

MOGALE CITY LOCAL MUNICIPALITY

FINAL ENVIRONMENTAL MANAGEMENT FRAMEWORK

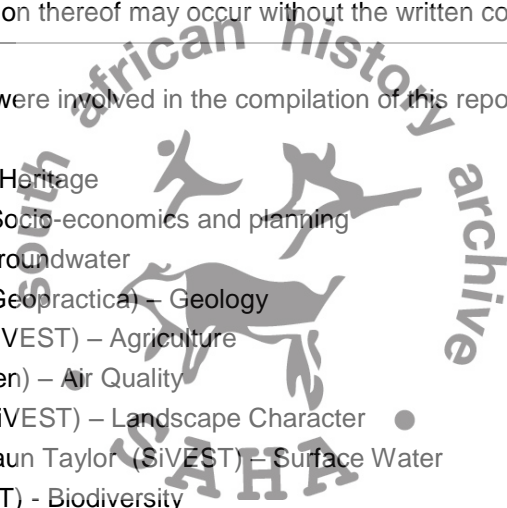
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MOGALE CITY

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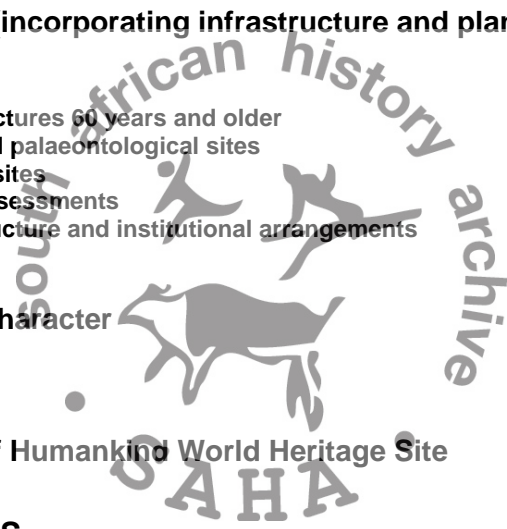
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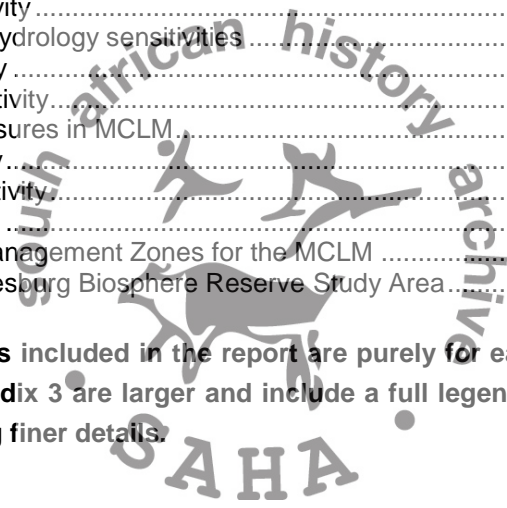
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Please note that all maps included in the report are purely for ease of reading. The larger maps included in Appendix 3 are larger and include a full legend and scale block. Please refer to these for viewing finer details.



GLOSSARY OF TERMS

List of Abbreviations

AMD:	Acid Mine Drainage
AQA:	Air Quality Act
ASAPA:	Association of South African Professional Archaeologists
BOD:	Biological Oxygen Demand
CBD:	Central Business District
CGS:	Council of Geoscience
CMP:	(Conservation) Management Plan
CO:	Carbon Monoxide
COD:	Chemical Oxygen Demand
CoHWHS:	Cradle of Humankind World Heritage Site
CRDP:	Comprehensive Rural Development Programme
DAFF:	Department of Agriculture, Forestry and Fisheries
DEA:	Department of Environmental Affairs
DIEM:	Department of Integrated Environmental Management
DLA:	Department of Land Affairs
DMA:	District Management Authority
DMR:	Department of Mineral and Resources
DWA:	Department of Water Affairs
EC:	Electrical Conductivity
ECA:	Environmental Conservation Act
EIA:	Environmental Impact Assessment
EMF:	Environmental Management Framework
EMP:	Environmental Management Plan
ENPAT:	Environmental Potential Atlas
GAPA:	Gauteng Potential Atlas
GDACE:	Gauteng Department of Agriculture, Conservation and the Environment
GDARD:	Gauteng Department of Agriculture and Rural Development
HIA:	Heritage Impact Assessment
ICLEI:	International Council for Local Environmental Initiatives
IDP:	Integrated Development Plan
IUCN:	International Union for Conservation of Nature
KTPS:	Krugersdorp Town Planning Scheme
LAB:	Local Action for Biodiversity
MAP:	Mean Annual Precipitation
MCLM:	Mogale City Local Municipality
MEC:	Member of Executive Council
NEMA:	National Environmental Management Act

NHBRC:	National Home Builders Registration Council
NHRA:	National Heritage Resources Act
NNR:	National Nuclear Regulator
NOx:	Oxides of Nitrogen
NSBA:	National Spatial Biodiversity Assessment
NWRS:	National Water Resource Strategy
O ₃ :	Ozone
PHRAG:	Gauteng Provincial Heritage Resources Authority
PUATPS:	Peri-Urban Areas Town Planning Scheme
ROD:	Record of Decision
SAHRA:	South African Heritage Resources Agency
SANBI:	South African National Biodiversity Institute
SANS:	South African National Standards
SEF:	Strategic Environmental Focus
SEMP:	Strategic Environmental Management Plan
SDF:	Spatial Development Framework
SO ₂ :	Sulphur Dioxide
SoER:	State of the Environment Report
UNESCO:	United Nations Educational, Scientific and Cultural Organisation
WRDM:	West Rand District Municipality
WUA:	Water Use's Association
ZAR:	Zuid Afrikaansche Republiek
ZES:	Zanokuhle Environmental Services



Glossary

Agricultural Potential: The possibility for land to be used for agricultural purposes based on various aspects such as soil and land type.

Agricultural Zone: An area dominated agricultural landuses, which includes the cultivation of crops as well as the breeding or raising of livestock and game animals.

Alien Species: Animals and plants invading and becoming established in areas where they do not normally occur.

Aquifer: A bounded underground accumulation of water in certain types of geological formations.

Basic Water Supply: The prescribed minimum standard of water supply services necessary for a reliable supply of sufficient quantity and quality of water to households, including informal households, to support life and personal hygiene.

Basic sanitation: The prescribed minimum standard of services necessary for the safe, hygienic and adequate collection, removal, disposal and purification of human excreta, domestic waste water and sewage from households, including informal households.

Biodiversity: A measure of the number and relative abundance of biological species. 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 part; this includes diversity within species, between species, and of ecosystems.

Biome: A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.

Climate: The average weather conditions which are characteristic of a particular region and prevail over a long period of type.

Conservation: The management of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystem function and integrity.

Ecosystem: Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.

Environment: NEMA defines “environment” as “the surroundings within which humans exist and that are made up of the land, water and atmosphere of the earth; micro-organisms, plant and animal life; any ... interrelationships among and between them and the physical, chemical aesthetic and cultural properties and conditions that influence human health and well-being”.

Environmental Impact: The degree of change in an environment resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts include both the direct or indirect consequences of an activity.

Environmental Impact Assessment: A systematic process of identifying, assessing and reporting environmental impacts associated with an activity and includes basic assessment and S&EIR.

Environmental Management: Making sure that environmental concerns are included at all stages of development, ensuring sustainable development.

Environmental Management Plan: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

Fauna: The animal life of a region.

Flora: The plant life of a region.

Habitat: The normal abode or locality of a living organism defined by the set of physical, chemical and biological features.

Heritage: Any place or object of cultural significance which is protected under the National Heritage Resource Act, 1999 (Act No. 25 of 1999).

Hydric soil: Soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring growth and regeneration of hydrophytic vegetation. These soils are found in wetlands.

Industrial Zone: An area dominated by commercial and manufacturing landuses.

Geology: The structure and composition of the earth.

Grasslands: Areas covered by grass with some trees, but differing from savanna woodlands by being generally cooler and drier.

Ground water: Water that is located below the ground surface.

Landscape Character: A description of the visual quality of a landscape which is influenced by the level of change from a completely natural setting and the evidence of human transformation such as built infrastructure.

Low density development: A development with a low number of dwellings per unit area.

Mining Zone: An area dominated by mining operations and activities.

Natural heritage: Natural features consisting of physical and biological formations, which are of outstanding universal value from an aesthetic or scientific point of view.

Natural Zone: An area characterised by limited human influence where the natural processes are largely intact and which is usually dominated by native plants and animals.

Policy: A government document, which sets out guidelines for decision-making and action. In a democratic environment, it is the product of government and specialist involvement in a consultative process with communities and helps to set priorities and allocate resources.

Rare and endangered species: Species, which have naturally small populations, and species, which have been reduced to small (often unstable) populations by man's activities.

Riparian: Areas adjacent to water or influenced by free water associated with streams or rivers on geological surfaces occupying the lowest position on a watershed.

Red Data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Reduction: Reduction in capacity of the vegetation or soil to support life, through damage to physical, chemical or biological properties. Reduction of resource potential by one or a combination of processes acting on the land, such as: soil erosion by wind and/or water; deterioration of the physical, chemical and biological or economic properties of soil; and long-term loss of natural vegetation.

Rural Zone: A sparsely populated area which is not located within a city or town and is characterised by agriculture, vegetation and open spaces.

Savanna: Arid to semi-arid area supporting a mix of grass, trees and shrubs, the proportions of each varying with rainfall, soil type and other physical factors.

Small scale development: A development with a light footprint / small extent relative to the natural environment, which will not result in massive clearing or destruction of habitat.

Socio-economic environment: The part of the environment that is linked to human activities for example; social, economic, cultural and political activities. Themes that form part of the socio-economic environment are the economy, health, education, safety and security as well as environmental governance.

Surface Water: Water which is located above the ground.

Sustainable development: Providing for the needs of the present without impairing the ability of future generations to meet their own needs.

Sustainable rural development: The establishment and maintenance of stable rural communities that attract and retain skilled people and contribute to growth and development.

Topography: The physical surface features of the earth which include all natural and man made features.

Urban edge: A demarcated line around an urban area in order to manage, direct and control the outer limits of development and establish a limit beyond which urban development is not permitted.

Urban sprawl: Unplanned and uncontrolled urban development which spreads into areas surrounding a city.

Urban Zone: A built up and populated area which is characteristic of cities and towns.

Veld: South African term for natural vegetation, usually grassland, typically containing scattered shrubs or trees.

Wetlands: Areas of land that are periodically or permanently waterlogged for a sufficient period of time to sustain aquatic processes and biological activity adapted to the wet environment. Wetlands include vleis, bogs, mires, swamps, marshes, dolomitic eyes and pans.

World Heritage Site: Architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science. The protection of world heritage sites is the duty of the international community as a whole.

MOGALE CITY

FINAL ENVIRONMENTAL MANAGEMENT FRAMEWORK

1 INTRODUCTION

SiVEST Environmental Division has been appointed to undertake a review of the Mogale City Local Municipality's (MCLM) existing Environmental Management Framework (EMF). The EMF was created to support decision making in order to ensure protection of the natural resource base within the MCLM. The current EMF was compiled in 2003 (conducted by SEF) and it is envisaged that this report will be revised based on new information available as well as researching some additional information, where applicable.

The current EMF has identified priority areas around which this particular study is centered. The project team has approached these areas in a holistic manner in order to ensure that the planning and environmental issues are not resolved separately but strategically as a whole. The project has drawn strongly on the information included in the recently completed Spatial Development Framework (SDF) and the Integrated Development Plan (IDP) 2009/10.

The review process has been conducted in line with Guideline 6: Environmental Management Frameworks in support of the EIA regulations, 2005. These guidelines were created to ensure that EMF documents comply with the National Environmental Management Act, 1988 (Act No. 107 of 1998) and to assist consultants with compilations of EMF documents. In addition the report has been compiled in line with the newly promulgated EMF Regulations (2010).

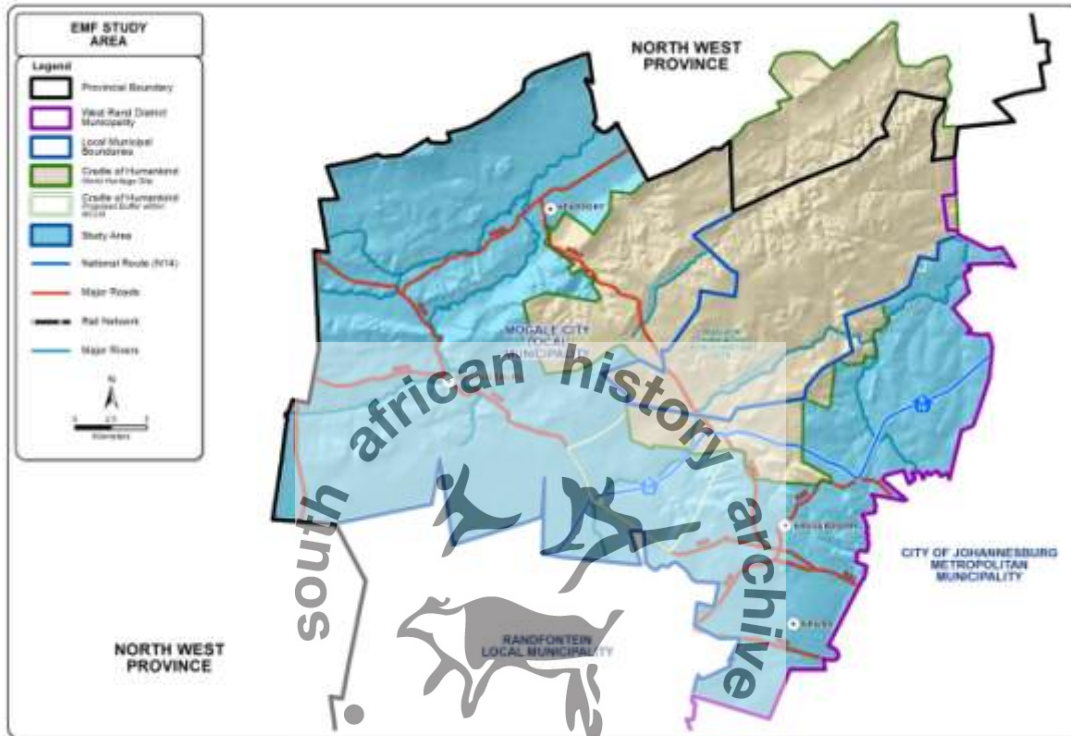
The EMF is a decision support tool that streamlines decision making for authorities in order to ensure that sensitive areas identified are managed and maintained in an environmentally sustainable manner. The importance of the sustainable development and planning of this area is critical to the success both in terms of future economic development of the area but also for the conservation of the unique biodiversity of the area.

The MCLM falls within the West Rand District Municipality and is located on the western border of Gauteng, adjoining the City of Johannesburg and the North West Province at 1740 masl). The area of jurisdiction is approximately 110 000 ha.

An EMF is currently being compiled for the Cradle of Humankind World Heritage Site (CoHWHS). The study area for this EMF stretches beyond the boundaries of the CoHWHS and includes the proposed buffer. This is an area of overlap for both EMF studies and has been accommodated

accordingly. The original buffer zone has been reconsidered and has changed accordingly. Only a small portion of the MCLM falls with the current proposed buffer which relates solely to the dolomite which has been identified as a priority for the Cradle.

The study area is illustrated below in Map 1.



Map 1: Mogale City EMF Study Area

* Please note that all maps included in this document have been printed in A3 size and are included in Appendix 3.

2 LEGAL CONTEXT

Section 24 (3) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, allows the relevant officer (Minister or MEC) to compile a document which highlights the various biophysical and social issues of a specific area, preferably spatially, in a way which will assist with decision making. This being the basis for an EMF.

This EMF is compiled in terms of Regulation 3 of the New (18 June 2010) NEMA EMF Regulations (No. R 547, in Government Gazette No. 33306)

In addition to this legislation, this section highlights the relevance of various other pieces of legislation to the EMF.

2.1 The Constitution of South Africa (Act No. 108 of 1996)

Chapter 2 of the Constitution, the supreme law of South Africa, states that everyone has the right “to have the environment protected through reasonable legislative and other measures that promote conservation and secure ecologically sustainable development and the use of natural resources, while promoting justifiable economic and social development”.

The core of an EMF is to identify sensitive areas and ensure that these are managed and preserved in an ecological and sustainable manner; which is the ultimate aim of this EMF.

2.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

Table 1: NEMA references to EMFs

Act	Extract	Relevance
NEMA – Section 24	(2) The Minister, or an MEC with the concurrence of the Minister, may identify- (a) activities which may not commence without environmental authorisation from the competent authority; (b) geographical areas based on environmental attributes, and as specified in spatial development tools adopted in the prescribed manner by the environmental authority, in which specified activities may not commence without environmental authorisation from the competent authority; (c) geographical areas based on environmental attributes, and specified in spatial development tools adopted in the prescribed manner by the environmental authority, in which	This section relates to delisting as described in section 24(2) a-b and the delisting of activities as per section 24(2)d. Delisting of activities will happen in areas where environmental concerns are low and to allow officials to provide service delivery timeously. Delisting is unlikely to be possible due to the promulgation of the 2010 NEMA regulations which have attempted to negate the need for this activity.

Act	Extract	Relevance
	<p>specified activities may be excluded from authorisation by the competent authority; (d) activities contemplated in paragraphs (a) and (b) that may commence without an environmental authorisation, but that must comply with prescribed norms or standards: Provided that where an activity falls under the jurisdiction of another Minister or MEC, a decision in respect of paragraphs (a) to (d) must be taken after consultation with such other Minister or MEC.</p>	
	<p>24 (3) The Minister, or an MEC with the concurrence of the Minister, may compile information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be taken into account by every competent authority.</p>	<p>The section highlights the activity of compiling a spatial tool to assist with planning and decision making i.e. an EMF. It is the legislation under which this document is compiled.</p>
	<p>(4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment- (b) must include, with respect to every application for an environmental authorisation and where applicable- (vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3);</p>	<p>The Act makes reference to EMF documents being used to compile and supplement other environmental documents such as EIA's etc. This will be the role of the EMF.</p>

All development applications need to be considered in terms of the NEMA EIA regulations published on the 18th of June 2010. These regulations determine which activities require an Environmental Impact Assessment.

The MCLM and provincial and national authorities responsible for authorising current as well as any proposed activities within the municipal area have a responsibility to ensure that those activities conform to the principles of NEMA. Proponents of such activities are obliged to take actions to prevent pollution or degradation of the environment in terms of Section 28 of NEMA.

Any activities which take place around, or which have the potential to affect wetlands etc must comply with the principles of NEMA and the NEMA regulations, as assessed below.

2.3 Guideline 6: Environmental Management Frameworks

Guidelines of the Environmental Management Framework in support of the EIA Regulations, 2006, state that EMF's are used to facilitate the compilation and consideration of applications for environmental authorization. Although these regulations were promulgated in 2006, they still remain relevant to the EMF process. In this regard:

- EMF's provide applicants with an early indication of the areas in which it would be potentially appropriate to undertake an activity;
- Co-operative governance is facilitated through the identification of different regulatory responsibilities and recommending mechanisms for addressing the needs of the relevant authorities; and
- The competent authority has information which will guide decision-making.

The guiding principles for an EMF are as follows:

- The EMF should be customized to the context of the area;
- The EMF should be undertaken with reference to environmental goals and priorities;
- The EMF should encourage sustainable development;
- The scope of the EMF should provide assistance to all level and types of environmental and planning-decision making in that area;
- The EMF should place specific focus on the issue and information that matter in decision making in the area;
- Ecological, social, health and other aspects that are relevant in the area should be reflected in the EMF;
- The EMF should be clear and easy to understand;
- The process of developing the EMF should provide for an appropriate level of public participation; and
- The process of developing the EMF should be carried out fairly, impartially and professionally, having regard to legal and policy requirements as well as guidelines applicable to the area.

This EMF has been compiled in order to comply with these guidelines and to ensure that the final product is in line with the legislative requirements.

2.4 Regulation 4 of New (18 June 2010) NEMA EMF Regulations

Regulation 4 of the New (18 June 2010) NEMA regulations allows for the MEC or Minister to initiate the compilation of an EMF. This regulation supplements the Guideline document and assists the author with guidelines for information to be included in an EMF document.

Table 2 indicates sections of the report that have addressed some of the requirements of an EMF as outlined in regulation 4 of the New (18 June 2010) NEMA EMF Regulations (No. R 547, in Government Gazette No. 33306)



Table 2: EMF requirements as per regulation 4 of NEMA (18 June 2010)

An EMF must:	Reference in this report
Identify by way of a map or otherwise the geographical area to which it applies	Section 1 of EMF
Specify the attributes of the environment in the area, including the sensitivity, extent, interrelationship and significance of those attributes	Section 6 & 9 of EMF
Identify any parts in the area to which those attributes relate	Section 9 of EMF
State the conservation status of the area and in those parts	Section 9 (Biodiversity) of EMF
State the environmental management priorities of the area	Section 11 & 13
Indicate the kind of developments or land uses that would have a significant impact on those attributes and those that would not	Section 13
Indicate the kind of development or land uses that would be undesirable in the area or in specific parts of the area	Section 13
Indicate the parts of the area with specific socio-cultural values and the nature of those values	Section 9
Identify information gaps	Sections 6 & 7
Indicate a revision schedule for the environmental Management Framework	Section 15
Include any other matters that may be specified	included

2.5 National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)

The aim of this law is to regulate air quality and protect the environment in South Africa through reasonable measures to prevent pollution and ecological degradation, while securing sustainable development. The Act also provides national norms and standards for air quality management, monitoring and control.

The National Environmental Management (NEMA): Air Quality Act 39 of 2004 (AQA) has shifted the approach of air quality management from source-based control to receptor-based control. The basis of this approach will be control of all major sources, including mining, industrial, vehicles and domestic sources in terms of ambient air concentrations and will be the responsibility of Local Government.

The NEM:AQA act is comparable with international best practice. It is “outcomes driven”. The main objective of the act is to bring about air quality that is not harmful to citizen’s health. The ultimate outcome of the efficient and effective implementation of the AQA, is, of course, ambient air that is not harmful to health and well being of all across the nation. The act was signed by the President in 2005. Certain sections came into effect towards the end of that year. However, the sections relating to atmospheric emissions licensing provisions only came into effect on the 01 April 2010.

This Act stipulates that Minister must, or MEC may, by notice in the Gazette publish a list of activities which may result in atmospheric emissions and which may have significant detrimental effect on the environment. Government Gazette 32434 of 24 July 2009 listed activities which require an atmospheric emission license before it commences.

A new list of all activities requiring atmospheric emissions licenses in order to operate was also promulgated in Government Gazette 33064 of 31 March 2010 Government Gazette, Notice No. 248. Minimum emission standards are set for all the listed activities. Such activities include mineral, metallurgical, chemical processing and certain types of waste disposal, amongst others.

The Act makes provision for ‘measures of the control of dust in specified places or areas, either in general or by specified machinery or in specified instances’. More stringent standards can be established at the provincial and local levels. The control and management of emissions in AQA relates to the listing of activities that are sources of emission and the issuing of atmospheric emission licences. Published on 24 December 2009, national ambient air emission standards are established for each of these activities and an atmospheric emission licence will be required to operate. The issuing of emission licences for Listed Activities will be the responsibility of the Metropolitan and District Municipalities. In addition, the minister may declare any substance contributing to air pollution as a priority pollutant. Any industries or industrial sectors that emit these priority pollutants will be required to implement a Pollution Prevention Plan. On 01 April 2010, the Minister proclaimed that sections 21, 22, 36 to 49, 51(1)(e), 51(1)(f), 51(3), 60 and 61 of the Act will come into effect. The minister also proclaimed “List of activities which result in atmospheric emissions which have or may have a significant detrimental effect on environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage” on the same date.

2.6 National Forest Act, 1998 (Act No. 84 of 1998)

The National Forest Act, 1998 (Act No. 84 of 1998) was promulgated to provide for the sustainable management and development of forests for the benefit of all and to promote the

sustainable use of these forests. In addition to this function the Act also provides for the protection of trees which are threatened. A protected tree list was published in GN 32731 of 27 November 2009 and is of relevance to proposed developments within the MCLM as some of these trees are present within the study area.

2.7 National Water Act (Act No. 36 of 1998);

The National Water Act, 1998 (Act No. 36 of 1998) hereafter referred to as the Act was created in order to ensure the protection and sustainable use of water resources in South Africa. The Act recognises that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users. Bearing these principles in mind there are a number of stipulations of the Act that are relevant to the protection and current state and impacts upon surface water resources in the Mogale City Local Municipality.

Firstly, it is important to discuss the type of surface water resource protected under the Act; under the Act a water resource includes a watercourse, surface water, estuary, or aquifer. A 'watercourse' is defined as (inter alia):

- a river or spring;
- a natural channel in which water flows regularly or intermittently;
- a wetland, lake or dam into which, or from which, water flows;
- In this context it is important to note that reference to a watercourse includes, where relevant, its bed and banks.

It is important to note that water resources, including wetlands and other watercourses are protected under the National Water Act. 'Protection' of a water resource, as defined in the Act entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource
- The rehabilitation of the water resource

In the context of rehabilitation projects and the identification of the impacts on surface water resources, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia):

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body, for example the excavation of a wetland or changes to the morphology of a water body can be considered to be pollution. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include measures to (inter alia):

- cease, modify, or control any act or process causing the pollution;
- comply with any prescribed waste standard or management practice;
- contain or prevent the movement of pollutants;
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse.

The above stipulations of the Act have implications for the management, protection, and rehabilitation of surface water resources in the MCLM, in the light of threats acting on, and current impacts on surface water resources as discussed below.

The Act has implications for the management and protection of wetlands and other surface water resources within the MCLM. The Act provides a number of duties to landowners and managers in terms of the sustainable and responsible management of wetlands, as detailed above. Importantly there is also a duty for the reversal or remediation of any degradation to wetlands. This has implications for management actions related to wetlands in order to achieve a desired state for this part aspect of the natural environment of the municipality.

2.8 Water Services Act, 1997 (Act No. 108 of 1997)

The Water Services Act, 1997 (Act No. 108 of 1997) relates to the provision of services. The Act was created to ensure rights of access to basic water supply and basic sanitation and to regulate this provision.

The Act is of specific relevance to the formalisation of informal townships and putting the Act into operation in these areas. This point being an important aspect in the context of the MCLM where several areas are in need of the implementation of this Act.

2.9 National Heritage Resource Act (Act No. 25 of 1999);

The National Heritage Resources Act of NHRA (Act No. 25 of 1999), which is the most important piece of legislation that governs heritage management in South Africa, defines the heritage resources of South Africa as physical places and objects that are of cultural significance or other special value for the present community and which for future generations must be considered part of the national estate.

Terms such as cultural significance and value can have different meanings, but the prime reasons for conserving heritage resources today (as it was in the past) are linked to political and ethical motives. However, more utilitarian reasons, such as the educational and economic potential of conserving heritage, also play a role, and in this respect there is a definite link with education (social upliftment) and tourism. In fact, without heritage resources, tourism in the province would not be possible.

These places and objects include:

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including—
 - I. ancestral graves;
 - II. royal graves and graves of traditional leaders;

- III. graves of victims of conflict;
- IV. graves of individuals designated by the Minister by notice in the Gazette;
- V. historical graves and cemeteries; and
- VI. other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
 - I. movable objects, including—
 - II. objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 - III. objects to which oral traditions are attached or which are associated with living heritage;
 - IV. ethnographic art and objects;
 - V. military objects;
 - VI. objects of decorative or fine art;
 - VII. objects of scientific or technological interest; and
 - VIII. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

The Act recognises a heritage resource to be part of the national estate if it is of cultural significance and value because of:

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery (or labour) in South Africa.

It should be noted that the NHRA is primarily concerned with places and objects that have been created by humans. However, the fact that the NHRA also provides for the protection of natural places and objects has resulted in a few grey areas where it seems to overlap with other national legislation (linkage). The implication is that the Act also provides for the protection of heritage resources such as the following:

- Meteorites
- Geological occurrences (meteorite craters, type sites, etc)
- Plants and animals with cultural/scientific significance (totem animals, plants with religious uses, etc) (biological diversity) (linkage)
- Domesticated plants and animals (agriculture) (linkage)
- Hydrology (water) (linkages in terms of intangible heritage)

This legislation has been consulted when considering the heritage rich MCLM in association with the COHWHS and is referred to in the heritage section of this report.

2.10 Conservation of Agricultural Resources Act (Act No. 43 of 1983);

The Act provides for the regulation of control over the utilization of the natural agricultural resources in order to promote the conservation of soil, water resources and vegetation (including wetlands). This Act has determined the various categories of alien plant species which are present in South Africa based on their ability to colonise i.e. how invasive they are. Several alien species of concern are present within the study area and these require management.

2.11 National Environmental Management: Biodiversity Act (Act No. 10 of 2004);

The NEMBA was put in place to provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998. The Act provides a framework through which species and ecosystems can be protected whilst still promoting sustainable use of indigenous biological resources.

The EMF must promote the implementation of the NEMBA through the guidelines that are put forward. This relates to areas of sensitivity, which would trigger the requirement for biodiversity assessments, being identified by authorities and ensuring that these studies are carried out accordingly.

2.12 World Heritage Convention Act, 1999 (Act No. 49 of 1999)

The World Heritage Convention Act, 1999 (Act No. 49 of 1999) was put in place to ensure the incorporation of the World Heritage Convention into South African law. The Act ensures the preservation of cultural and natural heritage in the country recognising that these are priceless and irreplaceable possessions in an international context and that the loss of these could lead to an impoverishment of heritage of the people of South Africa and the world.

UNESCO (United Nations Educational, Scientific and Cultural Organisation) formulated the World Heritage Convention in 1972 in order to ensure that an effective system of collective protection of the cultural and natural heritage of outstanding universal value is organised and present on a permanent basis and in accordance with modern scientific methods.

The study area is located next to a registered World Heritage Site – the Cradle of Humankind and hence the relevance for the inclusion of this Act. Activities taking place within the MCLM need to take cognisance of the World Heritage Convention and World Heritage Convention Act in order to contribute to preserving the strong heritage features which have contributed to forming the WHS.

2.13 National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) was implemented to place emphasis on activities relating to waste generation and the associated pollution risks. Activities relating to waste generation and disposal were removed from the NEMA EIA Regulations and new Regulations under the Waste Act were promulgated in 2008. These now govern these activities.

The EMF will provide awareness of this Act and ensure that the activities are taken into cognisance when assessing development applications.

2.14 Mogale City Local Municipality Integrated Development Plan

Mogale City has, in terms of the Municipal Structures Act (Act 32 of 2000) prepared an Integrated Development Plan (IDP), which is an overarching document to guide development in its area. This document has taken into consideration the relevant principles and directives from, but not limited to, those listed in the table below. These acts, policies and frameworks create a legal

environment in which planning can take place. The Mogale IDP takes cognisance of the municipality's legislative obligations in terms of its mandate and the fulfillment of the directive given by this legal environment.

