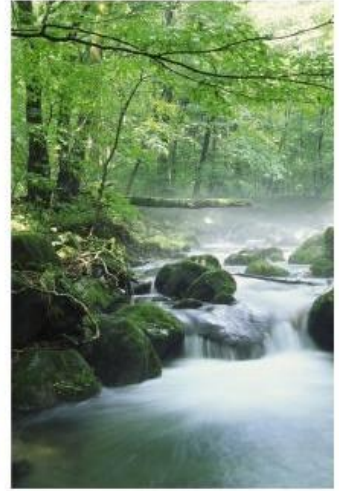




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Final Environmental Management Plan The proposed H39 Pipeline Construction

Prepared

By

Asande Projects cc

For

Rand Water

Date: May 2012

**Environment, Engineering, Water Resources, Ecological Analysis,
Socio-economic Analysis, Economics, Agriculture**

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ABBREVIATIONS

EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ER	Engineers Representative
I&AP	Interested and Affected Parties
SAHRA	South African Heritage Resources Agency

DEFINITIONS

Alien species - Plants and animals which do not arrive naturally in an area - they are brought in by humans. Alien plants often force indigenous species out of the area.

Alternative - A possible course of action, in place of another, that would meet the same purpose and need defined by the development proposal. Alternatives considered in the EIA process can include location and/or routing alternatives, layout alternatives, process and/or design alternatives, scheduling alternatives or input alternatives.

Aspect – Element of an organisation's activities, products or services that can interact with the environment.

Auditing - A systematic, documented, periodic and objective evaluation of how well the environmental management plan is being implemented and is performing with the aim of helping to safeguard the environment by: facilitating management control which would include meeting regulatory requirements. Results of the audit help the organisation to improve its environmental policies and management systems.

Biodiversity - The rich variety of plants and animals that live in their own environment. Fynbos is a good example of rich biodiversity in the Cape.

Built environment - Physical surroundings created by human activity, e.g. buildings, houses, roads, bridges and harbours.

Conservation - Protecting, using and saving resources wisely, especially the biodiversity found in an area.

Contamination - Polluting or making something impure.

Corrective (or remedial) action - Response required to address an environmental problem that is in conflict with the requirements of the EMP. The need for corrective action may be determined through monitoring, audits or management review.

Degradation - The lowering of the quality of the environment through human activities, e.g. river degradation, soil degradation.

Ecology - The scientific study of the relationship between living things (animals, plants and humans) and their environment.

Ecosystem - The relationship and interaction between plants, animals and the non-living environment.

Environment - Our surroundings, including living and non-living elements, e.g. land, soil, plants, animals, air, water and humans. The environment also refers to our social and economic surroundings, and our effect on our surroundings.

Environmental Impact Assessment (EIA) - An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of a proposed development. The EIA includes an evaluation of alternatives; recommendations for appropriate management actions for minimising or avoiding negative impacts and for enhancing positive impacts; as well as proposed monitoring measures.

Environmental policy - Statement of intent and principles in relation to overall environmental performance, providing a framework for the setting of objectives and targets.

Habitat - The physical environment that is home to plants and animals in an area, and where they live, feed and reproduce.

Hazardous waste – Waste, even in small amounts, that can cause damage to plants, animals, their habitat and the well-being of human beings, e.g. waste from factories, detergents, pesticides, hydrocarbons, etc.

Impact - A description of the potential effect or consequence of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Indigenous species - Plants and animals that are naturally found in an area.

Infrastructure - The network of facilities and services that are needed for economic activities, e.g. roads, electricity, water, sewerage.

Integrated Environmental Management (IEM) - A way of managing the environment by including environmental factors in all stages of development. This includes thinking about physical, social, cultural and economic factors and consulting with all the people affected by the proposed developments. Also called "IEM".

Mitigation - Measures designed to avoid, reduce or remedy adverse impacts

Natural environment - Our physical surroundings, including plants and animals, when they are unspoiled by human activities.

Over-utilisation - Over-using resources - this affects their future use and the environment.

Policy - A set of aims, guidelines and procedures to help you make decisions and manage an organisation or structure. Policies are based on people's values and goals. See Integrated Metropolitan Environmental Policy.

Process - Development usually happens through a process - a number of planned steps or stages.

Proponent – Developer. Entity which applies for environmental approval and is ultimately accountable for compliance to conditions stipulated in the Environmental authorisation (EA) and requirements of the EMP.

Recycling - Collecting, cleaning and re-using materials.

Resources - Parts of our natural environment that we use and protect, e.g. land, forests, water, wildlife, and minerals.

Stakeholders - A subgroup of the public whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. The term includes the proponent, authorities and all interested and affected

Sustainable development - Development that is planned to meet the needs of present and future generations, e.g. the need for basic environmental, social and economic services. Sustainable development includes using and maintaining resources responsibly.

Sustainability - Being able to meet the needs of present and future resources.

Waste Management – Classifying, recycling, treatment and disposal of waste generated during construction and decommissioning activities.

Wetlands - An area of land with water mostly at or near the surface, resulting in a waterlogged habitat containing characteristic vegetation species and soil types e.g. vleis, swamps.

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Lochner, P. 2005. Guideline for Environmental Management Plans. CSIR Report No ENV-S-C 2005-053 H. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

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SECTION 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

Rand Water intends to construct the H39 pipeline from the Klipfontein Reservoir to the Brakfontein Reservoir along Modderfontein Road, Dale Road, Hampton Road, Milner Road, Olifantsfontein Road and Olievenhoutbosch Avenue and terminating at the Brakfontein reservoir.

This environmental management plan is developed to minimize negative environmental impacts and to maximize positive ones. All the parties involved in the project will have to put a concerted effort to ensure that the EMP is implemented and pollution to the environment is minimised or prevented.

Issues related to compliance monitoring during construction are also discussed in this EMP. It is also important to note that this EMP will be implemented during the construction of the pipeline and the fact that this is a living document which is subject to regular update and review.

1.2 The purpose and scope of the Environmental Management Plan

The purpose of the Environmental Management Plan is to ensure that all impacts associated with the project are minimised, mitigated and monitored to comply with the provisions of the National Environmental Management Act 107 of 1998. Environmental Management Plan summarises the types of impacts that might occur because of the project and provide solutions on how those impacts can be mitigated and minimised.

Environmental Management Plan (EMP) prescribes and directs the management of all environmental aspects, physical, natural and / or social, associated with the construction of the H39 pipeline. This Environmental Management Plan must be read as a whole and complete document and is numbered accordingly.

1.3 Principles of the Environmental Management Plan

This EMP is compiled using the following concepts and implementation requirements so that the higher principles of sustainable development are realised:

- Continuous improvement. The project proponent (or implementing organisation) must commit to review and to continually improve environmental management, with the objective of improving overall environmental performance.
- Broad level of commitment. A broad level of commitment is required from all levels of management as well as the workforce in order for the development and implementation of this EMP to be successful and effective.
- Flexible and responsive. The implementation of the EMP must respond to new and changing circumstances, i.e. rapid short-term responses to problems or incidents. The EMP is a dynamic “living” document and thus regular planned review and revision of the EMP must be carried out.
- Integration across operations. This EMP must integrate across existing line functions and operational units such as health, safety and environmental departments in a company/project. This is done to change the redundant mindset of seeing environmental management as a single domain unit.
- Legislation. It is understood that any development project during its construction phase is a dynamic activity within a dynamic environment. The Developer, Engineer, Contractor and sub-contractor must therefore be aware that certain activities conducted during construction may require further licensing or environmental approval, e.g. river or stream diversions, bulk fuel storage, waste disposal, etc. The Contractor must consult the ER and ECO on a regular basis in this regard.

1.4 Emphasis of the EMP

This Environmental Management Plan is based on the following important points:

- Avoiding impacts by not performing certain actions.
- Minimizing impacts by limiting aspects of an action.
- Rectifying impacts through rehabilitation, restoration, etc of the affected environment.
- Compensating for impacts by providing substitute resources or environments

- Minimizing impacts by optimizing processes, structural elements and other design features.
- Provide ongoing monitoring and management of environmental impacts of a development and documenting of any digressions /good performances.
- The EMP is a legally binding document that all parties involved in the project must be aware of.

Environmental impacts can arise during construction, operation and decommissioning phases. The impact matrixes summarising the major effects that may potentially occur during the execution of the project are given in the subsequent section of this document. Information on the nature of impacts and their management is included in the document. Minimising the damage of the proposed activity depends on sound environmental practices in a framework of balanced environmental legislation. This document highlights what mitigation plan has been put in place to achieve an acceptable level of environmental performance.

1.5 Role players and responsibility matrix

In order for the EMP to be successfully implemented, all the role players involved in the project need to co-operate. For this to happen, role players must clearly understand their roles and responsibilities in the project, must be professional, form respectful and transparent relationships, and maintain open lines of communication.

Table 1: Functions and Responsibilities of the Project Team

KEY	FUNCTION	RESPONSIBILITY
D	Developer	Proponent ultimately accountable for ensuring compliance to the EMP and conditions contained in the Environmental Authorisation (EA). The ECO must be employed by the developer (full time or part time depending on the size of the project) to objectively monitor implementation of relevant environmental legislation, conditions of Environmental Authorisations (EA"s), and the EMP for the project. The developer is further responsible for providing and giving mandate to enable the ECO to perform responsibilities. The developer must ensure that the ECO is integrated as part of the project team.
CE	Consulting Engineer	Contracted by the developer to design and specify the project engineering aspects. Generally the engineer runs the works contract. The CE may also fulfil the role of Project Manager on the proponent"s behalf (See PM).

KEY	FUNCTION	RESPONSIBILITY
PM	Project Manger	The Project manager has over-all responsibility for managing the project, contractors, and consultants and for ensuring that the environmental management requirements are met. The CE may also act as the PM. All decisions regarding environmental procedures must be approved by the PM. The PM has the authority to stop any construction activity in contravention of the EMP in accordance with an agreed warning procedure.
ER	Engineers Representative	The consulting engineer"s representative on site. Has the power/mandate to issue site instructions and in some instances, variation orders to the contractor, following request by the ECO. The ER oversees site works, liaison with Contractor and ECO.

