

STATUS QUO REPORT
Environmental Management Framework
Msunduzi Municipality

Report Prepared for
**Department of Environmental Affairs and Tourism,
Department of Agriculture and Environmental
Affairs, and
Msunduzi Municipality**

Report No: 367998/FSQR

June 2009



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Department of Environmental Affairs and Tourism,
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SRK Project Number: 376998

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June 2009

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Executive Summary

The Msunduzi Municipality (Msunduzi), in partnership with the national Department of Environmental Affairs and Tourism (DEAT) and the KwaZulu-Natal Department of Agriculture and Environmental Affairs (DAEA), has commissioned the SRK Consulting team to produce an Environmental Management Framework (EMF) for Msunduzi. The purpose of this document, the Draft Status Quo Report, is to describe the baseline conditions within Msunduzi. In order to determine the baseline a number of specialist studies were undertaken. The products of these specialist studies include:

- Reports detailing the findings of the specialist study;
- Mapping of baseline information; and
- GIS data.

A brief summary of the specialist reports and key maps are included in the Status Quo Report, while the various stand alone Specialist Study Reports are included in Appendices 2-10. A brief description of the outcomes of the various specialist studies is included below.

Catchment Hydrology

This study assesses the hydrological responses of the catchment, to development. The indicators of which are flood peaks, volumes and floodlines. Due to the time and budget constraints a full flood assessment could not be carried out. The flood hydrology of the catchment has however been assessed. 1:100 year recurrence interval flood peaks were determined for catchments with areas greater than 5km² (47No). Based on the flood peak, average river slope and estimated channel profile a 1:100 year flood buffer zone was derived around the river centerline in order to highlight areas that would need a more detailed assessment during a development approval process. Where existing accurate floodlines have been determined (by others) these have been used. In addition to the modelled flood buffers, it is recommended that an integrated catchment management process be undertaken where the cumulative effects of development on catchment hydrology and the response of the catchment to development can be assessed. Also included should be; an assessment of measures to manage erosion and sedimentation, the identification of flood attenuation opportunities and the education of the relevant stakeholders in floodplain management.

Surface Water

The Msunduzi Catchment was divided into nine sub catchments and the health, ecological importance and sensitivity of the surface water resources (rivers and streams) within each sub catchment was determined. The pressures being exerted on the sub catchments, with regard to degradation of water quality where identified and recommendations for the management class, and actions to achieve the management class where provided.

Wetlands

The approximate boundaries of wetland systems within the Municipality were mapped based on the 2006 colour aerial imagery and thereafter, selected sites were ground-truthed to improve the

confidence of the boundary position. A confidence buffer was assigned to differentiate between wetlands, whose location and extent had been confirmed during ground-truthing, and those that had not. An additional 20m buffer was assigned to the mapped wetland areas to indicate areas where further ground-truthing of wetlands should be undertaken. In addition to the mapping of wetland areas, recommendations were made to assist with future management of wetland resources.

Agriculture

Information generated by the Bioresource Programme of the DAEA, modelled climate data, landcover information, and a 20m Digital Terrain Model were used to identify areas of high agricultural potential within Msunduzi. These high potential areas fall mainly in the western portions of the Municipality, with small pockets in the Bishopstowe and Umlaas Road areas. In addition to the mapping, recommendations were made for the management of agricultural productivity in the Municipality.

Biodiversity

All untransformed land within the municipality was mapped and classified in terms of its importance to biodiversity conservation. The targets for biodiversity conservation (determined from provincial limits set by Ezemvelo KZN Wildlife (EKZNW) and further expert opinions) were compared to mapped untransformed land to inform the biodiversity developments constraints map. Areas of high biodiversity importance are spread throughout the Municipality, however, as expected, there are fewer biodiversity resources in urban areas than in rural areas. In addition to the mapping of biodiversity constraints and opportunities, the specialist study provided recommendations for the future management of biodiversity resources within the Municipality.

Air Quality

Air pollution issues were identified and mapped to inform opportunities and constraints to development in the municipal area, and specifically development that would result in atmospheric emissions. The topography has a significant influence on the air quality in Msunduzi, as such a topographical model was used to identify areas of sensitivity within the municipality. From the sensitivity mapping it is clear that the Pietermaritzburg City centre is the most sensitive to air quality issues. This is of concern as the majority of emitters fall within this sensitive zone. Based on this sensitivity the location of both emitting development and sensitive receptors (for example hospitals and schools) can be facilitated. In addition to the mapping undertaken as part of the Air Quality Specialist study, recommendations were made for further work to be carried out.

Service Capacity

Based on discussions with relevant local, provincial and national authorities, as well as other stakeholders, the service capacity of the Municipality was assessed in terms of the location of existing services (electricity, water supply, sanitation, access roads, waste collection), their capacity to meet demand and the need for upgrading and maintenance. The information gathered was represented spatially to provide an indication of what areas would require servicing, or service upgrades, prior to further development. The assessment considered, primarily, the reticulation and bulk services. The provision of adequate services (in particular water and sanitation) and the maintenance of existing services have been identified as key issues by the residents of Msunduzi.

Socio –Economic Analysis and Planning

The study reviewed existing planning policies at national, provincial and local levels of planning, as well as existing socio economic statistics to determine the implications for the EMF. In terms of national and provincial policies, Pietermaritzburg has been identified as a focus area for development and economic growth. The N3 route has been identified as a provincial priority corridor. This, in turn, will create greater urbanization and economic development pressures on Msunduzi. The population of the Municipality has increased significantly (18 %) since 1996 and this expected to continue. The declaration of the City as both the administrative and legislative capital of the Province, and the Municipal Demarcation Board's recommendation that the Msunduzi Municipality become a Metropolitan Municipality, will have major implications for the city. Based on the trends identified above, it is anticipated that the pressure on land available for development and the demand for employment opportunities and social facilities will increase. It is therefore recommended that areas of environmental constraint should be used to inform the land use management system (LUMS), and that the type of developments, the density and other controls should be further investigated as part of the LUMS.

Cultural Heritage

In order to identify potentially sensitive heritage areas and inform opportunities and constraints to future development, heritage resources within the Msunduzi Municipal area were mapped from existing datasets. These findings were then used to inform the identification and mapping of larger zones of cultural, architectural, historical and archaeological importance, within the Municipality. A total of 646 heritage resource points and 32 heritage resource zones, within Msunduzi were identified and mapped. These heritage resources are concentrated in the Pietermaritzburg Central Business District (CBD) and surrounding suburbs, as well as in the Georgetown area of Edendale. The results of the heritage resource study further revealed a significant lack of formally recognised sites depicting traditional African culture and history, within Msunduzi. This lack of formally recognised traditional African sites is a serious gap in the available data, and needs to be highlighted as an urgent requirement for any future heritage resource work undertaken.

Geotechnical

Geotechnical conditions can vary over small distances, as such the report concentrated on identifying areas generally prone to geotechnical constraints. A summary of the typical geotechnical conditions related to the major landforms and geological conditions encountered within the study area was provided from desktop analysis of available data and an in-depth study of the geotechnical conditions for the Pietermaritzburg map sheet 2930CB was sourced from the Council for Geoscience. The Council for Geoscience mapping however does not cover the entire study area, it does however cover most of the study area subject to development pressure namely the Pietermaritzburg area. The diversity of the geotechnical conditions in the Msunduzi Municipality brought about by the geology and geomorphology (combined with the hilly areas surrounding the Pietermaritzburg CBD) result in a very complex interplay between slope gradient and potentially unstable transported sediments and soils. To address this and further inform the location of development it was recommended that a detailed geotechnical mapping exercise, similar to that conducted for the Pietermaritzburg map sheet area by the Council for Geoscience, be initiated to obtain the same level of detail for the entire Msunduzi municipal area.

Institutional

One of the products of the EMF is a Strategic Environmental Management Plan (SEMP) which will identify various action plans, for implementation by the Msunduzi Municipality, in order to achieve the desired state of the environment. An understanding of the relevant institutions and governance structures involved in environmental management in Msunduzi is critical to ensure that the action plans are aligned with the existing environmental management structures, and that any additional institutions required for implementing the EMF effectively, are identified.

The report provides an overview of the institutions governing the development and implementation of the EMF and the management of the various aspects of the environment that have been identified in the specialist studies undertaken, as part of the EMF process.

Overview of Ecosystem Goods and Services

The intention of the Ecosystem Goods and Services overview was to introduce the concept of Ecosystem Goods and Services Valuation and identify the types of goods and services that would be expected in Msunduzi. The study provided an indicative valuation using the Benefit Transfer Method to illustrate the potential value of goods and services and provided recommendations for further investigations in the future.

To illustrate the limitations of the Benefit Transfer Method two valuations were undertaken using different case studies. These valuations indicated that the value of goods and services in Msunduzi lie between 29 million and 355 million rand. From the large disparity between the two valuations it is clear that further work in Goods and Services valuation will need to be undertaken in order to better understand the real value of Ecosystem Goods and Services within the Municipality. To this end it is recommended that further valuation work focus on improving the understanding of Ecosystem Goods and Services and developing indicator based valuation tools. It is further recommended that the valuation work should focus on grasslands and wetlands as they have been identified as the most significant habitats.

Conclusion and Way Forward

The Status Quo Report provides a good indication of the status quo conditions within the municipal area. The next phase, which incorporates aspects of a Strategic Environmental Assessment (SEA), will build on these findings and focus on a consolidated map of development constraints. The SEA will also identify development trends and pressures and use these to identify any potential conflicts. Based on the existing environmental policy and legal or policy limits, a “Draft Desired State of the Environment” will be developed. Recommendations on how the EMF may be used in future to inform development planning tools like the SDF and LUMS, will be provided.

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Acronyms

AEL	Atmospheric Emission Licence
APPA	Air Pollution Prevention Act
AQMP	Air Quality Management Plan
Asgi-SA	Accelerated and Shared Growth Initiative for South Africa
CARA	Conservations of Agricultural Resources Act
CBD	Central Business District
CITES	Convention on International Trade in Endangered Species
DAEA	Department of Agriculture and Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DFA	Development Facilitation Act
DoT	Department of Transport
DTM	Digital Terrain Model
DWAF	Department of Water Affairs and Forestry
EGI Framework	Environmental Governance and Institutional Framework
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
GIS	Geographic Information Systems
GMO	Genetically Modified Organism
ICT	Information and Communication Technology
IDP	Integrated Development Plan
IWMP	Integrated Waste Management Plan
LDO	Land Development Objectives
LED	Local Economic Development
LUMS	Land Use Management System
MEC	Member of the Executive Council
MOSS	Municipal Open Space System
NEMA	National Environmental Management Act
NEMAQA	National Environmental Management: Air Quality Act
NSDP	National Spatial Development Perspective
PES	Present Ecological Status
PGDS	Provincial Growth and Development Strategy
PSC	Project Steering Committee
PSEDS	Provincial Spatial and Economic Development Strategy
SACN	South African Cities Network
SANRAL	South African national Roads Agency Limited
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEMP	Strategic Environmental Management Plan
UDF	Urban Development Framework
UDS	Urban Development Strategy
UMDM	uMgungundlovu District Municipality
UN	United Nations
UNESCO	United Nations Educational Scientific and Cultural Organisation
WHO	World Health Organisation

10 June 2009

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Msunduzi Environmental Management Framework

FINAL STATUS QUO REPORT

1 Introduction

The Msunduzi Municipality (Msunduzi), in partnership with the national Department of Environmental Affairs and Tourism (DEAT) and the KwaZulu-Natal Department of Agriculture and Environmental Affairs (DAEA), has recognised that in order to support sustainable social, economic and environmental development within the Municipality, the adoption and implementation of an appropriate policy to inform development planning and approval is required. A comprehensive environmental policy framework will allow systematic conservation planning and management of environmental resource use, while safeguarding important components and viable representative samples of the natural environment. To address these requirements, the preparation of an Environmental Management Framework (EMF) is proposed for the Msunduzi municipal area. In August 2007 SRK Consulting South Africa (Pty) Ltd. (SRK) was appointed to prepare the Msunduzi EMF, to include a Strategic Environmental Assessment (SEA), a Municipal Open Space System (MOSS), a Strategic Environmental Management Plan (SEMP) and a Spatial Decision Support Tool (SDST)

2 Status Quo Phase

2.1 Purpose of the Status Quo

The Status Quo phase of the project is that component where the baseline conditions, at the time of the study, within the Municipality are reported upon. During the Inception Phase, a Project Steering Committee (PSC) was formed and PSC meetings were held on the 23 August 2007, 30 October 2007 and 13 February 2008 in order to discuss and finalise the Inception Report. The Inception Report details the approach to the project and the scope of work for the various specialist studies to be

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undertaken as part of this Phase, the Status Quo Phase. To further inform the approach to the project, a Planning Workshop was convened on 19 September 2007. Representatives from a broad range of stakeholder groups including national, provincial and local government, academics, non-governmental organisations and local conservancies were invited to identify key environmental issues, goals and priorities affecting Msunduzi. The proposed project methodology, including information sources, scale of mapping and stakeholder consultation, was discussed.