Table 3: Relevant legislation and policies/frameworks

	NATIONAL	PROVINCIAL
Legislation	<ul style="list-style-type: none"> ▪ Constitution of the Republic of South Africa, 1996 ▪ National Environmental Management Act, 1998 (Act No 107 of 1998) ▪ National Environmental Management: Air Quality Act, Act 39 of 2004 ▪ National Environmental Management: Biodiversity Act (Act 10 of 2004) ▪ National Water Act (Act 36 of 1998) ▪ Water Services Act (Act 108 of 1997) ▪ Municipal Systems Act, 2000 (Act 32 of 2000) ▪ Development Facilitation Act, 1995 ▪ National Environmental Management Protected Areas Act, 2003 (Act 57 of 2003) ▪ UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972 ▪ World Heritage Convention Act, 1999 (Act 49 of 1999) ▪ Conservation of Agricultural Resources Act (Act 43 of 1983) ▪ National Forests Act (Act 84 of 1994) ▪ National Heritage Resources Act (Act 25 of 1999) ▪ The National Land Transport Act, 2009 (Act 5 of 2009) ▪ National Roads Act (Act 7 of 1998) ▪ National Housing Act, 1997 (Act No. 107 of 1997) and National Housing Code 	<ul style="list-style-type: none"> ▪ Gauteng Planning and Development Act, 2000 (Act 3 of 2000)
Policy/Fram	<ul style="list-style-type: none"> ▪ Millennium Development Goals, 2000 	<ul style="list-style-type: none"> ▪ Gauteng Spatial

ework	<ul style="list-style-type: none"> ▪ National 2014 Vision ▪ National spatial Development Perspective ▪ Breaking New Ground ▪ Comprehensive Rural Development Programme, 2009 (CRDP) ▪ White Paper on Spatial Planning and Land Use Management, 2001 	<p>Development Perspective</p> <ul style="list-style-type: none"> ▪ Gauteng Growth and Development Strategy ▪ Gauteng Global City Region ▪ Integrated Report for the Development and Management of the Cradle of Humankind World Heritage Site ▪ Gauteng Agricultural Hubs
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These documents together with local legislation and policies (including the Town Planning Schemes and By-laws, Integrated Development Plans and Spatial Frameworks) guide and inform development decisions.

The above policies all contain a severe gap in respect to the explicit reference of protection that needs to be directed at surface water resources. The SDF is the only document to make any mention of the need to maintain the physical integrity and linkages of surface water resources specifying a selection of river systems alone. No explicit attention is directed to wetland areas (for example, important peatlands in the region). Critically, the EMF largely ignores the entire spectrum of aquatic environments that are encompassed by the definition of surface water resources as maintained in this report. Very generalised management objectives that are essentially site-specific, have been proposed that relate to the approach a developer would have to undertake where ecologically sensitive areas are present. However, no spatial reference is made with regard to all potential surface water resources and the state of these environments, which neglects to indicate the sensitivity of these environments and their susceptibility to potential disturbance in terms of idealised developments set to take place in the municipality.

Hence, information relating to the surface water resources is clearly lacking. The earlier EMF document therefore, largely fails to meet its main purpose to identify areas of potential conflict between development proposals and critical and sensitive environments as far as surface water features are concerned. Measures to afford protection to these features of the natural environment in the form of policy-related guidelines are stressed. The management guidelines and desired state, as specified by this EMF (currently in preparation) must address these gaps whilst at the same time align with the imperatives of the above planning documentation.

2.15 Relevant Municipal Bylaws

The purpose of bylaws is to provide an effective legal and administrative framework to ensure that the way in which the Municipality controls, manages and develops its municipal region is done in an environmentally sustainable way, and is in the long-term upholding the interests of the whole community of Mogale City, including future generations. The following municipal bylaws are in place:

- Urban Greening & Biodiversity preservation

The purpose of this bylaw is to give guidance to all stakeholders involved in the planning, development and management of park, open spaces and other green infrastructure

- Informal settlements

This bylaw is provided to manage and control illegal occupation of land and to facilitate the formalization of authorized informal settlements with a view of eradicating informal settlements by 2014.

- Water Services

The purpose of this bylaw is to ensure the levels of service for the minimum standard for basic water supply and basic sanitation to consumers are met.

- Parks and Open spaces, Management of trees and facilities at Dams

This bylaw is to ensure that the recreational, educational, social and other opportunities which public open spaces offer are protected and enhanced to enable local communities, particularly historically disadvantaged communities, and the public to improve and enrich their quality of life.

The Bylaws will be taken into consideration when compiling the relevant guidelines based upon the zonation plan.

SiVEST Environmental Division has ensured that the above guidelines and legislation have been used to inform our review of the EMF for the Mogale City Local Municipality. The EMF has been created in such a way as to ensure that all development actions and proposals are aligned and appropriately considered within the identified sustainability parameters.

The current MCLM EMF was not compiled in terms of the EMF guidelines (Guideline 6) as published by DEAT in April 2006 when the new EIA regulations were promulgated. This EMF has

considered these guidelines as well as the new EMF Regulations and ensures compliance in this respect.



3 METHODOLOGY

This section highlights the process that is followed when compiling the EMF document and the methodology which has been implemented. The process is represented in Figure 1.

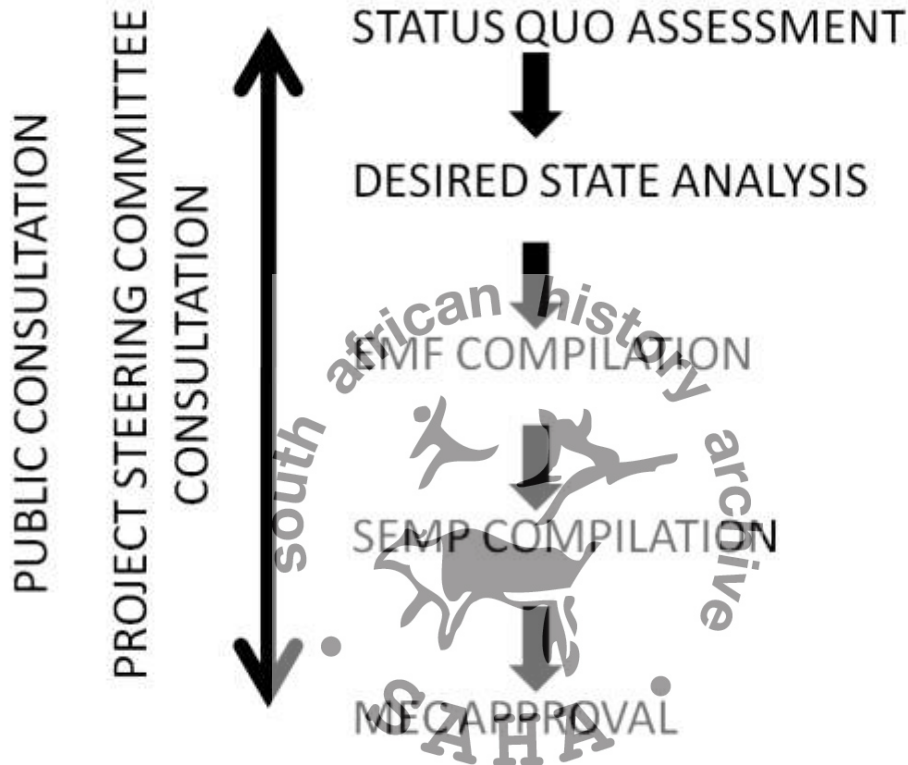


Figure 1: EMF Review Methodology

3.1 Status Quo Assessment

The Status Quo Assessment involved the review of existing information and the identification of gaps in the information based on the existing EMF and available information. This information assisted in identifying the existing state of the environment in the MCLM.

3.2 Desired State Analysis

The desired state analysis forms part of the EMF Report and documents the state in which the various environmental parameters should be in, in order to maintain ecological sustainability. The sensitivity of the study area is also identified in this section.

3.3 EMF Compilation

The EMF draws on the information identified in the status quo and desired state analysis to compile an environmental zonation plan which identifies environmental management zones to assist authorities with decision making.

3.4 SEMP Compilation

The Strategic Environmental Management Plan provides the guidelines which authorities will make use of to make decisions. The guidelines link back to each of the zones identified.

3.5 MEC Adoption

The EMF needs to be approved by the MEC prior to it being finalised with concurrence from the Minister. A notice will also be placed in the Government Gazette.

3.6 GIS Tool

Once the EMF is finalised, a GIS tool will be formulated for all departments at the MCLM to make use of when they receive a development application. This tool will also be compatible with GDARD GIS systems.

4 STRUCTURE OF THE EMF REPORT

The EMF report has been structured as follows:

- Introduction
- Legal Context
- Methodology
- Public Consultation
- Status Quo Findings
- Key Issues Identified During the Status Quo Phase
- Procedures Undertaken to Fill Gaps
- GIS Methodology
- Desired State Analysis
- Environmental Opportunities and Constraints
- Environmental Management Framework
- Strategic Environmental Management Plan
- Conclusion and Revision Schedule



5 PUBLIC CONSULTATION

As per the EMF Regulations the EMF has been supplemented with a Public Participation Process. The Status Quo Report was placed out for public comment for 30 days and was advertised in the Krugersdorp News.

A more thorough public participation process is being conducted during the EMF phase of the project which will entail various key stakeholder workshops to solicit comment from the key stakeholders within the study area. A database of stakeholders is included in this report.

In addition to the public consultation process, a thorough consultation process has been undertaken within the Project Steering Committee which was established at the inception of the project. This involved major authorities such as DEA, GDARD and the WRDM.

A newspaper indicating the availability of this report was placed in the Krugersdorp News on the 20th of January 2011 and the report will be available from the 20th of January to the 21st of February 2011 after which it will be finalised and prepared for the MEC.

The following workshops were held during the review period of the draft EMF Report:

Table 4: Public Consultation Meetings

Stakeholder Group	Date	Time	Venue
NGOs	09-Feb-11	10h00	ANC Caucus – Town hall
Mining	09-Feb-11	14h00	ANC Caucus – Town hall
Residents Associations	26 Feb-11	13h00	Laerskool Muldersdrif
Agriculture	10-Feb-11	10h00	ANC Caucus – Town hall
Conservation / Tourism	10-Feb-11	14h00	ANC Caucus – Town hall
Authorities / Councillors	11-Feb-11	10h00	ANC Caucus – Town hall

A detailed discussion document with all comments received during the review period and from these meetings is included in Appendix 4.

6 STATUS QUO FINDINGS

6.1 Climate

The MCLM has a strong summer rainfall regime with most of the annual rain falling between November and February. Mean Annual Precipitation (MAP) decreases from 750 mm near Krugersdorp, in the east, to approximately 600 mm for the areas west of Mogale City. Average mid-day temperatures range from 25 °C in summer to 16 °C in winter, while average night time temperatures range from 16 °C in summer to 6 °C in winter,

6.2 Topography

MCLM has very variable topography with ridge and mountain features in the north west of the study area and more undulating topography towards the eastern parts. The topography of MCLM ranges from 1220 masl in the east to 1840 masl at the Magaliesberg in the north-west. The Magaliesberg range forms part of the headwaters for the Crocodile River, which drains into the Limpopo catchment. The undulating topography yields many microhabitats owing to numerous micro-climates.

6.3 Biodiversity

The study area includes 2 biomes and nine regional vegetation communities. The MCLM straddles two biomes namely the Grassland and Savanna biomes. The mountainous nature of parts of the study area have resulted in the presence of the savanna biome whilst the flatter more undulating terrain is more suited to the grassland species.

Red data species that have been identified in the area includes:

- Birds – 30 red data species listed
- Mammals - 33 red data species listed
- Amphibians – The giant bullfrog *Pyxicephalus adspersus* is currently the only listed red data species in the municipal area
- Invertebrates – 9 red data species listed

The available habitat within the MCLM has resulted in several Red Data species being present. The loss of viable habitat has resulted in many species becoming threatened in Gauteng. The available habitat within the MCLM is thus critical to the conservation of these species.

The prominence of protected game reserves within the MCLM has also resulted in a large number of the Red Data mammal species being present particularly the larger mammals which are largely devoid in Gauteng due to the massive urbanisation that has taken place.

A number of prominent environmental features and resources exist within the MCLM. These include existing protected areas as well as formal and informal protected areas which include:

- Mogale's Gate Private Game Park
- Krugersdorp Municipal Game Reserve
- Walter Sisulu National Botanical Gardens and
- Hartebeestfontein Conservancy

Many opportunities are available to conserve the remaining natural areas within the study area. The maintenance of ecological connectivity remains the priority as this will ensure sustainability of habitats and prevent fragmentation.

6.4 Surface Water

Much of the municipal area consists of gently undulating topography with a number of ridges providing isolated areas of greater relief, including the linear ridges of the Magaliesberg, Witwatersberg and the western extension of the Witwatersrand / Northcliff Hill. The topography of the Cradle of Humankind WHS, a District Management Authority (DMA) neighbouring MCLM is dominated by the north-east trending ridges and valleys formed by the Transvaal Supergroup rock types. These ridges include the Magaliesberg mountain range lying to the north and north-west of the study area, and the crest of the Witwatersberg mountain range forming the northwest boundary of the site.

The MCLM encompasses six quaternary catchments. The majority of the area of the MCLM falls within the Limpopo catchment and drains northward via the Crocodile River and its tributaries into the Hartebeespoort dam and a small portion to the south of MCLM, falls within the Vaal catchment and drains via the Kliprivier.

The major rivers within the MCLM include:

- Crocodile River,
- Magalies River,
- Riet Spruit,
- Bloubank River and
- Jukskei River
- Tweelopiesspruit

Wetlands occur extensively across the Mogale City Municipal Area. The most common wetland form is the valley bottom wetland which occurs in most drainage systems. A particular characteristic of certain wetlands in the MCLM is the presence of peat. Peat-dominated wetlands store large quantities of carbon from the atmosphere through the accumulation of organic material over thousands of years. It is vital that these peat resources be kept intact due to their rarity and sensitivity, and due to their enhanced functionality, acting as natural filters for any contaminated water entering the system. Peat-based wetlands are under threat as peat is removed for horticultural purposes (peat mining) and is vulnerable to being destroyed by fires, especially if it is in a desiccated condition.

6.5 Agricultural Potential

The agricultural sector within MCLM plays a vital role in food production and enhances food security in both a local and regional context. Agriculture within the MCLM also contributes significantly to job creation and economic development, particularly in the rural portions of the study area. Agricultural activities in MCLM are extensive and relatively diverse with 32.29% of the total land surface under some form of agricultural production (Gauteng Agricultural Potential Atlas 3 – GAPA3). Crops grown in the study area include maize, tomatoes, cabbage, carrots and spinach with cultivated and wild flowers also contributing to gross agricultural income. Animal production (primarily red meat and poultry) occurs throughout the MCLM and contributes significantly to the economic status of the MCLM.

Farms within MCLM are within easy reach of large demand markets, such as Johannesburg and Pretoria. This close proximity reduces transport costs and allows local farmers to be more price competitive. The O. R. Tambo airport can also be used to reach national as well as international markets.

In terms of the roads network the MCLM is crossed by an extensive and relatively well maintained system. The major agriculture centres are situated around Hekpoort, Thorndale, Mogale City and Battery.

In general the western half of the MCLM has a higher agricultural potential than the eastern half. In terms of area 38% of the MCLM is classified as having high agricultural potential while 55% of the total land is classified as having low or zero agricultural potential.

6.6 Ground Water

The Mogale City Local Municipal (MCLM) area is underlain by a variety of rock types, most of which contain at least small amounts of groundwater suitable for local uses. One of the rock types in the MCLM, known as dolomite, is however regarded as a major aquifer that can supply large quantities of good quality groundwater.

Acidic mine water draining from the West Rand Mining Basin in the MCLM area began in 2002. Recent estimates put the rate of decant between 18 and 36 ML/d with a pH of about 3.0 and electrical conductivity (EC) of about 550 mS/m, compared to the pH of about 8.0 and EC of <30 mS/m of natural dolomite groundwater. At present, the acid mine drainage (AMD) is contained in holding facilities from where it is pumped to a treatment plant operated by Harmony Gold for neutralization and iron removal.

The Krugersdorp Game Reserve lies immediately downslope of the AMD, and receives polluted water via the Tweelopies Spruit (Other potential receptors of AMD include neighbouring smallholdings and, further afield, the Cradle of Humankind World Heritage Site. AMD is undoubtedly one of the most severe groundwater-related problems facing the MCLM, and it needs a long-term, sustainable plan for remediation and control. The situation is unlikely to improve naturally.

6.7 Geology

The dolomites in the MCLM belong to the Transvaal Supergroup (Malmani Subgroup of the Chuniespoort Group). The eastern portions of MCLM are underlain by a wide variety of geologic materials including granite and gneiss to the north-east of Krugersdorp. The Beaufort Group, which consists mainly of sandstone and shale, is found directly to the east of Krugersdorp, while the Witwatersrand, Dominion and Pongo Groups are located to the south-east of Krugersdorp. This variety of geologic materials has given rise to a diverse range of soils which cover the MCLM.

The existing urban areas are on quartzite which is deemed suitable for urban development. Muldersdrift is characterised by granite. This is significant since it might be prone to collapsible

soils which could increase the cost of building activities. However, this should not be seen as a major consideration for future development proposals

Several areas of undermining are present within MCLM. These are of particular concern due to the unstable nature of these areas

6.8 Socio economic (incorporating infrastructure and planning)

South Africa is faced with considerable challenges of service delivery particularly in the form of housing, infrastructure development and job creation. However, meeting these demands may not be to the detriment of and the non-protection of the physical environment with the goods and services it provides to sustain healthy livelihoods. Therefore, considering the country's need for economic growth, development must be guided to occur in a sustainable manner.

The population of the MCLM is 319 614 and the total land area of the municipality is some 110 000 hectares. Figures indicate that the population of the MCLM has increased by 29 927 between 2001 and 2007. This increase translates into 1.6% annual growth emanating from both natural growth and in-migration, and characteristic of the Gauteng Province. This population 51% of which is male is made largely of the young to working class generation below the age of 40 (Community Survey 2007 from Statistics South Africa).

The socio-economic characteristics differ considerably between the rural and the urban centres of development. The employment status and income levels in the urban core areas of the MCLM is relatively high, however this trend shifts downwards to the poorer and more rural areas of the Municipality where income levels are as low as R3200 per month. The MCLM has 50.16% employed people compared to Gauteng's 51.48%, whereas the unemployed make up 20.76% for the MCLM and 17.79% for Gauteng (Mogale City IDP 2009/10).

In term of characteristics of the households, the largest number of households is concentrated in the East and South of the MCLM in and around the CBD and there are a few to none traditional dwellings in the municipality. These communities are fairly well serviced particularly in the urban areas. A majority of residents have access to piped water, however, the greater part of the non-urban areas do not have access to basic sanitation services. Only the formal areas in the urban centres have access to refuse removal services. MCLM and Eskom provide Electricity to the study area.

The MCLM comprises of urban and rural areas with different levels of development. The land uses that play an important role in the local economy of the MCLM include mining, agriculture and industry, with mining activity having greatly modified the natural landscape of the area. Tourism,

eco-tourism, agriculture and business all have the potential to generate economic growth in the local economy. An issue of concern for the environment, which need to be considered further, is that the existing development patterns have already discounted slope and drainage constraints in the development of the municipal area.

6.9 Heritage

The MCLM is rich in heritage resources particularly a host of physical stock of heritage buildings and places of significance, and is representative of South Africa's deep-rooted natural and social history and cultural diversity. The City has a mandate in terms of the Constitution and heritage legislation to ensure their conservation through protection and sustainable utilisation.

The MCLM is located adjacent to the world renowned heritage site known as The Cradle of Humankind World Heritage Site. About 25 known sites of the hominid fossils, stone tools etc, occur within the study area. The historical gold rush, diverse architectural forms which took root on the African veld; and historic struggles against apartheid also contribute to the MCLM's unique sense of place. These assets should be carefully managed in line with best international practice and in compliance with applicable legislation.

The MCLM is host to a small number of declared provincial heritage sites signify an important historical event for this area. Palaeontological and archaeological places (Stone and Iron Age, rock art), as well as, all structures and buildings older than 60 years are by default, protected in accordance with SAHRA, as well as older burial places and public monuments and memorials. Approximately seventeen (17) historic sites were identified in the MCLM, as well as twenty 20 rock engraving sites, and approximately four cemetery sites and a military site. The MCLM further hosts various liberation struggles including The Paardekraal Monument (a provincial heritage site).

6.10 Landscape Character

Mogale City falls into two Geomorphic Provinces (SANBI, 2006): the Highveld in the eastern sector of the municipality and the Western Transvaal Basin in the west.

The municipal area is broadly divided into three geographical areas, each identified by specific land use and land cover characteristics. The eastern sector is characterized by urban development, while the central sector is dominated by agricultural activity and the western sector by natural habitats

Approximately 48% of the municipal area is characterised by high quality landscapes, much of which is located in the north-western sector, reflecting the presence of protected areas and ridges. There is however a significant amount of high quality landscape in the eastern sector, north of Krugersdorp, also reflecting the presence of protected areas, parks and reserve.

Moderate quality landscapes comprise 29% of the area, largely located in the central sector of the area as well as the north-eastern sector where agriculture is the dominant land use.

Poor quality landscapes comprise 23% of the area and correspond largely with urban areas and other areas where land cover has been significantly altered as a result of human activities.

6.11 Air Quality

MCLM reported an average wind velocity during 2007 and the first two months of 2008 of 3.5 and 5.7 m/s predominantly from the north easterly and north – north easterly directions with a relative humidity of 51% in 2008.

In 2007, MCLM presented data related to the levels of criteria pollutants. The criteria pollutants reported on are as follows:

- Sulphur Dioxide (SO₂);
- Oxides of Nitrogen (NO_x);
- Carbon Monoxide (CO);
- Ozone (O₃); and
- Particulate Matter.

Dust-fall as a result of mining activities and associated respiratory diseases is a major concern in the area.

7 KEY ISSUES IDENTIFIED DURING THE STATUS QUO PHASE

The status quo identified various issues and concerns and importantly several gaps. The table below summaries the findings of the status quo phase and highlights these gaps. The table also highlights what was done in order to fill the identified gaps.

Table 5: Key Issues identified during the Status Quo Phase

ENVIRONMENTAL PARAMETER	SUMMARY	GAPS	PROCEDURE UNDERTAKEN TO FILL GAPS
Biodiversity	<ul style="list-style-type: none"> ▪ Nine vegetation types present ▪ Several natural areas within the study area and associated protected areas ▪ Red Data species present ▪ Three different habitat types present ▪ Threats of fragmentation and habitat loss from urbanisation and agriculture 	<p>No detailed transformation data with regards to biodiversity</p>	<p>Detailed land use mapping. Detailed aerial photography was utilized to improve the current land use mapping.</p>
Surface Water	<ul style="list-style-type: none"> ▪ Several surface water features present ▪ Large wetland systems present including peatlands ▪ Valley bottom wetland dominate ▪ Important river systems present ▪ Many river classified as critically endangered in terms 	<p>No detailed spatial dataset of wetlands occurring within MCLM. Desktop mapping with minor field verification recommended.</p>	<p>Use of aerial photography for the delineation of the surface water features within the study area.</p>

	<p>of river health</p> <ul style="list-style-type: none"> ▪ Threats from sewage spills, AMD ▪ Ecosystems goods and services compromised by threats ▪ Riparian and wetland vegetation threatened by urbanisation, agriculture and alien invasion 		
Groundwater	<ul style="list-style-type: none"> ▪ Large area underlain by dolomite which contain compartments which hold groundwater well ▪ High yielding springs present like Maloney's eye ▪ Good aquifers present ▪ Very high risk of AMD which is currently being experienced ▪ Risk of contamination from effluent discharge 	<p>More groundwater monitoring infrastructure required and this is currently being implemented by the Department of Water Affairs.</p>	<p>Currently being undertaken by DWA.</p>
Geology	<ul style="list-style-type: none"> ▪ Variety of Geological features present ▪ Urban areas concentrated on quartzite ▪ Dolomitic areas considered to have low development potential 	<p>No gaps present although strict guidelines for building / foundations required</p>	

	<ul style="list-style-type: none"> ▪ Undermining present which also limits development potential ▪ Pressure to utilise dolomitic or undermined areas for development 		
Agricultural Potential	<ul style="list-style-type: none"> ▪ Dominant land use in MCLM ▪ Several areas of high agricultural potential ▪ Loss of high agricultural land to urban developments ▪ Unsustainable farming practices and thus loss of productivity ▪ Decrease in water supply and poor water quality 	Current agricultural data is out of date, more specifically; land use information is out of date. Mapping of land uses making use of detailed satellite photography is required. More detailed assessment into current agri trends is required.	Detailed land use mapping was utilised to refine information as well as latest Gauteng Agricultural Potential Atlas (GAPA).
Air Quality	<p>Little quantitative Air Quality data available due to faulty infrastructure.</p> <p>The criteria pollutants include:</p> <ul style="list-style-type: none"> ▪ Sulphur Dioxide (SO₂); ▪ Oxides of Nitrogen (NO_x); ▪ Carbon Monoxide (CO); ▪ Ozone (O₃); and ▪ Particulate Matter. 	Ambient air quality assessment needs to be conducted to accurately identify management zones.	An air quality assessment of the study area was undertaken in order to identify the current status quo and management guidelines which are needed in this regard.
Socio-economics	<ul style="list-style-type: none"> ▪ Population increasing in the MCLM ▪ Large rural 	No gaps identified at this stage due to updated recent studies	

	<p>component</p> <ul style="list-style-type: none"> ▪ High unemployment ▪ High service provision ▪ Development trends discounting slope and drainage constraints ▪ Threats from insufficient waste disposal practices ▪ Pressures from neighbouring municipalities ▪ Concentration on preserving rural nature and consolidating urban node 	being available to supplement the EMF	
Heritage	<ul style="list-style-type: none"> ▪ Heritage rich area linking into the COHWHS ▪ Vandalisation of heritage sites a major threat ▪ Increased awareness of heritage resources ▪ Urban development encroaching on heritage sites and often destroys them 	<p>No gaps with regards to identification of resources although it is likely that not all have been identified or document as certain areas have been concentrated on more.</p> <p>A research framework is thus recommended in order to continually supplement the information.</p> <p>A more detailed assessment of cultural landscapes needs to be undertaken to ensure a more robust heritage assessment</p>	Land use mapping utilised to identify cultural landscapes and character.
Landscape Character	<ul style="list-style-type: none"> ▪ Three geographical 	Current gaps relate to	Detailed land

	<p>areas identified</p> <ul style="list-style-type: none"> ▪ Urban, agriculture and natural ▪ Determine the landscape character and the ability for these areas to receive change ▪ Landscape quality rating of high, medium and low assigned according to land use ▪ A large proportion of the study area has a high quality landscape (48%) i.e. low capacity for change ▪ Anthropogenic activities such as land use change threatened these areas 	<p>integration with other environmental parameters and detailed land use mapping.</p>	<p>use mapping utilised to refine current zonation.</p>
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8 GIS METHODOLOGY

The GIS platform developed during the course of the study effectively enabled the integration of relevant base data sets with the findings of the specialist studies, allowing for the spatial delineation of areas of varying environmental sensitivity across the study area.

For each environmental parameter, relevant spatial features were assigned a sensitivity rating of High, Moderate or Low. Map overlay techniques were then applied to combine and synthesise the data sets to provide a single sensitivity map for each parameter. Details of the ratings applied to each feature are set out in the Table below.

Table 6: Land use categories

ENVIRONMENTAL PARAMETER	LAND –USE CATEGORIES
Biodiversity	
High	Natural/Intact vegetation Protected areas Ridges Wetlands and rivers including 32m buffer C-Plan: Irreplaceable
Moderate	Agricultural lands Impacted grasslands C-Plan Ecological Processes
Low	Remaining area
Agricultural Potential	
High	High agricultural potential
Moderate	Medium agricultural potential
Low	Low agricultural potential
Geology and Geohydrology	
High	Dolomitic areas Decant point Swartkrans / Steenkoppies compartments Maloneys eye Undermining
Moderate	Waste water treatment works Slimes dams
Low	Remaining area
Social	

High	Ridges Protected areas etc
Moderate	Agricultural Hub Urban 2 N12 Transition Zone
Low	Urban Development Zone Industry Mining
Heritage	
High	Cultural landscapes, Urban landscapes, sensitive buildings and sites
Moderate	Moderate heritage value
Low	Rest of study area
Landscape Character	
High	High visual sensitivity
Moderate	Moderate visual sensitivity
Low	Low visual sensitivity
Air Quality*	
Green	Clean
Yellow	Local Industrial control areas
Orange	Meet industrial requirements
Blue	Meet residential requirements
Grey	Transition areas and industrial buffer corridor

* Please note that air quality is categorised slightly differently due to the unique issues associated with air quality

These categories have been utilised to create the sensitivity maps illustrated in the section below.

9 DESIRED STATE ANALYSIS

This section of the report details the desired state of the environment. This section documents the state in which the various environmental parameters should be in, in order to maintain ecological sustainability.

9.1 Biodiversity

9.1.1 *Desired State*

The study area is rich in both floral and faunal biodiversity with a wide variety of vegetation types due to the varying topography. They are however under serious threat from increased urbanisation within the study area. With the development pressures that have been identified, it is crucial that areas within the study area that are rich in biodiversity or that have conservation importance are identified. By preserving these areas, biodiversity would be retained and the sense of place of the study area would be protected.

The major strategic environmental impacts on biodiversity in the study area vegetation that were identified:

- Urbanisation and poor planning
- Mismanagement and overgrazing
- Alien invasive species
- Fragmentation of habitat

The remaining patches of intact vegetation within the study area are critical to maintaining habitat linkage and species diversity. The mountainous nature of the study area has resulted in the inadvertent conservation of large areas of intact vegetation due to inaccessibility of these areas. The formal protection and awareness of these areas through the ambit of the EMF is thus critical to their future conservation.

The maintenance of ecological linkage is also critical to maintaining this biodiversity and areas that have such linkage must be preserved and maintained in order to retain this linkage and promote diversity. This is particularly of relevance in the more urban areas of the study area. In these instances it is most likely drainage lines which serve this purpose and these areas require protection in order to prevent isolation of these habitats.