KEY	FUNCTION	RESPONSIBILITY
ECO	Environmental Control Officer	Rand Water must appoint an ECO to objectively monitor implementation of relevant environmental legislation, conditions of Environmental Authorisations (EA"s), and the EMP for the project. The ECO must be on site prior to any site establishment and must endeavour to form an integral part of the project team. The ECO must be proactive and have access to specialist expertise as and when required, these include botanist"s ecologists etc. Further the ECO must also have access to expertise such as game capture, snake catching, etc. The ECO must conduct audits on compliance to relevant environmental legislation, conditions of EA, and the EMP for the project. The size and sensitivity of the development, based on the EIA, will determine the frequency at which the ECO will be required to conduct audits. (A minimum of a monthly site inspection must be undertaken). The ECO must be the liaison between the relevant authorities and the project team. The ECO must communicate and inform the developer and consulting engineers of any changes to environmental conditions as required by relevant authoritative bodies. The ECO must ensure that the registration and updating of all relevant EMP documentation is carried out. The ECO must be suitably experienced with the relevant environmental management qualifications and preferably competent in construction related methods and practices. The ECO must handle information received from whistle blowers as confidential and must address and report these incidences to the relevant Authority as soon as possible.

KEY	FUNCTION	RESPONSIBILITY
C	Contractor	The principle contractor, hereafter known as the „Contractor“, is responsible for implementation and compliance with the requirements of the EMP and conditions of the EA"s, contract and relevant environmental legislation. The Contractor must ensure that all sub-contractors have a copy of and are fully aware of the content and requirements of this EMP. The contractor is required, where specified, to provide Method Statements setting out in detail how the management actions contained in the EMP will be implemented.
LA	Lead Authority	The authorities are the relevant environmental department that has issued the Environmental Authorisation. The authorities are responsible for ensuring that the monitoring of the EMP and other authorisation documentation is carried out, this will be achieved by reviewing audit reports submitted by the ECO and conducting regular site visits.

KEY	FUNCTION	RESPONSIBILITY
OA	Other Authority	Other authorities are those that may be involved in the approval process of an EMP. Their involvement may include reviewing EMP"s to ensure the accuracy of the information relevant to their specific mandate. Other authorities may be involved in the development, review or implementation of an EMP. For example if a specific development requires a water use licence for the relevant national authority then that authority should review and comment on the content of the particular section pertaining to that mandate.
EAP	Environmental Assessment Practitioner	The definition of an environmental assessment practitioner in section 1 of NEMA is "the individual responsible for the planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management plans or any other appropriate environmental instruments introduced through regulations".

SECTION 2: ENVIRONMENTAL MONITORING DOCUMENTATION

2.1 Enforcement, monitoring and auditing

The ECO appointed by the developer is responsible for regular audits on compliance to relevant environmental legislation and the EMP for the project. Before any construction activities commence, the ECO must compile, an audit checklist based on the contents of this EMP Evidence of the following as **key performance indicators**, must be included in the audit reports where required:

- Complaints received from landowners and actions taken.
- Environmental incidents, such as oil spills, concrete spills, etc. and actions taken (litigation excluded).
- Incidents leading to litigation and legal contraventions.
- Environmental damage that needs rehabilitation measures to be taken.

A copy of all ECO monitoring reports, contractor method statements and pro forma documentation must be kept on site and be made available to the Department.

2.2 Awareness Training

The ECO appointed must be responsible for ensuring everyone on site is given an environmental awareness induction session which not only clearly defines what the environment is and gives specifics detailing the local environment but outlines the requirements of the EMP as a management tool to protect the environment.

Refresher courses must be conducted as and when required. The ECO must ensure daily toolbox talks include alerting the workforce to particular environmental concerns associated with the tasks for that day or the area/habitat in which they are working. Awareness posters and a hand out must be produced to create awareness throughout the site.

2.3 Contractor environmental Method Statements

Method Statements are written submissions to the Engineer by the Contractor, in collaboration with the ECO, in response to a request by the Engineer. The Method Statements set out the plant, materials, labour and method that the contractor proposes using to carry out an activity, identified by the Engineer. The Method Statements contain the appropriate detail such that the ECO and Engineer are able to assess whether the Contractor's proposal is in accordance with the requirements of the EMP. The contractor must sign each Method Statement along with the ECO and Engineer to formalise the approved Method Statement.

All Method Statements including those which may be required as *ad hoc* or emergency construction method statements must be submitted to the Engineer for approval prior to the commencement of the activity. Any changes to the method of works must be reflected by amendments to the original approved Method Statement. Any changes in this regard must be approved by the ECO and Engineer on the understanding that such changes are environmentally acceptable and in line with the requirements of this EMP and other disturbed areas. The method statement for this project is attached in the appendix.

2.4 Site documentation

The following is list of documentation that must be held on site and must be made available to the ECO and/or Approving Authority on request.

- Site daily diary /instruction book/ Incident reports;
- Copies of ECO reports (management and monitoring);
- Environmental Management Plan (EMP);
- Complaints register; and
- Method statements.
- Rehabilitation Plan
- Environmental Authorization

SECTION 3: LEGAL REQUIREMENT

3.1 Applicable legislation

The following is a summary of the applicable environmental legislation for the construction of the proposed H39 pipeline.

APPLICABLE LEGISLATION ALREADY IN EFFECT AT DATE OF THIS EMP
National Legislation
Constitution of South Africa (Act No. 108 Of 1996)
Environment Conservation Act (Act No. 73 Of 1989)
National Environmental Management Act (Act No. 107 Of 1998)
Hazardous Substances Act (Act No. 15 Of 1973)
Occupational Health and Safety Act (Act No. 85 Of 1993)
National Water Act (Act No. 36 Of 1998)
Conservation of Agricultural Resources Act (Act No. 43 Of 1983)
National Veld and Forest Fire Act (Act No. 101 1998)
Health Act (Act No. 63 Of 1977)
National Environmental Management: Biodiversity Act 10 Of 2004
National Forest Act (Act No. 84 Of 1998)
Agricultural Pests Act 36 Of 1983
Water Services Act 108 Of 1997
Mineral and Petroleum Resources Development Act 28 Of 2002
National Environmental Management: Protected Areas Act 57 Of 2003
Fencing Act 31 Of 1963
National Building Regulations and Building Standards Act 103 Of 1977
Disaster Management Act 57 Of 2002

SECTION 4: ENVIRONMENTAL MONITORING GUIDELINES

4.1 Structure of the EMP

The point of departure for this EMP is to ensure a pro-active rather than re-active approach to environmental performance by addressing potential problems before they occur. This will limit corrective measures needed during the construction phase of the project. Therefore, the purpose of an EMP is to provide management measures that must be implemented by Developers, Engineers and Contractors alike to ensure that the potential impacts of a proposed development are minimised. It must also be ensured that the EMP is maintained and upheld as a dynamic document in order for the project team to add or improve on issues that might be considered left out or not relevant to the project. In such instances the approving authority may authorise the ECO to make such changes.

The following tables form the core mitigation measures appropriate to the pre-construction and construction phase. The tables present the objectives to be achieved and the management actions that need to be implemented in order to mitigate the negative impacts and enhance the benefits of the project. Associated responsibilities, criteria/targets and timeframes are clearly specified.

4.2 Preconstruction Phase

This EMP, refers to the period of time leading up to and prior to commencement of construction activities, and is included to ensure pro-active environmental management measures with the goal of identifying avoidable environmental damage at the outset and sustain optimal environmental performance throughout the construction phase. Most impacts will occur during the construction phase and must be mitigated through the contingency plans identified in the pre-construction phase.

The bulk of environmental impacts will have immediate effect during the '**construction**' phase (e.g. noise, dust, and water pollution). If the site is monitored on a continual basis during the construction phase, it is possible to identify these impacts as they occur. These impacts will then

be mitigated through the measures outlined in this section, together with a commitment to sound environmental management from the project team.

The “**construction**” section refers to all construction and its operation-related activities that will occur within the approved area and access roads, until the project is completed. This “construction” section is divided into three functional areas, namely “materials”; “plant”; and “construction”. Each of these functional areas within the EMP contains specific mitigation requirements and requested contractor method statements stipulated where required.

4.3 Construction Phase

All construction activities undertaken on site must aim to limit disturbance, nuisance and interruptions to the lives and daily business of neighbours, local residents and local businesses. Construction and other staff should be courteous and respectful of the people potentially affected by construction activities, and be willing to address any activities that are causing excessive nuisance or inconvenience to any party. The construction phase must be completed in a short time possible. All construction activities must be undertaken with the safety of people and the environment as a first priority. Good housekeeping and a Clean Site Policy should be adopted by all persons involved in construction activities.

4.3.1 Management of construction site

The following principles are applicable for the management of the construction site

- Signs should be put up on the site indicating that no temporary jobs are available, thus limiting opportunistic labourers and crime.
- No firearms allowed on site or in vehicles transporting staff to / from site, (unless used by security personnel).
- All vehicles accessing the project site must adhere to road speed limits.
- Construction / management activities involving use of the service vehicle, machinery, hammering etc, must be limited to the hours between 7:00am and 5:00pm weekdays; 8:00am and 1:30pm on Saturdays; no noisy activities may take place on Sundays.
- A list of emergency contact numbers must be clearly displayed at the Construction site at all times.