The input provided during these meetings as discussed above, determined the scope of work for the various specialist studies and provided the basis upon which the Status Quo Phase of the project was undertaken.

2.2 Purpose of this Report

The Status Quo Report is informed by the various specialist studies that were conducted as part of this phase of the project. It provides a baseline description of the environment within Msunduzi. The report includes the following:

- Background to the Msunduzi EMF project;
- Details of the approach taken in determining the baseline conditions within the Municipality;
- An overview of the legislation that will impact on the preparation of the Msunduzi EMF;
- An outline of the Specialist Studies undertaken to include any assumptions and limitations, key findings and recommendations; and
- A way forward for the SEA phase of the EMF.

3 Approach

3.1 Status Quo Objectives

The objective of the Status Quo phase of the project is to determine the existing situation and provide a spatial representation of the Municipality's environment. This information will then enable the project team to make informed strategic recommendations for environmental management within the Municipality.

3.2 Project Program

The Inception phase of the project was undertaken from August 2007 to February 2008. The Status Quo phase then followed from March 2008 until January 2009. The SEA phase is underway and will be followed by the MOSS, SEMP and EMF that will be undertaken in parallel. For more detailed information regarding the project program refer to the Final Inception Report.

It is acknowledged that the schedule detailed above is not in accordance with what was originally envisaged for the project, however, this has been largely as result of the scarcity of readily available data which resulted in the specialist studies taking longer than originally planned.

4 Legal Overview

As part of the Status Quo Phase of the project an overview of the applicable legislation was required. The legal overview was included as part of the analysis of institutions governing Environmental

Management. The overview details the overarching environmental legislation being used to guide the EMF process, content and structure. This includes:

- The Republic of South Africa Constitution Act 110 of 1983 (The Constitution), specifically the Bill of Rights that provides for the protection of the environment and the right of every South African to a healthy environment;
- The National Environmental Management Act, No. 107 of 1998 (NEMA) that provides principles and guidelines to be considered in environmental planning and development and cooperative environmental governance;
- The NEMA Environmental Impact Assessment (EIA) Regulations, specifically Part 1 of Chapter 8 (General Matters) that governs the initiation, compilation and adoption of EMFs; and
- The Environment Conservation Act, No. 73 of 1989 (ECA) which has largely been superseded by the NEMA EIA regulations, but that remains in place as complimentary to NEMA EIA regulations, to address issues such as waste management.

In addition to the overarching legislation an overview of all legislation applicable to the various specialist studies has also been provided. The comprehensive overview of legislation is provided in the Institutional Status Quo Report included at Appendix 1.

5 Literature Review

As part of the Inception and Status Quo Phase of the project an extensive literature review was undertaken. This included reports and data produced during previous work. Table 1 provides a summary table of all reports obtained and reviewed as part of the EMF thus far. It is critical to note however, that during the remainder of the project it is anticipated that this list will be added to, therefore this table should not be considered final.

Table 1: Literature resources used during the Inception and Status Quo phases of the EMF

Name	Author	Date	Source	Comments
Strategic Environmental Assessment of the Mkhondeni Stream Catchment Area	Guy Nicholson Consulting	21-Jan-08	Guy Nicholson Consulting	Will inform much of the Situational Analysis Reporting
Ekurhuleni Municipality Final EMF Report	Africon and Environomics	2004	Ekurhuleni Municipality	Informed the methodology and approach
Msunduzi Spatial Development Framework	Udidi Development Consultants	2008	Msunduzi Municipality	Informed the service capacity specialist study and socio-economic and planning review. It will continue to inform the identification of opportunities and constraints
Gauteng Open Space Project	Strategic Environmental Focus	?	Ekurhuleni Municipality	Informed the methodology for the development of the draft MOSS
A short term Response to Flooding in the Msunduzi Catchment Vol 1 Disaster Management and Sustainable Development Strategy	INR - Duncan Hay	Mar-97	Msunduzi Environmental	Informed the Floodline assessment

Name	Author	Date	Source	Comments
A short term Response to Flooding in the Msunduzi Catchment Vol 3 Regulating Settlement and other development on floodplains	INR - Duncan Hay	Mar-97	Msunduzi Environmental	Informed the Floodline assessment
A short term Response to Flooding in the Msunduzi Catchment Vol 5 A long Terms Strategy for sustainable development of the Msunduzi River Catchment	INR - Duncan Hay	Mar-97	Msunduzi Environmental	Informed the Floodline assessment
Msunduzi Municipality Land Audit	Msunduzi: Corporate Strategic Planning Business Unit	Aug-04	Msunduzi Environmental	Comments to a large extent are missing but will be very useful in the preparation of the MOSS
Draft Darvill Bird Sanctuary Management Plan	?	Nov-03	Msunduzi Environmental	Will assist with the Biodiversity Assessment but is limited to a very specific area
Ashburton TLC Landscaping recommendations and proposals	Jo-Anne Hilliar & Murray Macaulay	?	Msunduzi Environmental	Focuses on how homeowners should integrate indigenous and endemic plants in their gardens. Not entirely relevant to the EMF but may be useful in terms of recommendations and action plans
The woody plant communities of Ashburton and their associated environmental determinants	Integrated Environmental Assessment Services	?	Msunduzi Environmental	Will assist with the Biodiversity Assessment but is limited to a very specific area
Greater PMB reconstruction project - Draft Environmental Component	INR - J Mander	Feb-95	Msunduzi Environmental	Good background overview of the study area, particularly cultural heritage information. Study is an overview and does not included detailed spatial information but does provide valuable background to the study area.
Draft Policy for Public Open Space in Urban Areas of KZN	Integrated Planning Services	Aug-97	Msunduzi Environmental	Very theoretical but will be of great assistance in the development of the MOSS
Msunduzi Local Development Plan	?	?	Msunduzi Environmental	Lack of date poses a problem but the report provides valuable background information regarding the study area. Information again is not mapped but rather described.
State-of-Rivers Report: uMgeni River and neighbouring rivers and streams.	Water Research Commission	2002	Water Research Commission	
State of Rivers within the Msunduzi Catchment Management Forum Area of Interest	Umgeni Water	Feb-03	Msunduzi Environmental	Information used in the assessment of surface water resources
State of Rivers Report: Umgeni River	Multiple	Jun-05	Msunduzi Environmental	Information used in the assessment of surface water resources
Integrating Catchments into Spatial Planning in uMhlathuze Municipality. Phase 1: Natural Areas Identification, Mapping and Functionality Assessment	Multiple - INR	3-Jun	uMhlathuze	

Name	Author	Date	Source	Comments
Msunduzi Valuation Role	Msunduzi	2008	Msunduzi Environmental	Format of concern as it isn't linked to the cadastral base
Species Lists	Msunduzi	?	Msunduzi Environmental	Will assist with the Biodiversity Assessment but is limited to very specific areas
South African Scoring System (SASS) Data Interpretation Guidelines	Dallas HF	2007	The Freshwater Consulting Group/ Freshwater Research Unit. UCT.	Used in the development of the River Health specialist study
Rivers Database	DWAF	2007	DWAF	Used in the development of the River Health specialist study
South African Water Quality Guidelines	DWAF	1996	DWAF	Used in the development of the River Health specialist study
Biomonitoring for effective management of wastewater discharges and the health of the river environment	Dickens CWS and Graham PM	1998	Aquatic Ecosystem Health and Management (1, 199-217)	Used in the development of the River Health specialist study
The South African Scoring System (SASS) version 5 Rapid Bioassessment Method for Rivers	Dickens CWS and Graham PM	2002	African Journal of Aquatic Sciences (27: 1-10)	Used in the development of the River Health specialist study
Ethekewini Municipality State of Rivers Report	Graham PM	2007	eThekwini Municipality	Used in the development of the River Health specialist study
Resource Quality Studies	Kleynhans CJ pers comm	June 2008	DWAF	Used in the development of the River Health specialist study
Resource Directed Measures for Protection of Water Resources	Kleynhans CJ and Hill L	1999	DWAF	Used in the development of the River Health specialist study
Modelling the impacts of land cover and land management practices on stream flow reduction	Lumsden TG, Jewitt GPW and Schulze RE	2003	Water Research Commission	Used in the development of the River Health specialist study
The Vegetation of South Africa, Lesotho and Swaziland	Mucina L and Rutherford MC eds.	2006	Strelitzia 19 SANBI	Used in the development of the River Health specialist study
Illness, with particular focus on Schistosomiasis, associated with recreational use of water by canoeists in the Msunduzi, Mngeni Rivers in KwaZulu-Natal	Oliver K.L.	2006	Unpublished MSc Thesis. CEAD, UKZN.	Used in the development of the River Health specialist study
Conservation planning and biodiversity: Assembling the best data for the job.	Pressey RL	2004	Conservation Biology, 18 (6),1677-1681.	Used in the development of the River Health specialist study
Scale-based freshwater conservation planning: Towards protecting freshwater biodiversity in KwaZulu-Natal, South Africa	Rivers-Moore N, Goodman P and Nel J	In Press	Submitted to the journal of Freshwater Biology	Used in the development of the River Health specialist study
A Complete Guide to the Freshwater Fishes of Southern Africa.	Skelton PH	2001	Struik Publishers, Cape Town	Used in the development of the River Health specialist study
Wet-Health: A technique for rapidly assessing wetland	D.M.Macfarlane W.N Ellery	2006	?	Used in the mapping of wetland areas