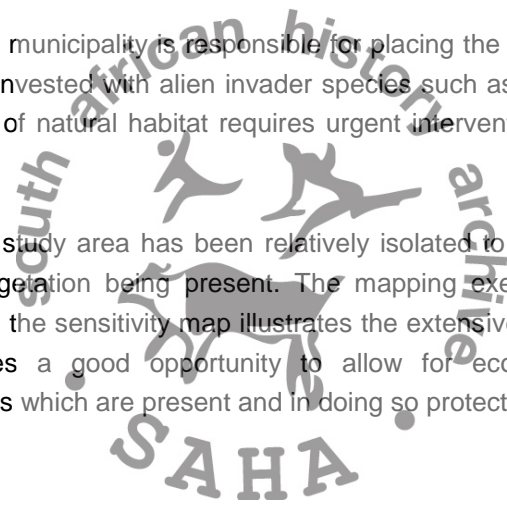
The faunal component is dominated by the presence of several bird species, including several protected species. Most large mammal species are absent from the study area due to the various anthropogenic factors present such as farming. Due to the large amount of natural areas within the study area, it is likely that the faunal diversity will be high. The conservation of these habitats as mentioned above is thus critical to retaining the faunal diversity which is present.

The Muldersdrift area is currently identified as a key development area and hence the biodiversity in this area is under pressure. The Muldersdrift Precinct Plan has however taken the sensitive biodiversity into account and has ensured that buffers around these areas are in place. The promotion of these areas as ecological as well as pedestrian (cyclists) is also mentioned which is good environmental practice.

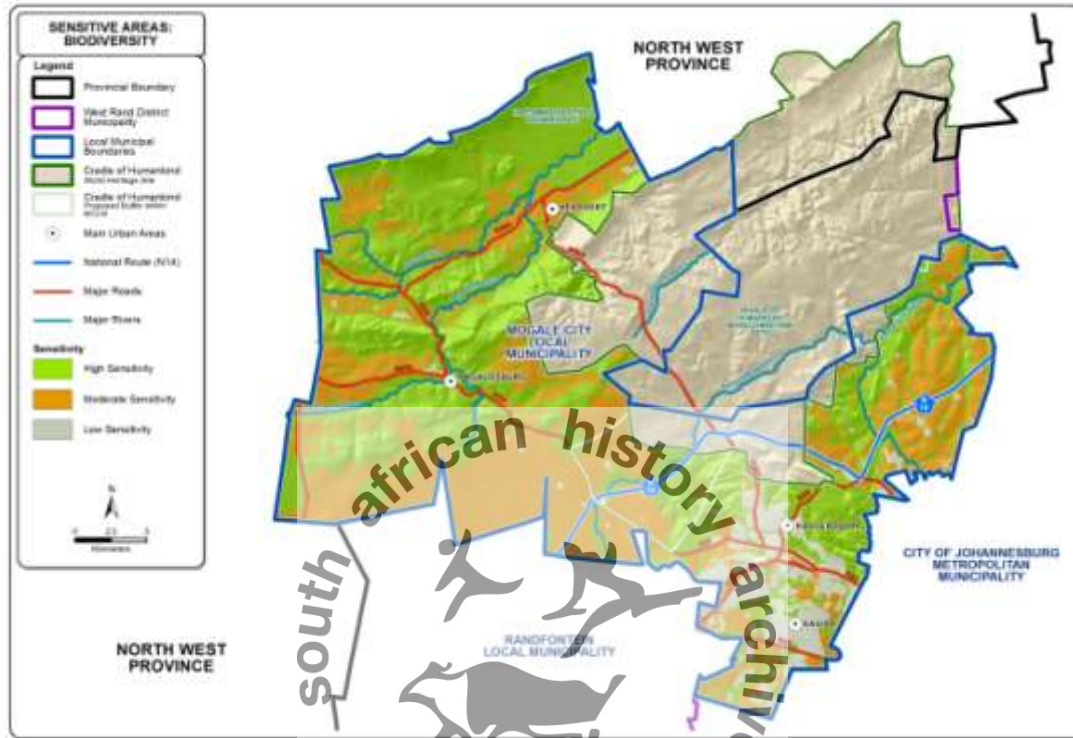
The desired state for biodiversity is to conserve the above mentioned features under the relevant legislation which govern biodiversity i.e. NEMA, NEMBA, NEMPAA, the National Forest Act etc.

Alien vegetation within the municipality is responsible for placing the desired state at risk. Rivers and wetlands are heavily invested with alien invader species such as the Black Wattle and Blue Gum. This transformation of natural habitat requires urgent intervention in order to achieve the desired state.

Transformation within the study area has been relatively isolated to the urban areas with large areas of fairly natural vegetation being present. The mapping exercise that was undertaken highlights these areas and the sensitivity map illustrates the extensive open areas present within the MCLM. This provides a good opportunity to allow for ecological linkage to ensure sustainability of the habitats which are present and in doing so protecting the species present.



9.1.2 Sensitivity



Map 2: Biodiversity Sensitivity

Large portions of the study area are considered to be moderately sensitive from a biodiversity perspective. These areas are mostly dominated by agriculture. Areas of high biodiversity are dominated by protected areas and higher areas which are relatively inaccessible as well as surface water features together with buffers. Areas of low sensitivity are centred around the urban areas. The mapping for biodiversity included C Plan version 2. At the time of completion version 3 was not yet complete however if available it will be incorporated into the final report.

9.2 Surface Water

In order to address the gap that was identified in the status quo phase, some background information has been included in order to put the desired state in context.

9.2.1 Background information

- Impacts

At the broadest level, changes to socio-economic and institutional systems act as driving forces which often lead to 'pressures' (which can be described as human activities which have the potential to cause adverse effects or 'negative impacts') on natural resources (Oman *et al.*, (2009)). Hence, operational and developmental activities in light of the above driving forces can be highlighted as primarily responsible for impacts on surface water resources. Various specialist studies identified in the Mogale SoER, 2003 indicate that such activities include urban (residential, commercial and industrial) and rural development. More specifically, several activities pin-pointed as impacting on water resources involve:

- increased development on the banks of rivers and wetlands;
- water abstraction activities and schemes, some of which are unsustainable;
- uncontrolled damming of rivers;
- peat mining (legal and illegal);
- mining activities (specifically sand dumps and slimes dams) where contaminated water is discharged through point or diffuse sources;
- road and culvert construction in wetland areas that changes the morphology of wetlands and increases the flow velocity of storm water into the system with resultant scouring and erosion effects;
- inferior road and culvert designs being constructed and implemented;
- uncontrolled veld fires which damage peat wetlands;
- channel formation from erosive actions;
- alien vegetation encroachment within wetlands and in particular along rivers (riparian zones).

These activities are principally viewed as contributing towards two categories of impacts, namely pollution related impacts and habitat transformation. Table 7 below outlines each category and the associated sources and resultant impacts.

Table 7. Primary Sources and Impacts to Surface Water Resources in the MCLM

IMPACT CATEGORY	SOURCE	IMPACT
<i>Pollution activities</i>	Urban (stormwater and run-off from roads, parking lots and other built up areas containing litter and various other pollutants) and/or industrial effluent return flows	High chemical oxygen demand (COD) in aquatic systems, solid and dissolved metal pollution, litter entering water resources
	Mining effluent, dewatering and discharge	Acid mine drainage, change in the pH that may potentially lead to high sulphuric acid concentrations resulting in serious odour problems and increased water corrosion, low pH of water which is toxic to living organisms, discharge of toxic substances into the surface and groundwater resources, higher concentration of TDS (total dissolved solids) in water indicating high salinity
	Sewage	Treated and untreated sewage effluents entering water resources, excessive influx of nutrients (orthophosphates and nitrates) leading to the eutrophication of water resources, high biological oxygen demand (BOD) leading to decreased dissolved oxygen availability for aquatic organisms, groundwater contamination
	Agricultural activities	Influx of nitrates, salinisation of water resources, degradation of water quality through agrochemicals and toxic leachate, pollution of ground and surface water resources

	Influx of diffuse pollution from dense settlements (i.e. Sewerage and cleaning and washing detergents)	Feacal contamination of water resources, elevated load of nutrients into receiving natural systems, discharge of untreated effluent into the aquatic environment, growth of biological material and algal blooms which are toxic to human, plants and animals, increased cost in purification of water for potable use, increased siltation in water courses because of lack of non paved surfaces
	Impoundments	Sedimentation and silt migration
	Construction activities near water resources	Influx of sediment and other pollutants resulting in sedimentation
	Dumping and littering	Waste materials (plastics, bottles etc.) entering water resources
<i>Habitat Transformation Activities</i>	Agricultural practices resulting in overgrazing	Can adversely affect vegetation, often leading to soil erosion, deteriorating the ability of many of the wetland areas to perform various functions i.e. reducing the effects of floods
	Establishment (accidental or intentionally) of alien invasive species	Disturbance of natural vegetation, displacement of natural vegetation, loss of high quality vegetation and natural biodiversity, loss of wetland functionality
	Subsistence and commercial agricultural activities	Decline of natural vegetation, destabilisation of the banks of water resources, increased sediment loads entering water resources
	Recreational parks	Clearance and/or cutting of wetland, riparian and littoral vegetation destroys the amount of available natural habitat, channelisation of wetlands and resultant loss of wetland habitat.
	Vagrant and informal establishment of human settlements	Destroy ecology of ecosystems, taints perceptions of the areas

	Urban development	Transformation of natural features resulting in artificial and unnatural surfaces, reduction of natural habitat, irreversible loss of ecosystem functionality
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- Wetlands

The RSA wetlands database of 2010 identifies a total of 384 wetlands in the MCLM occupying an area of approximately 803 hectares (Figure 1). A large portion of these wetlands falls within the domain of palustrine systems, whilst a few can be viewed as lacustrine systems comprising either flat depression wetlands or relatively small privately owned impoundments that have been created within valley bottom (palustrine) wetland systems. Importantly, no major dams occur in the MCLM. In general, most of the wetlands comprise valley bottom systems of which the higher proportion are channelled (94) whilst the remainder are un-channelled (78). A significant number (143) of hillslope seepages can be found in the MCLM, with pan or depression wetlands (69) being less in occurrence. However, the findings in this study show that a total area of approximately 4384 hectares of wetland area occurs in the MCLM, as determined through desktop means, in contrast to a wetland area of 803 hectares according to the RSA wetlands database. This, presumably, is due to the fact that the RSA Wetlands Database 2010 delineated limited areas at a broader scale. This study, on the other hand, delineated continuous areas of wetlands at a localised scale to account for the fuller extent of surface water resources in the MCLM. In terms of wetland health in the MCLM, there is no overall assessment on wetland health in the study area. However, as most of the streams and rivers occurring within the study area occur within a wider valley bottom wetland setting in which a defined river channel occurs, river health has been used as a determinant of state of health for these drainage systems occurring across the municipality.

- Rivers

River health can be broadly defined as the condition or 'state of health' of a riverine ecosystem. The health of a river system is dependent on a number of key structural and functional components such as geomorphology, hydrological regimes, water quality and physical habitat condition, which if degraded, will negatively affect the health of the river. Theoretically, degradation of these components has a corresponding adverse effect on the biological communities that occur within the river ecosystem. Thus the level of modification to the various components can be used to determine the health of a river. Table 8 outlines the four categories (Ecostatus Category) in which river health can be designated ranging from natural (the optimal condition) to poor.

Table 8. River Health Ecostatus Categorization

RIVER HEALTH CATEGORISATION		WATER RESOURCE CLASSIFICATION SYSTEM (NATIONAL WATER RESOURCE STRATEGY, 2004)	
Category	Description	Proposed Class	Description
Natural	No or negligible modification of instream and riparian habitats and biota	Natural	Human activity has caused no or minimal changes to the historically natural structure and functioning of biological communities, hydrological characteristics, chemical concentrations and the bed, banks and channel of the resource.
Good	Ecosystem essentially in good state: biodiversity largely intact	Moderately used or impacted	Resource conditions are slightly to moderately altered from the Natural class due to the impact of human activity and water use.
Fair	Sensitive species may be lost with tolerate or opportunistic species dominating.	heavily used or impacted	Resource conditions are significantly changed from the Natural class due to human activity and water use, but are nonetheless ecologically sustainable.
Poor	Mainly tolerant species present or alien species invasion; disrupted population dynamics; species are often diseased.	Unacceptably degraded resources	Due to over-exploitation, these rivers are already in a state that is ecologically unsustainable.

(Source: River Health Programme, 2005)

Information pertaining to the level of modification of rivers in the study area is sourced from a desktop study examining the Present Ecological Status Category of South African Rivers undertaken by Kleynhans (2000). Rivers in the study area have been assigned a rating relating to their level of modification and their state of riverine biodiversity. The Kleynhans study classifies rivers into 5 classes reflecting the degree of modification of the river, from an unmodified / natural state to a largely modified and unacceptable level of modification. The classification is based upon a number of attributes, including flow alterations, degree of fragmentation due to impoundments, water quality levels, stream bed condition, riparian or stream bank condition and the presence / absence of introduced in stream biota.

The South African National Biodiversity Institute (SANBI) and the Department of Environmental Affairs (DEA) undertook an assessment of biodiversity in South Africa at a national scale [the National Spatial Biodiversity Assessment (NSBA)], as part of the National Biodiversity Strategy and Action Plan. Various aspects of biodiversity were spatially assessed, including terrestrial, riverine, estuarine and marine biodiversity. The study resulted in the first ever systematic assessment of river biodiversity in South Africa. One of the outputs of the process was an assessment of conservation status of South African riverine ecosystems, based on the IUCN method to categorise species into critically endangered, endangered, vulnerable and least threatened. This process was undertaken at a national level and primarily examined mainstream rivers (Nel *et al*, 2004).

In the study area, most rivers have been assigned a 'Critically Endangered' status under the NSBA assessment. Critically endangered status implies that river heterogeneity signatures have an intact length of below their conservation target (10% of their total length). This further implies that the rivers have lost so much of their original natural habitat that ecosystem functioning has broken down and species associated with the ecosystem have been lost or are likely to be lost (Nel *et al*, 2004). On the other hand, endangered status implies that river heterogeneity signatures have an intact length greater than their conservation target (10% of their total length). They have lost significant amounts of their original natural habitat and therefore, their functioning is compromised (Nel *et al*, 2004).

Table 9 below summarises (where possible) the ecostatus category, present ecological status category and IUCN category of the major rivers in the MCLM. Evidently, the main rivers are shown to be in a moderately to largely modified state. Moreover, the ecostatus for some rivers are poor. According to the IUCN category the main rivers of the study area are either endangered or critically endangered. Conclusively the general state of river health for the MCLM is concerning.

Table 9. Summary of the various River Health Categories and Status for the Major Rivers of the MCLM

RIVER SYSTEM	ECOSTATUS CATEGORY	PRESENT ECOLOGICAL STATUS	IUCN CATEGORY
<i>Magalies River</i>	Poor	Class C - Moderately modified	*Critically endangered and Endangered
<i>Jukskei River</i>	-	Class D – Largely modified	Endangered
<i>Skeerpoort River</i>	Good	Class C - Moderately modified	Critically endangered
<i>Crocodile River</i>	Poor	Class C - Moderately modified	Endangered
<i>Bloubankspruit River</i>	-	Class C - Moderately modified	Endangered
<i>Wonderfonteinspruit River</i>	-	Class D – Largely modified	Endangered

*Note – The Magalies River has various reaches or segments along its total length that the IUCN has categorised individually. This explains why there are two categories for the Magalies River which applies to the concerned reaches or segments that were studied. For more information see Nel *et al* (2004).

- Water quality

The surface water quality is based on a statistical assessment of the available DWA data for the period 1979-2008 for key strategic points. The data was assessed against the DWA Water Quality Guidelines (1996) for irrigation, livestock water and (SANS241: 2005) for drinking water quality. Occasional spikes in pH and total dissolved solids have been recorded. Although surface water in the area is not generally used for potable purposes the South African National Standards (SANS) provides a useful benchmark against the more stringent irrigation and the more relaxed livestock watering guidelines.

The tables below show statistical summaries of the water quality parameters of some of the rivers in MCLM collected from various sampling stations in the area to the north of Krugersdorp. These stations were mainly operated by the Department of Water Affairs and recorded for the period between May 1979 and June 2008. The different parameters are compared with the SANS 241 standards which give the recommended limit for Class 1 drinking water. The parameters analysed are; pH, conductivity, Total Dissolved Solids, Calcium, Magnesium, Sodium, Potassium, Chloride, Sulphates and Carbonates ions.

Table 10. Statistical parameters of water quality parameters of three rivers in MCLM

River/parameter	pH	EC (mS/m)	TDS	Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	Cl ₂	SO ₄	HCO ₃
SANS 241 (2006)	5.0-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	Un-specified
Crocodile	7.0	26.3	175.5	16.6	5.9	15.0	4.0	17.6	18.8	64.4
Bloubank	7.4	50.9	350.0	42.1	24.8	9.8	0.7	19.6	65.0	150.2
Skeerpoort	7.45	28.5	225	25.7	18.4	2.2	0.15	1.5	4.2	153.5

Statistical parameters for the period of record 05/1979 to 06/2008 (Source: Hobbs, 2009). The statistical results of three rivers in Table 9 above show that the rivers fall within the DWA standards in terms of water quality and no deviations were noted during the monitoring period. It is imperative that these parameters remain within acceptable limits to sustain the health of the rivers and the water quality. Equally, it is important to note that the above results provide a generalised indication of the water quality for the rivers in 2008 and may not accurately reflect the actual condition of the river along the entire length. This is especially so where mining activities (past and present) are, or have, taken place and where these activities may be adversely affecting water quality on a localised scale.

- Water Quality trends of river systems

Several studies can be drawn upon indicating trends in the water quality of streams in the MCLM. Table 11 summarises this information.

Table 11. Trends in the Water Quality of some of the Rivers in the MCLM

River System	Trend	Source
<i>Crocodile River</i>	Experiencing water quality problems stemming from eutrophication and algal blooms	Fourie and Associates, 2004
<i>Jukskei River</i>	Experiencing water quality problems as a result of urbanisation, mining, industry and diffuse agricultural (fertilizer) run-off	DWA, 2003; SRK, 1999; EMF 2003; EMP, 2009
<i>Wonderfonteinspruit</i>	Experiencing poor water quality due to surface water run – off from a low cost housing. This water is high in Chemical Oxygen Demand (COD) and Biological Oxygen Demand	Opperman, 2008

	(BOD) concentration	
<i>Bloubank Spruit</i>	Water quality is good at Zwartkops except for the total dissolved solids and elevated nitrate levels. Water suitable for livestock watering; General river quality is primarily poor largely due to discharge of treated effluent from wastewater treatment works	Hobbs and Cobbing, 2007
<i>Magalies River</i>	Water quality parameters assessed in the river complied with SANS241:2005 and the DWA guidelines except for the total dissolved solids guideline for irrigation water	
<i>Tweelopiespruit</i>	Treated water discharged from the surrounding mines into the Tweelopiespruit makes this river system semi-toxic and unfit for use by animals; During heavy rain storms, untreated acid mine water flows into the Tweelopiespruit; Heavy metals from the water, or contaminated soil, are taken up by plants and get into animals through the food chain	Winde and Stoch, 2009; Du Toit, 2006

9.2.2 *Desired State*

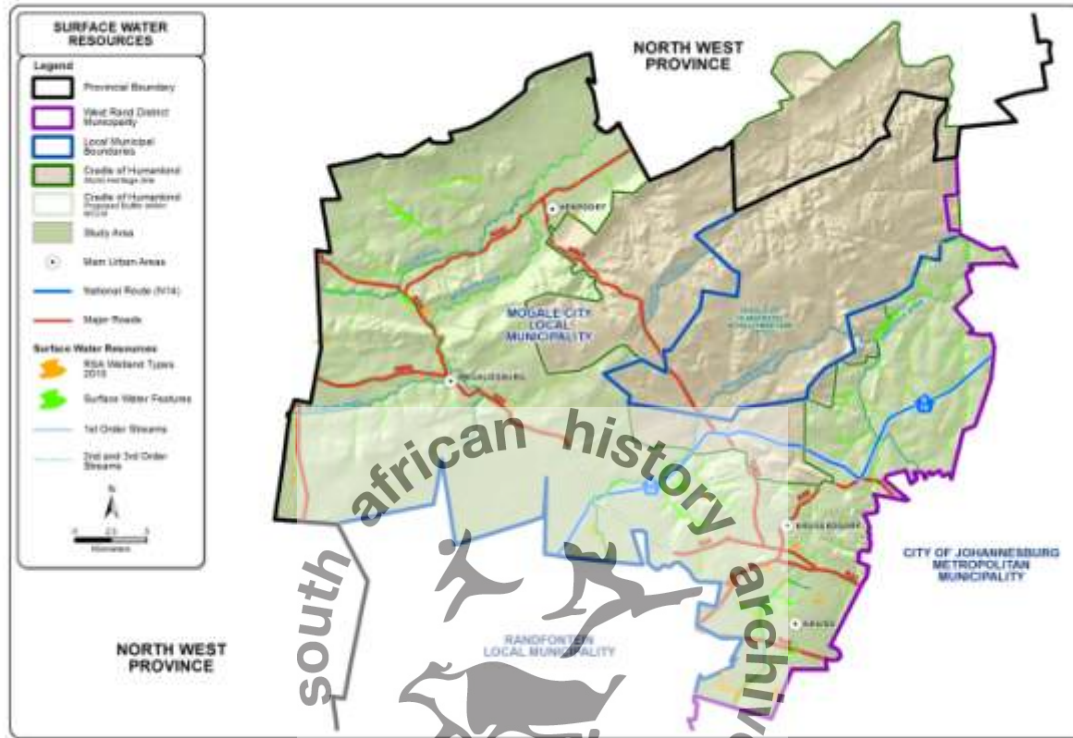
As an underlying principle, wetlands and all other surface water resources should be maintained as close to a natural state as possible. This implies two broad categories of objectives; to firstly maintain surface water resources that are in a pristine or largely natural state in this condition, and secondly, where possible to restore degraded / transformed surface water resources to as natural a state as possible.

It is recognised that, with respect to the latter case, in many parts of the municipal area the transformation of surface water resources is either complete and thus irreversible (e.g. where

urban development has occurred over wetlands, causing complete loss of the wetland), or that the attempt to reverse impacts on the water resource would not be economically or socially practical or sustainable. As an example, promoting a policy for the attempted rehabilitation of all areas of hydric soils that have been placed under cultivation would not be practical or sustainable, and may have deleterious socio-environmental impacts such as loss of jobs, worsening food security, etc. The environmental benefits of attempting to rehabilitate these wetland areas would not outweigh the negative effects that would result in other spheres and hence, would not be practical or sustainable. Rather rehabilitation attempts should be focussed upon areas where the rehabilitation effort would be practical and would be able to improve the state and functionality of the wetland, thus improving the ecosystem services provided by the wetland. Such rehabilitation efforts are likely to have a significant cost implication, which heightens the importance of prioritising actions which will result in definite and measurable improvements to wetland health and functioning.

The above perhaps, and most importantly, relates to the maintenance and preservation of wetlands and other surface water features that are currently judged to be in a largely natural state. It is in this context that management objectives are critical, as ensuring that actions / activities that could potentially lead to the degradation of wetlands and other surface water resources should be carefully controlled. Potential landuse change is a critical area in which the management objectives relating to surface water resources need to be applied, as most of the pressures acting on surface water resources are directly linked to landuse, where some tend to have a much greater impact on surface water resources than other landuse types. Landuse change has the potential to expose surface water resources to a new suite of threats that would have been unlikely to affect these environments previously. As the population of the municipal area grows, there is likely to be more and more demand for the expansion of urban areas into formerly vacant or agricultural areas on the peripheries of existing settlements that may have the potential to degrade wetlands and other surface water resources in these areas. Thus, sustainable landuse management is key to ensuring the dual components of the desired state for surface water resource management in the MCLM. This is reflected in most of the management objectives discussed below.

9.2.3 Surface water features



Map 3: Surface Water Features

All surface water features form part of the high biodiversity sensitivity layer as illustrated in the section above.

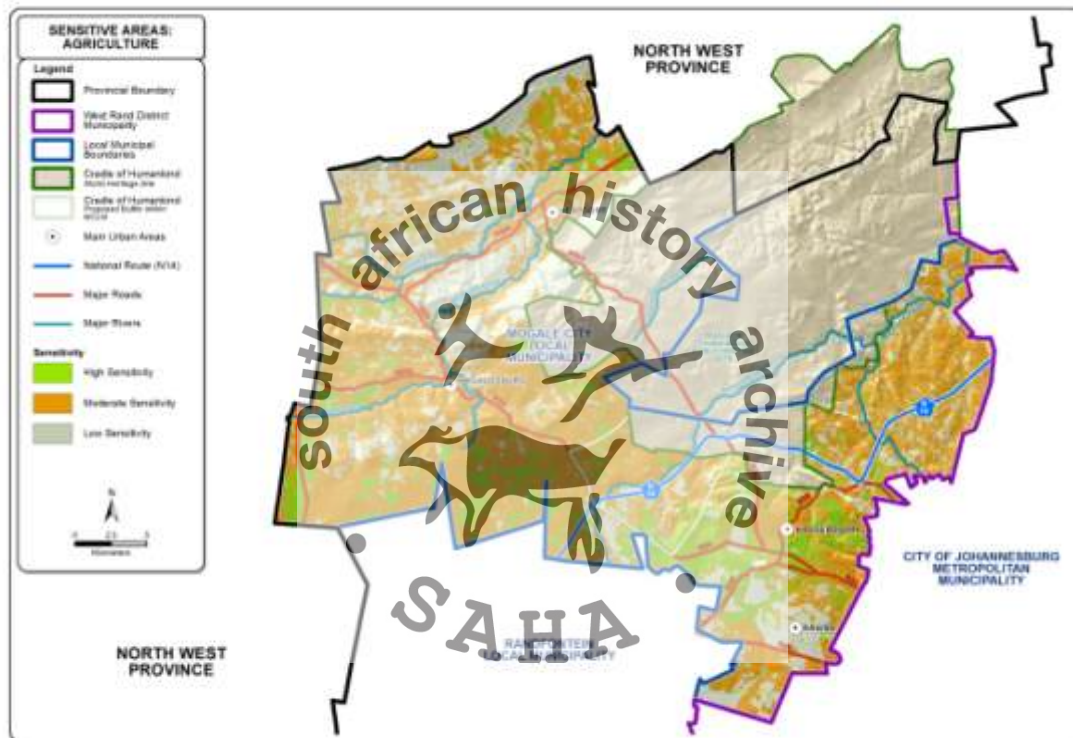
9.3 Agricultural Potential

9.3.1 Desired State

The desired state is essentially a target for a particular land use class, in this case agriculture, and revolves around a relatively simple question “*What should ideally be happening to agriculture in the future?*” This question refers to both current and proposed agricultural developments and their related activities.

The agricultural sector in the MCLM needs to align its future vision with those of the National Department of Agriculture, Forestry and Fisheries (DAFF). Owing to this, the desired state of agriculture in the MCLM should be to have a united and prosperous agricultural sector through the support of sustainable agricultural practices while also maximising growth, empowerment and income.

9.3.2 Sensitivity



Map 4: Agricultural sensitivity

Areas of high agricultural potential according to the Gauteng Agricultural Potential Atlas were determined to be of high sensitivity whereas areas of medium and low potential were determined to be of medium and low sensitivity accordingly. These areas are sensitive to transformation by other land uses.

9.4 Groundwater and Geology

9.4.1 Desired State - Groundwater

The desired state of groundwater in the MCLM area is one in which both the quantity and quality of the resource is managed in a sustainable way, in line with the requirements of the National Water Act. Where groundwater is polluted or the water table falls below acceptable levels, actions must be taken to bring these parameters back within satisfactory limits. At present groundwater quality in the dolomites is potentially threatened by a variety of activities, including mining (acid-mine drainage and leachate from mine waste dumps), discharge of effluent from wastewater treatment works, and agricultural effluents (e.g. nitrate fertilizers). Locally very poor groundwater quality has been recorded in some areas (particularly those close to former mines and slimes dams) although as a whole across the dolomites the groundwater quality is still good. The quantity of groundwater (closely related to water levels in the aquifers) may be declining in the Steenkoppies Compartment (due to groundwater abstractions for irrigation), but rising in the Zwartkrans Compartment (due partly to inflows from rising mine water levels in the adjacent Witwatersrand rocks). A small part of the Tweefontein Compartment is also found within the MCLM. There is still some uncertainty about the exact state of groundwater because the groundwater-monitoring network is presently not adequate to characterise the area's groundwater resources in detail.

The state of the MCLMs groundwater resources is critical not only to small-scale users of groundwater (e.g. farms and smallholdings) and to the environment (e.g. the flow of the Magalies River), but also to a valuable irrigation-based agricultural industry, which is a big local employer. At present several different organisations have an interest in groundwater management in the MCLM area, and there is limited coordination and cooperation between them. An important management objective would be to achieve close cooperation between different organisations (e.g. DWA, Council for Geoscience, the CSIR, the mining companies, etc).

