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ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

THE PROPOSED DEVELOPMENT OF VARIOUS PORTIONS OF THE FARM ROOIKOPPIES 297-JQ

PROPOSED MARIKANA EXTENSION

RUSTENBURG LOCAL MUNICIPALITY

Prepared for Homes 2000 (Pty) Limited

September 2020

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PROPOSED MARIKANA EXTENSION

RUSTENBURG LOCAL MUNICIPALITY

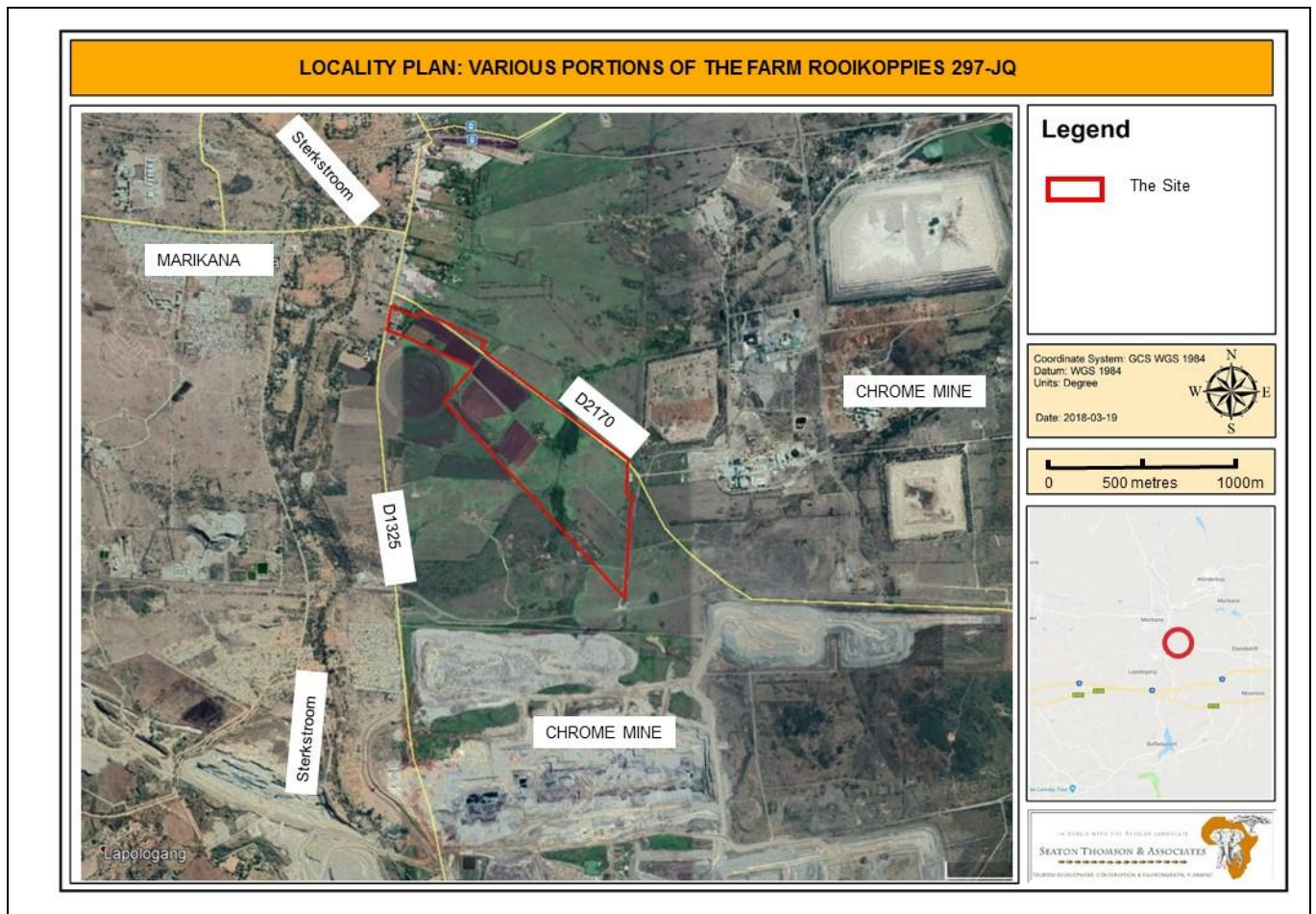
1. INTRODUCTION

The Environmental Management Plan (EMP) Report provides guidelines and directions to ensure that the proposed development is able to pursue its economic goals without impairing the long-term sustainability of the biophysical and cultural environment. The EMP addresses the managerial and operational activities of the development during and after construction. Once approved by the authority, compliance is obligatory for developers, contractors, municipality, service providers and property owners.

2. ACTIVITIES COVERED BY THE EMP/ DESCRIPTION OF ACTIVITY

The site comprises of 16 Portions of the Farm Rooikoppies 297-JQ, ie RE/16, 57, 58, RE/194, RE/195, 198, 199, 200, 201, 202, 203, 204, 205, 206 and 207, located in the Rustenburg Local Municipal area of the North West Province. These Portions measure a total of approximately 116 hectares, which are located to the east and south east of the village of Marikana, west and north of the Tharisa Chrome Mine. The site is within the Local Municipal area of Rustenburg, Bojanala District.

The approximate centre of the site is 25°42'41"S and 27°29'57"E



It is intended to develop the site for predominantly residential areas, to provide homes and accommodation, targeted at various income levels with a mix of diverse housing types and densities. Integrated with the residential components, will be the provision of associated community facilities and amenities, which would include mixed and diverse community centres, churches, educational and other institutional facilities, business opportunities for local shopping and retail, parks and open spaces. The envisaged residential uses would be primarily for the low and middle income levels of the community with a mix of diverse affordable housing types and densities.