- Disturbance to birds, animals and reptiles and their habitats should be prevented at all times.
- The Site Engineer must maintain a complaints register, and any Interested Party must record their comments therein. This must be available for review during audits.
- The ECO, Contractor and Manager of the project must be aware of the Interested and Affected party list. This must be updated with the names of any people who sign the register.
- Activities that may disrupt neighbours (e.g. delivery trucks, excessively noisy activities etc) must be preceded by notice being given to the affected neighbours at least 24 hours in advance.
- Should any items of historical, cultural or archaeological value be uncovered, the facilitator that should be contacted is Precious Vilakazi of Asande Projects at Midrand, telephone no 011-315 6794 and fax on 011-312 3359.
- All areas that have been of vegetation, including all roads, must be dampened periodically to avoid excessive dust.

4.3.2 Worker conduct

All workers in the construction camp are expected to follow these rules:

- Workers must be briefed by the person in charge of managing construction / management activities on what is allowed / not to do on the site during the working times. This must be repeated in weekly toolbox talks. The “No Go areas” will be clearly fenced off and marked and all workers are expected to conform to the rules applicable to such areas.
- No alcohol, drugs, snares, slingshots or animals may be brought onto the site.
- No fires may be made on the site unless under the guidance of the ECO for the purposes of controlled burning of grasslands.
- Workers that are under the influence of alcohol or drugs may not operate any vehicles or machinery.
- Construction workers should be made aware that they are not to make excessive noise (e.g. shouting/hooting).
- The harvesting of firewood, medicinal plants, tree bark, flowers or other natural materials is forbidden on the site and adjacent properties.
- Trespassing on neighbouring properties is forbidden. All workers must be shown the limits of the property and remain within these limits during the course of the working day.

- Workers must be instructed to be polite to neighbours, and be told to whom any interested members of the public may be directed to on site.
- Prior to the commencement of construction, all workers need to know what possible archaeological or historical objects of value may look like, and to notify the site manager if one is found.

4.3.3 Health and Safety

The contractor is responsible for drawing up health and safety plan in terms of the Occupational Health and Safety Act (Act no. 85 of 1993) to ensure safety for all workers. Implementation of safety measures, work procedures and first aid must be implemented. All workers are expected to wear protective gear all the time on site to prevent possible injury and no person should be allowed to enter construction site without the necessary protective gear. A record of all incidents should be kept on site and they should be reported to the project manager.

Adequate signage of hazardous working areas must be provided by the contractor. Emergency numbers should be made visible and these include local police, municipality, Rand Water and the fire department. Adequate training should be provided for all staff handling hazardous material. Bunded areas should be provided for the storage of all hazardous material. Firefighting equipment must be kept on site all the time.

4.3.4 Construction vehicles/equipment

The following principles are applicable for construction vehicles and/or equipment

- Access to the property must be via the approved construction access routings. No other access route may be used onto the property.
- Choice of site for the storage of vehicles / equipment during the construction process must take into account location of local residents and sensitive natural areas on the property.
- Construction vehicles are to be fitted with standard silencers prior to the beginning of construction.
- Equipment that is fitted with noise reduction facilities (e.g. side flaps, silencers etc) must be used as per operating instructions and maintained properly during site operations.

- All vehicles and equipment used on site must be operated by appropriately trained and or licensed individuals in compliance with all safety measures as laid out in the Occupational Health & Safety Act (OHSA).
- Vehicles and machinery are to be kept in good working order and to meet manufacturer's specifications for safety, fuel consumption etc.
- Should excessive emissions be observed, the site manager is to have the equipment seen to as soon as possible.
- No vehicles or equipment may be serviced on the property unless in a properly bunded work zone.
- Vehicle parking/storage areas must be appropriately surfaced such that oil, fuel and other fluid leaks do not pollute soil or water resources.
- Large delivery vehicles/trucks must not be allowed to block the road or cause damage to the road surface.

4.4 Operational & Maintenance Activities

The construction activities for the proposed activity should be sensitive to the surrounding area, and not cause nuisance or safety risks to local residents or businesses in the area. The project should be undertaken in an environmentally sustainable manner, with minimum negative impacts, and maximum positive impacts.

4.4.1 Fencing & security

Security staff employed on site must be aware of police and private security agents operating in the area, and work with these bodies in the prevention of crime in and around the property. The security fencing and lighting used must not result in negative visual impacts. The people in charge of jobs offer must make every attempt to discourage casual seekers of work from targeting the site. Once the staff complement is full, a notice should be placed on the site indicating that no jobs are available on the property. The perimeter fencing must continue to allow the passage of small animals onto and off the property.

4.4.2 Protection of human health

Any spills of fuels, oils, or any other hazardous materials must be attended to immediately. Appropriate hazardous materials clean-up agents must be contracted immediately and the relevant authorities notified of the spill.

4.4.3 Solid waste management

The following principles are applicable for solid waste management

- Solid waste must be collected at a central point. Sorting of the waste into organics, recyclable, hazardous and domestic waste should be undertaken at this point if possible.
- All recyclable materials (glass, paper etc) should be regularly collected by a recycling agent or delivered to a recycling depot.
- All hazardous waste must be collected and disposed of by a hazardous waste contractor.
- A composting site may be identified on the property for disposal of the organic waste with permission from Department of Water Affairs. This area would need to be away from sensitive natural environments, be screened (and fenced) and properly managed to avoid odour & insect nuisance.

4.5 Decommissioning Phase

This section includes principles for the decommissioning phase of the project. The following principles are applicable for the decommissioning phase

- All structures comprising the construction site are to be removed upon completion
- Construction camp should be thoroughly checked for oil spills and other substances and these should be cleaned thoroughly
- Hardened surfaces within the construction camp should be ripped, all foreign material removed and the affected areas should be top-soiled and re-grassed with indigenous plants.
- Cancellation of all temporary services should be organized by the contractor and all areas where these were installed must be rehabilitated to the satisfaction of the ECO.
- All rubble should be removed from site and disposed of at a registered land fill site.
- Watercourses should be cleared of all rubble and spoil material as a result of construction activities.
- Rehabilitation of areas affected by construction should start at the beginning of the rainy

- season recommended rehabilitation is in the form of active revegetation of affected areas, including areas where surface disturbances resulted from construction as well as areas that were used for alternative or other functions , such as storage areas, parking bays etc.
- Areas where topsoil was removed should be landscaped in order to reflect surrounding conditions
 - Rehabilitated areas should be sloped in such a way that erosion is prevented

4.6 Structure and Contents of Tables

The table consists of seven parts as follows:

“Phase of development” - This row will identify either pre-construction (planning) or actual construction phase.

“Impact / issue” - This row will identify the issue being addressed, e.g. Materials, site demarcation, heritage, etc.

Mitigation Measure - This column will include all the necessary mitigation measures for each impact/issue”.

Management objectives - This column will indicate what the management objectives to be achieved for each mitigation measure are.

Measurable targets - This column will indicate what evidence is to be used as an indication to whether or not the „Management objectives” have been implemented and hence achieved.

Frequency of action - These columns provide time guidelines for the „Responsible party” by which he/she is to action or manage the required mitigation.

Phase of development	PRE-CONSTRUCTION
Impact / issue	GENERAL PLANNING

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
Project contract and programme i. The EMP must be included as part of the tender documentation thereby making it part of the enquiry document to make the recommendations and constraints, as set out in this document, enforceable under the general conditions of contract. ii. A copy of this EMP must be available on site. The Contractor must ensure that all the personnel on site, sub-contractors and their team, suppliers, etc. are familiar with and understand the specifications contained in the EMP.	▪ Contingencies for minimising negative impacts anticipated to occur during the construction phase ▪ Ensure environmental awareness and formalise environmental responsibilities and implementation	▪ Contract records ▪ Signed declaration pro forma"s	-	
Appointments and duties of project team i. Before construction activities commence, role players must have a clear indication of to their role in the implementation of this EMP as indicated in 1.2.5 Table 1. ii. Subcontractor(s) contracts with the principle contractor must contain a clause to the effect that the disposal of all construction-generated refuse / waste to an officially approved dumping site is the responsibility of the subcontractor in question and that the subcontractors are bound to the management activities stipulated in this EMP.	▪ Contingencies for minimising negative impacts anticipated to occur during the construction phase	▪ Contract records ▪ Signed declaration pro forma"s	-	

Emergencies, non-compliance and communication i. The contractor must provide method statements on the protocols to be followed, and contingencies to be put in place for the following potential incidents before construction may begin: Contamination of natural water resources from spills; contamination of soils from spills; and fire. ii. Communication in emergencies must follow the suggested lines of communication as stipulated in this document. iii. The contractor understands that failure to adhere to the requirements of the EMP will result in fines to be determined by the ECO over and above the costs incurred for any remediation required as result of the specific non-compliance.	▪ Contingencies for minimising negative impacts anticipated to occur during the construction phase	▪ Method statements	As and when required	
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Phase of development	CONSTRUCTION
Impact / issue	Materials