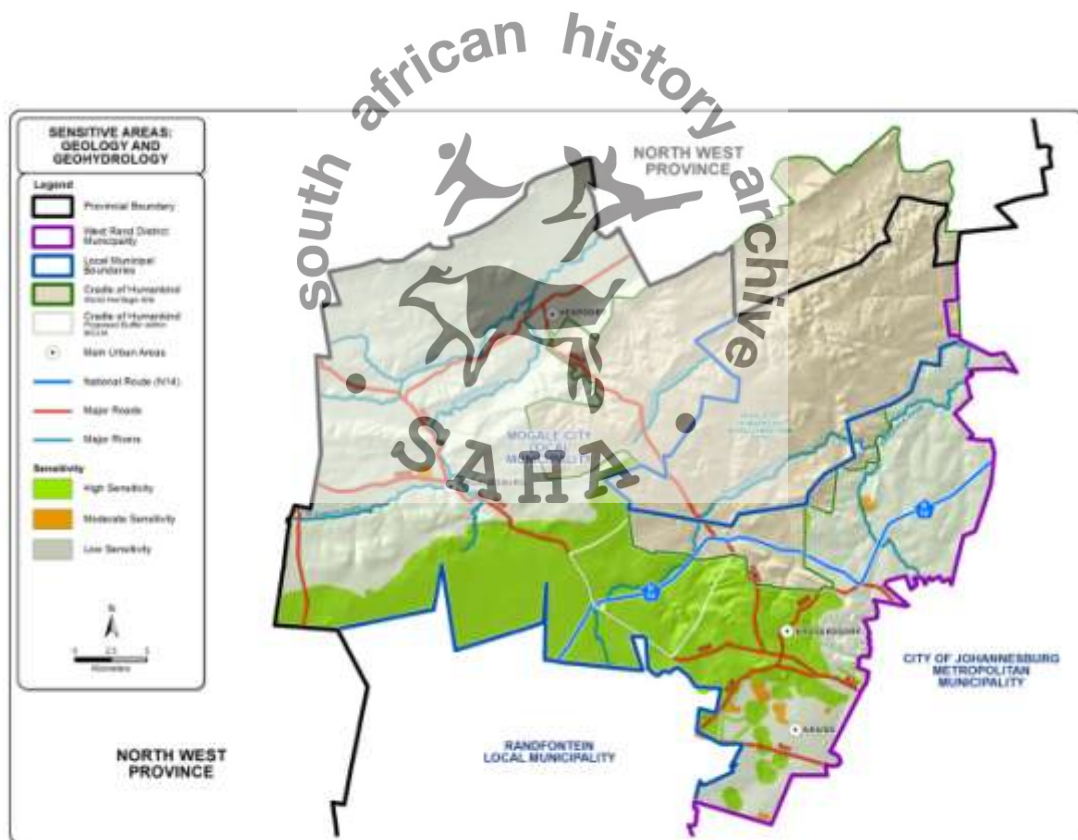
In summary therefore, the desired state of groundwater in the MCLM area is as follows:

- Groundwater quality and groundwater levels moving back to within acceptable parameters, and meeting legal and policy requirements.
- Adequate groundwater monitoring network (quality and levels) to enable the state of the groundwater resource to be adequately monitored (particularly in the dolomites). Such a network would also act as an early warning system.
- Strategy put in place for addressing identified problems, such as the low flows at Maloney's Eye and associated groundwater abstraction, the acid-mine drainage problem, and the problems of pollution emanating from mine waste dumps.
- Coordinated database of groundwater data, incorporating all available groundwater data

9.4.2 Desired State - Geology

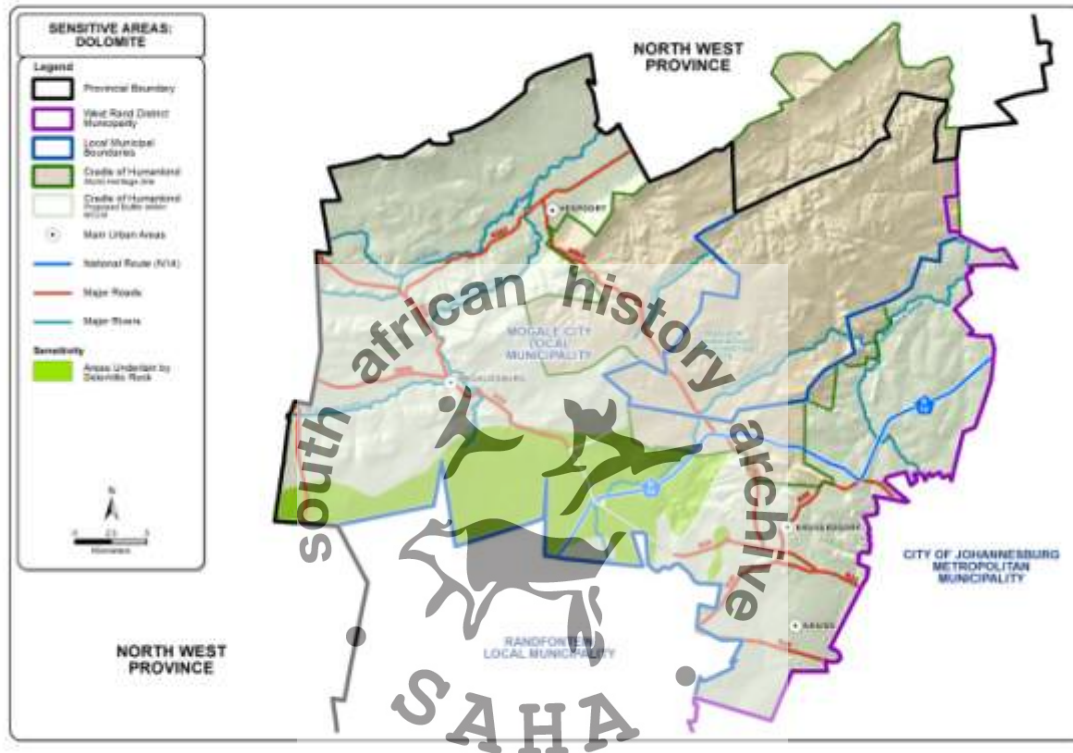
The geology of the earth as we see it today is the result of numerous cycles of deposition and weathering, movements of land masses and volcanic eruptions that have taken place over a period of hundreds of millions of years, and continues today, but at a rate that is all but invisible. Although mankind has used and often abused the earth's geological resources since the beginning of civilisation, he is unable to effect the basic geology of the planet. Consequently it is not considered possible to set targets for an idealised geological "desired state" but it is possible to create a situation where knowledge of the geology of an area, allows one to have a basic understanding of both the potential for development of an area, and the problems that may be associated with such a development. It is thus a requirement for decision makers to be aware of the geological features of the MCLM in order to protect these features.

9.4.3 Sensitivity



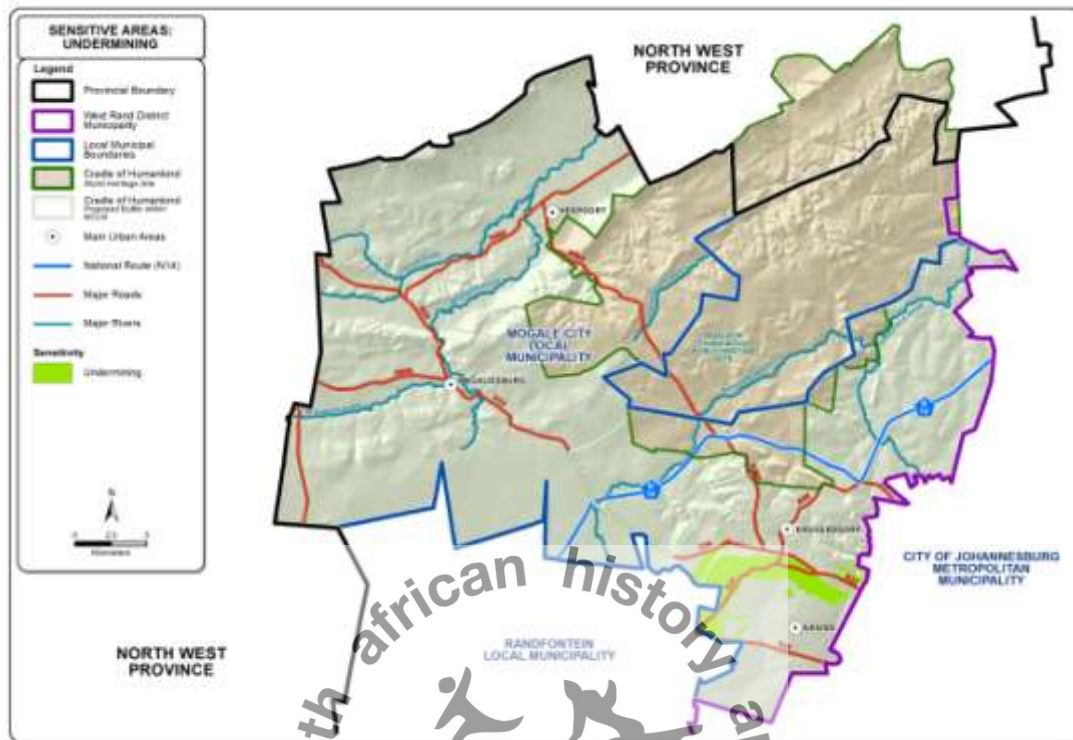
Map 5: Geology and Geohydrology sensitivities

The geology and geohydrology map illustrate the dolomitic areas, the decant point, the Maloney's eye and undermining as high sensitivity areas due to the major issues associated with these areas. Areas of medium sensitivity include the waste water treatment works and the slimes dams within the MCLM. The remainder of the study area is considered to be of low sensitivity from a groundwater perspective. This includes the granitic / weathered quartzite aquifers to the west of the study area as these are not considered to be sensitive at this stage as they are not under the same pressure as the dolomitic aquifers..



Map 6: Dolomitic sensitivity

Map 6 highlights the dolomitic areas within the MCLM, highlighting the sensitivity mentioned above.



Map 7: Undermining sensitivity

Map 7 indicates the area within the municipality that has been exposed to undermining activities and which should be subject to detailed geotechnical assessment prior to any development.

9.5 Radioactivity

9.5.1 Current Status Quo

Although no specific studies into radioactivity have been conducted for the EMF, the following information has been provided. This information lays the foundation for further studies into the matter. The EMF can also make recommendations for remediation in the hopes of improving the current status quo.

Contamination of soil and groundwater resources through Acid Mine Drainage, as mentioned above is a major concern for the MCLM. However in addition to AMD, the threat of radioactivity

through radon gas and radioactive dust has also been found to be a major concern (Land-Use after Mine Closure – Risk Assessment of Gold and Uranium Mine Residue Deposits on the Eastern Witwatersrand, South Africa. M. W. Sutton. Mine Closure. 2008).

The National Nuclear Regulator (NNR) has found that fine radioactive dust from relict mine dumps can result in deposits on agricultural lands result in radioactive contamination in addition to inhalation by humans (Radiological Impacts of the Mining Activities to the Public in the Wonderfontein spruit Catchment Area). An airborne radiometric survey that was conducted by the Council for GeoScience indicates that a large number of residential and built up areas fall within areas of high risk of radioactive contamination.

As an example, radioactive measurements surrounding the Tudor Dam in the MCLM have been determined to medium to high. At the site, uranium and radium concentrations were measured to be 2000Bq/kg for uranium and 1200 Bq/kg for radium. These exceed national and international clearance standards.

An explanation of this radioactivity would be that soil exposed after reclamation of mine residue deposits has elevated concentrations of heavy metals in the topsoil, notably, Co, Ni and Zn. These heavy metals will / have inevitably end up in the groundwater (AngloGold Ashanti West Wits Operations. Draft Environmental Impact Assessment Report, 2009)

A major situation arising due to the presence of radioactive soil is not only the movement of this dust but also the settlement of people on or near these areas. The Tudor Shaft Informal Settlement in Kagiso is a case in point. This settlement is located upon uranium tailings, adjacent to tailings dams and within 500m buffer zones of tailings dams.

The Chamber of Mines dictated a 500m buffer zone surrounding tailings deposits however these were not adhered to and as a result settlements have emerged in these areas. In addition these areas have not been rehabilitated suitably with metallophytes (plants which are able to metabolise heavy metals) contributing to the use of these areas (Surveying in the Vicinity of Witwatersrand Gold Mines. H. Coetzee. Mine Closure 2008 & Land-Use after Mine Closure – Risk Assessment of Gold and Uranium Mine Residue Deposits on the Eastern Witwatersrand, South Africa. M. W. Sutton. Mine Closure. 2008).

Mariette Liefverink is thanked for providing this information.

9.5.2 Desired State

The desired state in this regard would be to improve the dangerous current status quo. This would involve the clear demarcation of areas identified as having radioactive concerns and the fencing off of these areas until they can be remediated.

Accountability for these incidents also needs to be addressed timeously in order to ensure that remediation measures are implemented.

Urgent intervention is required in areas where human health is at risk, particularly in areas where settlement is located on or near radioactivity hot spots.

9.6 Socio economic (incorporating infrastructure and planning)

9.6.1 Development Pressures in MCLM

Development pressure is occurring in the east of the municipal area, south of the N14 Highway. Concentration of development is primarily occurring in this location, at the N14 and Hendrik Potgieter Drive intersection. This area falls within the Gauteng Urban Edge¹. The purpose of the provincial urban edge, as delineated in the Gauteng Spatial Development Framework² is to:

- combat urban sprawl
- create economies of urbanisation
- focus on in-fill and redevelopment
- protect natural environment
- support efficient infrastructure provision.

Land use changes have come about within the MCLM as a result of township establishment applications³. According to the City, the original zoning for the application sites was “underdetermined”. Therefore a change in land use is only considered if a township establishment application is made to the Local Authority.

Outside of the urban area covered by the Krugersdorp Town Planning Scheme (KTPS), the Peri-Urban Areas Town Planning Scheme 1975 (PUATPS), applies. In terms of the PUATPS an applicant can only acquire rights (consent use or township) and cannot apply for a rezoning. In

¹ While the term 'urban edge' is used throughout this document for consistency with the terminology of the Gauteng SDF, it must be considered as the Urban Development Boundary as it delineates the edge for **future** urban development.

² Gauteng Provincial Government: Development Planning and Local Government; Gauteng Spatial Development Framework, Phase 3.

³ It is noted that in terms of the Krugersdorp Town Planning Scheme that if the general amenity of the neighbourhood is affected by a land use, the local municipality can intervene.

terms of the PUTPS, the whole area outside of the KTPS is considered to be an “undetermined” use zone.

In the rural areas falling outside the KTPS, numerous consent use applications (and some subsequently approved) have been made to the municipality. These special consent applications have included additional residential dwelling units as well as non-residential uses in nature and include uses such as Bed and Breakfast facilities and tourist related accommodation; restaurants, wedding and conference facilities; game farms; flower nursery's and agri-industry related activities. Any change in land use can be applied for in terms of the PUTPS. The controlling factor enforced by the local municipality is the development control that the maximum coverage of the proposed development be limited to 10%⁴.

There are numerous clauses of the PUATPS that are relevant when considering enforcement to protect the natural environment:

- Peri-urban scheme restricts proximity of similar use or rights by distance of 5km.
- In terms of Section 6(1)(vii)(g) “provision must be made for the attractiveness and maintenance of the land and gardens to the satisfaction of the local authority.”
- Conditions of approval of consent application

In terms of table C of the scheme, the maximum coverage for the undetermined land use zone is 10% and height restriction is 1.

Rural Precinct Plans are currently being prepared for Hekpoort, Magaliesberg and Tarlton. These documents are currently available for public comment.

Areas of the Cradle of Humankind World Heritage Site fall outside the District Management Area (DMA) and within the jurisdiction of the Mogale City. The implication of this is that the decision making for change in land use will lie with the Mogale City Local Municipality. Furthermore, according to the municipality, the DMA is to be transferred to the Mogale City Local Municipality by July 2011. This has important implication that there is a strong environmental framework in place by the municipality to inform development decisions and guide investment opportunities in the area.

The existing Gauteng Urban Edge surrounds the Krugersdorp/Kagiso development area as well as the development node identified at the intersection of the R28 and N14 Roads. However, the area south of the N14, and to some extent the area north of the N14 is exposed to development pressure. The intent of the municipality would be to extend the existing urban edge from the node at the intersection of the R28 and N14, north of the N14. This would extend to the City of Johannesburg Metropolitan Municipal boundary. It is the intention of the MCLM that this revised urban edge would allow for integration of urban to rural, acting as an urban-rural interface

⁴ in terms of section 6.1.(c) of scheme and confirmed by the planning officials.

between the developed areas and the Cradle of Humankind. The northern area of Johannesburg municipality abuts the Mogale City municipality. In terms of the Johannesburg SDF the northern area of the metropolitan has impetus for growth and development and the Johannesburg policy implications for this area are to enhance and maintain the urban qualities of this area⁵. It therefore follows that there will be continued development pressure on MCLM in the area just north of the N14 corridor.

In addition to development protection in the CoHWHS, the MCLM must protect against development of the ridgeline. The Gauteng Department of Agriculture and Rural Development (GDARD) has formulated a policy for development guidelines on ridges⁶. Urbanisation and development of prime residential properties places pressure on the ridgeline and the environment that it offers.

The municipality recognises the need for development in its jurisdiction. It has recognised the main development needs as the need for residential development and the need to provide urban support and urban services in the area so as to improve the economic base of the municipality. As such, most applications are approved if they are going to be to the economic benefit of the MCLM. However, at the same time, it is evident that the urban expansion and development of Krugersdorp has resulted in areas of the municipality coming under development pressure. Moreover the MCLM contains unique environmental attributes. There is therefore the need to limit conflict between the need for economic development, service delivery pressures and the needs of conservation, and consider the development of the area holistically.

9.6.2 *Desired State*

The Integrated Development Plan and the spatial representation of the IDP's vision in the form of the Spatial Development Framework reflect the long-term vision for the sustainable development of the municipal area. The future development vision of the municipal area underpins the desired state of the environment for the EMP.

The Vision of the Mogale City Local Municipality is:

Quality Service delivery for all in Mogale City.

The IDP provides both the vision and mechanism for achieving long-term sustainability and, in turn, sustainable development is one of the core functions of the municipality.

⁵ City of Johannesburg, Spatial Development Framework.

⁶ Directorate of Nature Conservation (Dept of Agriculture, Conservation, Environment and Land Affairs).

The formulation of the SDF was, like the IDP, guided by provincial and national legislation and all relate to the national spatial development principles of –

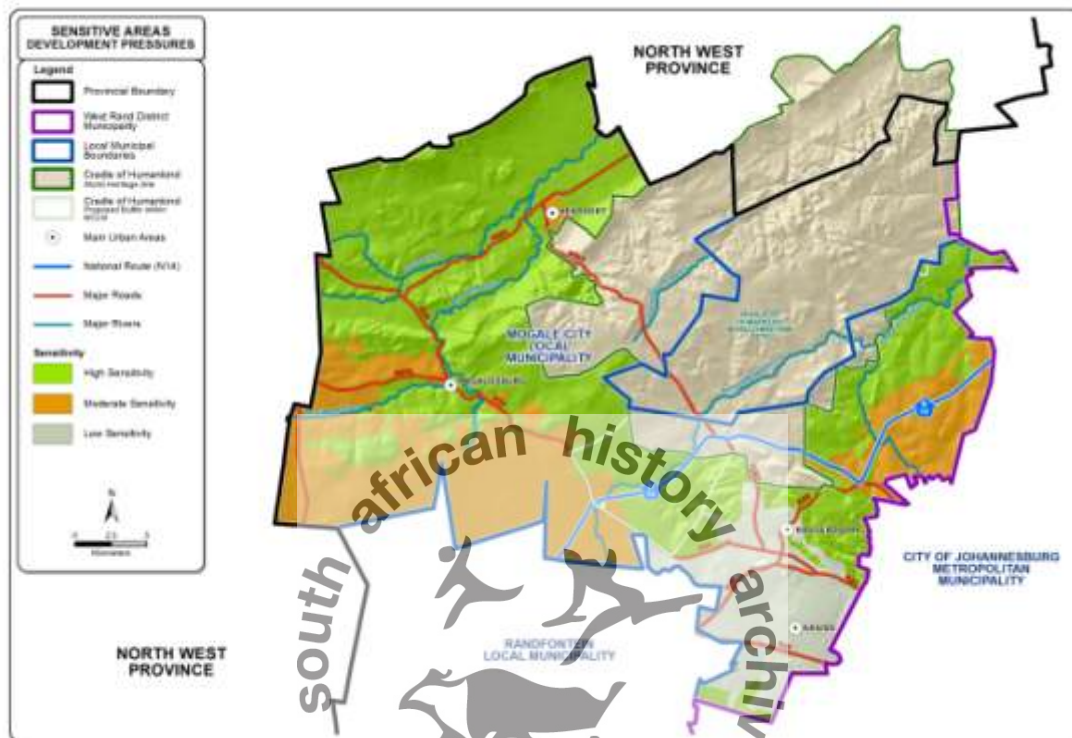
- Sustainability
- Efficiency
- Equity
- Integration
- Economic development⁷

In essence components of the desired state of the environment include:

- A safe and healthy environment – for this and future generations
- An environment that meets the basic needs of the city's community – both rich and poor
- An environment which positively affects quality of life; jobs and other activities of its citizens
- An environment that provides basic essential services to its community as well as to industry and commercial development
- A natural environment that is rich in biodiversity
- An environment whose ability to deliver ecological goods is not threatened by degradation
- An environment that continues to act as a key service provider meeting basic needs in terms of:
 - Climate regulation
 - Flood attenuation
 - Recreation
 - Food, water, air
 - Building materials and fuel
 - Waste-treatment – drainage, wastewater.

⁷ Mogale City Spatial Development Framework, 2009.

9.6.3 Sensitivity



Map 8: Development Pressures in MCLM

The areas of high sensitivity from a social perspective include the ridges and protected areas as these are under pressure from development applications. The agricultural hub and the areas surrounding the N14 / R28 intersection have been identified as moderate sensitivity as these areas are earmarked for development in terms of the SDF due to the defined movement corridor. Areas of low sensitivity would include the urban area of Krugersdorp and surrounds as well as the industrial and mining areas.

9.7 Heritage

In order to address the gap that was identified in the status quo phase, some background information has been included in order to put the desired state in context.

9.7.1 Background Information

- History of Mogale City

Mogale City is host to a small number of declared provincial heritage sites that seem to reflect only a tiny part of its history. However, it should be taken into account that palaeontological and archaeological places (Stone and Iron Age, rock art) are by default protected. Likewise all structures and buildings older than 60 years are protected by default, as well as older burial places and public monuments and memorials.

Relatively little is known about the earliest human occupation of Mogale City, although our knowledge has been gradually increased by the discovery of new fossils associated with early humans. However, there is little doubt that the first humans in the area may have been *Homo ergaster* who roamed the area about one million years ago during the Acheulian period of the Early Stone Age. The ancestor of *Homo ergaster*, *Australopithecus*, considered to be the earliest ancestor of humans, lived in the Sterkfontein Valley and other places north Krugersdorp (today the Cradle of Humankind – a World Heritage Site) almost three million years ago. During the Middle Stone Age, 200 000 years ago, modern man or *Homo sapiens* had emerged, manufacturing a wider range of tools with technologies more advanced than those from earlier periods. This enabled skilled hunter-gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time. The Late Stone Age, considered to have started some 30 000 years ago, is associated with the predecessors of the San and Khoi Khoi. San hunter-gatherer bands with their small (microlithic) stone tools lived in Mogale City.

To date, 950 hominid fossils, over 9 000 stone tools, 300 fragments of fossil wood and thousands of animal fossils, some the best preserved examples of a variety of unique and remarkable creatures that shared the earth with early hominids several million years ago, have been excavated in the area. Most sites are confined to the Cradle of Humankind, which does not fall within the municipal area. About 25 known sites occur inside the study area.

The Late Stone Age is also associated with the advent of rock art. In Southern Africa rock paintings are primarily found in hilly and mountainous areas where there are shelters, whilst rock engravings occur in the open on scattered rocks and outcrops. Mogale City is not known for its rock paintings, but there are a small number of about 20 rock engraving sites. Most of these engravings are attributed to the Khoisan communities that evolved during the later periods of the Late Stone Age.

Because colonial farmers, settlers and miners have continuously and intensively used the development area for the past 200 years, very few signs of Stone Age occupation in the form of surface deposits and finds of artefacts have survived.

Excavations at The Boulders indicate that between 350 AD and 600 AD early Tswana communities lived in the Midrand and neighbouring areas, building semi-permanent settlements of stone, wood and clay, growing crops, farming with livestock and manufacturing pots and iron implements. They moved out after 600 AD and returned about 1200 AD. Between 1100 AD and 1200 AD San communities inhabited the area. Tswana communities returned in about 1500 AD and stayed in the area until their displacement by the Matabele kingdom during the 1820s and early 1830s and by colonial settlers since the 1840s.

Evidence of Iron Age habitation in Mogale City can be found at various places, mainly in the form of stone-walled structures and artefact sites. About 25 sites have been incorporated into the database. Many Iron Age sites also occur inside the Cradle of Humankind World Heritage Site.

Mogale City was named after Chief Mogale, the young heir to the Po Chiefdom of the Batswana. The Po tribe, one of the original tribes, occupied the territory now known as Mogale City. They occupied an area that stretched from the Magaliesberg in the west to the present day Northcliff Ridge in the east, to the Vaal River in the southwest and Hartebeestpoort Dam in the northwest. In 1841, the earliest recorded use of Chief Mogale wa Mogale's name for the district was made.

The first white colonists who settled in the Mogale City area came for very much the same reasons as the Iron Age communities: water and grazing for cattle, water for crop-farming, trees, thatching grass, clay for making bricks and pots, mild climate, wildlife and the presence of the hills as shelter and protection. In the 1820s the first white people appeared on the scene, hunters, traders, missionaries and other travellers. Permanent occupation by whites began in the early 1840s, when Voortrekker farmers established the farms that today form Mogale City. These farms were subdivided many times over in more recent years and more farmsteads were established. Gradually the entire area was divided into farms. However, it was only since the 1880s that these farms were formally surveyed and mapped, and when not only their names (such as Paardekraal and Sterkfontein) but also the names of rivers (Crocodile, Blaauwbank Spruit) and other features (Zwartkop, Spioenkop) became permanent fixtures on maps. A number of farmsteads and cemeteries (white farmers and African farm workers) are known that were established during this era. The more rural parts of Mogale City are dotted with homesteads and remains of homesteads (often with cemeteries) associated with the habitation of African labour and tenant farmers.

The dolomite rocks of the area attracted the attention of early prospectors due to their similarity to the rocks of the already active Pilgrim's Rest goldfields. Gold deposits were discovered as early as 1874 in the Blaauwbank area near Magaliesburg and in 1875 at Kromdraai. In January 1886, finally, two prospectors, George Harrison and George Walker, discovered the Main Reef Leader

on the farm Langlaagte in the Johannesburg area. Other deposits on other farms followed soon and on 20 September 1886 nine farms on the Central Rand were declared public diggings. This was followed by the proclamation of gold-mines. A similar pattern was followed in Mogale City. The many prospecting trenches and pits dotting the landscape were the predecessors of some of the largest gold-mines in the country, such as Randfontein Estates, Luipaardsvlei Estates and Lancaster. The southern part of Mogale City is a mining landscape and about 15 sites have been identified, comprising headgears, reduction works and places (villages and compounds) to house the large labour force.

Dolomite areas also provided limestone for the gold refining process and the manufacture of building materials. Ironically it was through these destructive mining activities that the first fossils were discovered at Sterkfontein and neighbouring limestone mines. A few other sites related to limestone mining were identified to the north of Krugersdorp.

The Boer government soon realised the need for proclaiming a town to serve as a centre for the new goldfields west of Roodepoort and Johannesburg. The fledgling town of Krugersdorp (named after the State President of the Zuid-Afrikaansche Republiek) was proclaimed on a 428 hectares portion of the farm Paardekraal in 1887 whilst the remainder of the farm became public diggings. Municipal status was granted in 1903. The railway line from Johannesburg reached the town in 1891 and was extended to Randfontein and Potchefstroom in 1896. The completion of another important railway line, between Pretoria and Magaliesburg in 1925, gave rise to the establishment of the rural town of Magaliesburg in northern Mogale City. Krugersdorp is known for its public, commercial and residential buildings with historical associations, of which the railway station and the City Hall are provincial heritage sites. The former Magistrate's Office is a fine example of ZAR architecture and houses the Krugersdorp Museum.

The original village was gradually transformed into a town with solid buildings such as banks, hotels, stores, government buildings and public open spaces. The town site soon became too small and the residential population started spreading into suburbs such as Krugersdorp West and Krugersdorp North. Mogale City's (white) suburbs are the product of extensive urban sprawl and are regionalised into north, south, east and west, and they generally have different personalities. While the CBD and the immediate surrounding areas were formerly desirable living areas, the spatial accommodation of the suburbs has tended to see a flight from the city centre and immediate surrounds. The biggest sprawl lies to the east and north-east. Formerly consisting of peri-urban smallholdings, the eastern parts of Mogale City exploded in the 1970s and 1980s. The trend continued after the turn of the 20th century. The result was that many heritage features associated with an earlier past would have been altered and destroyed, so that the EMF heritage database is relatively thinly "populated" in this area.

The spread of the town was not confined to the need for providing more space for residential purposes but was also dictated by the requirement for industrial expansion. This led to the establishment of industrial townships such as Chamdor, Boltonia, Factoria and Delporton.

Early Krugersdorp did not offer its Black citizens much in the way of housing. While the mines generally looked after their own, and most domestics could expect to have sleep-in quarters, the remainder had to fend for themselves. Almost from the onset, when the town was first laid out, separate suburbs, or "locations" as they were known, were allocated for Black, Malay and Asian occupation. This is an aspect of colonial town planning that was not unique to the Transvaal, but was common to most other parts of southern Africa. Not only did it conform to existing Zuid Afrikaansche Republiek (ZAR), or Transvaal, policies, but the idea of separate residential areas for Black and White also suited the mining companies, who had recently adopted the "compound" as a means of housing their Black labourers. The core of the original Krugersdorp "location" still exists, known as Munsieville. Lewisham that later formed the core of Kagiso was established in 1926. Kagiso Township was established in 1956 for purposes of housing the large number of African residents who had migrated to the area, as well as for housing those displaced from former "black spots" and farming areas, whilst Azaadville became home to people of Asian origin.

Mogale City does not only reflect struggles for land and living space but also various liberation struggles. The Paardekraal Monument (a provincial heritage site) commemorates the start of the Transvaal War of Independence (1880-1881). Monuments near Kagiso and Soweto in the south reflect the Jameson Raid (1895-1896), a failed attempt at a political coup. The Witwatersberg, Magaliesberg and the hills around Krugersdorp contain many ruins of British blockhouses constructed during the Anglo-Boer War (1899-1902), of which two (Fort Harlech and Barton's Folly) are provincial heritage sites. Krugersdorp was the site of a major concentration camp for Boers and of a refugee camp for Blacks. A major battle, the Battle of Nooitgedacht (1900) was fought on the Magaliesberg. Memorials reflect the participation of (white) people in the First and Second World Wars.

The new political dispensation after 1994 effectively ended apartheid and began in a sense reversing the migrations brought about by forced removals through a process of land restitution and redistribution. In 2001 the Krugersdorp Local Council was renamed Mogale City and the former Krugersdorp District (proclaimed in 1895) became the Mogale City municipal area.

- Heritage resources

The "traditional" approach in defining, mapping and assessing the heritage aspects of the study area is based on the occurrence of heritage resources as individual "dots on the landscape" and as clusters combining such "dots". This approach is grounded in Section 3 of the National Heritage Resources Act (Act 25 of 1999), that defines any place or object of cultural significance as a heritage resource (see Section 1.2).

The concept of cultural landscapes is of more recent origin and, although the definitions of the National Heritage Resources Act bear reference, is primarily grounded in international doctrinal

texts in the form of Charters and Recommendations produced by ICOMOS and UNESCO. The most recent and authoritative text is the World Heritage Cultural Landscapes handbook, published by the World Heritage Centre (2009).

The term “cultural landscape” embraces a diversity of manifestations of the interaction between humankind and its natural environment. Cultural landscapes often reflect specific techniques of sustainable land-use, considering the characteristics and limits of the natural environment they are established in, and a specific spiritual relation to nature. Cultural landscapes are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal. They are categorized on the basis both of their value and of their representativity in terms of a clearly defined geo-cultural region and also for their capacity to illustrate the essential and distinct cultural elements of such regions. The term “cultural landscape” embraces a diversity of manifestations of the interaction between humankind and its natural environment.

The World Heritage Committee distinguishes between three categories of cultural landscapes:

- Clearly defined landscapes, designed and created intentionally by people, such as parkland and urban areas
- Organically evolved landscapes that has developed over time, including relic landscapes (where a certain activity has ceased to exist) and continuing landscapes (which retain an active social role and where the evolutionary process is still in progress)
- Associative landscapes, which are essentially natural landscapes with significant human associations in the realm of the intangible heritage

All three categories exist in the Mogale City area. However, they are too broad in terms of the practical mapping and assessment of heritage elements; hence, the below World Heritage criteria for classifying the type of cultural landscape have been adopted.