Name	Author	Date	Source	Comments
health.	D.Walters V.Koopman P. Goodman C. Goge			
WET-Ecoservices: A technique for rapidly assessing ecosystem services supplied by wetlands	D.C.Kotze, G.C. Marnwick, A.L. Batchelor, D.S. Lindley N.B. Collins	2007	WET-Management Series	Used in the mapping of wetland areas
A practical field procedure for identification and delineation of wetland and riparian areas	DWAF	2005	DWAF	Used in the mapping of wetland areas
Delineation of Wetland and Riparian Areas	DWAF	2006	DWAF	Used in the mapping of wetland areas
Marine Reserve Design Using Spatially Explicit Annealing, a Manual	Ball, I. R. and Possingham, H. P.	2000	http://www.uq.edu.au/marxan/	Informed the used of MARXAN (V1.8.2) as part of the conservation planning for Msunduzi
A conservation assessment of the Sub-tropical Thicket Biome.	R.M Cowling, A.T Lombard, M.Rouget, G.I.H.Kerley, T.Wolf, R. Sims-Castley A.T.Knight, J.H.Vlok, S.M.Pierce, A.F.Boshoff, S.L.Wilson,	2003	Terrestrial Ecology Research Unit Report No. 43, University of Port Elizabeth, South Africa. Available from http://cpu.uwc.ac.za .	Informed the biodiversity specialist study
Environmental law in South Africa	J.Glazewski,	2000	Butterworths	Informed review of environmental legislation, all be it somewhat outdated.
Non Marine Biodiversity targets for KwaZulu-Natal	Goodman, P.	2006	Unpublished Report. Biodiversity Division, KZN Wildlife	Informed the biodiversity specialist study
A GIS Based Habitat Suitability Analysis of the Oribi Antelope in KwaZulu-Natal	Hill A.D.	2008	Unpublished Master's thesis, University of KwaZulu-Natal	Informed the biodiversity specialist study
Systematic conservation planning	Margules CR, Pressey RL	2000	Nature. 405: 243-53	Informed the biodiversity specialist study
Conservation targets and information needs for regional conservation planning	Noss, R.	2004	Natural Areas Journal 24(3): 223-231	Informed the biodiversity specialist study
Improving the legislative approach to biodiversity conservation and sustainable management of natural resources in South Africa	Patterson, S. and Winstanley, T.	2003	Cape Town: EnAct International. 88p.	Informed the biodiversity specialist study
Systematic conservation planning products for land-use planning: Interpretation for implementation.	Pierce, S.M., Cowling, R.M., Knight, A.T., Lombard, A.T., Rouget, M. and Wolf, T.	2005	Biological Conservation (125): 441-458.	Informed the biodiversity specialist study
Mathematical methods for identifying representative reserve networks	Possingham, H. P., Ball I. R. Andelman S.	2000	In: S. Ferson and M. Burgman (eds) Quantitative methods for	Informed the biodiversity specialist study

Name	Author	Date	Source	Comments
			conservation biology. Springer-Verlag, New York, pp. 291-305	
Formulating conservation targets for biodiversity pattern and process in the Cape Floristic Region	Pressey, R.L., Cowling, R.M. and Rouget, M.	2003		Informed the biodiversity specialist study
C-Plan conservation planning software. User manual	Pressey R.L., Watts, M., Ridges, M. Barrett, T.	2005	NSW Department of Environment and Conservation http://www.ug.edu.au/~ugmwatts/cplan.html	Informed the biodiversity specialist study
Biodiversity priority areas in Cape Agulhas Municipality: Supporting land-use decision making in threatened ecosystems and special habitats	SANBI	2006	SANBI	Informed the biodiversity specialist study
Sustaining life on Earth: How the Convention on Biological Diversity promotes nature and human well-being.	Secretariat of the Convention on Biological Diversity	2000	Secretariat of the Convention on Biological Diversity	Informed the biodiversity specialist study
Conservation Land-Use Zoning (CLUZ) software	Smith, R.J.	2004	Durrell Institute of Conservation and Ecology, Canterbury, UK http://www.mosaic-conservation.org/cluz	Informed the biodiversity specialist study
The 2007 National Framework for Air Quality Management in the Republic of South Africa	DEAT	2007	Government Gazette 30284:3-101	Informed the Air Quality Specialist Study
Development and Implementation of Strategic Frameworks for Air Quality Management in the UK and the European Community	Elsom, D	1999	Journal of Environmental Planning and Management, 42(1): 103-121	Informed the Air Quality Specialist Study
Urban Air Quality	Fenger, J	1999	Atmospheric Environment, 33: 4877-4900.	Informed the Air Quality Specialist Study
Atmospheric Pollution: History, Science, and Regulation	Jacobson, M	2002	Cambridge University Press	Informed the Air Quality Specialist Study
Air Pollution and Health in Rapidly Developing Countries	McGranahan, G and Murray, F	2003	Earthscan Publications Ltd, London	Informed the Air Quality Specialist Study
Real-time analysis of atmospheric pollution and its implications in Pietermaritzburg	Simpson, A.J	1995	unpublished MSc thesis, Department of Geography, University of Natal, Pietermaritzburg	Informed the Air Quality Specialist Study
Air pollution over Pietermaritzburg during the passage of cold fronts	Simpson, A.J. and McGee O.S	1996	South African Journal of Science, 92 (1),	Informed the Air Quality Specialist Study

Name	Author	Date	Source	Comments
			45-46	
Analysis of the fumigation effects of pollutants over Pietermaritzburg	Simpson, A.J. and McGee, O.S	1996	South African Geographical Journal, 78(1), 41-46.	Informed the Air Quality Specialist Study
AQA/AQMP Project: National Norms and Standards for an Air Quality Management Plan.	Sivertsen, B	2007		Informed the Air Quality Specialist Study
Proceedings of the May 2007 Air Quality Monitoring Plan Seminar and Mini Workshops	Department of Health, eThekweni	2007	Department of Health, eThekweni	Informed the Air Quality Specialist Study
Earth under Siege – From Air Pollution to Global Change	Turco, R P	2002	Chapter 6: The Urban Syndrome. 2nd Edition. Oxford University Press, USA.	Informed the Air Quality Specialist Study
Towards an inversion climatology of Southern Africa: Part I, surface inversions	Tyson, P.D., Preston-Whyte, R.A. and Diab, R.D	1976	South African Geographical Journal, 58 (2), 151-163	Informed the Air Quality Specialist Study
Large-scale recirculation of air over southern Africa	Tyson, P.D., Garstang, M., and Swap, R	1996	Journal of Applied Meteorology, 35 (12), 2218-2236	Informed the Air Quality Specialist Study
Transport and recirculation of aerosols off southern Africa-macroscale plume structure,	Tyson, P.D. and D'Abreton, P.C.	1998	Journal of the Atmospheric Environment, 32 (9), 1511-1524	Informed the Air Quality Specialist Study
The Weather and Climate of Southern Africa, Second Edition	Tyson, P.D. and Preston-Whyte, R.A.	2000	Oxford University Press, Cape Town, South Africa	Informed the Air Quality Specialist Study
Air Quality and Health	World Health Organisation	2007	http://www.euro.who.int/eprise/main/WHO/Progs/AIQ/Home	Informed the Air Quality Specialist Study
Spatial Development Framework Review: Draft Conceptual Framework Report Greater Edendale - Imbali ABM	Iyer Rothaug Collaborative Cc	Sep 20 07	Msunduzi Municipality	Informed the Service Capacity Specialist Study
Edendale SDF Traffic and Transport Status Quo Assessment	Iliso Consulting	?	Msunduzi Municipality	Informed the Service Capacity Specialist Study
Edendale/ Nothdale Transportation Corridor Study	Arup, UWP and Iyer Rothaug Collaborative Cc	Aug 2007	Msunduzi Municipality	Informed the Service Capacity Specialist Study
The Service Capacity Review undertaken as part of the review of the Msunduzi Municipality SDF	Emanzini Engineers	2007	Msunduzi Municipality	Informed the Service Capacity Specialist Study
Development of a Transportation Plan – Phase 1 – Status Quo Review and Phase 2 – Development Framework for Msunduzi	Africon Engineering	?	Msunduzi Municipality: Roads and Drainage Section	Informed the Service Capacity Specialist Study

Name	Author	Date	Source	Comments
Msunduzi Municipalities Integrated Development Plan (IDP)	Msunduzi Municipality	2008-2012	Msunduzi Municipality	Informed the Service Capacity Specialist Study
Census 2001 data.	Statistics South Africa	2001		Informed the Service Capacity Specialist Study
Infrastructure Barometer Report	Development Bank of South Africa	2006	Development Bank of South Africa	Informed the Service Capacity Specialist Study
State of Human Settlement Report	CSIR	1999	CSIR	Informed the Service Capacity Specialist Study
uMgungundlovu Integrated Waste Management Plan	SRK Consulting	2004	SRK Consulting	Informed the Service Capacity Specialist Study
Report on the Archaeological, Cultural and Historical Resources within the Proposed Pietermaritzburg Metropolitan Area.	Natal Museum,	?	Natal Museum,	Informed the Cultural Heritage Specialist Study
The Buildings of Pietermaritzburg	Brian Basset Msunduzi Municipality	1986	Msunduzi Municipality	Informed the Cultural Heritage Specialist Study

In addition to these reports numerous data sets were obtained. It is important to note that while this list provides all data sets used to inform the Inception and Status Quo Phase of the project it is likely that this list will be added to in the remaining phases of the project.

Table 2: Data resources used during the Inception and Status Quo Phase of the EMF

Name	Author	Date	Source	Comments
Msunduzi Municipal GIS data	Various	?	Msunduzi GIS office	The lack of meta data associated with this data set limited its use, however the aerial photography provided was extensively used in the preparation of specialist studies.
Msunduzi SDF Informants	?	?	Msunduzi Municipality	Again the lack of meta data was a limiting factor but the land use data provided was used extensively in numerous specialist studies
Msunduzi SDF	Udidi	2009	Msunduzi Municipality / Udidi	The SDF was used in the identification of development trends in the Planning Report.
South African National Land Cover Database	CSIR	2000	CSIR	This land cover layer was extensively used in the Rivers, Hydrology and Biodiversity study
Umgeni Water Database	Umgeni Water	2008	Umgeni Water	The database was used to inform the determination of the current ecological status of surface water resources and the location of water reticulation and bulk supply
Bioresource Unit Mapping	Natural Resources Section of the DAEA	?	DAEA	The dataset was used to inform the identification of high priority agricultural land

Name	Author	Date	Source	Comments
KwaZulu-Natal Vegetation Map. Ver.2	Ezemvelo KZN Wildlife	21. Sep 2006	Ezemvelo KZN Wildlife Conservation Planning	Informed mapping of Biodiversity Attributes for the Msunduzi Municipality
10m contours	Surveyor General	?	PMB Maps and laminating	From the topographical map grip
Rainfall Statistics for Design Flood Estimation in South Africa	JC Smithers and RE Schulze	?	UKZN	Used in the modelling undertaken as part of the Hydrology Specialist Study
Land types of the map 2930 Durban	Land Type Survey Staff Institute for Soil, Climate & Water	2001	Memoirs agric. nat. Resour. S. Afr. No. 17.	Used in the modelling undertaken as part of the Hydrology Specialist Study

6 Specialist Studies

The Status Quo Assessment aims to determine the baseline environmental conditions within the Msunduzi municipal area. In order to determine the baseline, a number of specialist studies were undertaken. For each respective study a report detailing the study findings, mapping of baseline information and GIS data was developed. A brief summary of the specialist reports and key maps have been included in this report. In addition, more detail is provided in the various stand alone Specialist Study Reports that have been included in Appendices 1-12.

6.1 Catchment Hydrology

This was initially planned to be a floodline study, but has been revised to a catchment hydrology report, as this has more relevance to this stage of the EMF. Furthermore as the time and budget constraints limited a detailed assessment of all floodlines in the Msunduzi. Due to increasing urbanisation catchment management is becoming increasingly difficult. All development impacts on catchment runoff patterns, which then impact on current and future development downstream.

6.1.1 Objectives

The objectives of the study were firstly to determine 1:100 year recurrence interval flood peaks for all rivers, with a catchment area greater than 5 km², within the uMsunduzi catchment. The second objective was to create a flood buffer zone adjacent to the watercourses that could be used to identify areas that would need a more detailed assessment.

