora. For that reason it is important that these businesses manage their environmental impacts proactively and conduct environmental training for all staff. It is thus important that these businesses they are included in environmental education and action plans for the district. Out of 4 garages and workshops interviewed in Grahamstown all had environmental policies drawn up by the head offices of the corporation. No smaller workshops were surveyed. Despite these environmental policies, no environmental training has taken place and only 2 have oil collected for recycling.

Lack of proper environmental management of garages and repair workshops is most evident after heavy rain. Currently, downpours in Grahamstown cause a noticeable washing out of oils and greases from the storm drains into the Bloukrans River. This concern was raised by the farmers downstream from Grahamstown who cannot use the first flush of water down the river after a significant amount of rain due to the oils and greases that are washed from the town. The large quantities of litter washed down also cause blockages in irrigation pipes and pumps. Another important consideration of garages and dairies is the wash waters they produce. Garages which offer car washes will produce soapy waters which are not a problem as long as this water moves into municipal sewers. Dairies also need to have effective environmental management systems as washwaters can have high organic loading (high

chemical oxygen demand) as well as significant amount of chemical disinfectants. This can disrupt the functioning of sewerage works if disposed of in municipal sewers or impact negatively on ecosystems by killing beneficial organisms, changing water chemistry and causing eutrophication.

Miscellaneous

Other industries not listed above can also have environmental impacts. These industries include dry cleaners, ceramic industries, farming, printing and photographic operations.

There are three dry cleaning operations in Grahamstown. On interviewing one of the laundries, it was evident that no environmental management was taking place. Dry cleaning chemicals are highly toxic but were being disposed of in drains and containers were given to farmers for water. This practice has not only severe environmental implications, but severe health hazards to those using the containers.

Education around health and environmental impacts and correct disposal methods for all chemicals used in all processes is essential for the health of the people and the environment in Makana. Disposal options must also be made known and available and cooperation between industries which produce similar wastes could reduce costs to individual companies. Simple environmental management strategies would go a long way to addressing best practices, particularly for the handling and disposal of hazardous chemicals and wastes.

Air quality

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. The Kyoto protocol has caused renewed interest in cleaner technologies, recovering methane and biogas from landfills and sewage treatment works. This is expanded on under the section on landfills. Projects to reduce emissions

could become more economically viable as first world countries are becoming interested in funding emissions-reducing projects in order to claim carbon credits. Potential projects include:

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

References

Census 2001, Statistic South Africa.

Department of Water Affairs and Forestry, Second Edition, 1998. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.

Department of Water Affairs and Forestry, Second Edition, 1998. Waste Management Series. Minimum Requirements the handling, Classification and Disposal of Hazardous Waste.

Makana Municipal Records

Integrated Development Plan for Makana Municipality

Stakeholders and members of the community

Appendix 1.

Certificate of Analysis

Certificate of analysis Ght Sewage Disposal works
Date 2003/09/30

Sample identification	Raw sewage	Settled sewage	Filter feed	Filter effluent	Humus Effluent	1st pond effluent	Final effluent	Supernatant liquor	Digested sludge	Final filtered	General Standard
pH	6.9	7	7.1	6.8	7.1	7	7.3	-	6.7		
Conductivity at 25℃ (mS/m)	-						137				
Total dissolved solids at 180℃	-						906	1624			
Chloride as Cl	221	240	230	251	226	224	251				
Nitrate+Nitrite as N	-		0.3	1.6	1.1	1	0.8				15
Ammmonia as N	61	62	53	12	19	7.7	14	328			3
Chemical Oxygen Demand	973	973	472	239	177	92	67	79	78		75
Permanganate value(4hr)	53	34	28	11	15	8	12			12	
Total solids(%)	-								3.61		
Suspended solids	440	220	180	140	32	11	34	18600			25
Volatile matter	-								70.27		
Phosphate	-										10
Coliforms	-										$1x10^3$/100ml

Samples taken at: Grahamstown Sewage Disposal Works
Date: September 2003