Table 12: World Heritage Criteria

CRITERIA	DESCRIPTION
1	Masterpieces of human creative design
2	Important interchange of human values, over a span of time or within a cultural area, related to developments in architecture, technology, monumental arts, town-planning, landscape design
3	Important testimony to a cultural tradition that is living or has disappeared
4	Outstanding example of a type of building or architectural or technological ensemble or landscape that illustrates stages in human history
5	Outstanding example of a traditional human settlement or land-use representing a culture or cultures
6	Directly or indirectly associated with events or living traditions, ideas, beliefs, artistic and literary works
7	Important natural phenomena or areas of exceptional beauty and aesthetic importance
8	Outstanding examples representing major stages of earth's history, including record of life, geology, landforms
9	Outstanding examples representing ongoing ecological and biological processes in the evolution of terrestrial, marine, coastal and fresh water ecosystems and plant and animal communities
10	Important natural habitats for in-situ conservation of biological diversity

By applying and combining the above criteria, the following classes or categories of cultural landscapes can be distinguished:

- Palaeontological landscapes
- Archaeological landscapes
- Historical built environments
- Historical farmland

- Historical rural towns
- Natural landscapes
- Relic landscapes
- Burial grounds and graves
- Associated landscapes
- Historical farmsteads
- Historical institutional landscapes
- Scenic/Visual amenity landscapes

The 2003 Mogale City EMF did not follow the cultural landscapes approach at the time simply because it had not really been adopted by heritage specialists and hence there is a “gap” in this regard. This revised EMF aims to fill the gap as best as possible but at the same time also facilitate the proper evaluation and definition of cultural landscapes. For now the cultural landscapes that have been identified in Mogale City comprise of the following categories, most of which have been aligned with or superimposed on top of those landscape descriptions already in use with EMFs and similar strategic environmental assessments:

- Cultural landscape sensitivity 1: Relic landscapes consisting of heritage sites of medium to low significance
- Cultural landscape sensitivity 2: Historical farm land and werfs consisting of cultivated land, forest plantations and improved grassland
- Cultural landscape sensitivity 3: Built environment (urban areas), mines, quarries
- Cultural landscape sensitivity 4: Historic built environment, protected heritage sites, heritage sites of high significance (including graves and cemeteries), institutional landscapes (historic mines, prisons, military bases, hospitals etc), natural landscapes with intangible, palaeontological and archaeological potential (rivers, water bodies, ridges, unimproved grassland)

The 2003 EMF for Mogale City did not specifically address driving forces.

- Driving forces

The growth and development of the population is a major driving force in Mogale City. Its elements, such as population development, wealth creation, health, education, skills development, housing and development of recreation services have both positive and negative socio-economic implications for cultural heritage resources.

A positive driving force since 2003 (in a certain sense also a response) has been the increasing preservation of cultural heritage resources for the use of future generations and for the tourism potential.

The negative driving forces since 2003 include ongoing vandalism and deliberate degradation of heritage sites and areas for economic gain. Recreational demand is linked to the tourism potential of cultural heritage resources (including open spaces and urban precincts) which is growing in Mogale City. The city is ideally suited to provide the resources for these activities. This is closely linked to tourism development (the Cradle and other places) and requires extensive management to preserve the heritage sites and landscapes.

The ISSUE affecting heritage in this context is that heritage is increasingly considered (compared to pre-2003) when planning and developing housing, infrastructure and other requirements.

Policy and legislation (leadership, goals, indicators, strategies, enforcement and monitoring) have the potential to be both positive and negative driving forces for cultural heritage resources. The National Heritage Resources Act (Act No. 25 of 1999) and subsequent legislation (including municipal bylaws and regulations, e.g. those dealing with demolition applications) encourages heritage resources conservation. Recent municipal IDPs include heritage conservation issues. Unfortunately historical policies led to the separate development and settlement of, in most cases, urban communities in disadvantaged and marginal areas with little regard to the conservation of cultural heritage resources. This in effect caused the degradation of some cultural heritage sites and landscapes due to neglect by government and organs of state.

The emphasis has since 2003 shifted from the development of policy and legislation to the implementation, as is evident in the increasing number of local IDPs that are including heritage issues.

The ISSUE affecting heritage in this context is a basic lack of awareness of including heritage matters in broader policies and procedures; furthermore, lack of compliance with heritage and other legislation. However, there has been gradual improvement since 2003 as illustrated by the increasing number of demolition and alteration applications and Heritage Impact Assessments (submitted to SAHRA and PHRAG).

The city's numerous and diverse cultural heritage resources as a basis for economic development are the most obvious and possibly cost effective way for local communities to become part of the growing self-sustainability drive in South Africa.

Development of tourism since 2003 is a positive driving force in the preservation and development of existing known cultural heritage resources. There has been a proliferation of heritage tourism projects in and around Mogale City. This may also promote need for more basic research into the state and possible function of these resources for optimal conservation and utilisation in the city.

On the downside, continuing post-2003 economic development in the form of shopping malls, housing estates, office parks, re-use of mining buildings for industries etc sometimes lead to loss of cultural heritage.

The ISSUE affecting heritage here since 2003 is the ongoing loss of cultural heritage due to rapid economic development.

Since 2003 this trend still applies in cases where significant heritage resources are destroyed instead of being considered for rehabilitation and re-use. In other cases heritage resources are altered beyond recognition, thereby diminishing their significance. Visual impacts of new developments on the cultural landscape are sometimes not considered or are considered too late.

Conservation of the built environment remains, however, problematic due to the sensitivity surrounding the past political situation of the country. Opinions are divided along cultural and political lines about what part of South African history should be conserved or not. There are also inadequate budgets to maintain all historical sites. These sites are not being used effectively to generate an income for their own upkeep.

On the positive side there is an increasing trend (partially enforced by legislation) since 2003 to preserve heritage resources as part of larger conservation efforts, e.g. through urban regeneration projects, by placing them on heritage registers and as part of protected landscapes.

The ISSUE affecting heritage resources in this context since 2003 is that many developments still do not consider sufficiently the benefits associated with the economics of resource conservation. However, because of increasing awareness of the need to comply with heritage legislation, there is a gradual improvement in this regard.

9.7.2 *Desired State*

Heritage is a collective property which tells the history of a people, a city, or a territory, and is transmitted from one generation to the next. Heritage makes it possible for the present generations to understand their place in history and to better cope with the constant mutations in society: it is an element of stability in a rapidly changing world. Heritage is also an essential element that makes it possible for a people to show its uniqueness, to manifest its own way of perceiving the world and to express its capacity for cultural creativity.

To take action in favour of heritage is a necessary step for the perpetuation of the cultural elements that are necessary to the existence of a society. Sometimes, this also makes it possible to find solutions to a number of problems and difficult situations that a community and its

members encounter. To preserve the heritage is for a community to work towards the recovery of a collective memory and identity, and through this collective effort, create social cohesion. To valorise (add value to) the heritage means to contribute to a better mutual knowledge and understanding among the communities present within a territory, each one with its own particular cultural identity. This results finally in the maintenance of social harmony, which implies the recognition and respect for the differences in the cultural identity of each community, a determining factor in the implementation of a sustainable development policy.

The components of heritage are, foremost, the traditional solutions implemented in order to adapt to a particular context. They often remain an irreplaceable resource, allowing the populations to develop and evolve. The loss or the abandon of heritage is a risk that cannot be underestimated, as we see the extent to which many of today's alternatives to the traditional ways of life prove ill adapted and ineffective.

In a context of development, it is clearly evident that projects, including those that prove technically accurate, that do not take into account aspects of the local cultural identity, knowledge and know-how, have little chance of succeeding. On the other hand, heritage has today become a powerful instrument in the economic and territorial development of a community, when properly valorised and promoted, often in the context of tourism related activities.

Tourism centred on heritage, both cultural and natural, represents a major potential for local and national economic development. The development of tourism is a potential source of many types of financial gain, regarding the entrance fees to sites and museums, guided tours and visits, sales of handcrafts, documents and photos, and the development of the craft industry. It is also a source of more important financial repercussions in areas such as the hospitality industry, transportation and restaurant services. For local governments tourism is also a potential source of revenues through taxes.

The preservation of heritage can also generate new employment opportunities: creation of jobs in the areas of rehabilitation and maintenance of heritage sites (for local craftsmen and construction companies), its exploitation for research and management purposes (researchers, administrators, marketing and communication professionals, gardeners and guardians), but also in hotel trade and tourism management.

The use of available local resources (materials, know-how, and construction management) and their adaptation to contemporary needs makes it possible to reduce the costs in terms of investment and production. This in turn generates employment opportunities, additional profit, reduces construction costs, particularly in the housing sector. It also helps in making everyday products, such as medicine and food, more affordable.

The valorisation of the cultural assets of Mogale City constitutes a factor of attraction, not only for the tourists but also for a number of investors which could contribute to boost the local economy through the implementation of new activities such as industries and development projects.

Local governments such as Mogale City have a major role to play in the protection and conservation of heritage, as they work most closely with the populations who are the primary beneficiaries of development activities.

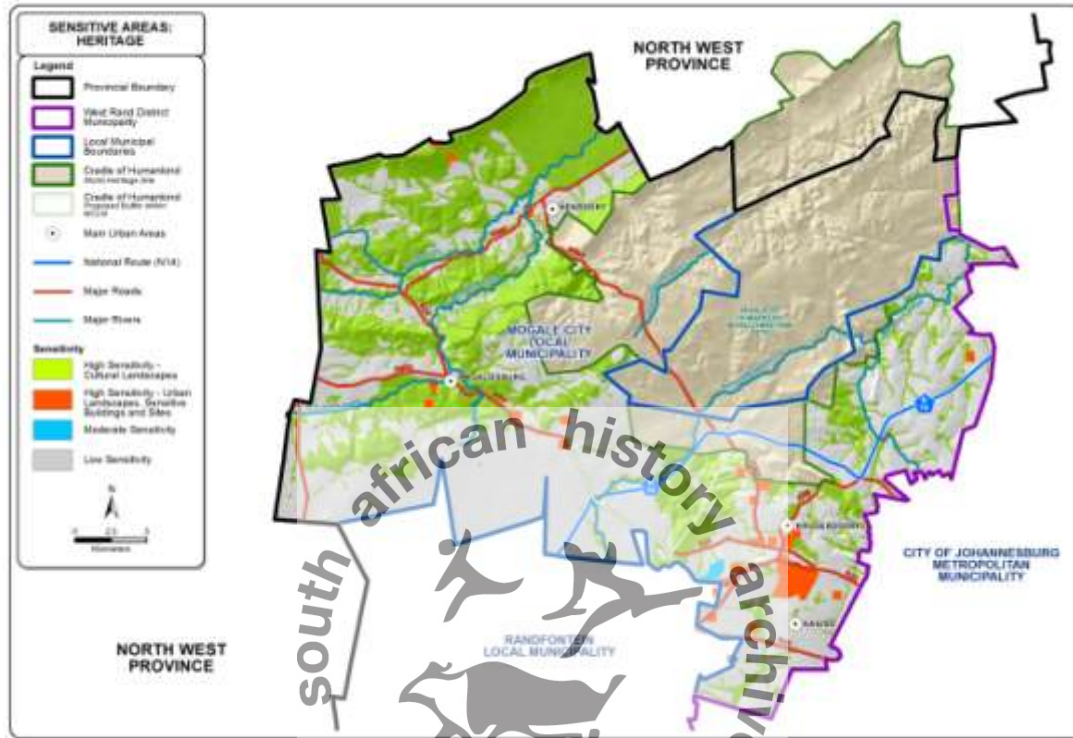
- Determinants

The attainment of a “desired state” regarding heritage resources management in Mogale City is, as elsewhere, informed by a combination of factors:

- General heritage management principles as encapsulated in international doctrinal texts and applicable national legislation and guidelines
- Government mandates (national, provincial, municipal)
- A Mogale City heritage management framework
- Stakeholder interests, values and aspirations
- Context (the range of legal, ecological, social and economic facts, conditions, causes and surroundings, that define the circumstances relevant to a problem)
- Vital attributes such as spirit of place, biological diversity, heritage, development potential, local community participation
- Threats to such vital attributes
- Responses to threats as well as to development trends and pressures as outlined in the sections above (macro-environmental factors)

On their own the above factors mean little, but they should be combined and harnessed through a municipal heritage management framework that will be part of the broader EMF.

9.7.3 Sensitivity



Map 9: Heritage Sensitivity

Cultural significance is embodied in the place itself (intrinsic significance), its fabric, setting, use, associations, meanings, records, related places and related objects.

Cultural significance is assessed in terms of the following criteria, some of which are embodied in the NHRA:

- Historic value: Material or intangible evidence resulting from changing social, political and environmental circumstances or conditions
- Rarity: Unique or unusual features also possess rarity value, apart from their age. Section 34 of the NHRA provided general protection for all structures older than 60 years. This does not imply that recently erected structures cannot possess rarity, or for that matter cultural value.
- Scientific value: Indicates research potential (the capacity to yield more knowledge)

- Typical: Indicates that the feature is a good example of a certain class or type of heritage resource
- Aesthetic: Other than artistic or architectural expression, aesthetic value can also be evident in craftsmanship, technique, visual cohesion (harmony), visual evidence of permanence and stability, setting etc.
- Technological: Indicates value in terms of a technological achievement
- Personal/Community: Indicates value in terms of association with a certain person, community, organisation or cultural group
- Landmark: A sense of place or belonging involves the physical and visual relationship between a feature and its environment.
- Condition (material integrity): Indicates substantial evidence of authentic fabric with minor degree of lost or obliterated fabric; also refers to a structure's restoration potential
- Sustainability: The potential for lasting economic viability (use) and the perpetuation of the original use or part thereof.

In terms of the above criteria, heritage sites (places) and cultural landscapes have been rated as low, medium or high. In accordance with generally accepted heritage thinking there are in principle no places and landscapes that have no cultural significance, unless proven otherwise.

9.8 Landscape Character

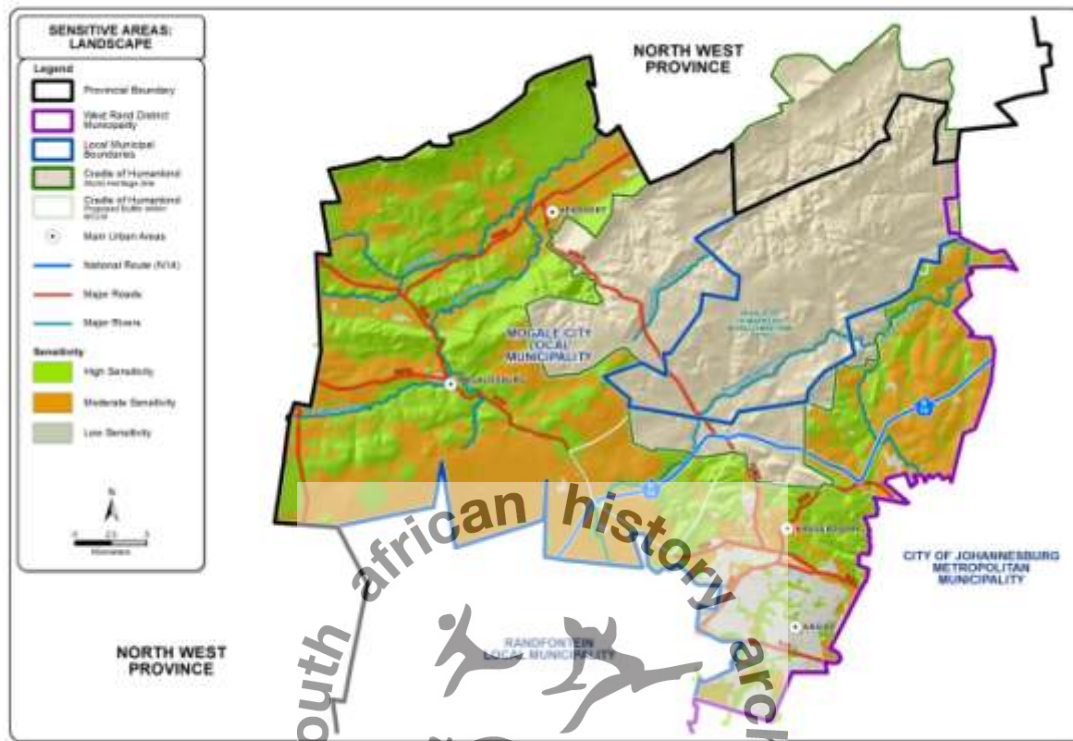
9.8.1 *Desired State*

Landscape is a natural resource, vital to the local and national identity and often a driver for local economies. Landscapes provide a dynamic backdrop to people's lives and as such any change in the landscape is likely to affect those people's lives. Careful management of these landscapes is therefore necessary to avoid undesirable change.

In the context of Mogale City, the landscape is a key driver for tourism in the area, with the natural areas being well-suited to scenic tourism routes as well as adventure tourism activities. The development of tourism in the area is an important facet of local economic development and as such the preservation and management of sensitive landscapes and the exiting 'sense of place' is critical.

Informed and responsible decision-making on the part of the MCLM is therefore required to ensure that future development is appropriately located within the landscape.

9.8.2 Sensitivity



Map 10: Landscape Sensitivity

Areas of high sensitivity are defined as such due to their sensitivity to change. Urban areas which are already heavily transformed have a high absorbance for change to the landscape and hence are categorised as low sensitivity.

9.9 Air Quality

In order to address the gap that was identified in the status quo phase, some background information has been included in order to put the desired state in context.

9.9.1 Background Information

Please refer to Appendix 1 for meteorological data.

- Air Quality Information

One air quality monitoring station exists within the MCLM. GDACE (GDARD) donated seven Air Quality Monitoring Stations to Municipalities in 2004, one of which was the donated to Mogale City and located at Leratong Hospital. The station is equipped with point source analysers. There is another station located in the Randfontein Local Municipality, close to Mogale City border, that would a give good indication of the status of air quality in the broader area (West Rand District Municipality Air Quality Management Plan – Complied by Strategic Environmental Focus), unfortunately no information sharing exists between the two municipalities.

Data related to the levels of criteria pollutants measured during 2007, were received from the Mogale City Local Municipality. The criteria pollutants reported on are as follows:

- Sulphur Dioxide (SO₂);
- Oxides of Nitrogen (NO_x);
- Carbon Monoxide (CO);
- Ozone (O₃); and
- Particulate Matter.

CO has an average concentration of 0.6 ppm with a constant distribution throughout the year. The National Ambient Air Quality Standard for CO hourly averaging period is 26 ppm. NO₂ and NO_x have hourly average concentrations of 53 ppb and 57 ppb, respectively with the highest values measured during the period June 2007 – August 2007. The National Ambient Air Quality Standard of 106 ppb hourly averaging period for NO₂ was not exceeded. NO has an average value of 7.4 ppb and a constant distribution throughout the year. O₃ has an 8 hourly average value of 19.17 ppb with the highest concentrations measured in March/ April of 2007 and August 2007. Again the National Ambient Air Quality Standard for 8 hourly averaging period of 61 ppb was not exceeded at the Mogale City monitoring station. There was no data available for PM₁₀ from April 2007 to December 2007 (Review of Mogale City Environmental Management Framework - Draft Status Quo Report - SiVEST).

Data related to the levels of criteria pollutants measured during 2007 and early 2008 were received from the Mogale City LM (Figure 10). The criteria pollutants reported on are SO₂, NO_x, CO, O₃ and PM₁₀. The Mogale City Air Quality monitoring station in Leratong was not in operation for many years but was re-commissioned in May 2010. Data for August and September 2010 was made available for inclusion in this report.

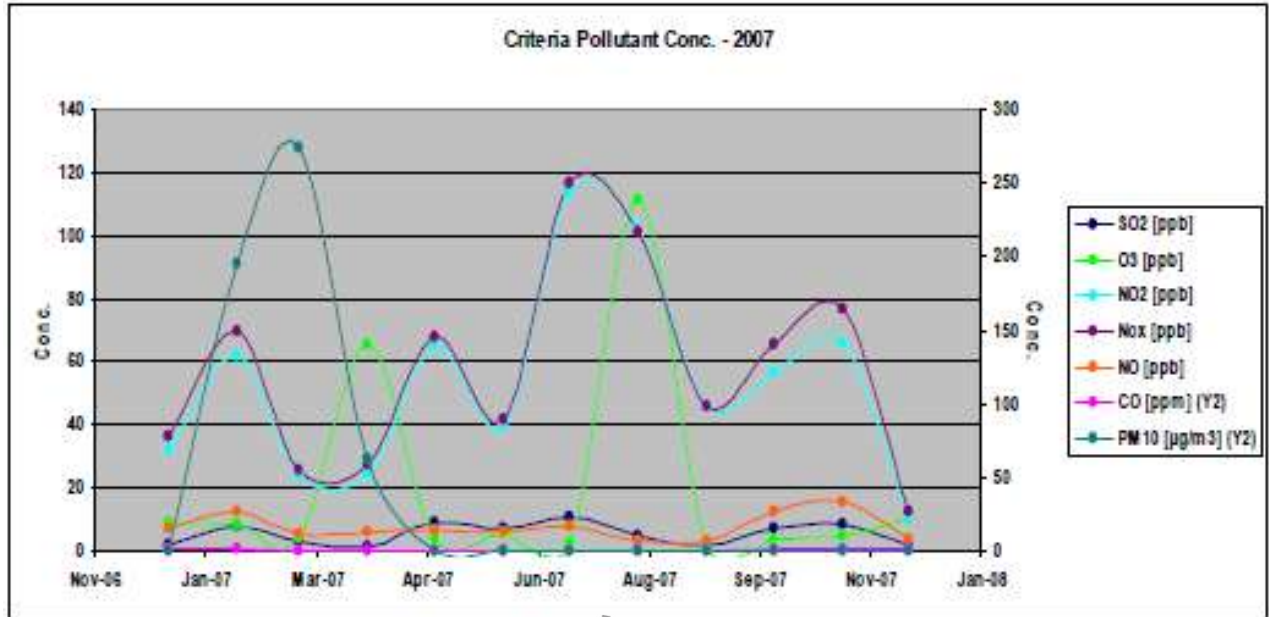


Figure 2: Criteria Pollutant Concentrations in the Mogale City Local Municipality – 2007.

The recently obtained monitoring data for August and September 2010 from Leratong Hospital Air Monitoring Station (part of GDARD ambient air quality monitoring network) from Zanokuhle Environmental Services (ZES) is presented below. The station records the following parameters; SO₂, O₃, NO_x, CO, PM₁₀, wind speed, wind direction, humidity, barometric pressure, solar radiation and ambient temperature. All monitors with the exception of NO_x and CO analysers were operational at the time the reports were compiled.

- Leratong Hospital Ambient Air Quality Data

Ambient air quality data for August and September 2010 were provided by ZES. Prior to August 2010 the station was not operational due to budget constraints and capacity issues. For the two months only PM₁₀, SO₂ and O₃ were presented. During August there were no exceedences of the PM₁₀, SO₂ or O₃ South African national standards. The maximum PM₁₀ daily average concentration recorded was 98 µg/m³ measured on 19th August 2010. During September 2010 there were no exceedences of the SO₂ and O₃ standards, however, there were two exceedences of the PM₁₀ daily average standard. The maximum daily average PM₁₀ concentrations was 178 µg/m³ measured on 17th September 2010.

The lack of reliable, long term air quality monitoring data for the municipality represents a major gap in air quality management within MCLM.

- Dust Fall Out Data

Although mining activity is on the decline in Gauteng, historical mining activities have left a host of mine dumps scattered around the province. In addition to this, operational mines also operate tailings dams, waste rock dumps and ore stockpiles. These are a major source of dust emissions in areas where they occur, especially during the late winter and early spring months, when wind speeds peak over Gauteng. These dust emissions pose a nuisance and health risk to nearby receptor communities.

The number of abandoned mine dumps are decreasing as a result of reworking and reclamation of the land for other land uses. However, the Dust from mine tailings on the West Rand remains problematic (Review of Mogale City Environmental Management Framework - Draft Status Quo Report - SiVEST).

During 2008, 2234 cases of Pneumonia in individuals under 5 years, 1016 Asthma visits in individuals under 18 years and 979 Asthma visits in individuals 18 years and older were reported in the West Rand District Municipality (WRDM).

Dust buckets have been installed as part of the Mogale Gold (owned by Mintails Limited) dust monitoring programme. This data was not made available for the purposes of this project.

- Sources of Air Pollution

Anthropogenic sources of air pollution within Mogale City include the following:

- Household fuel combustion;
- Industrial and mining emissions;
- Biomass burning (veld burning);
- Vehicle emissions, including vehicle exhaust and evaporative emissions and road dust entrainment; and
- Waste disposal, including landfills and waste incineration.

The combustion of fossil fuels within households for the purposes of cooking, heating and lighting is on-going in Mogale City. Population growth, reductions in household income levels, increases in informal (unserved) households and various cultural factors are believed to be responsible for the persistent use of coal and wood within the domestic sector. Coal, wood and paraffin combustion by households is estimated to be a significant contributor to particulate matter, carbon monoxide and volatile organic compound (including benzene) emissions within Mogale City. These pollutants have health implications for the residents of fuel burning households and for residents residing within or in close proximity to fuel burning communities. The significance of household coal and wood burning emissions is enhanced due to three factors:

- the low level of emissions,
- the coincidence of peak emissions with periods of poor atmospheric dispersion (i.e. night-time, winter-time), and,
- the release of such emissions within high human exposure areas with high contributions to both indoor and outdoor pollution concentrations. Household fuel burning also contributes to greenhouse gas emissions (e.g. methane).

It is anticipated that domestic fuel burning will persist in the short-term in South Africa. It is however likely to start to decrease in the medium-term as a result of lower population growth rates and on-going electrification, which can be seen from the graph below (usage of electricity is between 72% and 85% depending on usage mode) (Figure 11).

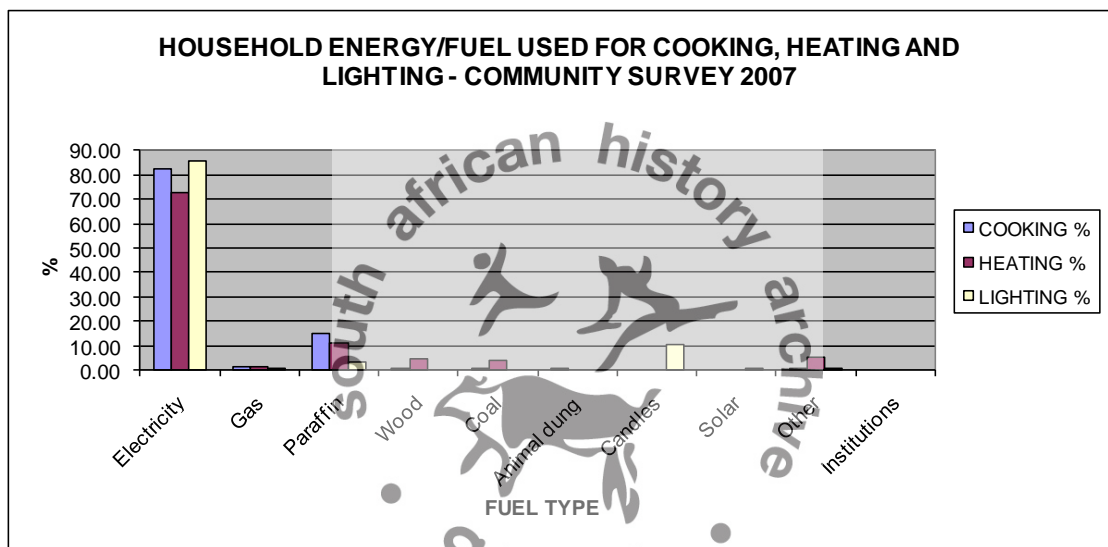


Figure 3: Household Energy/Fuel used for cooking heating and lighting in Mogale City Local Municipality*.

*Source: Statistics South Africa, Community Survey (Statistical release P0301), 2007.

Table 13: Breakdown of energy sources for Mogale City Local Municipality in 2007.

	COOKING (%)	HEATING (%)	LIGHTING (%)
Electricity	82.00	72.84	85.47
Gas	1.26	1.38	0.20
Paraffin	15.11	11.00	3.22
Wood	1.19	5.05	0.00
Coal	0.25	4.36	0.00
Animal dung	0.06	0.00	0.00
Candles	0.00	0.00	10.59

Solar	0.00	0.00	0.07
Other	0.13	5.37	0.45
Institutions	0.00	0.00	0.00
TOTAL	100.00	100.00	100.00

The industrial sector represents a significant source of particulate and sulphur dioxide emissions in addition to contributing to nitrogen dioxide, carbon dioxide, greenhouse gas, trace metals and organic compounds. Emissions associated with fuel usage, particularly coal, for the purpose of power generation and coke production represent a key contribution to the emissions from this sector. Fugitive dust emissions from wind erosion of stockpiles and open areas, materials handling, and on-site vehicle entrainment also contribute significantly to the extent of particulate emissions from industrial and mining operations.

Emissions from vehicles contribute primarily to carbon monoxide, nitrogen oxide, benzene, lead and 1.3 butadiene releases. Given the high level at which vehicle exhaust emissions occur and the proximity of roadways to human settlements, the potential exists for pollutants released to impact on human health. Elevated concentrations of nitrogen dioxide and benzene, in excess of health guidelines, are expected to occur in close proximity to busy roadways.

Biomass burning within Mogale City is anticipated to be a significant source of localised, episodic fine particulate emissions. This sector also contributes to total organic compounds and greenhouse gas emissions (CH₄, N₂O). Emissions from this source have not been quantified to date. Other sources anticipated to impact on the air quality within Mogale City but which have not to date been quantified include railway related releases, tyre burning, informal refuse burning, biomass (veld) burning and waste disposal related releases. Due to the toxicity of the compounds released from landfilling and waste incineration these sources are frequently characterised as representing 'toxic hotspots' where effective air pollution control is essential. Tyre burning and informal refuse burning are illegal and need to be eliminated.

9.9.2 *Desired State*

For the purpose of the Mogale City EMF the limits of acceptable change were identified through existing legal and policy limits, identified through the legal review undertaken as part of the institutional analysis, and the other specialist studies undertaken as part of the Status Quo Phase of the EMF. The limits of acceptable change are defined by National, Provincial, and Local laws and policies that are relevant for environment and more specifically air.

The desired state of the environment provides a sustainability framework against which the municipality can assess the sustainability of any plan, program or policy. The sustainability

framework includes an indication of the limits of acceptable change set down in legislation, policy and guidelines.