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
Handling				
Stockpiles i. All stockpiled material must be easily accessible without any environmental damage. ii. All temporarily stockpiled material must be stockpiled in such a way that the spread of materials are minimised. iii. No stockpiles should be placed within the 1:100 flood lines. iv. The contractor must avoid vegetated areas that will not be cleared. v. Storm water runoff from the stockpile sites and other related areas must be directed into the storm water system with the necessary pollution prevention measures such as silt traps and may not run freely into the immediate and surrounding environments.	▪ Minimise scaring of the soil surface and land features ▪ Minimise disturbance and loss of soil ▪ Minimise construction footprint ▪ Minimise sedimentation of nearby drainage lines ▪ Maintain the integrity of	▪ No visible erosion scars once construction is completed ▪ The footprint has not exceeded the agreed site. ▪ Minimal invasive weed growth ▪ No signs of	Daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
vi. Stockpiles are to be stabilized if signs of erosion are visible. vii. Soils from different horizons must be stock piled such that topsoil stockpiles do not get contaminated by sub-soil material. viii. Topsoil stockpiles must be monitored for invasive exotic vegetation growth. Contractors must remediate as and when required in consultation with the ER and ECO. ix. No plant, workforce or any construction related activities may be allowed onto the topsoil stockpiles. x. Topsoil stockpiles must be clearly demarcated as no-go areas. xi. Stock piles must not be higher than 2m to avoid compaction thereby maintaining the soil integrity and chemical composition.	topsoil's for landscaping and rehabilitation ▪ Containment of invasive plant growth ▪ Minimise contamination of storm water run-off	sedimentation and erosion		
Cement i. The contractors must provide and maintain a method statement for "cement and concrete batching". The method statement must provide information on proposed storage, washing & disposal of cement, packaging, tools and plant. ii. The mixing of concrete must only be done at specifically selected sites on mortar boards or similar structures to contain run-off into soils rocky outcrops. iii. Cleaning of cement mixing and handling equipment must be done using proper cleaning trays. iv. All empty containers must be stored in a dedicated area and later removed from the site for appropriate disposal at a licensed facility. v. Any spillage that may occur must be investigated and immediate remedial action must be taken. vi. The visible remains of concrete, either solid, or from washings, must be physically	▪ Minimise the possibility of cement residue entering into the surrounding environment ▪ Minimise pollution of soil, surface and ground water resources	▪ No evidence of contaminated soil on the construction site ▪ No evidence of contaminated water resources ▪ Method statement	Monitored daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
removed immediately and disposed of as waste to a registered landfill site. vii. Cement batching areas must be located in consultation with the ER and the ECO to ensure residues are contained and that the proposed location does not fall within sensitive areas such as drainage lines, storm water channels, etc.				
DANGEROUS AND TOXIC MATERIALS (Provision of storage facilities) i. Materials such as fuel, oil, paint, herbicide and insecticides must be sealed and stored in bermed areas or under lock and key, as appropriate, in well-ventilated areas. ii. Sufficient care must be taken when handling these materials to prevent pollution. Training on the handling of dangerous and toxic materials must be conducted for all staff prior to the commencement of construction. iii. In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs (DWA) must be informed immediately. iv. Storage areas must display the required safety signs depicting “no smoking”, No Naked lights” and “Danger” containers must be clearly marked to indicate contents as well as safety requirements. v. The contractor must supply a method statement for the storage of hazardous materials at tender stage. vi. Material Safety Data Sheets (MSDS) must be prepared for all hazardous substances on site and supplied by the supplier where relevant. MSDS’s must be updated as required.	- Prevention of pollution of soil, surface and ground water resources in the immediate and surrounding environments - Minimise chances of transgression of the acts controlling pollution	- No visible signs of pollution - No litigation due to transgression of pollution control acts	Monitor daily	
Bulk storage of fuels and oils i. The contractors must provide and maintain a method statement for “Diesel tanks and	Prevention of pollution of soil, surface and ground water resources in the	No visible signs of pollution	Once off, as required	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
refuelling procedures". ii. Bulk fuel storage tanks on the site must be on an impervious surface that is bunded and able to contain at least 110% of the volume of the tanks. The filler tap must be inside the bunded area where possible and the bund wall must not have a tap or valve. iii. A Flammable Liquid License must be obtained for diesel volumes greater than 200 litres. iv. Environmental Authorisation is required for volumes greater than 30 000 litres v. Bulk fuel storage tanks must be located in a portion of the construction camp where they do not pose a high risk in terms of water pollution (i.e. they must be located away from water courses). Bulk fuel storage tanks must be placed so that they are out of the way of traffic, so that the risk of the tanks being ruptured or damaged by vehicles is minimised. vi. Bulk fuel storage areas should be covered during the rainy season.	immediate and surrounding environments Minimise chances of transgression of the acts controlling pollution	- No litigation due to transgression of pollution control acts - Method statement		
Use of dangerous and toxic materials i. The contractor must keep the necessary materials and equipment on site to deal with spills/ fire of the materials present should they occur. ii. The contractor must set up a procedure for dealing with spills/ fire, which will include notifying the ECO and the relevant authorities prior to commencing with construction. These procedures must be developed with consultation and approval by the appointed ECO. iii. A record must be kept of all spills and the corrective action taken.	- Prevention of pollution of soil, surface and ground water resources in the immediate and surrounding environments - Minimise chances of transgression of the acts controlling pollution	- No pollution of the environment - No litigation due to transgression of pollution control acts	As required	

Phase of development	CONSTRUCTION
Impact / issue	PLANT

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
Eating areas and camp followers i. The contractors must provide and maintain a method statement for "Crew camps and construction lay down areas". ii. The Contractor must, in conjunction with the ECO, designate restricted eating areas for eating during normal working hours. Adequate closed refuse bins must be provided and cleaned on a daily basis. iii. No fires are to be lit outside of a facility designed to contain fires. The adequacy and positioning of these structures must be determined in consultation with the ECO. iv. The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited. v. Camp followers/informal traders must not be allowed to congregate on pavements or outside the construction site. However, at the contractors discretion facilities can be made available within the designated eating area. vi. Litter (even if originating outside the camp) and concrete bags etc. must be picked up daily and put into suitably closed bins.	▪ Control potential influx of vermin and flies ▪ Neat work place and hygienic environment ▪ Minimise negative social impacts to local residents and businesses	▪ No visual sign of vermin and flies ▪ No complaints from I & AP's	Once off, monitor daily	
Toilets and ablution facilities	▪ Ensure proper sanitation is	▪ Workforce use toilets provided	As and when required	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
i. The contractor is responsible for providing all sanitary arrangements for his and the sub-contractors team. A minimum of one chemical toilet must be provided per 15 persons. ii. Sanitary arrangements must be to the satisfaction of the ECO and the local authority. Toilets must be of the chemical type. The contractor must keep the toilets in a clean, neat and hygienic condition. The contractor must supply toilet paper at all toilets at all times. Toilet paper dispensers must be provided in all toilets. iii. Toilets provided by the contractor must be easily accessible and a maximum of 50m from the works area to ensure they are utilized. All toilets will be located within the contractor's camp. Should toilets be needed elsewhere, their location must first be approved by the ER and the ECO. No toilets should be allowed within the 1:100 flood lines; wetland riparian and other sensitive water course areas. iv. The contractor (who must use reputable toilet-servicing company) must be responsible for the cleaning, maintenance and servicing of the toilets. v. Toilets out on site must be secured to the ground and have a sufficient locking mechanism operational at all times.	achieved which will encourage the workforce to utilise toilets provided and not the surrounding habitat ▪ Minimise potential of diseases on site ▪ Minimise potential to pollute soils, water resources and natural habitats	▪ No complaints received from I & AP"s as well as members of the workforce ▪ No visible or measurable signs pollution of the environment (soils, ground and surface water)		

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
Waste management i. The contractors must provide and maintain a method statement for "solid waste management". The method statement must provide information on proposed licensed facility to be utilised and details of proposed record keeping for auditing purposes. ii. Waste must be separated into recyclable and non-recyclable waste, and must be separated as follows: · Hazardous waste: including (but not limited to) old oil, paint, etc, · General waste: including (but not limited to) construction rubble, · Reusable construction material. · Recyclable waste must preferably be deposited in separate bins. iii. Any illegal dumping of waste must not be tolerated, this action will result in a fine and if required further legal action will be taken. This aspect must be closely monitored and reported on; proof of legal dumping must be able to be produced on request. iv. Bins must be clearly marked for ease of management. v. All refuse bins must have a lid secured so that animals cannot gain access. vi. Sufficient closed containers must be strategically located around the construction site to handle the amount of litter, wastes, rubbish, debris, and builder's wastes generated on	▪ Sustainable management of waste by recycling ▪ To keep the site neat and tidy ▪ Minimise litigation and complaints by I&AP's ▪ Reduce visual impact ▪ Control potential influx of vermin and flies thereby minimising the potential of diseases on site and the surrounding environment ▪ Minimise potential to pollute soils, water resources and natural habitats	▪ Disposal of rubble and refuse in an appropriate manner with no rubble and refuse lying on site ▪ Site is neat and tidy ▪ No complaints from surrounding residents and businesses ▪ Sufficient containers available on site ▪ No visible or measurable signs of pollution of the environment (soils, ground and surface water) ▪ Method statement	Daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
the site. vii. Subcontractor(s) must contain a clause to the effect that the disposal of all construction-generated refuse / waste to an officially approved dumping site is the responsibility of the subcontractor in question and that the subcontractors are bound to the management activities stipulated in this EMP. Proof of this undertaking must be issued to the ECO. viii. All solid and chemical wastes that are generated must be removed and disposed of at a licensed waste disposal site. The contractor is to provide proof of such to the ECO. ix. Chemical containers and packaging brought onto the site must be removed for disposal at a suitable site. x. A skip, with a cover, must be used to contain refuse from campsite bins, rubble and other construction material.				
Dust i. The contractors must provide and maintain a method statement for "dust control". The method statement must provide information on the proposed source of water to be utilised and the details of the licenses acquired for such usage. ii. Potable water must not be used as a means of dust suppression, and alternative measures must be sourced. The construction camp must be watered during dry and windy conditions to control dust fallout. iii. Dust production must be controlled by regular watering of roads and works area, should the need arise. NB: Concrete	▪ Reduce dust fall out ▪ Reduce visual impact ▪ Minimise loss of valuable soil material	▪ No visible signs of dust ▪ No complaints from interested and Affected parties ▪ No incidences reported to ECO ▪ No visible evidence of dust contamination on the surrounding environment ▪ Method statement ▪ Baseline targets not exceeded during regular monitoring of dust counts	Monitored daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
dust is toxic and damages soil properties. Therefore watering to prevent dust spread must not be done where concrete dust has fallen or it will infiltrate into the soil. Concrete bags must not be allowed to blow around the site and spread cement dust. iv. In addition to the standard dust suppression measures and where these measures are not sufficient, main access roads and site camps must be surfaced with a temporary surface such as gravel to assist with dust suppression. v. At the end of construction, the site camp must be decommissioned by removing the temporary surface, ripping the area to loosen the soil and the area must be cleared of all spilled materials e.g. oils, concrete etc and the area must be re-vegetated with locally indigenous vegetation only, according to the landscape development plan for the project. vi. All vehicles transporting material that can be blown off (e.g. soil, rubble etc.) must be covered with a tarpaulin, and speed limits of 20 km/h must be adhered to. vii. Excessive dust conditions must be reported to the ECO. viii. Regular monitoring of dust fallout must be carried out and the records kept on site. Baseline dust measures must be sampled and approved by the ER and ECO prior to the commencement of construction activities.				