6.1.2 Methodology

The study was undertaken in terms of the following methodology:

- Delineation of the study area into sub-catchments with an average area of 5 km²;
- Determination of catchment parameters relating to hydrology and the compilation of a catchment runoff simulation model;
- Estimation of 1:100 year recurrence interval runoff peaks;
- Identification of an indicative flood zone around the main rivers;
- Sourcing and mapping of existing floodlines, where available;
- Review of the legislation pertaining to water; and
- Assessment/review of the broader issues relating to catchment management in the context of surface water management.

6.1.3 Results

The municipal boundary and the Msunduzi catchment boundary are very similar. This implies that activities in the Municipality will all have some form of influence on the rivers up to the outflow point. Any changes in the land use, without mitigation of runoff, will therefore result in increased flow peaks which would impact mainly on the densely urbanised lower reaches in the eastern portions of the Municipality. This is evidenced by the 1995 and other more recent flood events.

The uMsunduzi catchment can be divided into three storm rainfall areas, with 180mm, 220mm and 260mm adopted as the 1:100 year 24hour rainfall for the respective zones. The flood zones have been mapped and are shown on the attached Figure 2. In many of the smaller tributaries, the 32m buffer referred to in NEMA will govern, as this is the more conservative and will trigger a more accurate flood impact assessment

6.1.4 Recommendations

In terms of catchment management the following recommendations have been made:

- The development planning for the Municipality should incorporate an integrated catchment management process where the accumulative effects of development on catchment hydrology can be assessed. This will require the development of an integrated catchment simulation model, which can be used to model the proposed development scenarios. The type of model should be carefully selected, as the storm runoff, as well as average monthly runoff will need to be simulated. The model should also be able to simulate long term runoff with the assessment of the effect of the impact on base flows, being the focus;
- Flow gauging locations should be identified and, if necessary constructed, and the monitoring of stream flow should be initiated. It is recommended that some continuous monitoring stations should be included;
- A more accurate delineation of the 1:2, 1:5, 1:10, 1:50 and 1:100 year “planning floodlines” should be determined for the Municipality. This will require a more detailed survey of the flood plains and measurements of all relevant river crossing structures. Where possible, the assessment of velocities and flood depths in the watercourses and flood plains should be determined. This will be relevant to flood risk assessment and will be required for the disaster management planning requirements;
- The catchments of critical flood impact areas should be assessed to determine what flood mitigation measures need to be implemented and;
- The catchment hydrology aspects and the surface water resources assessment are mutually dependant and these two aspects should be linked.

6.2 Surface Water Resources

6.2.1 Objectives

The key objective of the Surface Water specialist study was to determine the health, ecological importance and sensitivity of the surface water resources (rivers and streams) in the area and identify pressures being exerted on them, to inform development planning.

6.2.2 Methodology

In order to determine the health, ecological importance and sensitivity of the surface water resources, the following steps were undertaken:

- The Municipality was divided into 9 sub-catchments representing similar ecological conditions and the present ecological status (PES) for each sub-catchment was assessed;

- Recent and historical water quality data was assessed together with current land use patterns, to identify drivers and pressures that would account for the state of the rivers and streams within each sub-catchment;
- Potential management classes for the various sub-catchments were suggested;
- Ecological specifications or benchmarks (Ecospec’s) were set for each of the sub-catchments; and
- Management actions to achieve the Ecospec’s were suggested.

6.2.3 Results

The water quality in the uMsunduzi catchment varies significantly. The system is fairly healthy in its upper reaches but surface water quality declines as it passes through the City of Pietermaritzburg. The City leaves a large “imprint” on the condition of the surface water resources in the catchment in general, but some sub-catchments are more affected than others. Figure 3 provides a summary of the present ecological state of rivers and streams within Msunduzi.

A number of sub-catchments are in an unacceptable state and pose long-term risks and pressures on the larger river network. The state of these sub-catchments will need to be improved through the implementation of management actions suggested in Figure 3 below. The target management classes for the uMsunduzi River are summarised in Figure 4.

6.2.4 Recommendations

The description, Ecological Importance and Sensitivity (EIS), state, target management class and recommendations to achieve the target management class are provided in Table 3 below for each sub-catchment.

Table 3: Table of sub-catchment description, EIS, state, target management class and management priorities.

Sub-catchment		EIS	State	Management class	Management priorities
No.	Description				
1	The uMsunduzi catchment above Henley dam	Moderate	Fair	Good	Reduce livestock pressure, improve sanitation systems, institute waste removal services, implement stormwater management in future construction, employ ecological sensitive agric techniques in riparian areas, begin wetland rehabilitation.
2	The uMsunduzi River between Henley Dam outflow and the Edendale weir	Low	Poor	Fair	Reduce livestock pressure, revamp sanitation system, improve waste removal services, incorporate stormwater management features in future construction and employ ecological sensitive agric techniques in riparian areas and wetland and riparian zone rehabilitation.
3	North of the uMsunduzi River from Henley Dam to Ashdown and up to Sweetwaters	Low	Good	Good	Reduce livestock pressure, improve sanitation system, waste removal services and stormwater management in future construction, alien plant removal and wetland rehabilitation.
4	South of the uMsunduzi from Henley to Plessislaer and up through Edendale	Low	Seriously Modified	Fair	Alien invasive plant removal management plan, revamp and expand sanitation infrastructure, improve waste removal,

Sub-catchment		EIS	State	Management class	Management priorities
No.	Description				
					rehabilitate wetlands and riparian zone, incorporate and implement stormwater management plan for new and existing developments and roadworks
5	Pietermaritzburg central uMsunduzi River from Edendale weir down to the city refuse dump.	Low	Seriously Modified	Fair	Improve stormwater run-off management (new bylaws/policies or alternate dispersal system e.g. French drains), revamp sanitation and stormwater systems and rehabilitate wetlands and riparian zone.
6	Pietermaritzburg North of the uMsunduzi from Hilton to Chase valley	Moderate	Seriously Modified	Fair	Revamp stormwater and sanitation systems, rehabilitate riparian zones
7	South of the uMsunduzi from Mkondeni to Lynnfield Park	Moderate	Natural	Good	Ensure proper management and mitigation measures for new developments, especially in terms of stormwater and sanitation systems. Maintenance and inspection of current infrastructure and investigation of possibly illegal abstractions and mitigation of mining run-off.
8	Lower Pietermaritzburg from the city dump to downstream of Darvill Water Works including Northdale and Hayfields	Moderate	Seriously Modified	Fair	Incorporate mitigation measures such as French drains etc. into the stormwater system, revamp sanitation system and improve waste removal and investigate and implement appropriate strategies for industrial pollution sources. Rehabilitate wetlands and riparian zones
9	Downstream of Pietermaritzburg from Darvill Water Works to the confluence with the Umgeni River	Low	Good	Good	Rehabilitate wetlands and riparian zone

6.3 Wetlands

6.3.1 Objectives

The objective of the Wetland specialist study was to identify and map wetland areas within the Municipality to inform development planning.

6.3.2 Methodology

The identification and mapping of wetlands within Msunduzi was achieved by capturing the approximate boundaries of wetland systems in GIS from colour aerial imagery (August 2006) as supplied by Msunduzi. Thereafter, key areas were ground-truthed to ensure that wetland areas had been appropriately identified. Ground truthed areas included the following:

- Edendale;
- Mkondeni;
- Vulindlela;
- Montrose; and
- Ferncliff areas.

To differentiate between wetland areas that had been ground-truthed and those that had not, a confidence buffer was assigned. The size of the confidence buffer was determined by the level of ground-truthing that was undertaken for each wetland system.

6.3.3 Results

A wetlands development constraints map, included as Figure 5, was developed. The map provides an indication of high development constraint areas (mapped wetland areas, open water and confidence buffers as discussed above) in red. In addition to areas indicated in red, areas with potential development constraints are identified in orange. These include areas within 20 meters of high development constraint (red areas) that are sensitive, due to their proximity to identified sensitive features i.e. rivers and potential wetland habitat.

6.3.4 Recommendations

Areas of high development constraint (areas demarcated in red on Figure 5) should be considered no-go areas and wetland delineation and wetland functionality assessments should be undertaken prior to any development within these areas. Prior to development within areas of development constraint (areas represented in orange on Figure 5), further investigation should be undertaken to determine whether wetlands exist on-site and, if not, whether any proposed development may impact on wetlands in close proximity. No wetland habitats have been identified for the areas with no development constraint. However, due to the variable nature of wetlands, it may still be possible for a wetland to occur in a no constraint zone. Therefore, developers should identify any areas with a visibly high water table for further investigation, prior to development. Developments should also be planned with off-site impacts (including any downstream wetlands) in mind.

The Wetland specialist study focused primarily on the mapping of wetlands within Msunduzi in order to flag areas which should be assessed prior to development. While this provides useful baseline information, the following activities could add significantly to the management of wetlands in the Municipality:

- Inclusion of significant wetlands in the MOSS system;
- Implementing a system to capture and update the available wetlands coverage;
- Assessment of the health of wetlands to inform future Status Quo reports; and.
- Undertaking an assessment of wetland benefits using Wet-Ecoservices

6.4 Agriculture

6.4.1 Objectives

The objective of the Agricultural specialist study was to consider current agricultural activities and a number of factors that impact on agricultural potential to identify areas that should be reserved for agricultural purposes.

6.4.2 Methodology

In undertaking the assessment of the agricultural resources, existing information, which is largely modelled data, was used. These data sets include:

- Information generated by the Bioresource Programme of the DAEEA;

- 2001 modelled climate data, and landcover information; and
- Land use undertaken by INR from colour aerial imagery (August 2006) supplied by Msunduzi.

Key factors that impact on agricultural potential are climate, slope and soil characteristics. Existing land use as well as evidence of previous cultivation was also investigated with the assumption that most high potential land has already been cultivated at some point. Therefore, to model areas of high agricultural potential the following steps were undertaken:

- Land potential information of the Bioresource Programme was mapped;
- Slope analysis was undertaken using a 20m Digital Terrain Model (DTM) data; and
- Areas currently under crop production were identified using the 2001 CSIR land use data, while areas previously cultivated were digitised from aerial photographs.

Those areas categorised as having good or high potential were retained, while those said to have moderate to very restricted potential were set aside for non agricultural development. Any areas with slopes >12% were also set aside for non agricultural land use. This is based on the fact that only slopes less than or equal to 12% can be used for annual crop production.

6.4.3 Results

Those areas that have high or good potential, slopes less than or equal to 12%, and have been or are being cultivated are shown in red on Figure 6. These areas fall mainly in the western portions of the Municipality, with small pockets in the Bishopstowe and Umlaas Road areas. Areas of cultivation and forestry on slopes >12% were not identified as lands to be reserved for agricultural purposes and were indicated as suitable for non agricultural development.

Flat areas ($\leq 12\%$) categorised by the Bioresource Programme as having good or high potential, with no evidence of previous cultivation, are shown in orange. This indicates that further investigation is required as to the agricultural potential of the area. Should the site prove to have high agricultural potential during site specific investigations then transformation to other land uses should not be permitted. These areas exist throughout the Municipality but are notably absent in the eastern parts of the Municipality. Areas where other forms of land use can be permitted are indicated in green. These include areas where agricultural potential is not particularly high. The map also shows the densely settled urban areas taken from the CSIR land use data which are not available for agricultural production (See Figure 6).

6.4.4 Recommendations

Beyond the recommendations above, with regard to the protection of agricultural land, the following recommendations are provided:

- Reserve high potential land for agricultural purposes by:
 - Ensuring the strategic development framework process takes into account areas of high agricultural productivity;
 - Subdivision of land into parcels that are not viable for agricultural production is prevented; and
 - Legislation related to development and transformation of agricultural land is enforced.