The three most important criteria for sustainability of local environment and particularly air quality are:

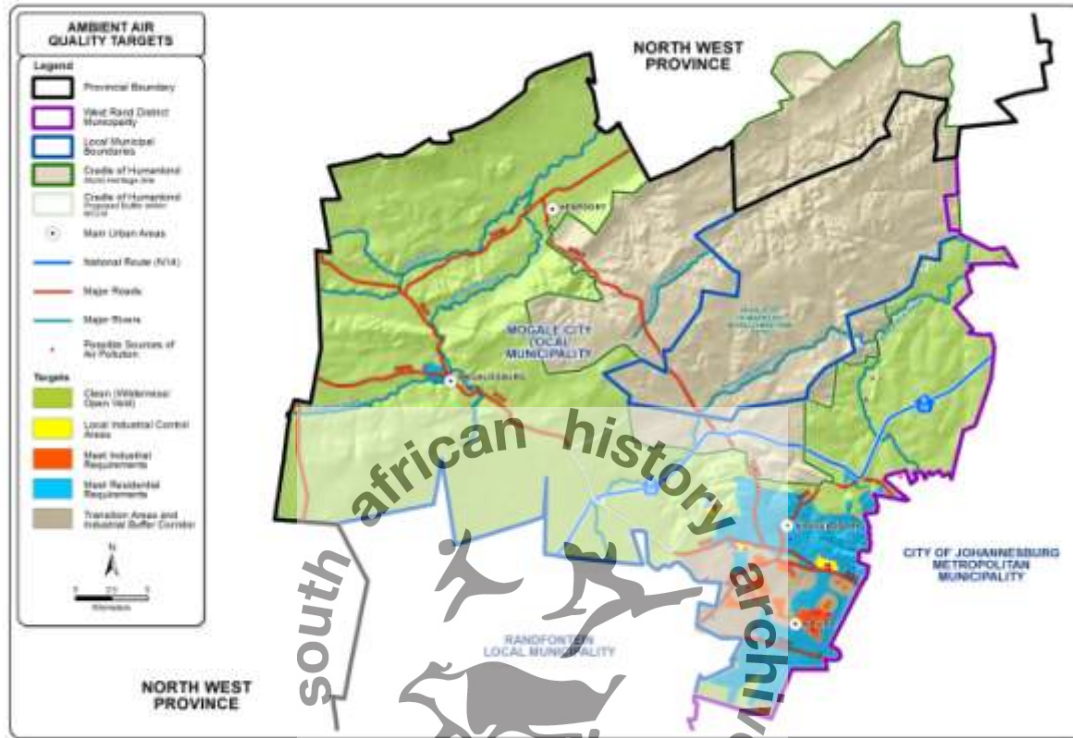
- Minimum air quality standards for the protection of human health and wellbeing and natural systems are maintained.
- A carbon neutral state is achieved through appropriate green house gas emission reductions, the use of alternative technology and carbon off-setting schemes.
- Clean, renewable and efficient energy sources; and, transportation options that reduce fossil fuel dependence are promoted, so as to reduce energy costs and produce low greenhouse gas emissions and other air contaminants.

Desired State reports on the vision for further development in the municipality, based on broad stakeholder consultation, sets out objectives and principles for future developments and management zones are delineated that form the basis for specific recommendations for land use change and development in the Strategic Environmental Management Plan.

Desired State Sets out principles based on those in Section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and outlines a set of management objectives to achieve the sustainable development vision.



9.9.3 Sensitivity



Map 11: Air Quality targets

Air Quality is one of the key environmental issues within Mogale City. The location of large tailings dams and mine dumps, coupled with major industrial area of Chamdor in the vicinity of densely populated areas of Kagiso and Rietvallei are the cause of high ambient concentrations of pollutants. The mapping of Air Quality constraints therefore focused on identifying areas sensitive to emissions and where residential targets should be met as well as areas where industrial targets should be met. Buffers are delineated around industrial areas and mine dumps. Green areas are considered to meet air quality guidelines. Local industrial control areas are indicated in 'yellow' and represent areas that have some industrial activities but not enough to be considered an industrial area.

NEMAQA provides the legislative means to enforce minimum air quality standards. It is therefore not the location of emitting industry that is critical, but the management thereof. Areas sensitive to air quality impacts are indicated in shades of 'blue' on the Ambient Air Quality Requirements map (Map 11).

It is noted that any emissions within Mogale City have the potential to impact negatively on air quality, specifically in the southern and south-eastern areas of Municipality. It is also notable that areas such as Kagiso and Rietvallei are more sensitive to emissions than Krugersdorp and surrounding areas while areas such as Magaliesberg and Muldersdrift are least susceptible to emissions. Prior to development that would result in significant emissions, air quality modelling should be undertaken to determine potential impacts. The level of air quality modelling should however be based on the location and the nature of the proposed development.

West Rand District Municipality is currently in the process of finalising an Air Quality Management Plan and compiling a comprehensive emissions inventory for existing industries. Once a complete AQMP has been compiled and implemented, a greater understanding of how industry is influencing air quality within West Rand District and subsequently Mogale City will be possible. Fugitive dust emissions from mine dumps and tailings dams are a major contributor to air quality issues within Mogale City and this poses management challenges that are not easy to resolve. However, ongoing ambient air monitoring and identification of all contributing sources of air pollution is critical. To this extent, developing capacity to keep existing ambient air monitoring stations operational and producing verifiable and sound measurement data and to commission new monitoring stations is of crucial importance.



10 ENVIRONMENTAL OPPORTUNITIES AND CONSTRAINTS

The following opportunities and constraints have been identified for the MCLM. These assist in identifying the management guidelines in order to utilise the opportunities and reduce the possible constraints and conflicts.

Table 14: Environmental Opportunities and Constraints in the MCLM

OPPORTUNITIES	CONSTRAINTS
BIODIVERSITY	
Establishment of conservancies	Loss of biodiversity through unsustainable development
Contribution to local tourism	Lack of awareness of biodiversity features ecological functioning
Conservation of biodiversity features	Lack of assessment of cumulative impacts
Proximity of CoHWHS	Lack of communication between environmental and planning authorities with regards to sensitive areas
Presence of mountainous areas which are high in biodiversity	Alien plant infestation
Protection of Red Data Species	Loss of biodiversity due to AMD
	Lack of capacity to monitor and conserve biodiversity features
	Loss of Red Data species through clearance of vegetation, destruction of habitats, water pollution, as well as a lack of understanding and appreciation for the long term value and benefits of biodiversity
SURFACE WATER	
Establishing open space systems and green corridors.	Lack of support and implementation by concerned authorities. Lack of resources for implementation.
The opportunity exists for an in-depth inventory to be compiled at the municipal scale for surface water resources having been identified here.	A lack of financial backing on the part of the local municipality may hinder this undertaking where funds are unavailable and where this is not pursued.
Existing formal conservation initiatives. This will allow formal conservation of surface water	A number of competing demands for financial resources may entail that other sectors such as

OPPORTUNITIES	CONSTRAINTS
resources in this area, and will allow for the potential future expansion of the formal conservation area.	housing etc. receive the majority of resources, restricting resources made available for surface water and wetland improvement and rehabilitation.
The predominance of agricultural land use over most parts of the MCLM is conducive for the establishment of conservancies through which the sustainable management of surface water resources can be encouraged and implemented	The large-scale transformation of certain catchments that has led to irreversible loss of wetlands and degradation of water resources.
The Working for Wetlands Project could be engaged to facilitate wetland rehabilitation planning in wetland catchments and reaches requiring wetland rehabilitation interventions	The prioritisation of socio-economic objectives and associated development may entail the further urbanisation of catchments and the potential associated impacts and degradation of surface water resources.
The existing planning framework for the MCLM (in particular the SDF) is based on a principle of sustainable development and the maintenance of biodiversity. This will facilitate the inclusion of more specific wetland and surface water resource protection and sustainable use guidelines into the planning framework.	
	Disregard for environmental planning in favour of service delivery and economic opportunities
AGRICULTURE	
<p>The establishment of agricultural production on underutilised high potential land: The agricultural status quo report indicates that MCLM has the potential to produce high quality yields as well as a diverse range of crops. MCLM has a number of well established farming hubs, which are situated on high potential soils and land types. There are however high potential areas which are underutilised in terms of agricultural development and these areas should be developed for agricultural production and protected from non-productive land uses.</p>	<p>Expansion of non-agricultural land uses: The primary pressure on agricultural land is the expanse of urban and non-productive land uses. Population growth and urbanisation is fuelling a need for land use change from agriculture to housing, industry and commercial land uses effectively reducing the area under production and thus reducing food security in the region. This is particularly true for urban centers such as Magaliesburg and Krugersdorp. This pressure has become a national problem and is shown in the fact that South Africa is now a net importer of food.</p>

OPPORTUNITIES	CONSTRAINTS
	Agricultural hubs near the urban edge are most at risk to this pressure as urbanisation is usually concentric in nature.
<p>Increasing production from established agricultural activities: Approximately 32% of MCLM is under cultivated land and while the yields from these areas contribute significantly to economic development there is room for improvement. Greater yields and more sustainable can be obtained by:</p> <ul style="list-style-type: none"> ▪ Improved land management (minimum till, fertiliser application), ▪ Correct crop selection, ▪ Better farmer support from government, ▪ Crop rotation programmes, ▪ The implementation of intercropping and ▪ The establishment of farmer training and land care seminars <p>It is recommended that smallholder operations in particular are targeted for increased production so as to reduce the yield gap between themselves and large commercial outfits.</p>	<p>Land reform: Land reform programmes have the potential to be both an opportunity and a constraint to agriculture in MCLM. For land reform to be successful it needs to be supported by the local farmers, community and government. However the persistent threat of land claims and land redistribution adds to the pressure on existing agricultural operations and could hamper long term planning within MCLM.</p>
<p>Establishment of niche markets: The production of organic fruit and vegetables, for small niche markets, is limited in MCLM and there is an opportunity to establish farms which produce high-end produce for both the local and international market.</p>	<p>Lack of training and expertise: Instances of land degradation and underperforming farms are often attributable to a lack of training and expertise. Lack of training and experience is particularly relevant to emerging farmers. Farming seminars/educational clinics, organised by either government or land care programmes, need to be implemented to improve capacity building and provide support to this critical sector of agriculture in MCLM.</p>
<p>Increase in Agri-tourism: Agri-tourism is a type of rural tourism related to farming activities. It is usually run by farmers, and can</p>	<p>Erosion and unsustainable farming practices: Over grazing, vegetation clearance, deep ploughing, lack of crop rotation and</p>

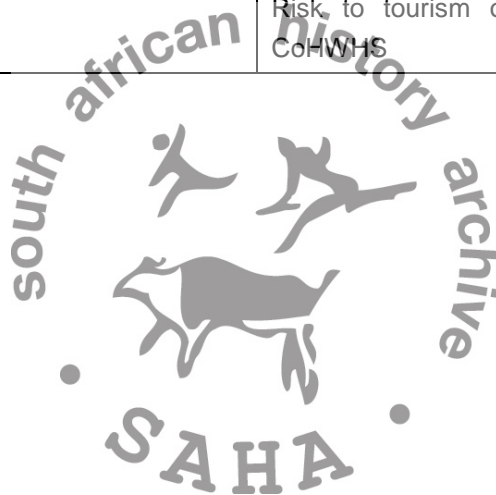
OPPORTUNITIES	CONSTRAINTS
<p>play a significant role in supplementing the farmer's income as well as create jobs and boost the local economy. An agri-tourism enterprise might include:</p> <ul style="list-style-type: none"> ▪ Outdoor recreation (fishing, hunting, wildlife study, horse riding) ▪ Educational experiences (cooking classes or tastings). ▪ Entertainment (harvest festivals) ▪ Hospitality services (farm stays, guided tours) and ▪ On-farm direct sales (u-pick operations, produce stands) (Internet 1). <p>Agri-tourism holds great potential thus it should be promoted in MCLM.</p>	<p>burning all contribute to the excessive loss of fertile top soil. South Africa's soil loss, primarily caused by water and wind erosion, is estimated at approximately 300 – 400 million tones of soil per year. Erosion and unsustainable farming practices in MCLM has had a negative effect on agricultural production and production potential.</p>
<p>Increase in agri-processing ventures (value added services): Converting basic produce into more valuable goods can significantly boost the local economy and increase the overall value of agricultural in the MCLM. Processing vegetables into vegetable soup is an example of agri-processing and is a significant agriculturally related opportunity which should be promoted in MCLM.</p>	<p>Bush encroachment and alien vegetation: Bush encroachment and alien infestation due to the poor veld management reduces the grazing capacity of MCLM's grasslands and is another adverse pressure on overall agricultural production.</p>
<p>Improved logistics, better use of transport networks and greater access to international market: Good road and rail network allow efficient and cost-effective transport of agricultural goods. These transport routes and access to other regional and international markets via O.R. Tambo airport should be exploited by agricultural producers in MCLM.</p>	<p>Water quantity and quality: The MCLM Status Quo report indicates that MCLM's rainfall is seasonal and thus some form of supplementary irrigation is required to produce sustainable harvests. There are a number of irrigation schemes located near Battery and Hekpoort which are dependent on a reliable source of water of a particular quality. Water for agricultural production competes against other water users and a rise in demands for water, due to development, inevitably causes the agricultural sector and any potential agricultural developments to suffer based on water use priority.</p>

OPPORTUNITIES	CONSTRAINTS
<p>Use of sludge and reclaimed water for irrigation: Established farmers around urban/suburban centres e.g. Magliesburg, Hekpoort should attempt to make use of treated sludge or reclaimed water in order to irrigate and fertilise their lands. This method of irrigation reduces the load on wastewater treatment plants and on freshwater resources.</p>	<p>Other pollution sources: Pollution emanating from mining operations and urban development are a threat to the sustainability of established and potential agricultural operations within MCLM. Agricultural lands near mining and urban centers are most at risk from this threat.</p>
	<p>Climate change: Anthropogenic emissions of greenhouse gasses have already produced a discernible human influence on the world's climate. Measured warming of the climate system is unequivocal, with a total global temperature increase of between 0.57 and 0.95 °C since 1850 and with 11 of the 12 warmest years in the global temperature record up to the end of 2006 having occurred in the 12 year period 1995-2006 (IPCC, 2007). Increases in temperatures and associated increase in rainfall variability will continue to place stress on the agricultural sector in MCLM and South Africa.</p>
	<p>Crime: Poverty related crime is common in rural agricultural areas and has an adverse impact on agricultural production and profitability. According to the Gauteng census of agriculture Provincial Statistics (2002) the Krugersdorp farming community was subjected to a number of agriculturally related crimes including stock, tool and crop theft which resulted in substantial losses over the financial year.</p>
GROUNDWATER	
Improvement of current groundwater quality	Increase in AMD due to lack of management of discharge points
Implementation of improved groundwater monitoring	Loss of karst topography due to AMD increasing
Partnerships between the private and public sectors to curb the risks associated with AMD	Lack of service provision and hence potential pollution of groundwater aquifers

OPPORTUNITIES	CONSTRAINTS
Improvement of infrastructure in place to attenuate and treat AMD	Over abstraction of dolomitic and granitic aquifers
Protection of karst topography of CoHWHS	
Improvement of service provision	
Increased awareness of sensitivity of dolomitic aquifers	
GEOLOGY	
Opportunity for conservation where development cannot take place i.e. on dolomitic areas	Development on dolomitic and undermined areas
Ridges provide areas of high biodiversity	Potential development of dolomitic sinkholes
SOCIAL AND INFRASTRUCTURE	
Natural physical elements of beauty	Lack of investment in infrastructure
Cradle of Humankind tourism potential	Low economic growth
Historical town of Magaliesburg	Low levels of skills and job opportunities
Natural beauty	Poor quality of disadvantaged settlements
Large percentage of land considered to have medium to high levels of biodiversity	Large poor and underserved population.
High value agricultural land that forms part of a Gauteng Agricultural Hub.	Uncoordinated and unmanaged development in the Muldersdrift area.
The availability of land to the east of the N14 in the Muldersdrift area to accommodate long-term growth in Mogale City.	Demand for development and expansion
Urban areas in Mogale City form part of the Gauteng Global City Region – in economic hub of South Africa.	Lack of investment in public environment.
Location in terms of the Lanseria Airport and the N14 highway.	Poor physical and functional integration between greater Kagiso area and Krugersdorp Mining land that provides a constraint to development.
An established Primary Node (Krugersdorp CBD).	Dolomite.
Cradle of Humankind Buffer Zone.	Existing developments have not considered natural features.
Tourism opportunities in extensive rural environment	Unfavourable economic climate
Linkages with Johannesburg economic development	Lack of resources to meet demand
N14 and Lanseria development opportunities	Financial constraints.

OPPORTUNITIES	CONSTRAINTS
Creation of a benchmark development area in the Muldersdrift area based on Sustainable Human Settlements and New Urbanism	Low skill and employment levels affect ability to pay and focus of population on meeting basic needs first.
Rural service centres (Magaliesburg, Tarlton and Hekpoort)	Potential health hazards posed by mine dumps.
	Rural land invasion.
HERITAGE	
Promote heritage features as tourism attractions	Vandalism and destruction of heritage features
Increase awareness of heritage features	Loss of heritage features due to development not taking heritage / culture into account
Link in with the heritage features of the CoHWHS	Unknown heritage features within the MCLM whether they be on private property or underground
Conservation and upkeep of heritage features	Loss of heritage features through the increase in AMD particularly in karst areas
Promotion of historical towns such as Magaliesburg	Loss of cultural landscapes through
Consideration of heritage features prior to development applications being approved	
Increase awareness of cultural landscapes	
LANDSCAPE CHARACTER	
Presence of significant scenic, natural landscapes	Development pressures within the MCLM have resulted in increasing encroachment on sensitive landscapes
Many sensitive landscapes are found in existing protected areas and conservancies	Uncoordinated and unmanaged development in certain areas has negatively impacted landscapes
GDARD development guidelines for ridges (2001) provides a mechanism for the preservation of ridge landscapes	Degraded landscapes in disadvantaged settlements
Established tourism routes in the area (Magalies Meander)	
Proximity to Cradle of Humankind World Heritage Site enhances tourism potential	
AIR QUALITY	
Implementation of long term monitoring in terms of the NEMAQA	Air quality issues are exacerbated by insufficient air quality governance

OPPORTUNITIES	CONSTRAINTS
Improvement of air quality in the MCLM with the removal of mine dumps which are reworked	Lack of accurate information due to sporadic measurements for many priority pollutants, insufficient monitoring stations and very little in-stack monitoring
	The provisions of the National Environmental Management: Air Quality Act (NEMAQA) Act No. 39 of 2004 have yet to be implemented with regards to air quality
	Inappropriate strategies in place to manage the existing situation
	Lack of understanding of the air quality situation in the area
	Decline in human health
	Increase in local pollutants
	Risk to tourism opportunities in an around CoHWHs



11 BROAD MANAGEMENT OBJECTIVES

For the purposes of this document a 'management objective' has been defined as:

- A formally established, more or less quantitative target that is actively sought and provides a direction for management action

The management objectives identified will aim to assist in the arrival at the desired state in the MCLM. There are a number of management objectives that can be identified, as explored below:

Table 15: Broad Management Objectives

ENVIRONMENTAL PARAMETER	MANAGEMENT OBJECTIVE
Biodiversity	<ul style="list-style-type: none"> Maintain intact natural vegetation Promote and maintain ecological linkage Avoid fragmentation of habitats Ensure compliance with relevant legislation Ensure biodiversity is taken into consideration regardless of EIA requirements Promote environmental awareness
Surface water	<ul style="list-style-type: none"> Maintain hydrological functioning of rivers and wetlands Use of buffers when considering development Ensure that ecosystem goods and services are maintained and not compromise
Agricultural Potential	<ul style="list-style-type: none"> Utilise the full potential of agricultural land in a sustainable manner Protect areas of high agricultural potential land
Groundwater	<ul style="list-style-type: none"> Improve water quality Increase management interventions Encourage active participation in curbing the AMD problem within the study area
Geology	<ul style="list-style-type: none"> Discourage development on sensitive geology such as dolomite or undermined land
Socio-economics	<ul style="list-style-type: none"> Minimise development on and around sensitive areas Ensure that new development is strictly assessed in terms of environmental concerns before planning approval Promote sustainable rural development Promote the provision of improved services in terms of housing and general services to impoverished communities

	Discourage the development of informal settlements
Heritage	Promote and conserve heritage features in terms of the Heritage Resources Act Promote the presence of the Cradle of Humankind World Heritage Site
Landscape character	Promote the preservation of sensitive landscapes Promote the creation and retention of a unique sense of place
Air Quality	Improve monitoring and implement long term monitoring plans to ensure suitable air quality

The management objectives identified above are explored further in the guidelines below.



12 ENVIRONMENTAL MANAGEMENT FRAMEWORK

12.1 Methodology for identification of Environmental Management Zones

The GIS platform developed during the course of the study provided the basis for the identification of Environmental management zones. Each zone is essentially a synthesis of different types of land use and land cover, as well as delineated protected areas.

In order to ensure that the delineation of the Management Zones reflects current land use patterns in the MCLM, existing land use data was updated using the Municipality's latest (2010), high resolution digital aerial photography.

Once the component spatial features had been determined for the zones map overlay techniques were applied to the relevant data sets to produce each zone. Details of the spatial components of each zone are set out in the Table below

Each Environmental Management Zone is composed of various land-use attributes each of which has a level of sensitivity namely high, medium or low.

Each land use utilised to determine the management zones has activities which are likely to require an environmental process to be followed in terms of NEMA. These potential activities are included in Appendix 2 to guide the decision maker so as to advise applicants accordingly.

12.2 Environmental Management Zones

Based on the methodology discussed above, the following zones have been identified:

Table 16: Environmental Management Zones

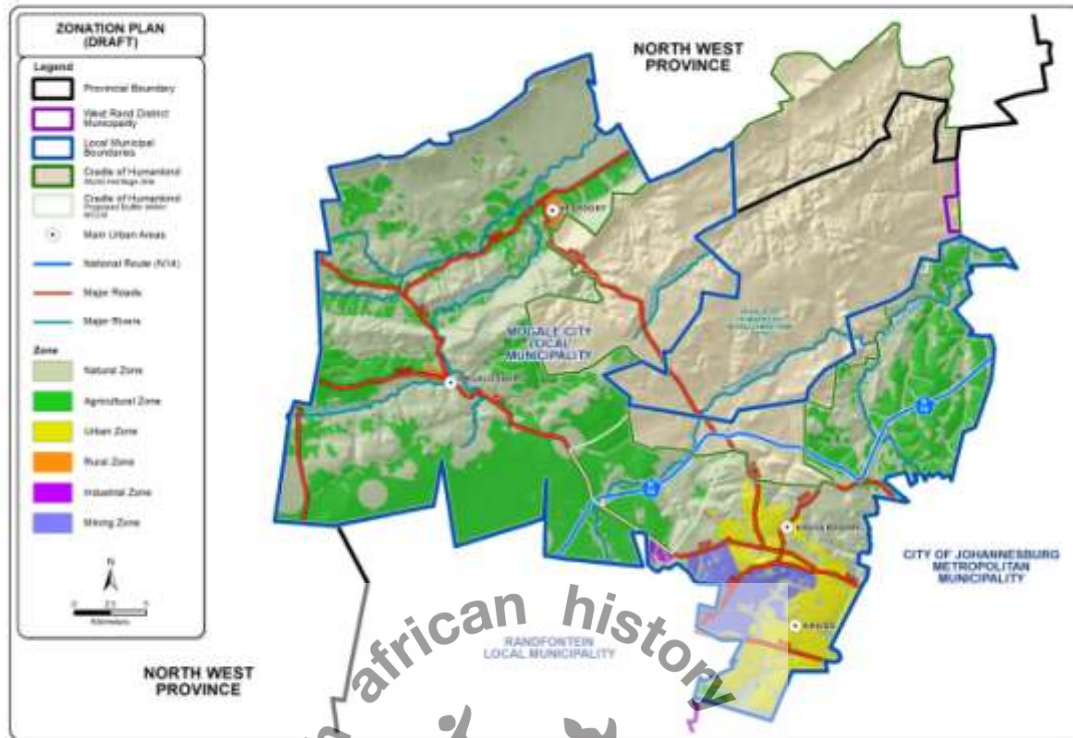
HIERARCHY	ZONE	LAND-USE CATEGORIES
1	Natural zone	Protected areas Irreplaceable sites Intact grasslands Indigenous vegetation Ridges Wetlands and rivers Impacted grasslands
2	Agricultural zone	All agricultural areas according to land use
3	Urban zone	All built up areas
4	Rural zone	All rural towns and development
5	Industrial zone	All industrial areas
6	Mining zone	Active and dormant mining areas

The biophysical zone assumes the highest level of importance and over-rides all other zones. As a result, there are portions of the biophysical zone in urban areas as well as in natural areas. Subzones have therefore been created to accommodate differing management guidelines for biophysical areas within urban or natural areas. These are highlighted in Table 17.

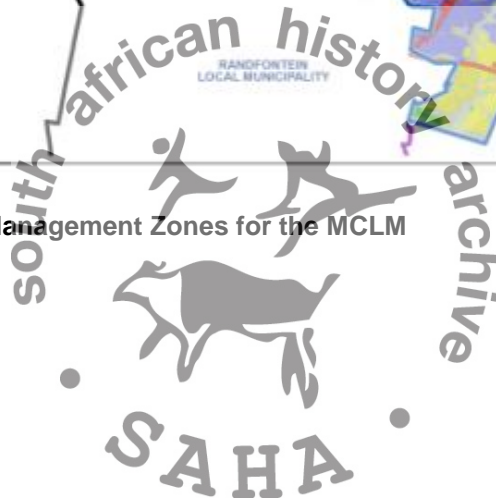
Table 17: Subdivision of the Biophysical zone

ZONE	SUBZONE	LANDUSE
Natural	Subzone A	Within urban area
	Subzone B	Natural areas

It is important to note that urban areas are defined as areas occurring within the urban edge and rural areas are those that fall outside of this area.



Map 12: Environmental Management Zones for the MCLM



13 STRATEGIC ENVIRONMENTAL MANAGEMENT PLAN

13.1 Management guidelines according to zone

The following management guidelines correspond with the zonation map. The preferable land uses listed here imply that those not listed are not preferable. These guidelines should be consulted first prior to consulting the more detailed management guidelines for each environmental parameter listed below.

Table 18: Management Guidelines according to Zone

ZONE	SUBZONE	MANAGEMENT GUIDELINES	PREFERABLE LAND USES
NATURAL ZONE	A (URBAN)	<ol style="list-style-type: none"> 1. Consult EIA Regulations 2. Maintain ecological linkage in an urban environment 3. Insist upon indigenous landscaping 4. Alien plant management implementation 5. Ensure buffers for rivers and wetlands are in place 6. Ensure development is compatible with land use 7. Ensure that the proposed development takes the visual environment into account 8. Implement GDARD Ridge policy if ridge present 9. Ensure Water Use License is in place if required. 	<ul style="list-style-type: none"> Open space systems Parks Low density development relating to tourism or conservation Any development or activity that will not have a detrimental impact on biodiversity within the urban environment
	B (NATURAL / RURAL)	<ol style="list-style-type: none"> 1. Consult EIA Regulations 2. Ensure maintenance ecological linkage 3. Insist on indigenous landscaping 	<ul style="list-style-type: none"> Low density development relating to tourism or conservation

		<ol style="list-style-type: none"> 4. Alien plant management implementation 5. Ensure buffers for rivers and wetlands are in place 6. Ensure Water Use License is in place if required. 7. Consult NEMBA to ensure protection of ecosystems if relevant 8. Ensure qualified specialist undertakes relevant biodiversity assessments and make recommendations in this regard 9. Ensure all aspects of the environment are assessed 10. Cross check land-use suitability with SDF 11. If an EIA is undertaken ensure the following: Heritage / culture is taken into account infrastructure & service requirements are examined and that the development can be accommodated 12. Ensure development is compatible with land use 13: Ensure that the proposed development takes the visual environment into account 14. Implement GDARD Ridge policy if ridge present 14. Ensure that MCLM DIEM is aware of special consent developments 	Any development or activity that will not have a detrimental impact on biodiversity in a more rural / natural context
AGRICULTURAL ZONE	N/A	<ol style="list-style-type: none"> 1. Consult EIA Regulations 2. Suggest agricultural study to ensure site is sustainable for agricultural land use suggested 3. Ensure that no heritage features will be lost due to agricultural activities 4. Ensure compliance with National Water Act 5. Ensure General Authorisations are adhered to. 	<ul style="list-style-type: none"> ▪ Dryland cultivation (subsistence and commercial) ▪ Irrigated cultivation (subsistence and commercial) ▪ Agricultural supplies and services, including agri-industrial facilities and storage

		<p>6. Ensure Water Use License is in place if required.</p> <p>7. New water uses must be monitored through the use of meters</p> <p>8. No urbanisation in these areas to take place in these areas</p> <p>9. Ensure sustainable rural development i.e. no urban sprawl and large scale development such as industry etc</p> <p>10. Ensure buffers on wetlands and rivers are implemented</p> <p>11. Ensure that heritage sites are protected if present.</p> <p>12. Implement GDARD Ridge policy if ridge present</p> <p>13. Water usage must be conducted in a sustainable manner in order to conserve water resources.</p> <p>14. The establishment of “green villages” in agricultural areas must be not jeopardise high agricultural land and must take sustainable rural development into consideration.</p>	<ul style="list-style-type: none"> ▪ Farm worker villages/housing ▪ Nature based tourism and associated recreational facilities that are compatible with agricultural activities ▪ Nature and resource conservation ▪ Natural open space/protected areas ▪ Farm stalls ▪ Conservancies ▪ Hiking, horse riding and adventure trails <p>Any development or activity that will not have a detrimental impact on arable land or the environment as a whole</p>
URBAN ZONE	N/A	<p>1. Consult EIA Regulations</p> <p>2. Ensure in-fill development within the urban edge as defined by the SDF</p> <p>3. Ensure that heritage sites are protected particularly buildings older than 60 years.</p> <p>4. Promote sense of place by preserving the existing visual environment where relevant</p> <p>5. Ensure that developments adhere to GDARD ridge policy</p> <p>6. Ensure urban renewal takes place</p>	<p>Residential, Commercial development, Light industrial, infrastructure, bulk services</p> <p>Any development or activity that compatible with the urban environment and will not have a detrimental impact on the environment</p>

		<p>7. Ensure that bulk services and general service provision are present and / or improved from the current situation</p> <p>8. Ensure Water Use License is in place if required.</p> <p>9. Ensure development is compatible with land use</p> <p>10. Ensure that the proposed development takes the visual environment into account</p> <p>11. LUMS (Land Use Management System) must be in place</p> <p>12. Precinct plan required to manage and control development in the node.</p> <p>13. Formulate and implement a Open Space Framework for Mogale City.</p> <p>14. Formulation and implementation of ridgeline policy at council level.</p> <p>15. Cumulative development analysis be required.</p> <p>16. Landscape and visual impact assessment required.</p> <p>17. Site specific need and desirability report.</p> <p>18. Take cognisance of the possible presence of dolomite and the risks associated</p> <p>19. Consult PWV344 Report regarding developments on dolomitic land</p> <p>20. Ensure safety measures for areas that have been determined to be sensitive from a radioactivity point of view i.e. near mine dumps and tailings dams</p>	
RURAL ZONE	N/A	<p>1. Consult EIA Regulations</p> <p>2. Ensure preservation of sense of place and cultural landscapes</p>	Small scale residential, agri-tourism, conservation, leisure and ecotourism

		<ol style="list-style-type: none"> 3. Ensure that developments adhere to GDARD ridge policy 4. Ensure the removal of exotic and alien invasive plants 5. Ensure services are available for proposed developments 6. Consult zonation plan to confirm / deny the presence of dolomite 7. Ensure development is compatible with land use 8. Ensure Water Use License is in place if required. 9. Ensure that the proposed development takes the visual environment into account 10. Develop standards and parameters for subdivisions in the rural environment 11. Consult MCLM environmental management guidelines for subdivisions 12. The review of the special consent guidelines and procedure. An environmental process must be incorporated into special consent applications 13: Consult with GDARD and other water management authorities regarding surface water concerns, 	
INDUSTRIAL ZONE	N/A	<ol style="list-style-type: none"> 1. Consult EIA Regulations 2. Ensure that all applicable licenses are being applied for i.e. air quality, effluent discharge etc 3. Ensure the development is compatible with industrial land use 4. Ensure that wetland and river buffers are adhered to 5. Ensure Water Use License is in place if required. 	<p>Light and heavy industry i.e. factories and warehouses</p> <p>Any development or activity that is compatible with industrial land use and will not have a detrimental impact on the environment</p>

		<ul style="list-style-type: none"> 6. Ensure that services are available for the proposed development 7. Take cognisance of the possible presence of dolomite 8. Ensure that groundwater is not compromised by the proposed development 9. Ensure that the proposed development takes the visual environment into account 10. Ensure NEMWA is taken into account. 11. Consult with GDARD and other water management authorities regarding surface water concerns 	
MINING ZONE	N/A	<ul style="list-style-type: none"> 1. Consult EIA Regulations and MPRDA Regulations 2. Ensure that all applicable licenses are being applied 3. Identify the risks / benefits to the current AMD situation 4. Ensure that groundwater is not compromised by the proposed development 5. Ensure Water Use License is in place if required. 6. Ensure that wetlands and rivers are protected from destruction and pollution impacts 7. Ensure sustainability of a mining operation in the current economic climate 8. Ensure that the proposed development takes the visual environment into account 9. Consult with GDARD and other water management authorities regarding surface water concerns 	<p>Mining</p> <p>Any development or activity that is compatible with mining land use and will not have a detrimental impact on the environment</p>

The following non-desirable activities have been identified for the Natural Zone. These correspond with the Cradle of Humankind EMF:

- Subdivision of farm portions or land
- Agri-industry or expansion of existing operations
- Abattoirs
- Cultivation of virgin soil – the transformation of land for cultivation of virgin soil
- Feedlots
- Panel beating, scrap yards
- Industrial activity or factories
- Filling stations
- Crematoria
- Communication towers
- Semi formal rural development
- Golf estates
- Informal rural settlement
- Lifestyle estates or expansion of existing estates on agricultural land
- High density residential development or expansion of existing facilities
- Taverns
- Taxi ranks
- Waste disposal facilities
- Quarrying and any other kind of excavation
- Mining
- Aircraft landing strips or expansion of existing strips
- Helipads or expansion
- Conference facilities or expansion
- Business premises or expansion of existing facilities
- Roadside advertising
- Intensive agriculture or expansion
- Holiday accommodation
- Infrastructure: Bulk services

13.2 Management Guidelines per Environmental Parameter

The following guidelines have been proposed for the various environmental parameters which have been assessed in terms of the EMF. These guidelines are to be consulted once the zone specific guidelines have been consulted to make recommendations based on the issues pertaining to a development site.