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
Noise i. Prior to the commencement of any construction activities, a baseline ambient noise survey must be carried out. Equivalent continuous rating levels must be recorded for day-time (06:00 to 22:00) and night-time (22:00 to 06:00). These records must be kept on site. ii. In terms of noise impact for various increases over the ambient, the National Noise Regulations define an increase of 7dB as “disturbing”. Noise levels during construction must therefore be kept within 7dB of the baseline data. iii. Regular monitoring of noise levels must conducted during construction and the records kept on site. iv. All construction vehicles must be in a good working order to reduce possible noise pollution. v. Work hours during the construction phase must be strictly enforced unless permission is given. Permission must not be granted without consultation with the local residents and businesses by the ECO. vi. Noise reduction is essential and Contractors must endeavour to limit unnecessary noise, especially loud talking, shouting or whistling, radios, sirens or hooters, motor revving, etc. The use of silent compressors is a specific requirement. vii. Noisy activities must take place only during working hours. The ECO must inform the residents of houses and businesses adjacent to the development in writing 24 hours prior to any	▪ Maintain noise levels below “disturbing” as defined in the National Noise Regulations ▪ Minimise the nuisance factor of the development	▪ No complaints from surrounding landowners or I&AP's	As and when required	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
planned activities that will be unusually noisy or any other activities that could reasonably have an impact on the adjacent sites. These activities could include, but are not limited to, blasting, piling, use of pneumatic jack-hammers and compressors, bulk demolitions, etc.				

Phase of development	CONSTRUCTION
Impact / issue	Construction

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
Hydrology i. The ER and or the ECO must assess whether regular water sampling of surface and or ground water resources within the immediate and surrounding environment are necessary. Should this be the case, baseline data from sampling must be obtained relevant to the activity and sensitivity of the area. Regular sampling must then be carried out to determine deviations from the baseline data. ii. Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced; this must be done in consultation with the Resident engineer as well as the ECO. Storm water, wherever possible, should be allowed to soak into the land in the area on which the water fell e.g. retention ponds iii. In the event of pollution caused as a result of construction activities, the contractor, according to section 20 of the National Water Act, 1998 (Act No. 36 of 1998) is be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas.	- Minimise pollution of soil, surface and ground water resources in the immediate and surrounding environments - Minimise impeding the natural flow of water - Minimise the impact on natural water flow dynamics - Minimise scarring of the soil surface and land features - Minimise damage to river and stream embankments	- No visible signs of pollution - No signs of siltation of water courses - No visible erosion scarring once construction is completed - Minimum loss of topsoil - No access roads through river and stream banks	As and when required, monitor daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
iv. The contractor must ensure that excessive quantities of sand, silt and silt-laden water do not enter the storm water system. Design of the storm water drainage system must ensure that the local and surrounding natural systems are not negatively impacted. Appropriate measures, e.g. erection of silt traps, or drainage retention areas to prevent silt and sand entering drainage or watercourses must be taken. These measures must be reviewed and audited by the ECO. v. No wastewater may run freely into any of the surrounding streets or naturally vegetated areas. Runoff containing high sediment loads must not be released into natural or municipal drainage systems or nearby watercourses. If this becomes a problem it is recommended that an attenuation pond be constructed to allow solids to settle prior to runoff leaving the site. vi. Approval must be obtained from DWAF for any activities that require authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998). vii. A relevant specialist must be consulted prior to the demarcation of drainage lines and wetlands. viii. No vehicular access is allowed in permanently wet areas. ix. It must be ensured that all equipment to be used is not the cause irreparable damage to wet areas. The contractor must, where required, use alternative methods of construction in such areas. x. "NO ENTRY" signs must be strategically placed along rivers, streams and other natural or man-made drainage lines which are in close proximity to access routes. xi. No roads are to be cut through river and stream banks as this may lead to erosion causing siltation of streams and downstream dams. Existing drifts and bridges must be used if the landowner gives his consent. Such structures must then be thoroughly examined for strength and durability before they are used.	▪ Minimise erosion of embankments and subsequent siltation of rivers and streams ▪ Minimise damage to riverine habitats	▪ No visible erosion scars on embankments once construction is completed ▪ No erosion or siltation downstream ▪ No deviation from baseline data during regular sampling		
Soil	▪ Minimise scaring of the soil surface and land features	▪ No visible erosion scars once	Daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
i. The contractors must provide and maintain a method statement for “management of topsoil”. ii. Topsoil must be stripped from all areas that are to be utilized during the construction period and where permanent structures and access is required. These areas will include the permanent works, pipeline trenches, stockpiles, access roads, construction camps and laydown areas. Topsoil must be stripped after search and rescue (Fauna and Flora) has been conducted and clearing of woody vegetation and before excavation or construction commences. iii. Topsoil must be deemed to be the top layer of soil containing organic material, nutrients and plant seeds. For this reason it is an extremely valuable resource for the rehabilitation and vegetation of disturbed areas. iv. Ripping must be done to a depth of 250 mm in two directions at right angles. Topsoil must be placed in the same soil zone from which it has been stripped. v. At the beginning of the construction phase, topsoil removed for vegetation clearance must be stripped to a minimum depth of 150 mm and stockpiled on the demarcated topsoil stockpile areas. vi. All topsoil must be removed and stockpiled on the site. vii. However, the use of topsoil for rehabilitation contaminated by the seed of alien vegetation (e.g. blackjacks, etc.) must not be permitted unless a programme to germinate the seed and eradicate the seedlings is drawn up and approved, or some other mitigatory feature is found. This must be approved by the ECO. viii. Single handling is recommended. Stock piles must not be higher than 2m to avoid compaction. ix. Dust suppression is necessary for stockpiles older than a month – with either water or a	▪ Minimise disturbance and loss of soil ▪ Minimise construction footprint ▪ Minimise sedimentation of nearby drainage lines ▪ Maintain the integrity of topsoil's for future landscaping and rehabilitation ▪ Containment of invasive plant growth	construction is completed ▪ The footprint has not exceeded the agreed site in terms of EA etc. ▪ Minimal invasive weed growth ▪ No signs of sedimentation and erosion ▪ Method statement		

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
biodegradable chemical binding agent. x. Backfilling must be undertaken in such a way that the final contours blend with the surrounding environment. xi. Remediated slopes must be graded to preferably 1:2 xii. Slopes can then be capped with topsoil. This requires a minimum layer of 100 mm in most areas. xiii. Disturbed surfaces to be rehabilitated must be ripped and the area must be backfilled with excavated material from the site.				
Access route/haul roads i. The site should be accessed from existing road servitude. The dirt road turning into the identified construction area should be used, to access the construction area. ii. No unauthorised access is permitted. Any authorised clearing for access roads must be done under the supervision of the ECO. iii. Any damaged or degradation will be investigated and fines issued, the affected areas must be immediately rehabilitated. iv. Access roads for earthmoving-equipment must be clearly designated and be positioned as close as possible to the proposed development site. No driving off from the marked roads is permitted and designated parking areas must be identified and demarcated with applicable signage. v. Neither the site nor its access roads must be allowed to be utilised for recreational activities, this includes but is not limited to quad bikes, 4x4"s and dirt bikes. Security personnel must be informed and ensure that this is enforced.	- Minimise loss of topsoil and enhancement of erosion - Minimise fauna and flora displacement by destruction of natural habitats	- No erosion on access roads after completion of construction - No loss of topsoil due to runoff water on access roads	As required, monitor daily	
Workshop equipment, maintenance and storage	Prevent pollution of the	No pollution of the	Monitor daily	

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
i. The contractors must provide and maintain a method statement for “workshop maintenance and cleaning of plant”. ii. All maintenance and washing of vehicles and equipment must take place in the workshop area that is equipped with a bund wall and grease trap oil separator. During servicing of vehicles or equipment, a suitable drip tray must be used to prevent spills onto the soil, especially where emergency repairs are done outside the workshop area. Leaking equipment must be repaired immediately or be removed from site to facilitate repair. All potentially hazardous and non-degradable waste must be collected and removed to a registered waste site. iii. Workshop areas must be monitored for oil and fuel spills and such spills must be cleaned and remediated to the satisfaction of the ECO or ER. Cleaning and remediation must be done with products that are in line with best environmental practice i.e. SUNSORB iv. A method statement is required from the Contractor, tendering for the project to show procedures for dealing with possible emergencies that can occur, such as fire and accidental leaks and spillage. v. The Contractor must be in possession of an emergency spill kit that is complete and available at all times on site. The Contractor must ensure that senior and other relevant members of the workforce are trained in dealing with spills by using emergency spill kits. i. The following must be applied: ▪ All contaminated soil / yard stone shall be removed and disposed of as hazardous waste at a registered facility or placed in containers to be taken to one central point where bio-remediation can be done. A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site. ▪ All spills of hazardous substances must be reported to the ER or ECO.	environment ▪ Minimise chance of transgression of the acts controlling pollution Disposal of hazardous substances in an appropriate manner	environment ▪ No litigation due to transgression of pollution control acts ▪ Method statement		

MITIGATION MEASURE	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS	FREQUENCY OF ACTION	NOTES
The contractor must comply with the regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).				
Cultural and Heritage Resources Artefacts Local museums and the South African Heritage Resources Agency (SAHRA) should be informed if any artefacts are discovered in an affected area. Workers should be aware of procedures to follow in such circumstances. Any discovered artefacts should not be removed and the ECO should be informed so that necessary action can be taken.	proper training to workers on how to deal with artefacts discoveries		Monthly	

SECTION 5: CONCLUSION

5.1. Conclusion

The assessment conducted indicates that the proposed activity would not have adverse impacts on the environment as the proposed construction of the pipe will be done in the road reserve and in an urban area. In order to ensure sustainable development construction of the pipeline should be done responsibly and harm to the environment should be minimised. This EMP will ensure that all impacts that could result from construction are well managed.