- Maintain the potential of the agricultural land within the Municipality to prevent forms of land degradation that include soil erosion, pollution of ground water, invasion of areas by alien plants, loss of vegetation cover, etc. by:
 - Enforcement of CARA (in time this will be replaced by the Sustainable Utilisation of Agricultural Resources Act); and
 - Creating awareness regarding causes of land degradation and methods of preventing it. This is critically important as increasing populations and demand for land, for a range of purposes, will result in the use of steep or floodplain areas for agricultural purposes.

In undertaking the Agricultural specialist study a number of areas that require further attention have been identified. These are activities that cannot be undertaken within the scope of the current study, but which would add value to the process of developing the EMF and include the following:

- Ground-truthing of high potential areas identified through this study; this may include an assessment of the viability of agriculture in highly productive areas; and
- Tracking of land degradation, particularly those categorised as having good agricultural potential.

6.5 Biodiversity

6.5.1 Objectives

The objective of the biodiversity specialist study was to assess the importance of untransformed land for biodiversity conservation within Msunduzi to inform future development planning.

6.5.2 Methodology

As a first phase, preliminary data collection was undertaken to map and classify all untransformed land within the Municipality. This included the selection of biodiversity features to be included in the study in consultation with EKZWN.

The second phase required that areas of untransformed land be classified in terms of their importance to biodiversity conservation. This included collation of species distribution information from existing species records and modelling species distributions from expert ratings of vegetation types and mapped land use classes. For plant species and vegetation types these maps were further refined by qualitatively assigning grassland condition ratings to all grassland fragments based on aerial photo interpretation.

Phase three involved a formal conservation planning exercise, similar to that used by EKZWN, to produce the municipal “C-Plan”. Targets for biodiversity conservation were determined from provincial limits set by EKZWN and further expert opinion. These targets were then compared to the distributions mapped in phase two above to inform the development of a developments constraints map.

6.5.3 Results

The results of the biodiversity specialist study are presented spatially. The areas of high biodiversity importance are spread throughout the Municipality, however, as expected, there are fewer biodiversity resources in urban areas than in rural areas. The results of the conservation plan

highlight the need for the conservation of remaining habitats but indicate that targets for all but four of the biodiversity features could still be achieved within Msunduzi.

6.5.4 Recommendations

Recommendations to manage impacts on biodiversity, as a result of land use changes, are as follows:

- Areas of high biodiversity constraint are not recommended for development which would result in land transformation. Prior to any development within a high constraint area a full biodiversity assessment, to include the identification of biodiversity resources, assessment of potential impacts on these resources and development of mitigation measures to reduce the impact on biodiversity, is recommended;
- Development within development constraint areas can potentially take place, but prior to development, biodiversity resources on-site should be identified and the impact of the development on these resources assessed. The development should then only proceed in a manner that would limit potential impacts to important biodiversity elements occurring on the site. This may include amending the layout or extent of the proposed development.
- While no development constraints are identified for the remaining areas, should development be planned for a previously untransformed site, it is recommended that a site visit be undertaken to confirm that no biodiversity resources occur on the site; and
- The requirements for further investigation may be triggered as a result of an EIA however, it is critical that, for areas of high constraint, a biodiversity impact assessment be undertaken whether the development constitutes a listed activity in terms of the NEMA EIA regulations or not.

While there are currently many initiatives to address the management of invasive alien vegetation, the following recommendations are made to further reduce the impact of invasive alien vegetation on biodiversity:

- Undertake an alien vegetation survey of the Municipality;
- Subdivide the Municipality into manageable units, identify all municipal owned land within the units and prioritise units in need of weed control; and
- Identify the most effective methods of weed control, based on the target species and make reasonable allowances in terms of budget and staff to implement weed clearing control proposed for the coming year.

It was recommended that the municipal rating system may also be employed to assist in biodiversity conservation by:

- Providing exemptions or reducing the rated property values for properties with high biodiversity constraints, this should however not include properties infested with invasive alien plants;
- Providing rebates for property owners who manage properties in sustainable manner; and
- Introduce penalties for properties not complying with environmental requirements.

The Biodiversity specialist study noted that by implementing a system to assess the effectiveness of biodiversity conservation within protected areas further biodiversity conservation may be achieved. It was noted that areas of high biodiversity importance such as the MOSS should be zones

accordingly and a review of the capacity of Msunduzi's Department of Parks and Gardens Department should be undertaken in light of the requirements for implementing both the MOSS and the EMF. Due to the rate at which development in the eThekweni Municipality has advanced in the direction of the Msunduzi south-western boundary, partnerships with Mkhambathini Municipality (and eThekweni) should be developed to assist in biodiversity conservation. In addition to the recommendations provided above, recommendations for further work to be undertaken have been provided. These recommendations will inform the development of the SEMP to be prepared as part of Phase 3 of the EMF project.

6.6 Air quality

6.6.1 Objectives

The objective of the air quality specialist study was to identify and map existing and potential air pollution issues and areas ('hot-spots') to inform the identification of opportunities and constraints to development in the municipal area; specifically development that would result in atmospheric emissions.

6.6.2 Methodology

The following indicators of Air Quality were used to inform the assessment:

- SO₂;
- PM10;
- Smoke (Historical);
- Benzene; and
- Odour complaints

Historical ambient monitoring data of the above mentioned indicators were used to provide an indication of the current state of air quality within Msunduzi. However, due to the dynamic nature of air movement, continuous monitoring is required to determine long-term trends in air quality. To provide an indication of the source of air quality issues, identified emission sources were mapped. Unfortunately no in-stack monitoring is currently being undertaken in Msunduzi and therefore no measurement of the emissions from the various sources is available. The Municipality is however, in the process of developing an emissions inventory in partnership with the industries identified as emission sources. When compared with the location of the inversion layer, it is notable that a large majority of the emissions sources are within the inversion layer. This is of some concern as the inversion layer blocks the dispersion of emissions resulting in all emissions being trapped in the City bowl and resulting in the poor air quality in this area.

Due to the topography of Pietermaritzburg, the movement of pollutants in the air within the Municipality is similar to that of water i.e. flowing from the higher areas into the basin, in which the CBD exists. Therefore, topography plays a large part in impacts as a result of emissions. Topography was used as a guide to identify areas sensitive to emissions, and therefore inform the assessment criteria required for emitting industries.

6.6.3 Results

Figure 8 demonstrates the sensitivity of areas within the Msunduzi to emissions. Areas indicated in red are most sensitive i.e. being within the inversion layer, and therefore the least suitable for industry. It is notable, however, that due to industries' need for flat areas on which to establish, the majority of industrial development historically occurred within the most sensitive zone. The orange zone indicates areas that may on occasion fall within the inversion layer as the inversion layer may move up or down depending on day to day climatic conditions. Finally, areas indicated as green are outside the inversion layer.

While it would be preferable to locate industry in the orange, or better still the green areas, this does not eliminate the potential impacts on air quality in the City. During still winter nights, katabatic flow moves the air down the slopes into the valleys and beneath the inversion layer. Therefore, as detailed further below, it is recommended that all emitting development be subject to air quality modelling. The level of modelling required will, however, be determined by the sensitivity of the receiving environment.

6.6.4 Recommendations

The overriding problem facing Msunduzi is the paucity of data regarding pollutant sources. This is now being addressed by Msunduzi, but acquisition of such data takes time and resources. The following recommendations have been made to ensure the appropriate information is collected:

- Provide sufficient and appropriate resources to continue the process of collecting isokinetic monitoring information from industry.
- Provide sufficient resources to further assess the use of heavy fuels by major appliances within Msunduzi and other appropriate emission reduction plans.
- Traffic count data should be used to model emissions and the impact of vehicular pollutants. This modelling should start with the busiest routes and intersections and findings should then be used to inform future transportation planning.
- Meteorological data from the following sites should be collated to build an understanding of the seasonal dispersion conditions in Msunduzi:
 - Oribi Airport
 - Publicity House
 - Edendale.
- Once a thorough source inventory of emission data, meteorological data and supplementary data, such as traffic counts has been gathered, an urban dispersion model should be constructed to assess holistic impact and hence constraints and opportunities of air quality in Msunduzi. Ideally this should tie in very closely with the formalization of the Msunduzi Municipal Air Quality Management Plan.

Further development expected to have emissions that would impact on Air Quality should be subject to air quality modelling. However, in the least sensitive areas i.e. those indicated in Green on Figure 8, a minimum requirement of a Tier 1 Air Quality Assessment should be sufficient to address air quality issues. For areas indicated in orange, a Tier 2 Air Quality Assessment is suggested while for

the most sensitive areas i.e. those within the inversion layer and indicated in red on Figure 8, a Tier 3 Air Quality Assessment should be undertaken.

6.7 Service Capacity

6.7.1 Objectives

The objective of the Service Capacity specialist study was to determine what infrastructure exists in Msunduzi, the capacity of that infrastructure in terms of water, sanitation, roads, electricity, waste and stormwater, and the capacity of the service infrastructure for possible future expansion. This was determined through discussions with relevant local, provincial and national authorities and other stakeholders such as Eskom, Umgeni Water, Department of Transport (DoT) and South African National Roads Agency Limited (SANRAL).

6.7.2 Methodology

The assessment of each of the service sectors was undertaken at a desktop level in order to provide a summarised spatial description of the state of the service sectors for each area in Msunduzi. This was achieved through the following steps:

- Key personnel / informants were identified and asked to complete a questionnaire in order to assess the capacity/state of each service. The questionnaires were then followed up with interviews;
- Msunduzi IDP 2008;
- Available GIS data and any other pertinent information for each of the service sectors was obtained from the key personnel; and
- Layout drawings of Msunduzi, for each service sector, were produced that describe:
 - The state of the infrastructure;
 - Challenges being faced at present; and
 - Areas in which the infrastructure currently being upgraded.

6.7.3 Results

With the incorporation of the Greater Edendale area into the Msunduzi Municipality in 1996, followed by the Vulindlela area in 2000, Msunduzi has inherited a number of different levels of service in water and sanitation. Negotiations to sell the Vulindlela Water Systems to the Municipality, by Umgeni Water, are in progress. Extensive backlogs in water and sanitation do, however, exist in Vulindlela.

Potable water

The Umgeni River system is the main source of potable water for Msunduzi, eThekweni and a number of other local municipalities. The system is somewhat complex in that it includes a number of storage dams, treatment works and inter-basin transfer schemes. Bulk water supply to Msunduzi is the responsibility of Umgeni Water.

It is our understanding that the current demand for water exceeds the capacity of the Umgeni system and that augmentation from other river systems will be required in future. Transfer schemes from the Mooi River and the Umkomaas River are already in advanced stages of planning and design,

however, the implementation of these schemes may not be achieved in time to reduce the risk of shortfalls.

The bulk of the Msunduzi water supply is from Midmar dam and is purified at the Midmar treatment works. The remainder of the water is treated at the DV Harris treatment works which also sources its water from Midmar Dam.

The majority of Msunduzi is fully reticulated with bulk supply of potable water being supplied, either by Umgeni Water (supplied to rural schemes including the Vulindlela areas) or by the Msunduzi Municipality Water and Sanitation Sub-unit (the rest of the Msunduzi Municipality). The Central Business District (CBD) currently has sufficient infrastructure capacity to meet potable water demands but due to the age of the reticulation system constant upgrades and repairs of pipes and fittings is required. Some areas in the Greater Edendale and Bishopstowe are supplied water by means of tankers and boreholes. The elimination of tankers and boreholes is an high priority to ensure that every consumer in the Municipality is receiving a first level of service. Potable water reticulation systems in areas such as Ashburton, Lynnfield Park, Athlone, Montrose, Hayfields, Lincoln Meade, Copesville and Bishopstowe are currently in the process of being upgraded due to the rapid increase in development (mainly simplex/complex housing units).