13.3 Biodiversity

In areas of biodiversity significance, it is essential that environmental legislation is implemented to ensure that these areas are protected by this legislation. Development applications must consider in fill development and ecological linkage must be incorporated into site layouts if relevant.

The Gauteng Ridges Policy must be strictly enforced to ensure not only less visual pollution but also maintenance of sensitive montane vegetation which often houses Red Data species. These areas often form movement corridors for fauna and flora.

Industrial developments or any other developments that result in waste or emissions regardless of where they are located within the MCLM, must have the necessary permits in terms of the NEMAQA, NEMWA. In addition, all effluent discharge must be disclosed to the MCLM to ensure that Municipal Treatment Works can handle these amounts and can be treated suitably. This will ensure that these potential impacts do not contaminate the biodiversity features within the MCLM, particularly river systems as these are inexplicably linked and would result in large scale cumulative impacts.

The current crisis with the Acid-Mine Drainage is a good example of this in practice. The AMD is not being treated accordingly and is thus spilling out into the natural environment resulting in major cumulative impacts on the Karst and surface water environment.

In the more natural areas of the municipality, the presence of protected trees is likely to be addressed as part of development applications. This may arise despite a site not requiring an EIA. Decision making authorities must ensure that these are taken into account when reviewing any development application (refer to decision making flow chart below).

In areas where a biodiversity assessment is required, the principles of the NEMBA must be implemented as part of the assessment to ensure the protection of endangered and critically endangered habitats and species.

If a development is located within an area that is sensitive from a biodiversity perspective and the developer wishes to continue with an EIA despite recommendations, the suggestion for off-set conservation sites must be investigated and suggested to ensure that suitable habitat is protected.

The MCLM must promote the establishment of more conservancies and protected areas with the emphasis on ecotourism. Residential development must be centred around the urban areas within the urban edge avoiding urban sprawl.

The development of an Open Space System within the urban environment is essential to maintaining ecological linkage within the municipality particularly between the urban and rural environments.

In addition to the above, it is recommended that a biodiversity strategy be compiled for the MCLM. The LAB format is recommended for this purpose. Local Action for Biodiversity (LAB) is a global urban biodiversity programme coordinated by ICLEI (International Council for Local Environmental Initiatives) – Local Governments for Sustainability.

The LAB format was established in 2006 with a select group of local and regional authorities from around the world. Since then, this process has been a groundbreaking method of managing and conserving biodiversity at a local level.

The LAB Programme is an accessible and enabling platform for committed, leading local governments from around the world. This is achieved by profiling and promoting the importance of urban biodiversity and the role of local governments in its management, as well as by sharing the experiences, successes and challenges of urban biodiversity management in the participating cities and local authorities. Furthermore, technical support, networking opportunities, and advocacy are provided (<http://www.iclei.org/index.php?id=6237>).

The eThekweni Municipality, The City of Cape Town, Ekurhuleni Metro, Bergervier Municipality and Cape Winelands District Municipality are amongst the South African municipalities which have joined the LAB programme.

13.4 Surface Water

The management guidelines identified will aim to assist in the arrival at the desired state for surface water resources in the MCLM. There are a number of management guidelines that can be identified, as explored below:

13.4.1 'Good' governance to protect surface water resources

As explored above, there are a number of laws and regulations that have been set out to protect and ensure the sustainable use of surface water resources. The most important of which are the National Water Act and Environmental Impact Assessment Regulations promulgated under the National Environmental Management Act. It is absolutely essential that these laws be properly enforced and applied to all proposed activities that have the potential to adversely affect surface water resources. Should these laws and regulations be poorly enforced, the possibility of development and other activities exerting a negative impact on surface water resources that could lead to potential negative outcomes (such as the loss of wetland habitat) would be much more likely to occur. Moreover, it is imperative that the relevant government departments be provided with sufficient resources and competent staffing to ensure that development within the municipal area be conducted in a sustainable manner. It is essential that those responsible for enforcing environmental laws be provided with the resources and legal backing to ensure transgressors of the law are held to account.

As identified above, the poor maintenance of water (sewage) treatment facilities is a major factor in the pollution of surface water resources. The maintenance and proper running of these facilities is a critical aspect of governance responsibility placed on the local municipality that relates to surface water resources and one that needs to be upheld.

13.4.2 The undertaking of a wetland municipal inventory

In order to ensure that the dual objectives of protecting those wetlands or catchments that are in a largely natural state and improving the state of those wetlands which have been degraded are achieved, it is important to gain a spatial understanding of the state of wetlands across the municipal area. This is especially important in light of the fact that extremely sensitive wetlands (such as peatlands) are prevalent in the MCLM. It is thus strongly recommended that a spatial wetland inventory be undertaken (beyond the scope of this EMF study through which wetland areas have been identified at a desktop level) that aims to categorise wetlands in terms of their type and state which can then be used to identify and prioritise specific areas or catchments within the local municipality for different types of management intervention. The inventory can also serve as a point for departure where more in-depth studies can be directed where identified. In addition to this, the inventory can also form a basis from which specific wetlands of importance can be identified and/or those that are under threat can be flagged. The compilation of such an inventory is a critical component of the wetland rehabilitation planning as discussed below.

13.4.3 Rehabilitation planning and implementation for priority wetlands / catchments

In order to attain the goal of improving wetland state in areas where wetlands have been degraded, wetland rehabilitation planning and implementation should be utilised as the primary tool to achieve this aspect of desired state. The South African National Biodiversity Institute (SANBI) undertakes wetland rehabilitation planning and implementation through the Working for Wetlands Programme. Once the wetland state inventory has been completed for the municipal area, it is recommended that the MCLM engage with SANBI and the Working for Wetlands Programme to allow those catchments requiring rehabilitation intervention to be included within current and future phases of wetland rehabilitation. This would allow the prioritisation of catchments or reaches for rehabilitation. Engaging and involving the Working for Wetlands Programme would enable wetland rehabilitation to be completed in the Municipality through existing frameworks with proven successes. It would also allow the socio-economic benefits of the labour-intensive approach of the programme to be felt in the municipal area. Restoration of wetland and river functionality can also lead to greater ecosystems service delivery and a subsequent reduction in related costs.

13.4.4 Compilation and adoption of landuse-specific guidelines for sustainable management of surface water resources

As has been explored above, landuse and especially landuse change is one of the primary drivers of surface water resource degradation in the municipal area. An examination of the many of the pressures currently acting on surface water resources and wetlands that lead to impacts upon those surface water resources (see above) reveals that many impacts emanate from 'poor' landuse practices, e.g. poor agricultural land management in the form of too frequent or poorly timed burning regimes that may negatively impact plant species diversity within wetlands, or which may negatively affect fauna within the wetland by destroying habitat. As another example, poorly designed urban stormwater development can lead to erosion of watercourses and the direct pollution of the drainage system. In all cases, a set of guidelines for sustainable landuse management with respect to surface water resources and wetlands can be compiled which can be used to educate and guide land managers and others in terms of sustainable land use practices that will not adversely affect surface water resources. An example of a component of such a guideline is provided in Table 18 below. These guidelines should be broken down according to the landuse type, as each landuse type is different and would require a different set of guidelines.

Table 19. A component of Proposed Guidelines for sustainable agricultural landuse management for the agricultural sector

Agriculture	
KEY FEATURE	Environmental Land-use Management Guidelines

WETLANDS	An area of 25% of a wetland should not be grazed for a whole year (guidelines produced by the Mondi Wetlands Project). Rotational grazing should be used to rest camps.
	During the dry season (Winter) wetlands should be only be grazed at a stocking density of animal units/ha that is approved by the local department of agriculture).
	Livestock should be limited to the outer edges of wetlands as far as possible and kept away from the wettest parts to prevent excessive trampling and resultant erosion.
	Wetlands must be constantly monitored for signs of erosion, especially caused by cattle movement.
	According to generic wetland guidelines produced by the Mondi Wetlands Project, burning of wetlands should take place on a 3-4 year basis and rotational burning must be encouraged.
	'Cool' fires should be used to burn wetlands as these do not destroy all vegetation and do not destroy the growth points of plants or the roots. Wetlands should be burnt when the relative humidity is high and when air temperature is low. This is ideally done when the grass is moist after rain or in the evenings or very early mornings when dew is present.
	Wetlands should be burnt in late winter / early spring to allow quick regrowth and protect the soil.
	Landowners must take cognisance of faunal species present in wetlands (e.g. grass or marsh owls), especially breeding fauna when burning, or grazing.
	No Crops should be cultivated within a wetland area
	Establish a buffer of at least 10m between the edge of a wetland and cultivated land. This buffer area should contain natural vegetation.
	Wetland draining should be ceased and rehabilitation started. Use of Agrochemicals such as pesticides, herbicides or artificial fertilisers in cultivated areas must be discouraged

13.4.5 *Establishment of Buffer Zones and Corridors for the protection of wetland and riparian habitat*

The mere delineation of wetlands and riparian zones is insufficient to ensure that an area of adequate size for each of the two ecosystems is properly conserved. Riparian zones and wetlands are transition environments or 'ecotones' between terrestrial and essentially aquatic environments. They are sites where nutrient concentrations change as water flows between the two ecosystems, serving as important buffers between uplands and open waters (Holland *et al.*, 1990). Therefore, extended areas beyond that actual interface of aquatic and upland

environments are necessary (in this instance, particularly on the terrestrial side where developments usually take place) in order for adequate exchanges to take place and processes to occur. Under these auspices, authorities deemed it necessary to establish a set of buffers for sensitive ecosystems and their biological inhabitants. As such, the formerly known Gauteng Department of Conservation and Environment (GDACE), now known as the Gauteng Department of Agriculture and Rural Development (GDARD), established guidelines which sought to implement a restricted buffer zone from the outer edge of wetlands and riparian zones to that of the adjacent terrestrial zone.

A standard buffer zone area specifically for wetlands and rivers has been devised separately for each ecosystem, although the extent varies based on the location of the environment within or outside the Gauteng Urban Edge (2007). Wetlands have a standard buffer zone of 30 metres from the edge of the temporary zone when within the urban edge, whereas a 50 metre buffer is applicable when outside the urban edge. On the other hand, rivers/streams have a buffer of 32 metres from the edge of the riparian zone when within the urban edge and a buffer of 100 metres when outside the urban edge. As it currently stands, the urban edge follows conservatively around existing urban areas within the MCLM (SDF, 2011). These guidelines should be stringently adhered to if the remaining areas of wetlands and riparian areas and the ecological linkages to terrestrial environments are to be satisfactorily conserved. Lastly, mention should also be made with respect to the buffer zones of wetland and river ecosystem fauna. Where such information is available relating to the existence of such fauna in these ecosystems, the appropriate buffer zones should be integrated with the provisional buffer zones established for rivers and wetlands. These buffer zones are likely to be greater than those for wetlands and rivers and are significant as such.

13.4.6 Establishment of Open Spaces or Green Corridors

Given the longitudinal dimension and connectivity between rivers and some wetland ecosystems, the opportunity exists for the formal establishment of green corridors or inter-connected open space systems. These linkages are vital not only for the flow of nutrients but also the flow of faunal and floral species. Connectivity is severed when a physical boundary separates an environment. Hence, even where permeable or semi-permeable structures (such as fences) are concerned, the connectivity between the environments is affected and thus likely to result in negative consequences (such as 'edge effects' in this example). Establishing a network of corridors will help to contribute to the ecological requirements of the component subsystems including wetlands and rivers. Moreover, these environmental linkages will conform with and add to the requirements of the overarching development plan to develop open spaces (IDP) and to create environmental linkages (SDF).

13.4.7 *Introducing surface water protection specifications into development planning*

It is recommended that the above wetland and surface water-specific land-use management guidelines be included within the development planning framework of the MCLM. It is recommended that in order to assist with attaining of the goal of a desired state of wetlands in the Local Municipality that limitations to the types of development that would be permitted nearby wetlands and riverine areas be implemented. "Development" in this case refers rather to the potential level of transformation (of the receiving environment) rather than the actual type of development.

The importance of including environmental (specifically surface water resource) protection into planning guidelines lies in the following objectives that would be able to be achieved:

- To facilitate the conservation of areas important for achieving biodiversity targets
- To encourage environmentally sustainable land use management
- To reasonably guide and control land use change

It is strongly recommended that the land-use management guidelines as considered above be used in this context and be formalised to guide development planning.

The principle that all wetlands and riverine areas should be treated as exclusion zones should be incorporated into development planning in the MCLM. Under this principle, only certain low impact activities would be allowed to occur. This would provide an extra layer of protection to surface water resources in the MCLM in addition to existing legislation that protects surface water resources.

13.4.8 *Special attention and monitoring of excessively polluted wetland areas and rivers*

Many of the most serious impacts affecting surface water resources originate from ongoing mining activities and abandoned mining areas which have untreated flows and large amounts of diffuse run-off pouring into rivers and wetlands. Areas where pollution is being released into these sensitive environments (where identifiable) should be given special attention. A generic aim in environmental management is to always improve degraded areas. Hence, affected areas should be identified, managed and monitored with the intent to achieving an acceptable and desired state.

The person / department / organisation responsible for the management and rehabilitation of former mining areas needs to be identified at a high level. It is recognised that the management and rehabilitation of former mining areas (especially mining areas which have been inactive for many years) is particularly problematic and is a 'grey area' in terms of financial responsibility for the rehabilitation of the mining area. In the light of the water pollution-related problems facing the Witwatersrand mining areas, government and the mining sector need to find a solution to the issue of financial responsibility for rehabilitation / management of former mining areas.

13.4.9 Engagement with / education of major land-users and stakeholders

Relating closely to the above, it is suggested that the relevant custodians of wetland conservation within the municipal area engage in an education programme for major land-users and stakeholders such as organised agriculture and the mining sector and any large state organs which are landowners to promote the sustainable use of land and the conservation and protection of surface water resources.

13.4.10 Formal / Informal conservation of largely natural catchments

Wetlands are highly sensitive features of the natural environment and contain much of the remaining biodiversity within the municipal area. As such pristine wetlands should be afforded protection in order to remain in as natural a state as possible. Furthermore, wetlands that have the potential to be significantly diverse and highly functional should accordingly be rehabilitated and also afforded protection.

A key management objective to achieve this aim, especially in parts of the municipality where catchments still exist in a largely natural state, would be the creation of more formally protected areas, or the creation of more conservancies in which sustainable agricultural and other land-use management practices could be implemented and encouraged. The creation of conservancies would allow the current agricultural land-uses to continue, but would allow the proposed land-use management guidelines to be formally implemented as part of the management of the conservancy.

13.5 Agricultural Potential

The management guidelines outlined in this section are formulated to maximise opportunities and reduce constraints (see above) in an attempt to build towards the desired state of agriculture in MCLM. The proposed agricultural management guidelines for MCLM are summarised below:

- The conservation/protection of high potential land and productive agricultural land from non-productive/non-agricultural land use activities.
- The promotion of sustainable water use. Agriculture is the biggest user of water in South Africa and thus the sustainable use of water is paramount. The establishment of subsidies or incentives for sustainable water users could encourage further water savings. The use of treated sludge/reclaimed water for irrigation can also reduce the water use demands from agriculture.
- The use of modern farming technology such as polytunnels and hydroponics should be implemented near urban centres. These intensive farms can be used to maximise production yields and meet export quality requirements in a relatively small area.
- Optimal use of existing service and transport infrastructure and the effective implementation of road and rail maintenance plans.
- The promotion and implementation of agricultural training and skills development workshops.
- Encouragement of dialogue between commercial farmers, emerging farmers, regional stakeholders, local communities and government departments.
- The promotion and reward of sustainable agricultural practices. This may come in the form of tax/cost breaks, subsidies etc.
- The encouragement of farmers and land owners to practice conservation and protect environmentally sensitive areas within an agricultural setting. Sensitive areas include wetlands and areas of natural vegetation.
- The allocation of money and support to smaller niche market start up.
- The promotion and support of existing and potential agri-tourism ventures with MCLM.
- The exploration of possible agri-processing ventures within MCLM should also be a short- to medium-term management objective.

13.6 Groundwater

The National Water Act (Act 36 of 1998) recognises groundwater as public water, and replaces the old “riparian” principle in which groundwater was a private asset, owned by the landowner. Groundwater is now seen as part of the water cycle, and therefore as connected to other water resources. The National Environmental Management Act of 1998 and the Minerals and Petroleum Resources Development Act of 2002 lay out new obligations for the mining and other industries in terms of the monitoring and remediation of pollution of water resources, including groundwater.

The National Water Act has introduced the concept of the Reserve to South African water resource management. Essentially, that part of the water resource that is necessary for environmental functions and for basic human needs (e.g. drinking and stock watering) is guaranteed by law and must be protected.

The National Water Act stipulates the development of a National Water Resource Strategy (NWRS), whose purpose is to "...provide the framework for the protection, use, development, conservation, management and control of water resources for the country as a whole" (Sections 5 to 7). The first edition of the NWRS was published in 2004, and a second edition is due to be completed in early 2011. The NWRS is a legal document and is binding on all authorities and institutions exercising powers or performing duties under the NWA. It is also the over-arching strategy document governing long-term water resources policy, planning and allocation. It is the document most likely to be seen and read by planners or officials outside of the water field. The NWRS intends that the following should take place:

- Monitoring of major aquifers by Catchment Management Agencies (or the DWA Regional Offices where CMAs are not yet operable) to determine trends in water levels and water quality resulting from human activity.
- Monitoring of groundwater to determine local impacts, including the provision of groundwater data by local groundwater users as part of the conditions of their general authorisations and licenses.

It should be noted that the National Water Act (Section 14) states that any person may be required to provide DWA with groundwater data necessary for the purposes of a groundwater monitoring network, or for the management and protection of water resources.

It is arguable that the intentions of the National Water Act and the National Water Resource Strategy are not being wholly met in the MCLM area at present, since the current groundwater monitoring arrangements are not adequate to fully characterise the groundwater conditions. The requirements of the National Environmental Management Act and the Minerals and Petroleum Resources Development Act in terms of monitoring and remediating groundwater pollution are also sometimes ignored.

The Department of Water Affairs has published clear guidelines for the Assessment, Planning and Management of groundwater in South Africa, available on the DWA website at www.DWA.gov.za/groundwater/documents. Assessment, Planning and Management of groundwater are related steps, each one of which affects the others in an iterative way. A lack of effective assessment, planning and management of groundwater resources can result not only in poor service delivery to water users, but also to significant detrimental impacts on the aquifer systems themselves. The three steps are summarised as follows:

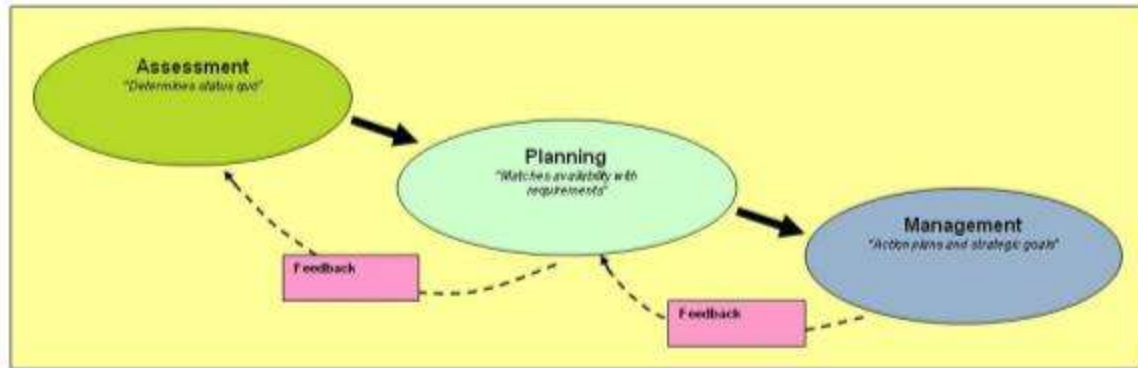


Figure 4: DWA Assessment, Planning and Management Process Summary

Following the recommendations of the DWA Guideline, it is clear that monitoring of groundwater in the MCLM area must be accompanied by Planning and Management actions. There is a need to translate monitoring of groundwater resources in the MCLM area into useful data products such as reports, which can inform decision makers. The data products should in turn lead to management actions aimed at improving sustainable management of groundwater resources.

The area of dolomite aquifer around Tarlton was proclaimed as a Subterranean Water Control Area, in terms of the 1956 Water Act. Today interested parties in the Steenkoppies Compartment are in the process of setting up a Water User Association (WUA) to be known as the Steenkoppies Aquifer Management Association in order to more effectively manage the dolomite groundwater resources in that area. A WUA is a co-operative association of individual water users who wish to undertake water-related activities for their mutual benefit, and it enables water users to pool resources. When this WUA is established, close cooperation between the WUA, DWA and MCLM is necessary in order to optimally manage the groundwater and associated environmental impacts such as flows to the Maloney's Eye spring.

The area has been subject to DWA Directives in the past as regards groundwater use, and the possibility of zero abstractions during periods of low flows at Maloney's Eye has been raised – a situation that would have a detrimental effect on irrigators. In 2008 DWA restricted the use of irrigation water in the compartment to certain days and times, and dependent on the volume of flow at Maloney's Eye. When flows at the eye are less than 93 L/s, then all abstractions apart from Schedule 1 use were prohibited – it is not known whether this is enforced at present. The notice also called for the details of all irrigators to be submitted to DWA within 21 days of publication of the notice. It is not known at present to what extent this has been enforced. DWA directives also apply to the monitoring of mine water effluent.

Of the 64 boreholes captured in this record, fewer than half have records that extend up to the present day. Of the boreholes that lack modern records, it is not known how many are still in existence.

The following management guidelines aimed at the sustainable use of groundwater in the MCLM are recommended:

- An adequate number of monitoring boreholes. Further boreholes are particularly needed in the vicinity of Maloney's Eye, and close to the decant point south of the Krugersdorp Game Reserve. Further monitoring boreholes in the Krugersdorp Game Reserve below the ridge of quartzite separating the dolomites of the Zwartkrans Compartment from the inlier of dolomite in which the decant occurs are particularly needed. Active HYDSTRA groundwater level monitoring boreholes are not available near Maloney's Eye, nor near the decant point. Where new monitoring boreholes need to be drilled, this could be carried out in partnership with the Department of Water Affairs, who in the past have indicated a willingness to assist with drilling costs.
- Coordination with DWA and others when monitoring results show unacceptable levels, and a strategy to reduce (for example) irrigation water abstraction gradually if water levels dictate this.
- Formal MCLM representation on the soon-to-be-formed Steenkoppies Aquifer Management Association (a Water User Association), so that the municipality can discuss the best ways of achieving its groundwater management guidelines in this compartment. Similar engagement with other WUAs in the MCLM area, or assistance to be provided with initiating these if necessary.
- Continuous dialogue with the DWA Regional Office, and later with the relevant Catchment Management Agency (when this is formed). It may be possible to "resurrect" some of the closed HYDSTRA boreholes in collaboration with DWA, for a fraction of the cost of drilling new boreholes.
- All groundwater monitoring results should be submitted to DWA for inclusion in their database (the National Groundwater Archive).
- The issue of treatment of the AMD decant water, and the financial background to this, needs to be resolved as soon as possible. The lack of a long-term plan for the AMD problem contributes to continual discharge of polluted water into the aquifer. DWA have an AMD Strategy – if this is available then its implementation needs to be actioned.
- The MCLM should ideally obtain all groundwater data that is being collected in the MCLM area. However this data is not always submitted to the MCLM at present. This includes data collected by private companies (e.g. mining companies), data collected by farmers and smallholders, and data collected by research institutions (e.g. the Council for Geoscience and the CSIR). An increase in the amount of data that is held by MCLM can be achieved in this way for relatively little cost.

It is also necessary to monitor individual point-discharges of pollution, including the decant point south of the Krugersdorp Game Reserve, the wastewater treatment plants, and the slimes dams. The lesser aquifers in the rocks surrounding the dolomites also require some monitoring and attention, but at present not to the same level as that needed by the dolomites. However there

are some high-yielding boreholes in the Pretoria Group quartzite rocks (i.e. the rocks overlying the dolomites) north of Maloney's Eye which fall under the jurisdiction of the MCLM, and monitoring of one or more of these is recommended. Relatively little is known about groundwater levels and groundwater quality in the Tweefontein compartment (a small area of which falls under the MCLM), but it is thought that groundwater conditions in this compartment are better than those in the other two compartments.

13.7 Geology

In order to create the education required as mentioned above, there must be sufficient broad based information to allow the successful preliminary planning of all future developments. This would be achieved when:-

- the area covered by the Mogale City Local Municipality (MCLM) could be divided into zones, and that for each zone the following data was available:-
 - the basic geological and geotechnical properties
 - information in respect of expected foundation conditions
 - possible uses of insitu materials for commercial and/or industrial processes
 - information in respect of anticipated geo-hazards
- a standard procedure established for the completion of geotechnical investigations - from "broad brush" to detailed "site specific"

At present the Council of Geoscience (CGS) is obliged by the Geoscience Act, 1993 (Act No. 100 of 1993) to amongst other things: - advise government institutions and the general public on the judicious and safe use of land.

There is no indication in the objectives of the Geoscience Act that the Council has a duty to regulate development on land where geo-hazards are anticipated. Despite this, the CGS currently has quasi legislative control over the development of residential developments in areas underlain by dolomite (it should be noted that a substantial portion of the central area of MCLM is underlain by dolomite).

In terms of the Housing Consumer Protection Measures Act, the National Home Builders Registration Council (NHBR) requires that anyone wishing to build a home on dolomite land must first appoint a competent person to prepare a detailed report setting out the appropriate precautionary measures to be undertaken. This report must be produced in terms of SANS 1936, parts 1 to 4, and must in turn be submitted to the CGS for their confirmation. Should the confirmation not be granted, then the NHBR is at liberty to disallow the development.

Although the CGS currently have no legislative control of developments on dolomite land other than domestic dwellings, it would be good practice for MCLM to require a similar detailed reporting procedure for all developments taking place in these areas. However, the Geoscience Act 100 of 1993 is in the process of being amended and the Geoscience Amendment Bill (B2009) will shortly be submitted to Parliament. It appears that the intention of this amendment is amongst other things to ensure that the CGS has direct control over ALL developments taking place on dolomite land. In those areas where undermining has taken place, the current preliminary recommendations for limitations of developments are set out below in Table 20.

Table 20: Recommended Development Limits on Undermined Ground *

DEPTH OF SHALLOWEST WORKING OF POTENTIALLY ECONOMIC REEF BELOW SURFACE (m)	NUMBER OF STOREYS ALLOWED IN PROPOSED BUILDINGS	MAXIMUM ALLOWABLE HEIGHT OF WALLS IN BUILDINGS (m)
0 - 91	None	n/a
91 - 122	1 with 1 basement	4.8
122 - 152	2 with 1 basement	8.2
152 – 183	3 with 1 basement	11.5
183 – 213	4 with 1 basement	14.9
213 – 244	5 with 1 basement	18.2
> 244	No restrictions except where excessive widths exist	

* Note: Data taken from Engineering Geology of Southern Africa – A.B.A, Brink, Vol 1

13.8 Socio economic (incorporating infrastructure and planning)

The overall objective of an EMF for MCLM is to facilitate effective and efficient decision-making, providing proactive input into development proposals, as well as to provide a platform of environmental sensitivity to assist in establishing priorities for conservation planning.