Undertaking of Compliance

I/We_____ herby, in terms of National Environmental Management (Act 107 of 1998)
undertake to give effect to every undertaking contained in this document, and accept full responsibility
thereof.

Signed at _____ this _____ day _____ of _____ 2011

Witnesses

Signature of Rand Water Project Manager

APPENDIX

APPENDIX 1: INCIDENT AND EMERGENCY MANAGEMENT

Environmental and Heritage Value Identification

Where an environmental and/or heritage value, is discovered on site that has not previously been identified, protocols to be followed are outlined in this EMP

Incident and Emergency Management and Response

Any environmental incidents and emergencies or non conformances detected shall be notified to the appropriate internal personnel, formally recorded on the Incident Register and where required by regulatory authorities. The procedures to be adopted will be based on the internal procedural documents.

Where a non-conformance is identified, either through audits or general observations, or through reports from the public and/or any agencies, a corrective action request will be developed. The request will clearly:

- Describe the nature of the non-conformance;
- List the criteria against which the non-conformance has been determined;
- Record who identified the non-conformance, when and where; and
- Recommended measures to rectify the non-conformance and ensure it does not happen again.

APPENDIX 2: DECLARATION OF UNDERSTANDING

I, _____

Representing _____

Declare that I have read and understood the contents of the Environmental Management Plan for:

Contract _____

I also declare that I understand my responsibilities in terms of enforcing and implementing the Environmental Specifications for the aforementioned Contract.

Signed: _____

Place: _____

Date: _____

Witness 1: _____

Witness2: _____

APPENDIX 3: INCIDENT AND ENVIRONMENTAL LOG

ENVIRONMENTAL INCIDENT LOG				
Date	Env. Condition	Comments <i>(Include any possible explanations for current condition and possible responsible parties. Include photographs, records etc. if available)</i>	Corrective Action Taken <i>(Give details and attach documentation as far as possible)</i>	Signature

APPENDIX 4: STORM WATER MANAGEMENT PLAN

STORM WATER MANAGEMENT PLAN FOR RAND WATER H39 PIPELINE FROM: KLIPFONTEIN RESERVOIR - BRAKFONTAIN RESERVOIR

The aim is to minimize soil loss from the site due both to wind and water, also to reduce pollution to the receiving environment.

CONTROL OF DAMAGE TO SOIL AND WATER

A4.1 Topsoil

A4.1.1 Topsoil and Subsoil

- Topsoil shall be stripped from the areas where work will be executed prior to the commencement of the site establishment, construction and stockpiled for use in reinstatement and rehabilitation
- Sub-soil to be used for:
 - Roads;
 - Any part of the site where beams are to be constructed from overburden, subsoil and excavated material;
 - Any area upon which structures, buildings and hard standings are to be constructed;
 - Any area which is to be used for temporary storage of materials including topsoil stockpiles;
 - Areas which could be polluted by any aspect of the construction activity; and
 - Areas designated for the dumping of spoil.

A4.1.2 The Contractor shall ensure that subsoil and topsoil are not mixed during stripping, excavation, reinstatement and rehabilitation. Topsoil will be placed on top of the reinstatement area.

A4.1.3 Stripping of topsoil shall be undertaken in such a way as to minimize erosion by wind or water runoff.

A4.1.4 Areas from which topsoil is to be removed shall be cleared of any foreign material and alien plant material which may come to form part of the topsoil during removal including bricks, rubble, any waste material, litter, excess vegetation and other material which could reduce the quality of the topsoil. Any germinating alien species must be removed before seed or sprouting can occur.

A4.1.5 Topsoil shall be stockpiled in areas designated by the Engineer in consultation with the Environmental Officer. Where required the stockpiles shall either be vegetated or covered by a suitable fabric to prevent erosion and invasion by weeds.

A4.1.6 Topsoil shall be stripped from the above areas to a depth not exceeding 300mm from the original ground level unless otherwise specified by the Engineer in consultation with the Environmental Officer, after clearing and grubbing of the area is complete.

A4.1.7 The stockpile of soil will not be higher than 1,5m in height.

A4.2 Dust

A4.2.1 The Contractor shall ensure that a minimum of dust is generated by construction and related activities. Roads and working areas should be maintained regularly and this may include spraying with water. Water used for this purpose shall be used in quantities small enough not to generate run off.

A4.2.2 Dust from spoil dumps and borrow pits shall be controlled by the Contractor as specified.

A4.3 Streams, rivers, wetlands and other water bodies

A4.3.1 Site staff shall not be permitted to use any stream, river, other open water body or natural water source adjacent to or within the designated area for the purposes of bathing, washing of clothing or vehicles nor disposal of any type of waste.

A4.3.2 Streams, rivers, wetlands and other open water bodies or natural water sources adjacent to or within the designated area shall not be used for construction activities such as washing of equipment or disposal of any type of waste.

A4.3.3 The Contractor shall not in any way modify nor damage the banks or bed of streams, rivers, wetlands, other open water bodies and drainage lines adjacent to or within the designated area, unless required as part of the construction project specification.

A4.3.4 Where the modification or disturbance of stream banks or beds, wetlands and water bodies is unavoidable or is required in terms of the contract (e.g. pipeline scour chambers), the disturbance of the water body shall be kept to a minimum, particularly as regards the removal of riparian vegetation and opening up of the stream channel.

A4.3.5 No pollution of water is allowed.

A4.4 Storm water

A4.4.1 At all stages of the contract, storm water control measures as specified by the Engineer shall be applied to keep soil on site by minimizing:

- Erosion of temporary stockpiles of topsoil and permanent spoil dumps;
- Erosion from construction, excavations and borrow pits;
- Silt-laden run off from all areas stripped of vegetation, including excavation surfaces and stockpiles of spoil and topsoil;
- Contaminated run off from storage areas; thereby preventing it from entering water courses.

A4.4.2 At all stages of the contract, erosion of bare soil, other excavation surfaces and stockpiles of topsoil and spoil shall be prevented by the application of erosion control measures as specified by the Engineer.

Should erosion occur due to negligence on the part of the Contractor to apply the above

measures, the Contractor will be responsible for reinstatement of the area to its former state at his own expense. Any surface water pollution occurring as a result of this negligence will be cleaned up by the Contractor or a nominated clean up organization at the expenses of the Contractor.

A4.4.3 Cross and side storm water drainage measures shall be constructed on access and haul roads to the site and roads within the site.

A4.4.4 The Contractor shall ensure that run off from access and haul roads, and that diverted into cross and side drains, does not cause erosion.

Litter traps and oil traps to be kept clean, siltation ponds to be used to slow water down before leaving the site where applicable.

APPENDIX 5: METHOD STATEMENT

INSTALLATION METHOD FOR THE H39 PIPELINE THROUGH THE (WETLANDS, CROSSINGS)

A5.1 Introductory and General Comments

- Under all circumstance, care shall be taken to ensure that construction methods have as little impact as possible on the wetland crossings.
- Care shall be taken to ensure that construction methods do not increase the soil load of the wetland.
- The use of water from the wetland for construction purposes shall not be allowed. The contractor shall be required to make provision for the supply of all water required for construction purposes if needed from the approved water sources.
- Areas not prone to flooding shall be identified for stockpiling of topsoil and excavated material as it was indicated in the master plans submitted to DWA. Soil stockpiling will be separated according to its layers. The stockpile areas shall be protected from being washed away during rainfall events.
- Disturbance in wetlands during construction will be limited as far as possible by minimizing the access of construction vehicles, personnel and equipment to these areas.

A5.2 CROSSING OF WETLAND (BY OPEN TRENCH (ENCASEMENT)

(NB: Each wetland shall be treated independently and the Environmental Control Officer (ECO) on site should monitor all activities taking place in the wetland areas.

Note: Pipe jacking will only take place in the high ways and other high traffic area. There will be no pipe jacking through the wetlands

A5.2.1 Route

In the wetland crossings, the existing route will be used to access the site, if not possible the route shall be selected to minimize the impact on local flora and fauna of the wetland area in general; and where possible, the route shall be positioned in disturbed areas of the wetland.

A5.2.2 Vegetation

The contractor shall not remove any vegetation within the wetlands, other than absolutely necessary along the construction route. Selected indigenous / protected plants shall be pointed out to the contractor for removal and reinstatement by the ECO. These plants shall be carefully removed and nurtured at EMS (Rand Water nursery). After construction these plants shall be reinstated.

A5.2.3 Topsoil / Stockpiling

Topsoil shall be separated from bulk excavation. The excavated material shall be stockpiled and stored in dedicated areas. These areas shall be positioned and protected to prevent the excavated material from contaminating the wetland during storm events.

Stockpiling will be avoided in instances where areas display flows or higher velocity flow to avoid sediment being transported into the wetland.

A5.2.4 Excavation / Backfilling

The method of excavation and backfilling employed will be to:

- Excavate an open trench on the wetland by an excavator (machinery) to a position 3 meters from the delineated boundary of the wetland; the open trench shall have a width of size of pipe plus working space of 600mm (i.e. 2900mm of width) and depth of 1m cover to top of pipe plus size of pipe (1700mm) plus bedding of 300mm plus in water logged areas rock/stone mattress of 300mm.
- The pipe will then be laid within the trench, concrete encased and backfilled. The concrete encasement is to protect the pipe against floating and erosion. The concrete encasement will provide a minimum cover of 300mm on all sides of the pipe.
- The contractor shall backfill the trench in the wetland with the material originally removed from the area. This will be in accordance with the natural soil profile in the wetland.
- Care shall be taken not to permanently affect the natural surface or sub-surface flow (lateral and longitudinal groundwater movement) within the wetland. This will be achieved by reinstating the surface to its original state and by careful selection and compaction of the backfill to ensure consistency with the surrounding soil conditions.
- All unused backfill material will be removed from the wetland for disposal in a registered disposal site and proof of disposal shall be provided to the ECO.