Sanitation

The capacity for sewage processing at Darvill Sewage Treatment Works (Darvill) has reached critical proportions and extensions to the existing sewer network will need to be evaluated in the context of Darvill's processing capacity.

Waterborne sewerage is provided to the CBD and areas such as Athlone, Montrose, Pelham, Bisley, Hayfields and Lincoln Meade. Some of the areas that have full sewerage network systems require constant maintenance due to aged infrastructure. The densification due to the construction of new developments also necessitates upgrades to the existing systems

Sewage disposal is provided to the Greater Edendale area through numerous systems. Efforts, however, are being made to upgrade older systems such as conservancy tanks and Ventilated Pit Latrines (VIP) to ensure a first level of service. The elimination of conservancy tanks is a priority, and VIP's are only recommended in areas without sufficient water to support a water-borne sewerage system.

Vulindlela area is in critical need of sanitation infrastructure and in certain areas a level of service of less than 1 exists. Vulindlela currently has a backlog of approximately 31000 V.I.P's. This is as a result of informal settlement of areas that have not been identified for service provision.

The Ashburton area is currently being serviced by septic tanks. With current densities in the area this option is generally suitable, however with the anticipated increase in high density housing, a formal sewer system will be required. The Ashburton area is downstream of Darvill, therefore in order to provide water borne sewerage disposal to the area, the sewerage will either need to be pumped to Darvill (not generally a preferred option) or to a new treatment works. The new treatment works would need to be constructed downstream of Darvill near the confluence with the Mpushi River and

Msunduzi Rivers. Based on the current capacity constraints at Darvill the latter option appears to be more practical.

Road infrastructure

The Msunduzi IDP (2008/9) indicates that Traffic in the Msunduzi Municipality has increased by 30% since 1992. Due to limited budget, construction of new roads has been inadequate and alternative low cost traffic management measures have been implemented by Msunduzi. On many arterial routes peak hour traffic volumes have reached saturation levels and significant delays occur. The situation will deteriorate in future years as traffic volumes continue to increase. To address the capacity issues five priority road projects have been identified namely:

- Upgrade of Church Street/N3 Interchange
- Burger Street Extension
- Route 7B
- Otto's Bluff – Cornor Road Link
- Oldfield Road – Market Road Link

The majority of vehicle traffic into the CBD travels from the Northern Suburbs, Hayfields, and Lincoln Meade areas resulting in congestions at the main intersection points during peak hours (7am - 8am and 4pm - 6pm). The New England Road / N3 off-ramp has been upgraded and there is a proposal to upgrade the Chota Motala (Church Street) /N3 off-ramp using a similar design. The upgrade of the Chota Motala Bridge will alleviate traffic congestion, particularly for the residents of the Northern suburbs, namely - Woodlands, Allandale, Bombay Heights and Orient Heights

The Vulindlela area has very limited primary access road infrastructure and transport in this area consists mainly of cyclists and pedestrians. A cyclist/ pedestrian pathway has been constructed from Edendale to the CBD and has assisted in decreasing pedestrian injury and accidents on the Edendale Road.

Solid Waste

All solid waste collected by the Municipality (as well as some form outside the Municipal area) is disposed of at the New England Road landfill site, however, the remaining capacity of the New England Road landfill site is limited. Msunduzi's elevation to Metro status will mean that it will be responsible for its own waste disposal. There is currently a process underway to identify a new landfill site for the uMgungundlovu District Municipality. The decision of whether to partner with the District and use the district landfill site, or identify a new Msunduzi Metro landfill site, will require much debate.

Due to the fact that approximately 40% of the waste currently disposed of at the New England Road landfill site is of an industrial nature, it is critical that the identification of a new site take the needs of industry into account.

Illegal dumping of waste was identified as a key challenge in Msunduzi as this also affects the other service sectors, such as stormwater and sewer reticulation. The majority of waste is generated in the

northern suburbs and the Imbali/ Slangspruit areas, while the Vulindlela area produces far less. This trend was attributed to economic factors.

The rapid increase in housing developments (mainly simplex/ complex units) in areas such as Lincoln Meade, Pelham and Chase Valley have resulted in increased amounts of waste being generated, leading to capacity/resource constraints in terms of the collection of the waste.

Stormwater

The rapidly increasing density of settlement, including housing, industrial and commercial development, is resulting in increased storm water run-off. This, coupled with the destruction, degradation and reduction of wet lands and inappropriate use of flood plains, has significantly increased the risk of downstream flooding. The frequency and magnitude of flood events is as a result of climate change and is also likely to increase significantly.

Communities living within or in close proximity to flood plains, such as Sobantu, Imbali, Allandale, Rosedale, Oakpark, Townbush Valley and Prestbury are most at risk. Damage to infrastructure, such as roads, bridges, culverts, sewers and water pipelines is likely to occur if measures to protect flood plains and wetlands, are not introduced and implemented. The management and reduction of Stormwater generated in site also needs to be addressed.

A backlog of stormwater services in Vulindlela is noted and the following areas require stormwater infrastructure upgrades:

- Sweetwaters;
- Large areas of Edendale particularly Dambuza and Imbali;
- Willowfontein; and
- Ambleton.

A key challenge in the maintenance of stormwater infrastructure is the illegal dumping of waste, which results in stormwater systems becoming blocked (a recent study by SRK on stormwater infrastructure in Edendale, showed nearly 60% of stormwater infrastructure was not functioning correctly). In addition, constant upgrading of existing infrastructure is also required to address higher demands caused by the increase in residential development and aging infrastructure.

Electricity

The provision of electricity in Msunduzi is demand driven. The demand triggers the need to plan for additional capacity and/or the location and extent of the electricity network distribution. Eskom is the sole bulk supplier of electricity to the Council and hence there is mandatory need for co-ordinated planning between the two entities. Supply projects are identified as the demand arises. Capacity enhancement projects, which are identified in the Master Plans, need to be planned for at least 10 years in advance.

The Msunduzi 2008/09 IDP review indicates that many of the electrical substations are nearly 40 years old and are in urgent need of replacement. To address this Msunduzi has embarked on a 10 year replacement program.

The spatial development framework (SDF) gives insight into the possible zoning and developmental pattern of various settlements and establishments which ideally, should inform the capacity and extent of electricity infrastructure development. The Municipality is in the process of developing a detailed SDF that identifies areas for different types of development. It is critical, that prior to the development of these areas servitudes for the provision of bulk infrastructure be identified.

6.7.4 Recommendations

To address the issues raised during the assessment of Service Capacity, the following recommendations have been made:

- The Municipality needs to improve maintenance of all existing infrastructure as failures and ineffective performance are having a negative effect on the environment.
- The provision of additional potable water storage capacity in the supply reservoirs will improve the reliability of the supply of the bulk supply system. The losses in terms of leakages and under-recovery of sales should also be addressed.
- Darvill needs to be urgently upgraded or an additional treatment works constructed, near the confluence with the Mpushi River and Msunduzi River. Failure to do so could have an impact on river water quality and limit development expansion in some areas.
- Solid waste collection and disposal is a major problem (particularly in Edendale and Vulindela) and an additional waste disposal site is urgently required.
- Development in the flood plain (particularly informal) and increased flood levels, due to this development, require management as a matter of urgency.
- An integrated cost model should be considered for service provision to enable the municipality to identify areas where the provision of services will be most cost effective. This will enable the municipality to encourage development in these areas. Similar models exist in other municipalities and these determine the cost of the provision of roads, water, sewage, electricity and stormwater to a pre-determined area mainly for low cost housing. This enables the identification of an “urban edge” within which the costs of the provision of services are significantly lower than outside this area. “Cost shocks” can also be identified where the provision of new treatment facilities, or major roads etc., are required. This process is useful to inform planning relating to densification and in which direction growth should be encouraged.
- The prime areas of concern at this stage are the Vulindlela and Edendale areas. The Vulindlela area remains very underdeveloped, while, Edendale, on the other hand, has higher levels of service provision. However the maintenance of Edendale infrastructure remains problematic due to the inappropriate use of services in the area. Improving and maintaining the infrastructure will facilitate development in this area, thus increasing capital spending and providing employment etc.
- Traffic congestion, particularly in the CBD and N3, will need to be addressed as this is impacting on development opportunities. Furthermore, the upgrading of roads in the outlying areas (Edendale, Vulindela) needs to be accelerated as many of the gravel roads are in a poor condition.

- It is critical that the Municipal planning process include the identification of servitudes for bulk services. The Msunduzi SDF is in the process of being finalised and identifies future development areas. The SDF should therefore inform the location of future bulk service supply.

6.8 Socio-economic analysis and planning policy review.

6.8.1 Objectives

The objective of the socio-economic analysis and planning policy review was to provide and overview of the socio-economic and spatial development trends and patterns to inform potential conflicts.

6.8.2 Methodology

The preparation of an EMF for Msunduzi forms part of the integrated planning process and constitutes a refinement of the environmental management section of the IDP. The socio-economic analysis and planning policy review was prepared on the basis of secondary data, particularly:

- Development planning policies and legislation.
- Development plans for both local and district municipalities. This includes the IDPs and the associated sector plans.
- Research reports on various development issues across the spheres of government.
- Spatial data contained in various sector plans as developed by either uMgungundlovu District and/or Msunduzi.

6.8.3 Results

National and Provincial Planning

National and provincial development policies identify Pietermaritzburg as a focus area for development and economic growth. The National Spatial Development Perspective (NSDP) and the Provincial Spatial and Economic Development Strategy (PSEDS) highlight Msunduzi's strategic location along the N3 Corridor between Gauteng and Durban. Msunduzi is categorized in the NSDP and PSEDS as a secondary node with potential for industrial, commercial and administrative development. The area also serves as a Provincial administrative hub and commercial centre for the midlands region. The recent relocation of government departments to Msunduzi, has highlighted the administrative function Msunduzi fulfils. The recent development of the Liberty Midlands Mall and regeneration of the city demonstrates Msunduzi's status as a regional economic hub. This has however put enormous pressure on the city to release land for offices and additional residential development, which has inadvertently impacted on efforts to conserve environmentally sensitive and highly productive agricultural land.

Local Planning

The road network, spatial structure and the impact of post 1994 spatial planning has strongly affected the development trends and patterns within Msunduzi. The City also demonstrates development trends characteristic of most cities in South Africa namely a central core in the central business district (CBD) with several major access routes radiating outwards. In Msunduzi, these occur in the form of the N3 and its linkages through the city, and east-west axis linking the northern

and the southern parts of the city through the city centre. This however results in inefficient spatial structure that will need to be addressed in future planning.

Msunduzi is essentially a services economy and the fact that it is the administrative centre for KZN (the provincial capital) as well as the major link between the coast and inland regions, affects its economy in a number of ways and generates specific opportunities. The purpose of the Msunduzi Spatial Development Framework (SDF) is to identify spatially how these opportunities may be realised. The nodes identified for growth within Msunduzi are as follows:

- **CBD Node:** It consists of Pietermaritzburg CBD; Liberty Midlands Mall, the motor world, Sanctuary Site and the Royal Agricultural Show grounds;
- **Regional Multi-Use Node:** One existing node (Liberty Mall and surrounds) and one proposed (in the Edendale area);
- **Community Multi Use Node:** Edendale node will be consolidated at this level and a new node at Shenstone;
- **Neighbourhood Multi-Use Node:** a number of such nodes have been identified; and
- **Focus Multi-Use Node:** Camps Drift

In addition to the development nodes identified, the following development corridors have been identified in the SDF:

- **Provincial Priority Corridor:** The N3;
- **Activity Spines:** occur along major arterials leading into or from the CBD node; and
- **Arterial Roads and Bypasses:** aimed at improving accessibility, alleviating congestion and allowing previously disadvantaged areas to be part of the local economy.