Planning and development in the MCLM should apply the following policy principles:

- Government investment must focus on areas with economic growth potential;
- Land development must take place in an integrated manner, both spatially and institutionally with land development in rural and urban areas in support of each other;
- Development must be channelled into nodes and corridors;
- Historically distorted development patterns must be corrected by means of physical and social integration and the redirecting of investment to areas of highest value and accessibility;
- Economically, socially and environmentally sustainable development practices and processes must be encouraged.

Planning specific guidelines required to guide the EMF towards achieving the desired state of environment for MCLM, while enforcing government policies include:

- To achieve a more sustainable and environmentally friendly acceptable development path.
- To plan and manage all spheres of the natural environments as critical ecological and socio-economic assets in order to sustain the Mogale Local Municipality's natural environment.
- To manage and preserve access to a secure and safe water supply to human settlements in Mogale City.
- To manage and mitigate the environmental impacts of emissions, effluents and waste water disposal.
- To preserve open space for both the creation of quality outdoor recreation as well as the enhancement of air quality.
- To ensure the sustainable use of the environment's natural energy and material supply.
- To minimise the impact of development on the natural and man-made environment.
- To minimise potential losses or damage to flora, fauna and the natural habitats, through urbanisation and development.
- To allow for the provision of infrastructure while mitigating adverse impacts on the natural environment during both construction and operation phases.
- Manage uncontrolled urban expansion and the protection of MCLM's natural resources.
- Undertake planning to facilitate integration of environmental management in areas.
- Create and promote sustainable human settlements
- Promote safe, healthy and efficient living environments that take the surrounding environment into account.
- Conserve and manage the cultural and heritage resources in the MCLM.
- Ensure economic activities give due consideration to the human and environmental impacts of the activity.

13.9 Heritage

Various areas of MCLM could be subject to the National Heritage Resources Act. The section below highlights the procedures that would need to be followed should heritage features be present.

13.9.1 Buildings and structures 60 years and older

Demolitions of and alterations to all such structures and buildings are subject to a permit granted by the PHRAG in accordance with Section 34 of the NHRA in general and the PHRAG guidelines in particular.

13.9.2 Archaeological and palaeontological sites

Sampling (test excavations), excavations and destruction of such sites are subject to a NHRA Section 35 permit granted by SAHRA to an archaeologist who must be accredited with the Association of South African Professional Archaeologists (ASAPA).

13.9.3 Graves and burial sites

The management of the damage, destruction, exhumation and alteration of graves and burial sites is complicated and is regulated in terms of different sets of legislation. Four categories of graves can be identified. These are:

- Graves younger than 60 years;
- Graves older than 60 years, but younger than 100 years;
- Graves older than 100 years;
- Graves of victims of conflict or of individuals of royal descent.

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act 65 of 1983. These graves fall under the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning or in some cases the MEC for Housing and Welfare. Authorization for exhumation and re-interment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. The institution undertaking the relocation must be authorized under Section 24 of the Human Tissues Act 65 of 1983 to handle and transport human remains.

Graves older than 60 years, but younger than 100 years, fall under the jurisdiction of two acts, namely the National Heritage Resources Act 25 of 1999 (Section 36) as well as the Human Tissues Act 65 of 1983. Should graves older than 60 years, or if the age of the grave cannot be ascertained either by a grave marking or through a social consultation process, be located outside a formal cemetery, the Procedure for Consulting Regarding Burial Grounds and Graves

(Section 36(5) of the Heritage Resources Act 25 of 1999) is applicable. However, graves older than 60 years but younger than 100 years, which are located within a formal cemetery administered by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation. If the grave is not located within a formal cemetery, but is to be relocated to one, permission must also be acquired from the local authority and all regulations, laws and by-laws set by the cemetery authority must be adhered to. The institution undertaking the relocation must be authorized under Section 24 of the Human Tissues Act 65 of 1983 to handle and transport human remains. A qualified archaeologist accredited by SAHRA must personally supervise any alteration to, or relocation of, graves in this category.

Graves older than 100 years are classified as archaeological, and are protected in terms of Section 35 of the National Heritage Resources Act 25 of 1999. Authorization from SAHRA is required for these graves. A qualified archaeologist accredited by SAHRA must also supervise any alteration or relocation of graves in this category. On the discretion of SAHRA, the Procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) might also be required. If the grave is situated in cemetery administered by a local authority the authorizations as set out for graves younger than 60 years are also applicable over and above SAHRA authorization. The institution undertaking the relocation must be authorised under Section 24 of the Human Tissues Act 65 of 1983 to handle and transport human remains.

All graves of victims of conflict regardless of how old they are or where they are situated are protected by Act 25 of 1999 (National Heritage Resources Act). SAHRA authorisation is required for all graves in this category. Any alteration to a grave in this category or the relocation thereof must be personally supervised by a qualified archaeologist accredited by SAHRA. If the grave is situated in a cemetery administered by a local authority the authorisations as set out for graves younger than 60 years are also applicable over and above SAHRA authorization. On the discretion of SAHRA the Procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999 (National Heritage Resources Act)) might also be required. In order to handle and transport human remains the institution conducting the relocation should be authorized under Section 24 of Act 65 of 1983 (Human Tissues Act).

13.9.4 Heritage impact assessments

Section 38 (1) of the NHRA requires a Heritage Impact Assessment (HIA), to be conducted by an independent heritage management consultant, for the following development categories:

- Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length
- Construction of bridge or similar structure exceeding 50m in length

- Development or other activity that will change the character of a site -
 - Exceeding 5000 sq m
 - Involving three or more existing erven or subdivisions
 - Involving three or more erven or divisions that have been consolidated within past five years
 - Rezoning of site exceeding 10 000 sq m
 - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- Any other development category, public open space, squares, parks, recreation grounds

This section applies to all proposed developments, regardless of the fact that the proposed development site may embody “low” or even “no cultural significance.” The onus is on the developer and his/her heritage consultant to verify the absence or presence of heritage features and, should the latter be the case, to assess potential development impacts and to recommend mechanisms to manage such impacts.

In most cases, heritage impact assessments are done as part of:

- Basic or full environmental impact assessments
- Town planning applications
- Applications for subdivision of properties

Should neither of one or any of the above apply, a stand-alone heritage impact assessment is still compulsory.

Heritage impacts are categorised as:

- Neutral (no impact)
- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries
- Indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment
- Cumulative impacts that are combinations of the above

Impact can be managed through one or a combination of the following measures:

- Mitigation (minimising adverse impacts through further documentation and research as well as monitoring before a place is altered or destroyed)
- Avoidance
- Compensation (balancing of making good the destruction of one heritage feature by the preservation of another one)

- Enhancement (positive impacts on heritage features)
- Rehabilitation (re-use of preserved heritage features)
- Interpretation (providing information on heritage features)
- Memorialisation (retaining the memory of heritage features that have been destroyed)
- No action
- Relocation (historic equipment, graves)
- Alternatives

With regard to Mogale City, all heritage impact assessment reports are considered by the PHRAG subject to the adherence of compulsory minimum requirements for HIA submissions.

According to Section 38 (2) of the NHRA, a developer must at the very earliest stages of initiating such a development, notify the PHRAG and furnish it with details regarding the location, nature and extent of the proposed development. The PHRAG will then consider such a notification and inform the developer if a HIA is necessary or if the developer can be exempted from submitting a HIA application. In practice this does not happen and in most cases a HIA is prepared and submitted as a precautionary measure.

Any HIA submission is expected to comply with the following statutory requirements (Section 38 (3)):

- Identification, mapping and history of heritage features
- Cultural significance assessment
- Conceptual impact of proposed development
- Information about benefits of proposed development
- Public participation report
- Possible mitigation measures to deal with anticipated adverse impacts before and during construction
- Consideration of alternatives and management of preserved heritage features, e.g. through a Heritage Conservation Management Plan

The following is required to ensure that heritage issues are sufficiently addressed by the MCLM:

13.9.5 Organisational structure and institutional arrangements

As a first step, an organizational structure is needed, composed of the following elements:

- Drafting of a charter of principles, authorities and responsibilities;

- Introduction of an institutional heritage desk/structure for Mogale City (ideally part of city planning), including description of units, individual positions, general operating procedures, etc.;
- Preparation of basic policies, legislation, bylaws and guidelines;
- Development of a cultural resources review and approval system for development plans and projects that is linked to land use planning, the EMF and the EIA process;
- Design of a budget and accounting system;
- Preparation of an inventory of cultural sites, with emphasis on areas that are likely to be subject to impact from development in the short and medium term;
- Development of coordination mechanisms with planning authorities, municipal governments and other agencies involved with cultural resources; and
- Preparation of a work plan for a preliminary cultural resources management plan.

The following must however be taken into account:

- In many developing countries qualified staff for heritage management in the public and private sectors is in short supply. Training and capacity building in heritage management (not only for heritage officials but also for other municipal officials) is therefore needed and should cover issues such as heritage policy, legislation, and regulation; use of economic and fiscal instruments in cultural resource management; conservation of cultural resources in land use planning and through the permitting and EIA process; development and implementation of site management plans; surveying, recording and inventorying; and public education.
- Precise information on the form, materials, history, function, and condition of the cultural heritage is necessary for its safeguarding. Inventories form the basis for managing cultural resources and should provide information for planners and administrators at national and local levels. Lack of adequate information on heritage is perhaps the single greatest obstacle to effective protection. EIA requirements will serve to reinforce the importance of maintaining comprehensive and easy-to-use inventories.

13.9.6 *Monitoring system*

Monitoring of heritage is a systematic periodical surveillance of known heritage objects or sites, by the use of replicable methods. The intention is to identify changes in physical condition of heritage objects or sites or objects over time. Monitoring is based on assumptions of cause and effect and the results help identify potential threats and development trends in order to facilitate administrative management decisions.

Heritage monitoring is defined as a tool that both

- Helps measure to what extent heritage management is successful in accomplishing national preservation goals, and
- Identifies the physical condition of heritage objects and sites (archaeological and architectural monuments and sites as well as cultural landscapes).

To date no standardised heritage monitoring systems exist in South Africa and the below list just serves as a guideline regarding what issues need to be monitored.⁸

Background information

- Municipal objectives for the administration of heritage sites and objects
- Municipal heritage policies

Monitoring procedures

- Municipal reporting systems
- Responsibilities
- Standardised system for recording monitoring activities
- Frequency of monitoring objects and sites (e.g. daily, weekly, annually, etc)
- Quality of monitoring data (e.g. precise, approximate, trend estimation)
- Monitoring indicators (e.g. loss, state of preservation, potential threats, development trends)
- Monitoring of cultural landscapes, sites and objects (e.g. within context, as single places, at particular deterioration level, other)
- Level of collaboration with other sectors (e.g. health, environment, water, etc)
- Cognizance of limiting factors (e.g. none, high costs, lack of competence, limited access to data, poor data quality, limited access to sites, etc)
- Monitoring of heritage sites and objects to ensure compliance with the NHRA and with RODs issued in terms of ECA/NEMA and the NHRA where developments are concerned

13.10 Landscape Character

Most areas of landscape significance coincide with areas of biodiversity significance and as such, it is essential that environmental legislation is implemented to ensure adequate protection of these areas. In addition, the Gauteng Ridges Policy must be strictly enforced to limit visual pollution and preserve landscape character.

⁸ Demotec – A (Evk4-Ct-2002-80011) Questionnaire - Monitoring Of Cultural Heritage.

Given the development pressures being experienced within the MCLM, urban expansion and development must be appropriately managed and co-ordinated to minimise negative impacts on the landscape.

Visual Impact Assessments should be required in respect of any proposed developments located in sensitive landscapes or within the 'viewshed' of the Cradle of Humankind WHS as delineated in the EMF for that area.

13.11 Air Quality

A shift from end of pipe air pollution control through the exclusive implementation of command and control measures to effects-based air quality management using proactive, flexible, varied and fair measures is of paramount importance (Merafong City State of the Environment Report - SEF/Bohlweki WRDM Collaboration, 2005). The key approaches that should be implemented in order to achieve policy objectives are (according to the National Framework for Air Quality Management):

- Opportunities for public participation in the protection and enhancement of air quality
- Public access to air quality information
- The prevention of air pollution and degradation of air quality
- The reduction of discharges likely to impair air quality, including the reduction of air pollution at source
- The promotion of efficient and effective air quality management
- Effective air quality monitoring, and
- Regular reporting on air quality.

Effective air quality management under the Air Quality Act is dependent on the following conditions being met:

- Review and refinement of regulations under the Air Quality Act, e.g. ambient air quality standards, emission limits, guidelines for air quality monitoring, modelling and management.
- Capacity building of local, provincial and national government personnel in terms of provision of adequate training, support and resources.
- Development and effective implementation of coherent air quality management systems comprising current and comprehensive emissions inventories, cost-effective and well run monitoring networks, suitable air dispersion models.
- Standardisation of monitoring methods, emissions inventories, modelling approaches and source, emissions, air quality and meteorological data reporting.

13.12 The Cradle of Humankind World Heritage Site

The study area is located adjacent to the CoHWHS as is referred to throughout this document. A buffer has been proposed around the Cradle in attempt to manage development within and around the area (buffer was taken as correct at the time of publishing). The management guidelines have been compiled to ensure cognisance is taken of the Cradle particularly with regards to potential visual impacts within and around the buffer. The Cradle was established as a World Heritage Site in 1999 due to the presence of early hominid fossils which were discovered in 1947. Since this time several further fossil remains have been discovered hence the importance of the area from a national and international perspective. The reason for the prominence of fossil remains is due to the vast karst landscape that exists within the cradle which is highly conducive the formation of fossils. These limestone formations are extremely susceptible to contamination and the threat of AMD moving into the cradle is a major concern for the Management Authority. The action plans and management guidelines suggested in this report in terms of groundwater management will indirectly assist the Cradle with trying to avoid this AMD damaging the karst landscape. The destruction of the karst landscape would be the destruction of the WHS hence the importance placed on this factor by the Cradle.

It is hoped that the MCLM EMF will align with the guidelines suggested by the Cradle EMF which is currently underway. The majority of the proposed buffer is located within the biophysical and Agricultural zones which are not likely to be subject to large scale development according to the management guidelines that have been recommended. The establishment of a committee consisting of both MCLM and Cradle Management Authority officials is critical to the management of the proposed buffer. This will ensure alignment with both parties intentions for the study area and avoid future conflict with regards to development.

14 ACTION PLANS

14.1 Rivers and Wetlands

Any activities that would degrade or impinge on aquatic or wetland habitat is subject to strict development guideline policies. Construction activities within a water body or within riparian and buffer conservation zones require that an application be made to the DWA for a water user's license. According to the activity, an EIA would have to be undertaken specific to the activity that would be used to guide the stipulations and parameters laid out in the water user's license agreement. An example of this would be the application to construct an impoundment structure across a watercourse. If it is found that the structure would inhibit the natural migration of aquatic biota, provision would have to be made for the construction of a migrational bypass facility.

Construction activities that have a proposed association with any wetlands or other water bodies requires that a wetland delineation survey be undertaken that determines the outer limits of the permanent, seasonal, and temporary zones of the wetland according to DWA guidelines for delineating wetlands and riparian zones (1995) by a sufficiently qualified practitioner. A wetland conservation buffer zone is also required to be designated from the edge of the temporary zones of the wetland in question. The width of this zone varies and is determined whether the wetland falls within the urban cadastral boundary or not, but is usually allocated as 32m and 100m for wetlands within the cadastral boundary and outside of this boundary, respectively.

The following action plans are recommended:

- Detailed inventorying and evaluation of wetlands
- Preparation of management plans for wetlands
- Implementation of buffer management plan for rivers and wetlands
- Detailed wetland rehabilitation plan for the plugging of the drains
- Assessment of the potential (negative) socio-economic impacts of the rehabilitation efforts and associated alterations to the current hydrological regime of the wetland on the areas of commercial crop cultivation and associated infrastructure located immediately-adjacent to the wetland periphery
- Removal of alien invasive vegetation along the riparian corridor
- Setting up and maintaining riparian vegetation along river corridors
- Setting up and Implementing Environmental Management Plans for riparian corridors
- Action plan for the improvement of water quality

14.2 Ridges

The GDARD development guidelines for ridges (2001) sets certain parameters and limitations on the allowances of construction and development activities on the various ridge systems found throughout the Gauteng Province. Ridge systems are classified (classes 1 to 4) according to the degree of historical transformation through encroachment of development or alien vegetation. The more pristine the ecological integrity of the ridge habitat is classified as, the stricter the guidelines for construction and development are.

The following action plans are recommended:

- Action plan for the strict implementation of the GDARD ridges policy
- Enforce stricter development guidelines with regards to buildings relating to ridges to compliment the Ridges Policy

14.3 Alien vegetation

Alien invasive species utilise large volume of water and result in loss of indigenous species within the study area. They thus need to be removed and this removal needs to be phased and the correct measures utilised for this removal.

The following action plan is recommended:

- Implementation plan for the removal of alien vegetation

14.4 Habitats

It is important to protect the habitats identified in order to ensure their long term sustainability. The following action plans are recommended in this regard:

- Preparation of action plans for the protection of critically endangered habitat types
- Protection of wetlands systems (refer to surface water action plans)
- Formal Protection of Red Data sites
- Action plan for the proclamation of more protected areas or conservancies
- Action plan for the creation of functional ecological corridors within the MCLM

- Improve ecological functioning of municipal parks through indigenous landscaping and improved environmental management
- Prepare site specific environmental management plans for unique habitats

14.5 Fauna and Flora

Several faunal and floral species are present within the MCLM although numbers are declining, especially those which have been identified as Red Data species. Many of the species are on the brink of local extinction and implementation plans are essential to their survival. The key to the protection of faunal and flora species is the protection of their habitats, thus if the action plans for habitat protection are implemented then this will filter down to a species level.

A biodiversity strategy in terms of the LAB programme should be compiled to ensure the long term conservation of biodiversity and to place priority on this environmental parameter. These strategies must take stewardship programmes into consideration.

14.6 Agriculture

Agriculture forms one of the dominant land uses in the MCLM and has a large influence of the biophysical and social environments. The following action plans are recommended:

- Incorporation of measures for the protection of biological and landscape diversity into farming
- Action plan for the education of farmers about biodiversity protection
- Action for promoting active communication with the Department of Agriculture and the MCLM
- Promotion of sustainable farming practices on suitable land
- Establishment of monitoring committees to work with the farmers

14.7 Mining

Although the majority of mining activities have decreased within the MCLM, remnants do remain and these have issues associated with them. The following action plans are recommended in this regard:

- Action plan for the active rehabilitation of old mining areas
- Action plan for the removal of mine dumps which result in air pollution
- Action plan for the active participation in mining applications
- Action for the establishment of a committee to address AMD (see groundwater)

Acknowledgement is made in this report regarding the risks associated with radioactivity within the study area. This lays the foundation for the measurement of improvement in the next review period. It is recommended that the next EMF places more focus on this area in order to ensure that the situation is closely monitored.

14.8 Industry

Large scale industry is present in and around the town of Krugersdorp and is likely to expand. The following action plans are recommended:

- Action plan to ensure that industrial activities take place within the urban environment and with compatible land uses
- Action plan to closely monitor industrial activities, particularly with regards to air quality, water and effluent license compliance
- Action plan to establish a monitoring committee in this regard

14.9 Urban Environment

The urban environment in MCLM is constantly expanding as the mining industry downsizes. This expansion more often than not results in conflict with the environment on some level: The following action plans are recommended for the urban environment:

- Action plan to ensure that urban land use is limited to within the identified urban edge
- Action plan to establish a constant interaction between departments within the MCLM with regards to development applications. This is of particular relevance to the planning, infrastructure and environmental departments (refer to decision making flow chart below)

14.10 Groundwater

The presence of sensitive dolomitic aquifers within the MCLM and the recent concerns relating to AMD have resulted in severe risks to the groundwater within the MCLM. At present the groundwater is being severely compromised by AMD and action is imperative in this regard. The following action plans are recommended:

- Action plan to establish a committee to address the AMD concerns in conjunction with the Department of Water Affairs and other stakeholders such as the mines etc
- Action plan to establish an in-house task team to address the AMD concerns

14.11 Tourism

Tourism is an area which needs to be developed in Mogale City. The following action plans are recommended:

- Action plan to ensure that all tourism development applications are assessed by all relevant departments (see decision making flow chart below) regardless of EIA requirements
- Action plan to compile a tourism strategy document for MCLM to ensure the development of the industry within the MCLM

14.12 Heritage

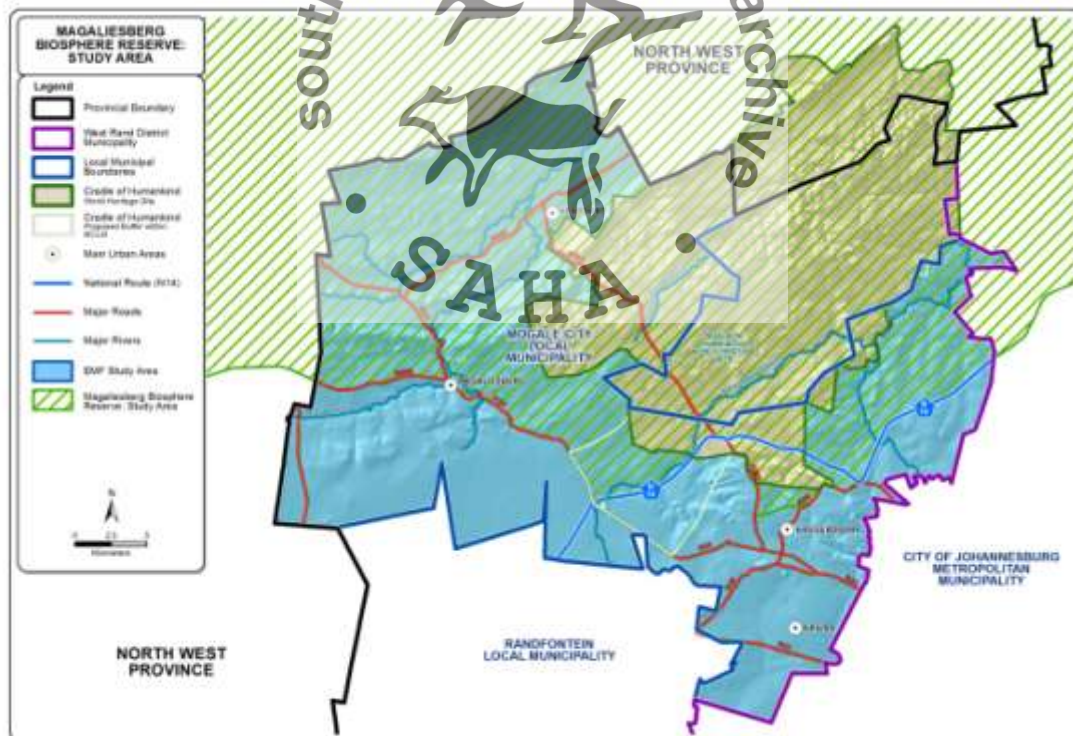
The following action plans are recommended from a heritage perspective.

- Ongoing research and development studies (surveys, databases)
- Formal protection of heritage sites
- The establishment and development of a local register of heritage resources
- Proclamation of heritage areas and urban heritage conservation areas
- Regular assessment of conservation status quo of sites in order to facilitate budgeting for necessary actions (maintenance, physical protection etc)
- Promotion and awareness of heritage sites in accordance with Section 44 of the NHRA (interpretive plaques, tourism etc)
- Red-flagging sensitive sites and areas in municipal cadastral information systems
- Linkages with other initiatives (ENPAT, C-Plan, DLA etc)
- Creation and maintenance of database of regional and local heritage specialists and information sources

- Enforcement of site-specific Site (Conservation) Management Plans (CMPs) in accordance with Section 47 of the Act
- General awareness programme concerning heritage management
- Integration of heritage issues with Integrated Development Plans and Spatial Development Plans
- Any other forms of compliance with the NHRA

14.13 Magaliesburg Biosphere Initiative

The Mogale City Local Municipality contains parts of the biodiversity rich Magaliesburg. This area forms a large portion of the high biodiversity sensitive areas identified in the EMF. Efforts are being put in place to protect this natural area. The Magaliesburg Biosphere initiative is currently in the planning phases. The map below indicates the current study area that is being proposed. Due to the early stages of this process, the study area has not been taken into consideration for the zonation plan. However the Biosphere study area will need to be included in the next EMF review period when the proposed area has been approved.



Map 13: Proposed Magaliesburg Biosphere Reserve Study Area

14.14 Rural Environment

Pressure for subdivision of the rural areas is evident within the study area. This is further illustrated by the survey conducted by the Muldersdrift Sustainable Development Forum (MSDF). The survey was conducted amongst land owners in the areas represented by the MSDF to determine the land owners' preferences, regarding developments in their areas. The survey concentrated particularly on preferences regarding land- use and development density issues. Farmers were asked which of the following developments they would prefer in their area:

Which of the following developments would you prefer in your area:

- Nothing (No development i.e. the status quo)
- Farming
- 8 Hectare Subdivision
- 2 Hectare Subdivision
- 1 Hectare Subdivision
- Less than 1 Hectare Subdivision
- Town House or Estates Development
- Industrial Development

The results of the survey indicate the following

	Nothing	Farming	8 Hectare	2 Hectare	1 Hectare	< 1 Hec	Township	Industrial	Commercial-
Total	17	10.8	3.5	21	33.5	27.5	28	5	5.2
%	11.3	7.2	2.3	13.9	22.2	18.2	18.5	3.0	3.4

This is merely an example of landowners in an area indicating their preferences. Dialogue needs to be entered into with landowners in an area to ensure that these preferences are taken into account. This identifies an area for expansion in the follow up to this EMF when it is reviewed.

15 DECISION MAKING

In order to assist the decision makers with the process that should be followed,

Figure 5 highlights the steps that should be following when a development application comes into MCLM. The diagram should be consulted by all relevant departments in order to ensure that communication channels are kept open and an integrated decision can be taken on the development in question. The flow chart should be consulted once the land use and environmental management zone have been identified through the use of the GIS tool.



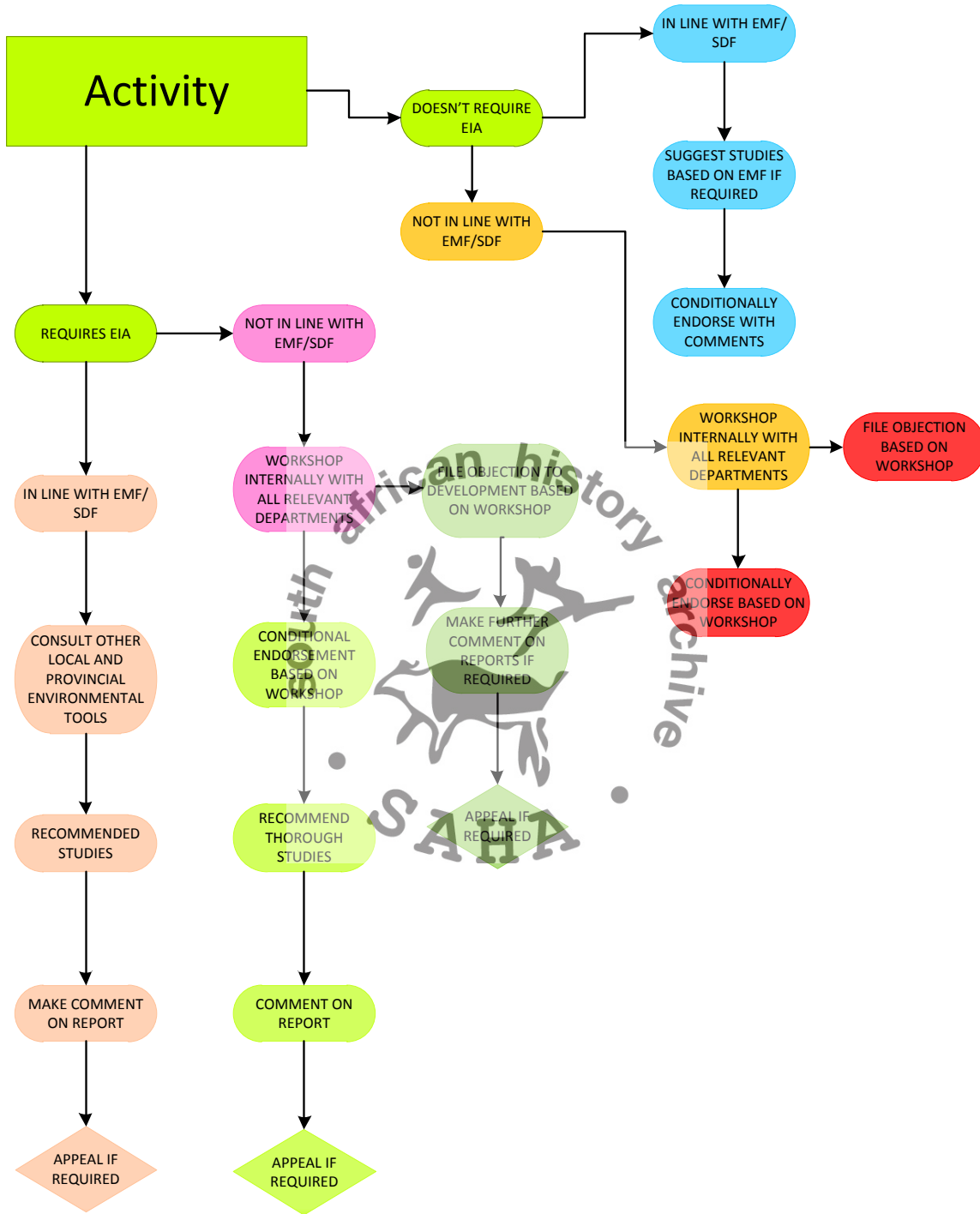


Figure 5: Decision making process

16 CONCLUSION AND REVISION SCHEDULE

The EMF process will need to be revised in approximately 5 years time or sooner if new information becomes available that can facilitate a thorough update. It is not recommended that the process be termed a revision as it has become clear through this process, that new information is very likely to be required for the process as well as a thorough public participation process. It is imperative that the EMF be updated prior to the revision of the Spatial Development Framework (SDF) as the EMF will inform the SDF.

The action plans need to be implemented prior to the next update of the EMF to ensure that the improvement in the desired state is measurable when the next status quo is undertaken.



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Interviews

Mr Kholisile Nzolo, Museum Curator and Heritage Manager, Mogale City, 6 May 2010





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