A5.2.5 Clay lenses

The contractor shall identify any clay lenses within the depth of excavation. The contractor shall re-seal any impermeable layer that is breached by construction within either by using clay removed from the trench, or any other appropriate material.

A5.2.6 Protection against floating and erosion

The pipe shall be protected against floating and erosion by encasing it in 15 MPa/19mm class concrete. The encasement shall provide 300mm cover on all sides of the pipe. The pipe will have a minimum cover of 1 metre. The cross section of the pipe trench through a wetland, as well as a cross section through the concrete encased pipeline is shown on the typical wetland crossing detail drawing (i.e. Wetland crossing by trenching (encasement)) attached.

A5.2.7 Cleaning up and reinstatement of the Site

- The contractor shall reinstate the original wetland geometry and topography in both cross-sectional and longitudinal profiles
- The contractor shall remove all foreign items used during construction from the wetland, immediately after construction is completed.
- All areas compacted by construction machines shall be ripped and disked after construction.
- Temporary construction roads in proximity of the wetland shall be completely removed and rehabilitated to the approval of the environmental control officer.
- The contractor shall re vegetate the construction areas
- All waste rock shall be removed from the area and no rocky debris with sharp edges should be left behind.

A5.2.8 General Comments

- The contractor shall not remove any vegetation within the floodplain of the wetland, other than what is absolutely necessary along the route. Selected indigenous / protected plants shall be pointed out to the contractor for removal. These plants shall be carefully removed and nurtured at EMS (Rand Water nursery).
- Topsoil shall be separated from bulk excavation. The topsoil and excavated material shall be stockpiled and stored in dedicated areas outside the floodplain. These areas shall be

positioned and protected to prevent the excavated material from contaminating the wetland during storm events.

- Stockpiling will not be allowed in areas of channeled flows or high flow velocity, to prevent sediment being transported into the wetland.
- All areas compacted by construction machines shall be ripped and reinstated after construction.
- Temporary construction roads in the flood plain shall be completely removed and rehabilitated to the satisfaction of the environmental control officer.
- The contractor shall re-vegetate the construction area.

APPENDIX 6: REHABILITATION PLAN

Flora and Fauna Management and Rehabilitation Plan

A6.1. Introduction and Background

A6.1.1 Introduction

Rand Water proposes the construction of H39 Pipeline within the City of Johannesburg Metropolitan Municipality's ward 110, City of Ekurhuleni and City of Tshwane, the site falls within Gauteng Province.

The study site has the approximate coordinates from the starting point is S26° 04'33.61" E28° 11'15.68", the middle point is S26° 03'37.74" E28° 10'50.81" and the end point of the activity is S26° 03'03.62" E28° 10'33.07", covering three portions of land. Figure 1 show the study area.

A6.1.2 Purpose & Scope

The purpose of this Flora & Fauna Management Plan is to describe the controls and monitoring to be implemented for the management of flora and fauna as part of the continued operations for the proposed H39 Pipeline construction for Rand Water. The Plan forms part of the proposed H39 Pipeline construction for Environmental Management Strategy (EMS).

A6.1.3 Historical Context

The Proposed H39 Pipeline construction has been largely cleared of native vegetation, primarily for agriculture and other land uses, including urban development. Ongoing pressures from economic development have resulted in further threats to natural habitats and increased the need for "biodiversity sensitive" development practices. Similar land use patterns occur in the vicinity of the Proposed H39 pipeline construction, which is surrounded by construction developments and a small portion of agricultural development, with scattered patches of native vegetation.

The current development consent for the proposed H39 pipeline construction permits disturbance of a further small hectares in the surrounding area of the project. In order to compensate for the loss of habitat for threatened fauna associated with this additional disturbance, a comprehensive Biodiversity Strategy will be implemented. Details of the Strategy will be provided.

A6.1.4 Management areas

The purposed H39 pipeline construction can be divided into two management areas:

1. Biodiversity Offset Areas
2. Rehabilitation

More than 24 vegetation communities occur within the proposed H39 pipeline construction of the management areas: Riparian Vegetation, *Elegia* spp, *Streptocarpus* spp, *Urochloa mosambicensis*, *Zanthoxylum* spp.

A6.1.5 Rehabilitation

The contractor is committed to the ongoing rehabilitation of disturbed areas to native vegetation and Fauna to expand on existing local vegetation communities and provide habitat for endangered and threatened fauna known to occur in the area. This is one of the reasons to identify a need to develop specialized rehabilitation techniques if it were to achieve its rehabilitation objectives.

Asande Projects has a great deal of emphasis on the standard of rehabilitation. The primary aim is to pursue a proactive rehabilitation strategy and maximize the amount of rehabilitation that can be undertaken on an annual basis, thereby reducing the impact of the project upon the surrounding landscape. The objective has not been to plant the maximum available area with available seed, rather ensure that the best outcomes practical are achieved with the limited seed available.

The end land use objective for the rehabilitation of the overburden emplacements at the proposed H39 pipeline construction is to create a conservation area comprising fauna and flora that will complement the biodiversity conservation areas being created in surrounding areas.

The contractor will be committed to rehabilitating native vegetations communities to the maximum extent practical. This will be through both replicating local vegetations communities to the extent found to be practical, and through the creation of more open vegetations communities. The latter is restricted to areas being rehabilitated with topsoil from previous lands, which contains competitive species that restrict germination and establishment of many of the vegetations species.

A6.1.6 Regional biodiversity context

In terms of the regional biodiversity context, the proposed H39 pipeline construction is situated in the Gauteng province. This area is characterized by land covered with buffalo grassed, *Felicia* spp, scattered eucalypts, *Angophora Casuarina* and *Allocasuarina* trees with small isolated remnants of natural vegetation and good quality fauna habitat.

The small portion of land is cleared agricultural land, which insignificant. However, the remaining space was identified as a local and regionally significant remnant of natural vegetation and habitat for native flora and fauna. The basis of this assessment was determined by regional vegetation mapping. The dominant vegetation community is Kweek grass.

Furthermore, 5 species of birds, 1 reptile species and some invertebrates have been recorded in the land. A number of these species have been assessed as likely to be significantly impacted by the development, further information relating to the management strategies for flora and fauna species are discussed below.

A6.2. Objectives

The objectives of this Flora and Fauna Management Plan are to:

- re-establish and maintain stable land forms, landscapes and fully functioning ecosystems;
- maintain, and where practicable, enhance the biodiversity, including the genetic of native fauna and flora species to ensure their long term viability;
- maintain and enhance habitat for native fauna to improve the likelihood of their long term survival;
- provide details of, and implement targeted strategies for the conservation and management of threatened species, populations and communities and their habitats;
- Control, and where practicable, eradicate threats to threatened species, populations and communities and their habitats. Specifically, provide details of strategies for the management of fires and weeds for monitoring the impacts
- of these strategies;
- specify and implement monitoring requirements to provide information to assist management of threatened species, populations and communities, their habitats, and ecosystems;

- facilitate the establishment of vegetation, where possible, creating links to areas of remnant vegetation surrounding the project area;
- guide the implementation of the Biodiversity Strategy;
- develop objectives and identify mechanisms for the long term security of biodiversity conservation areas; and
- identify and implement best practice biodiversity conservation and rehabilitation measures.

A6.3. Roles and Responsibilities of the contractors

Specific responsibilities under this Plan are as follows:

- ensure that adequate resources are available to implement the requirements of this Plan.
- co-ordinate the implementation of the Mt Owen Complex flora and fauna monitoring program in accordance with this Plan;
- co-ordinate the implementation of flora and fauna management measures in accordance with this Plan;
- co-ordinate the management of records and reporting of flora and fauna monitoring results;
- co-ordinate training relevant to the Plan;
- ensure appropriate security arrangements, under this Plan, are in place;
- co-ordinate the implementation of the Biodiversity Strategy; and
- co-ordinate periodic reviews of this Plan.
- conduct an annual review on the performance against the requirements of this Plan and the Biodiversity Strategy.

A6.4. Management Strategies

A6.4.1 Land Management

A6.4.1.1 Erosion Control

Erosion and sediment control is critical to the long term stability of the land surface. The primary objective of the Erosion Control Plan is to protect soil resources. This will be achieved through the implementation of the following control measures:

- minimizing the area of disturbance;
- control of noxious plants and fauna; and
- implementing erosion control measures as required.

A6.5. Vegetation clearing

The objectives for land clearing at the proposed area of the project are:

- to clear the minimum area of native vegetation necessary to conduct the approved the proposed H39 pipeline construction;
- to maximise the usage of the products of clearing to improve biodiversity values;
- to minimize impacts on native fauna and flora, particularly threatened species, populations and communities; and
- to preserve the genetic diversity of local populations of native flora and fauna.

These objectives will be achieved through the implementation of the following measures:

- clearing will be staged, and will occur as close as practicable to the proposed H39 pipeline construction area;
- the area to be cleared will be clearly marked;
- habitat trees will be identified and marked prior to clearing;
- prior to clearing, pre-clearing fauna surveys will be conducted and a clearing permit issued;
- cleared vegetation will be preferentially used in projects related to vegetation regeneration and plantings, and the creation or enhancement of native flora and fauna habitat.
- Any remaining material will be mulched for use in rehabilitation;
- recoverable viable seed will be collected prior to clearing;
- where practical, large ground debris and standing dead timber will be collected for redistribution in offset areas and rehabilitation;
- identified habitat trees will only be cleared following the removal of surrounding
- care (prior to the clearing of the tree) and placed into care or re-located, depending on the condition and species of the fauna and flora;
- topsoil will be removed subsequent to clearing and stored rehabilitation
- rehabilitation and planting projects; and
- where practicable, clearing will be timed to avoid the breeding cycles of relevant threatened fauna species.