Socio- Economic Conditions

Msunduzi is characterised by a complex ethnic mix, the majority of population residing in Msunduzi is African with Whites and Asians representing more affluent ethnic minorities. In addition to strategic location and development pressures emanating from the national and provincial development imperatives, a relatively high rate of urbanisation will be another major driver for development in Msunduzi. Urbanisation has manifested itself in informal settlements in the southern and northern areas of the Municipality. Movement of a large number of low income people into the city exerts pressure on the municipality to release land and provide a range of housing products targeting this segment of the population. The new housing policy (Breaking New Ground) seeks to promote integrated communities and requires that low cost housing projects should be located in close proximity to areas of urban opportunities such as employment opportunity areas and the city centre. With the exception of Acacia Park and Signal Hill, there has been no low income infill development within the city and in the predominantly middle to high income areas. A large number of strategically located vacant underutilised land parcels exist within the city. Infill developments, and spread of projects intended to address urbanisation will contribute to the spatial transformation of the city and creation of near urbanism.

The housing needs arising from the relocation of government officials to the city has also contributed to the demand for housing. This has not however led to massive housing delivery. Instead, this has occurred in areas such as Hillcrest.

The majority of the population are employed in the community/social/personal sector, which is expected in the provincial capital. Unemployment in the Municipality is decreasing however a large portion of individuals/households fall within the low to middle income category. Literacy and levels of education have increased in the Municipality since 1996 and majority of the municipal area has access to educational facilities, with the exception of the eastern areas. The majority of the Municipality has access to basic services, however the backlog in water provision and reliance in Msunduzi on pit and bucket latrines remains higher than the national average. The provision of health facilities is also unevenly distributed and the majority of individuals/households do not meet the CSIR Redbook Planning Standards of being within 2km of a clinic. While the central and northern areas of the Municipality are well served with health facilities, the eastern and western areas are not.

Development Trends

While Msunduzi has been identified at a national and provincial level as a secondary node, the N3 is seen as a primary development corridor. It is the major link and trade route between Gauteng (economic powerhouse) and Durban (the busiest port in Africa). The N3 serves as a focus area for development, particularly industrial, commercial and medium density housing. In Msunduzi, target areas include Pietermaritzburg and Ashburton. eThekweni is also preparing to release land in Cato Ridge for industrial development. In fact, the whole area along the N3 from Howick in the west to Cato Ridge in the east is seen as a development pressure zone, in the short to medium term, with development occurring mainly at strategic intersections. In the long term, focus will be on areas between the intersections thus leading to the closure of the gap between Pietermaritzburg and Durban. Development in these areas however is largely speculative and driven mainly by land prices.

Although Msunduzi is located at an intersection of a national development corridor and a provincial development corridor, commercial, industrial and upmarket housing development is likely to focus mainly along the N3. While low to middle income housing areas are expected to develop along the north south development axis. Land along the N3 has become very expensive and this limits the possibility of low and lower middle income housing, and creates opportunities for the consolidation of the northern and southern suburbs. Programs such as the Greater Edendale Development Initiative are intended to consolidate Greater Edendale and attract non-residential investment into the area. Limited opportunities however do exist for industrial and commercial developments exist along the north-south corridor.

6.8.4 Recommendations

There is a need to curb urban sprawl and promote equitable access to urban opportunities, public facilities and social amenities. Development of areas such as Ekrosini will facilitate integration with the city centre and the neighbouring suburbs such as Ridge Park, the Grange and Westgate.

As strategically located land within the city becomes a scarce, development pressure on Ashburton and Camperdown will increase. Development will occur along the N3 corridor with particular focus

being paid to the N3 interchanges. The number and type of development projects being considered in the area at present suggests that the current development texture cannot be sustained any longer. By virtue of its location along the N3 corridor and R103 as a parallel unlimited access route presents the area as a logical focus area for mixed land use development.

The need to protect high value agricultural land has been identified at the highest level. As such the municipality will need to identify and develop strategies to ensure that these areas are maintained for agricultural production. To this end agricultural zones should be identified in the LUMS. It also important that areas and programs to encourage urban agriculture be identified and implemented. This would enable the urban poor to further secure their livelihoods.

The implementation of the Municipal Open Space system would add social, economic and ecological value to the municipality. The extension of the CBD has resulted in the loss of “urban lungs” within the city, such as the Royal Agricultural Showground, Polo fields and Bird Sanctuary, being encroached onto. It is necessary to identify alternative areas that can provide a similar function be identified elsewhere. The protection of a sustainable open space system would ensure that the natural resource base of the city would continue to supply environmental goods and services in the long-term. This sustainable delivery of environmental services is critical in meeting the needs of all of the city’s communities, but most importantly the basic needs of the urban and rural poor.

Provisions also need to be put in place for the urban renewal of the “uptown” and “downtown” areas of the CBD. The area is currently in a state of decay and an environmental eyesore and requires upgrading. It is important that environmental management plans be compiled for the nodal areas identified in the SDF to ensure environmentally sustainable development.

6.9 Cultural Heritage Assessment

6.9.1 Objectives

The objective of the Cultural Heritage specialist study was to identify potentially sensitive heritage areas within Msunduzi to inform opportunities for and constraints to future development.

6.9.2 Methodology

To achieve the objectives above, heritage resources within the municipal boundary were mapped from existing datasets. These maps were then used to inform the identification and mapping of larger zones of cultural, architectural, historical and archaeological importance within the Municipality. The zones were identified through workshops and meetings with various specialists in the fields of cultural heritage, architecture and archaeology.

6.9.3 Results

A total of 646 heritage resource points and 32 heritage resource zones within Msunduzi were identified and mapped during the heritage resource study. The results of the mapping undertaken for the heritage resource study revealed that the greatest majority of the heritage resources located within Msunduzi consist of architectural resources, in the form of built structures (mostly buildings). These are concentrated within the Pietermaritzburg Central Business District (CBD) and its surrounding suburbs, as well as in the Georgetown area of Edendale.

A significant number of unidentified historical and cultural resources are also present within Msunduzi. These consist of places of worship (churches, mosques and temples), cemeteries, open spaces, areas of political significance and areas of past economic significance, to mention but a few.

A number of archaeological sites were also identified in Msunduzi as part of the heritage resource study. However, as no systematic archaeological survey of the municipal area has been undertaken to date, the extent of the Municipality's archaeological resource base is largely unknown.

6.9.4 Recommendations

The heritage resource study undertaken for the Msunduzi EMF has served to identify and provide an overview of the Municipality's rich cultural, architectural, historical and archaeological resource base. The results of the heritage resource study did, however, also reveal that many important African cultural sites have not yet been formally recognised within Msunduzi. This lack of formally recognised traditional African sites is a serious gap in the available data, and needs to be highlighted as an urgent requirement for any future heritage resource work undertaken.

Based on the findings of the Cultural Heritage specialist study, the following recommendations for future work to be undertaken have been provided.

- An extensive public participation programme should be undertaken to identify sites of cultural and historical significance, particularly sites of traditional African and Indian significance;
- A database of all cultural heritage resources should be developed and be continually updated based on any new reports received or additional resources identified;
- Existing resources such as oral histories and Heritage Impact Assessments submitted as part of the Environmental Impact Assessment process, should be included in the database;
- Archaeological surveys and, if necessary, excavations should be carried out in all areas earmarked for development; and.
- Archaeological studies need to be carried out along the Dorpsruit, Slangspruit and Msunduzi Riverine areas to determine the archaeological significance of these zones.

6.10 Geotechnical Overview

6.10.1 Objectives

The objective of the Geotechnical Overview is to inform the EMF process on the key geotechnical aspects that require consideration when assessing or planning development.

6.10.2 Methodology

Geotechnical conditions can vary over small distances, so the report provides an overview of expected conditions to inform planning and decision making. To address the requirements of the study a summary of the typical geotechnical conditions related to the major landforms and geological conditions encountered within the study area is provided. This was achieved by undertaking a desktop study of literature sources and maps to include the following:

- 5m and 10m contours as available for areas within the municipality;
- 1: 50 000 geological map of Pietermaritzburg and environs;

- 1:50 000 geotechnical map of Pietermaritzburg and Environs (2930CB) and explanation booklet;
- 1: 250 000 geological map;
- 1: 250 000 soil type map;
- 1: 250 000 slope classification map;
- Land Type Survey Staff. 2001. Land types of the map 2930 Durban. Memoirs agric. nat. Resour. S. Afr. No. 17. ARC - Institute for Soil, Climate & Water, Pretoria.
- Land Type Survey Staff. 2001. Land type map 2930 Durban. In Land type map series (1:250 000 scale). ARC - Institute for Soil, Climate & Water, Pretoria.

In addition to the summary of geotechnical conditions, an in-depth study of the geotechnical conditions for the Pietermaritzburg map sheet 2930CB was sourced from the Council for Geoscience (CGS). The mapping evaluates the interrelation between the factors mentioned above. The mapping does not cover the entire study area, but provides a good indication of geotechnical conditions for the CBD and surrounding areas, which are the areas that are subject to much of the development pressure in the municipality.

6.10.3 Results

The predominant lithologies present in the Msunduzi municipal area are comprised of sedimentary rocks of the Ecca Group and Dwyka Formation which form part of the lower Karoo Supergroup. The aforementioned sediments are extensively intruded by Jurassic post-Karoo dolerite sheets, dykes and sills that intermittently outcrop across the entire municipal area. Each major lithological sequence exhibits a distinct set of geotechnical conditions. When combined with general slope characteristics of the area these conditions can be expected to vary greatly within a region of similar underlying geology.

The diversity of the geotechnical conditions in the Msunduzi Municipality brought about by the geology and geomorphology (combined with the hilly areas surrounding the Pietermaritzburg CBD) result in a very complex interplay between slope gradient and potentially unstable transported sediments and soils.

From the information reviewed for this study it is concluded that to accurately identify and set up a database with adequate detail to delineate and rate the severity of all the critical geotechnical factors present within the entire Msunduzi study area would entail extensive field work, ortho-photo interpretation, sampling and analyses.

6.10.4 Recommendations

It is recommended that a detailed geotechnical mapping exercise, similar to that conducted for the Pietermaritzburg map sheet area by the Council for Geoscience, be initiated to obtain the same level of detail for the entire Msunduzi municipal area.

Procurement of the electronic version of the data produced for the Pietermaritzburg map sheet, currently available from the Council for Geoscience, would assist further in the strategic

identification of development areas and would allow for the integration of this data set with the other datasets produced as part of the Msunduzi EMF Status Quo Analysis.

The relevant personnel in the Municipality and the DAEA who are involved in the planning and EIA approval process should have a sound understanding of the potential geotechnical issues in the Municipal area as summarised in this report. This will enable the Municipality to verify that they and/or other parties have investigated and addressed potential geotechnical issues accordingly, before approval is granted or development commences.

6.11 Institutional Framework

6.11.1 Objectives

The purpose of the Institutional Status Quo Assessment is to identify the existing institutions that govern environmental management and decision making in Msunduzi Municipality in order to inform the development of the SEMP as part of Phase 3 of the EMF.

6.11.2 Methodology

The Institutional Framework provides an overview of the institutions that will play a role in the development and implementation of the EMF. This included an overview of applicable legislation and role-players. The Institutional Framework also provides a synthesis of the institutions identified in the other specialist studies undertaken as part of Status Quo Phase of the EMF.