A6.6. Seed collection

The key objectives of the strategy for seed collection, handling and propagation are to provide a resource to;

- enhance the regeneration of native indigenous vegetation within designated rehabilitation and biodiversity conservation areas;
- facilitate active re-forestation of equivalent land types; and
- facilitate re-vegetation of disturbed areas using native indigenous species as part of site rehabilitation.

The general principles of the seed collection strategy include;

- maximizing the use of seed and propagation material from existing indigenous native
- grasses, herbs, shrubs and trees in order to best maintain genetic diversity.
- co-ordinating forest topsoil removal where possible with open cut operations to ensure minimal handling and storage. It contains an important reserve of indigenous plant seeds and soil microflora.
- Respreading this over reshaped mine spoil areas will maximise the preservation of local genetic material and the re-establishment of a similar range and mix of species to that of the original vegetation.
- supporting seed collection by a quality seed record system. Parent trees in remnants within the surrounding grazing areas are isolated and may have problems of seed viability due to poor cross pollination. Germination records must be established for optimisation of seed collection and propagation.
- requiring a mix of provenance plants on the site areas to determine the most suitable, with establishment through natural selection.

A6.7. Fauna management

A6.7.1 Fauna Impact Assessment

A fauna impact assessment was undertaken as part of the fauna and flora assessment report for the proposed H39 pipeline construction

A6.7.1.1 General Measures

- debris from the construction area including old stumps, branches, logs and litter will be collected and spread throughout the rehabilitation areas, where practicable;
- domestic stock will be permanently excluded from rehabilitation and conservation areas;
- activities that are not essential for management of conservation areas will be prohibited;
- feral animals and weeds will be controlled by means that do not affect non-target species
- Control measures will be undertaken in response to evidence of their presence;
- during clearing of treed areas, where practicable, trunks and limbs containing hollows will be removed for placement in the regeneration/ re-forestation/ wildlife corridor areas;

A6.7.1.2 Reptiles

- reptiles found in the course of activity in the site area will be relocated to the management area if practical;
- employees will be instructed to avoid killing snakes and lizards; and
- suitable ground habitat will be created in rehabilitation and conservation areas.

A6.7.1.3 Birds

It should be noted that different birds have different habitat requirements. Rehabilitation and Re-forestation areas will be rehabilitated to develop a dry sclerophyll forest complex. This habitat will favour certain bird species recorded in the management areas and encourage their use by other as yet unrecorded, dry sclerophyll forest-inhabiting species at the expense of those species whose preferred habitat is woodland or grassland. This is deemed acceptable as these more open habitats are widespread in the surrounding area and throughout the site area.

Within an area of 1,000 hectares or so, there is only likely to be a few such trees suitable for the species. Identification of any suitable habitat trees within the proposed area will be undertaken and their location determined. Where practicable, inspections of suitable hollows will be undertaken to determine whether they are utilized by the species.

General management strategies include the installation of suitably designed nesting boxes to maintain the present population of obligate hollow users throughout the management area (i.e. replace those hollows lost due to the clearing for proposed project).

A6.8. Flora Management

A6.8.1 Vegetation Communities

Six terrestrial vegetation and aquatic flora communities have been recorded in area of the project.

Each of the community areas show relatively high levels of disturbance, with evidence of past grazing activities and other disturbance activities.

The site area is dominated by yellow thatching grass. Variations in canopy over the site have been shown to be influenced by soil type. The area displays minimal evidence of poor vegetation health.

A6.8.2 Aquatic Vegetation

Aquatic vegetation occurs in the project area in the natural wetland. Water Couch (*Paspalum distichum*) and Kikuyu (*Pennisetum clandestinum*) dominate the top banks of natural waterways, while also occurring on eroded bank shelves and the bed of the waterways. Shallow areas of drainage lines are dominated by sedges and rushes, with the weed species *Juncus acutus* is found in high densities in many locations.

A6.9. Management Strategies

A range of management strategies will be implemented to reduce the impact of the proposed H39 pipeline construction on endangered flora. The most significant strategy proposed to mitigate the loss of regionally significant vegetation communities is the formal conservation of land communities through the Biodiversity strategy. Also included is the rehabilitation and remediation of pasture and isolated remnants adjacent to currently vegetated areas which will enhance the long term viability of the site area and the surrounding areas.

- rehabilitation of disturbed areas and the West Dump with endangered species, to Develop vegetation community;
- diversion channels will be planted with endangered riparian, aquatic and semi-aquatic vegetation to provide stabilisation of the system and provide habitat for species dependant on riparian and aquatic ecosystems such as some invertebrates.
- water management structures, including monitoring of pest species populations. The monitoring inspections will assess the following characteristics and will be recorded on a standard recording sheet:

- general health of the aquatic vegetation
- occurrence and abundance of weed and pest species signs of disturbance
- any observable impacts of the disturbance such as the effectiveness of sediment and erosion control structures
- the qualitative habitat attributes of the aquatic vegetation
- the presence of aquatic, amphibian and reptile species utilising the habitat; and
- ongoing monitoring of proposed habitat compensation areas, once established.

A6.10. Implementation

The program will be run over approximately one year and have a primary aim of determining best practice for the restoration of ecosystem. This will:

- require components dealing with the reestablishment of fauna and vegetation strata, competition with weeds and rebuilding of soil processes.
- the timeframe for the establishment of ecosystem in these areas will depend on a number of environmental factors, including rainfall.

A6.11. Flora monitoring program

This research has delineated the vegetation Complex into three main communities:

- Upper Slopes Community;
- Lower Slopes Community; and
- Rehabilitation Community.

The general objectives for this research are:

- to develop an understanding of plant diversity and function as part of ecological processes in the Upper and Lower Slopes Communities and rehabilitation areas; and
- to identify and understand barriers, and seek solutions to problems, in the restoration of vegetation remnants in all communities.

A6.11.1. General flora inspections

The flora monitoring program will also include regular checks of the following aspects:

- revegetation germination rates;
- plant health;

- feral animals and the need for control;
- weed infestation and the need for control;
- requirements for additional planting to be undertaken;
- the need for further fertilisation;
- requirement for application of lime or gypsum to control pH and improve soil structure;
- erosion and the need for repair of eroded areas;
- fire management – the development and implementation of fire regimes designed to maximize seedling germination and their survival until at least reproductive status is reached, and the long term viability of each vegetation association;
- the quality and effectiveness of fencing;
- signs of disturbance, either by animals or humans; and
- the success of any management programs implemented following previous monitoring
- inspections.

Monitoring results will be assessed and utilized in the continual improvement and refinement of rehabilitation techniques. In the event that monitoring reveals unsatisfactory progress the Environmental Officer appointed by the contractor will organize maintenance of the site.

Maintenance shall include, but not be limited to;

- replanting failed and unsatisfactory plantings;
- repairing erosion;
- fire management;
- pest and weed control;
- maintenance and repair of fencing; and
- appropriate and effective stabilisation of all rehabilitated slopes.

A6.11.2 Schedule

The flora monitoring program will be undertaken seasonally.

A6.12 Fauna monitoring

A6.12.1 Objectives

The contractor will appoint an environmental officer to conduct regular fauna monitoring. The primary aim of the monitoring program is to provide information that is useful in ensuring the continued survival and management of the native fauna of the study area. The key objectives of the program are to:

- provide information on species present;
- provide information on the distribution and habitat use of species in the management areas;
- provide information on the success of fauna management and conservation programs; and
- to enable informed decisions about future monitoring and management practices.

A6.12.2 Monitoring program

The contractor will operate a fauna monitoring program for a variety of species including:

- Reptiles;
- Birds.

A6.12.2.1 Reptiles

The aim of the reptile monitoring program is to establish approximate distribution and abundance of species within the different areas enabling the implementation of suitable management strategies.

A6.12.2.2 Birds

The aim of the bird monitoring program is to establish approximate distribution and abundance of species, and their habitat usage, within the different areas enabling implementation of suitable management strategies.

A6.13. Mitigation Measures

- Minimize the loss of flora and fauna in areas that are not directly affected by the new development;
- Reduce the levels of disturbance on the area;

- All the operational phases of the project on the areas should be suitably top soiled and vegetated; and
- Disturbed surfaces to be rehabilitated must be ripped, and the area must be backfilled with topsoil or overburden.
- Provide permeable surfaces to address increased runoff volumes at source and allow infiltration of the runoff and reduce risk of siltation of downstream water bodies.
- Implement an ecologically-sensitive stormwater management plan that includes not allowing stormwater to be discharged directly into the identified riparian zone of the non-perennial river.
- Footprint size should be kept at a minimum so as to maintain natural vegetation cover especially along the riparian zone; only vegetation indigenous to the area should be considered for landscaping purposes.
- Although no red data or protected species were observed on site, should these be observed during construction or operation phases of the mine then specialist advice should be sought to ensure the protection of these species.
- Implement an alien invasive management.

A6.14. Conclusion

Results of this study show that the anticipated effects of the proposed H39 pipeline construction project will not be highly significant if the suggested mitigation measures assigned are to be implemented and environmental monitoring programmes are established in view to comply with the Conservation of Agricultural Resources Act, 43 of 1983.

In addition, the current investigation in the area showed that the current land was already disturbed by past activities, which has resulted in emigration of many fauna species.

A6.15. Recommendations

- A long term monitoring programme should be established focusing on the bird populations in general. Consideration needs to be given to any offsite development and loss of feeding habitats for birds outside the proposed site.
- Mitigation measures discussed above will be implemented to ensure the continued ecological functioning of the habitats utilised by fauna in the area.

- Adopt a rehabilitation process at the end of the proposed project to ensure suitable potential land capability and land use.
- For the protection of some biodiversity not identified during site visit and data collection, this is the reason for developing and subsequently managing a system of linked natural vegetation corridors around the site should be adequate. These vegetations corridor would probably provide sufficient habitat for the rest of species observed in the area.