The following sources were used in the production of the Institutional Framework:

- Review of relevant South African legislation;
- DAEA's Environmental toolkit (undated), specifically section 3 Tools – Policy and Legislative Overview;
- The Msunduzi Municipality 2008/2012 Integrated Development Plan (IDP) review;
- Specialist studies undertaken to inform the Status Quo Assessment;
- Internet searches consisting mainly of the department websites; and
- Interviews with the following specialists :
 - The Institute of Natural Resources (Biodiversity, Wetlands, Agriculture and Water Quality);
 - SRK specialist team (Services, Hydrology and Geotechnical);
 - WSP Environmental (Air Quality); and
 - Isibuko Se Africa (Planning).

6.11.3 Results

The aim of the Institutional Framework was not to provide a comprehensive list of environmental legislation but to focus on the legislation and policy most applicable to the development and implementation to the EMF process, namely:

- Republic of South Africa Constitution Act 110 of 1983 (The Constitution);
- National Environmental Management Act, No. 107 of 1998 (NEMA);

- NEMA Environmental Impact Assessment (EIA) Regulations of 2006;
- Environment Conservation Act, No. 73 of 1989 (ECA);
- Local Government Municipal Structures Act 117 of 1998 (Municipal Structures Act);
- Municipal Systems Act 32 of 1998 (Municipal Systems Act); and
- Municipal Planning and Performance Management Regulations (2001)

The Institutional Framework identified three main role players in the development and implementation of the EMF that are portrayed in Figure 1, below.

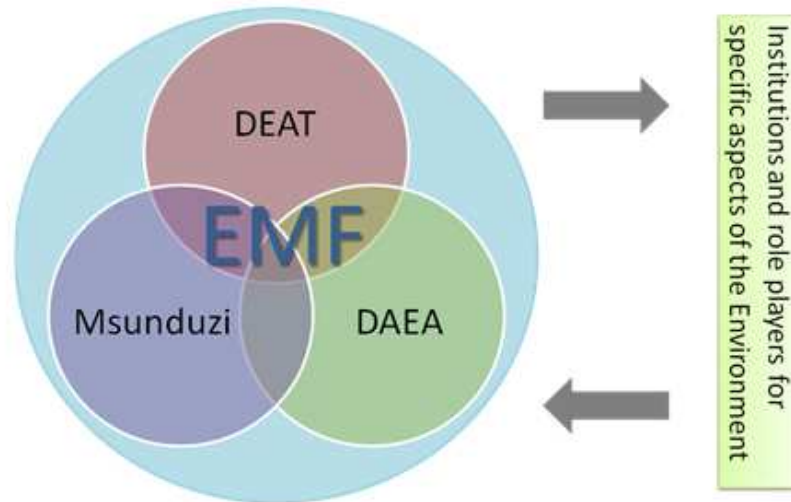


Figure 1: Key role-players in the Msunduzi EMF

For each of these role-players a breakdown of the organisational structure is provided and an indication of how this relates to the EMF.

A synthesis of the institutions identified in the other specialist studies undertaken as part of Status Quo Phase of the EMF is also provided. This included an overview of the following for each aspect of the environment:

- Applicable legislation and policy at the following levels:
 - International;
 - National;
 - Provincial; and
 - Municipal.
- Legal and policy limits;
- Role-players associated with the management of that aspect of the environment.

The role-players identified at a national, provincial and local level are summarised in Table 4 below.

Table 4: Environmental role-players

	National	Provincial	Local	Civil Society
EMF	DEAT	DAEA	Msunduzi	LA 21
Hydrology	DWAF	DWAF DAEA	Msunduzi Enviro Water & sanitation Building inspectorate Disaster management	
Surface Water	DWAF	DWAF DAEA EKZNW	Msunduzi enviro Msunduzi Health	DWAF Msunduzi CMF DUCT
Wetlands	DEAT DWAF Working for Wetlands	DWAF EKZNW DAEA	Msunduzi enviro	Mondi wetland programme DWAF Msunduzi CMF DUCT
Agriculture	DoA	DAEA – Soil conservation DAEA – Land use regulatory DAEA – Natural resources		KwaNalu
Biodiversity	DEAT SANBI	DAEA EKZNW	Msunduzi enviro	
Air Quality	DEAT	DAEA	Msunduzi Health uMgungundlovu DM	PCB: Air quality forum
Service Provision	SANRAL Eskom Telkom Transnet DWAF	DWAF DoT	Msunduzi water & sanitation Msunduzi Roads City engineers etc Umgeni Water uMgungundlovu DM	uMgungundlovu Waste Management Forum
Planning	The presidency DPLG DoH National treasury DLA DWAF	Office of the Premier DTLGA DoH DAEA DoT PPDC	uMgungundlovu DM Msunduzi town planning	IDP Forum
Cultural Heritage	National heritage council	Amafa	Msunduzi town planning Natal Museum	

6.11.4 Recommendations

The Institutional Status Quo analysis demonstrates that there is currently a progressive legal framework to achieve integrated environmental management and to support the development and implementation of the EMF. While there is a growing awareness of environmental issues, weak intergovernmental relations around environmental matters persist. Msunduzi, through their IDP, IEM Policy and LA 21 Forum has demonstrated its commitment to meeting its environmental responsibilities. However, the lack of resources within Msunduzi to fulfil its environmental obligations, is a concern. Capacity and resources at the local level will be critical for the

implementation of the EMF and both the Metro proposal and EMF will provide opportunities to address these constraints.

Implementation of the EMF will require a review of existing decision-making structures to incorporate environmental considerations. This may be achieved by incorporating priority environmental issues in the Municipality's Performance Management System.

The complexity of assessing environmental governance has limited the review of how role-players engage in the EIA and IDP process, or the degree to which environmental considerations are being included in municipal decision making. To cater for this shortcoming a desired state of environmental governance will be developed in the SEA phase of the project. This provides an indication of what the municipality should aim towards.

6.12 Overview of Ecosystem Goods and Services

6.12.1 Objectives

In the development of an EMF thus far, there have been indications of the value of different land-uses and environmental quality standards. The objective of the goods and services valuation study however was to:

- Introduce the concept of ecosystem valuation;
- Explore the possible valuation methods available to Msunduzi;
- Provide an indicative value of goods and services based on existing case studies in other areas; and
- Explain the policy and management implications of ecosystem valuation.

6.12.2 Methodology

The goods and services valuation study provides:

- An overview of what ecosystem goods and services are;
- The main goods and services expected within the Municipality based on the ecosystems identified in the Biodiversity specialist study;
- An indicative valuation of the goods and services based on the Benefit Transfer Method for illustrative purposes; and
- Recommendations for the type of management information that would be required to support future environmental and resource valuations.

6.12.3 Results

The Benefit Transfer Method estimates the value of an ecosystem from existing studies of a roughly similar ecosystem. This method is not ideal as it assumes that the value of similar ecosystems are identical, this is however rarely the case and similar ecosystems can in fact vary greatly in value depending on the extent to which certain values are realised and the valuation techniques employed. The value provided therefore is largely for illustrative purposes. Further, in an attempt to illustrate

the inconsistency that results from using the Benefit Transfer Method, based on different valuation methodologies, two indicative valuations of the ecosystem goods and services within Msunduzi have been provided and are included below in Table 5.

Table 5: Indicative ecosystem valuation (based on studies by Mander, De Wit & De Groot)

Msunduzi Habitat types	Extent available (1)	Estimated value of goods and services (2)	Total value, by extent available	Values based on Ethekewini study (3)	Total value, by extent available
		Lower Bound Estimates		Upper Bound Estimates	
Units	ha	R/ha per annum	R'000s per annum	R/ha per annum	R'000s per annum
Drakensberg Foothill Moist Grassland	612	350	214	2,405	1,471
Dry Ngongoni veld	1449	250	362	2,405	3,485
Eastern Mistbeld forest	1535	250	384	18,458	28,335
Eastern Valley bushveld	2692	250	673	14,613	39,338
KZN Hinterland Thornveld	5563	250	1,391	14,613	81,292
Midlands mistbelt grasslands	6814	350	2,385	2,405	16,388
Moist Ngongoni veld	998	250	250	2,405	2,400
Wetlands	903	26,192	23,651	202,151	182,542
Totals	20,566		29,310		355,251

Notes:

(1) Total remaining untransformed land available in the municipality

(2) Based on value added studies, grassland and conservation farming in particular. The higher range estimates based on Mander's PES study has been used for grasslands, while De Wit's 2006 figure for total value added per ha for all ecosystems in South Africa has been used for the rest. The wetlands figure is based on a 2006 Ramsar study, at a \$ value of 3 274 per ha. While much higher than the other figures, it is smaller than the Ethekewini value by a factor of 10, so is considered to be quite conservative for our purposes. Due to difficulties adapting Ethekewini ecosystems to those found in Msunduzi, only the values for Forest, Wetland, Grassland & dry valley thicket were used

(3) Using the lower range estimates, the total value of ecosystem services available to Msunduzi is in the order of R27 – R29 million per year. The second indicative valuation uses the same area as the first, but multiplies this by the substantially higher values used in a similar study in eThekewini. This results in a valuation estimate of R266 – 355 million per year. Concern is however noted that the latter valuations are not strongly defensible on economic grounds. Further work in the valuation ecosystem goods and services within the Municipality is therefore recommended.

6.12.4 Recommendations

It was recommended that future ecosystem valuation efforts be focussed on developing suitable indicators to allow the relative ranking of proposals, and in improving the understanding of ecosystem goods and services provided within the Msunduzi Municipality as opposed to deriving absolute economic values for ecosystems.

Indicators of expected ecosystem benefits can be used to compare alternative management options and determine the relative benefits of proposed projects. Indicator-based valuation tools may be less expensive and require less time to apply. Indicators of expected benefits are more useful for managing spending to achieve the greatest environmental and economic payoff.

It was recommended that further valuation work should be focused on grasslands and wetlands as these are identified as the most significant habitats within the municipality.

It was recommended that the following information be collected to inform future valuations:

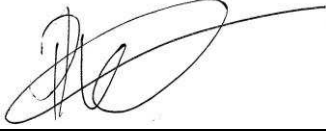
- Investigation regarding the biodiversity value of transformed areas such as such as field crops, utility, and recreational land;
- Review of the effectiveness of the ongoing alien invasive clearing programme;
- Ongoing verification and updating of the Cplan, as transformation takes place;
- Ranking of the habitats according to the biodiversity assessment, and their importance in terms of conservation;
- An indication of the condition of various habitats to include:
 - Condition and use (i.e. grazing) of grassland areas;
 - Functionality assessment of wetland habitats; and
 - Indication of species diversity and abundance.

7 Conclusions and Way Forward

The Status Quo Report provides a baseline description of the conditions within Msunduzi, together with an identification of opportunities and constraints for the aspects of the environment detailed above. It must be noted that in many cases the data on the existing conditions is limited and / or not very well documented. Additional data collection particularly with regard to environmental issues is critical. However, it is proposed that what is available provides a good indication of the status quo conditions within the municipal area. To address the information gaps, the status quo report and the associated specialist studies have identified future information gathering to be undertaken. These recommendations will be expanded upon in the SEMP. Based on the findings in this report, the SEA will be compiled. The SEA will focus on creating a Consolidated Development Constraints Map based on the opportunities and constraints identified during the Status Quo assessment. The SEA will then identify development trends and pressures and use these to identify any potential conflicts or development trends that may be unsustainable due to the receiving environment. The SEA will also provide an indication of the “Draft Desired State of the Environment” based on the existing environmental policy developed by Msunduzi and legal or policy limits as identified above and in the various specialist studies. Finally, the SEA will provide an analysis of how environment and planning should be integrated with a view to how the EMF may be used in the future to inform development planning tools like the SDF and LUMS.

Should you have any queries please do not hesitate to contact the undersigned.

Yours faithfully,



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CONSULTING

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