The project will include the provision of all bulk and internal services and infrastructure, including roads, water, sewerage, power and stormwater management. A sewerage treatment plant will need to be provided to manage sewage effluent and a water reservoir to store potable water.

Several package treatment technologies exist for the treatment of domestic wastewater in SA and the most common types installed in is an activated sludge/extended aeration plant. In most cases, these systems consist of a septic tank, followed by an aerated tank, a clarifier and a disinfection tank. Microorganisms are suspended in the sludge by means of aeration and mixing. Activated sludge systems can be continuously or intermittently fed or operated as a fill and draw system. An suitable engineered system will be installed that meets authority standards and requirements.

3. OWNER / DEVELOPER OF SITE/ MUNICIPALITY

HOMES 2000 (PTY) LTD

The developer is ultimately responsible for:

- Commissioning the preparation, implementation and monitoring of the EMPr.
- Ensuring that the EMPr is submitted for approval with the Environmental Impact Assessment and that approval in the form of a Environmental Authorization is given before development begins.
- Appointing the Environmental Control Officer (ECO).
- Ensuring compliance by all parties and the imposition of penalties for non-compliance through the ECO.
- Appointment of an Internal Environmental Officer (IEO)
- Bearing the costs of development and implementation.
- Implementing corrective action where required
- After the development has been completed and individual buyers take ownership, the above responsibilities devolve to the property owners association or other appropriate organisation.

4. ENVIRONMENTAL CONSULTANT

SEATON ENVIRONMENTAL CC

The consultant is responsible for:

- Preparing the EMP.
- Facilitating its submission to the Authority for an Environmental Authorization.
- The consultant is *not* responsible for the implementation or the monitoring of the EMPr unless expressly commissioned to do so.

Seaton Thomson and Associates have more than 30 years' experience in town, regional and environmental planning. This includes environmental impact assessment and environmental management. The Company has undertaken numerous EIA and BA applications for authorisation under both the Environment Conservation Act (Act 73 of 1989) and the National Environmental Management Act (NEMA)(as amended) (Act 107 of 1998) in all Provinces in South Africa, including diverse land use development applications, various types of bulk and service infrastructure, filling stations and game lodges in conservation areas.

5. AUTHORITY

NORTH WEST PROVINCIAL DEPARTMENT OF DEPARTMENT OF ECONOMIC DEVELOPMENT, ENVIRONMENT, CONSERVATION AND TOURISM (DECECT)

The Authority is responsible for:

- Appraising the EMPr in the light of the Environmental Impact Assessment Report findings and other relevant information.
- Calling for modifications, extensions or further information if required.
- Issuing an Environmental Authorization on the Environmental Impact Report, which includes approval (or otherwise) of the EMPr

6. ENVIRONMENTAL CONTROL OFFICER (ECO)

TO BE APPOINTED

The ECO is appointed by the developer and is responsible for:

- Implementing all aspects of the EMP.
- Monitoring and verifying compliance with the EMPr by contractors, sub-contractors, agents, property owners and any other parties concerned with the development.
- Being fully familiar with relevant legislation and regulations.
- Providing guidance and assistance to all participants in implementing and complying with the EMP.
- Keeping a permanent, written and photographic record of activities, instances of non-compliance.
- Implementing corrective action with regard to the EMPr and imposing appropriate penalties for non-compliance as authorised by the owner/developer.

7. CONTRACTORS AND SERVICE PROVIDERS

All contractors, sub-contractors and service providers are responsible for:

- Incorporating the EMPr into their contracts and signing agreements to comply with its conditions.
- Submitting an obligatory Methods Statement for approval by the ECO before any work is undertaken.
- Adhering to any instructions issued by the ECO.

8. PROPERTY OWNERS ASSOCIATION OR SIMILAR BODY

Once ownership of the development falls to the buyers of properties, responsibility for implementing all aspects of the EMPr must be incorporated into the constitution of the property owners associations, body corporates, managing agencies etc...

LEGEND

- PROJECT BOUNDARY - 1:16,1 HA
- MAJOR ROADS, ROAD NETWORK, ROAD BYWAYS, GRAVEL A & B
- PROPOSED ACCESS POINTS
- WETLAND, SPARAMA WOODLANDS & BUFFER ZONES
- ROCKY MOSAIC
- DISTURBED ROCKY MOSAIC
- GRASS
- RAILWAY, RDS
- SETBACKLINE AREA - ISLAND-DATED AREA
- FUTURE DEVELOPMENT AREA

DEVELOPMENT PROPOSAL

- R D P UNITS - 200 m²
- BONDED UNITS - 280 m² - 300m²
- MIXED USES
- STREET 20 M
- STREET 16 M
- STREET 10 M
- PARKS
- BUSINESS
- COMMUNITY FACILITY

DEVELOPMENT POTENTIAL

R D P UNITS
 FREEHOLD EYEN: 15,8 Ha @ 200 m² - 400 EYEN
 HIGH DENSITY UNITS: 5,49 Ha @ 80 UNITS / HA - 293 UNITS
TOTAL POTENTIAL - 975 UNITS

BONDED UNITS
 FREEHOLD EYEN: 35,45 Ha @ 280 m² - 300 EYEN
 HIGH DENSITY UNITS: 4,70 Ha @ 80 UNITS / HA - 380 UNITS
TOTAL POTENTIAL - 1260 UNITS
TOTAL POTENTIAL - 2235 UNITS

REHABILITATED AREA - FUTURE AREA

R D P UNITS
 FREEHOLD EYEN: 5,27 Ha @ 200 m² - 300 EYEN
TOTAL POTENTIAL - 300 UNITS

BONDED UNITS
 FREEHOLD EYEN: 2,566 Ha @ 300 m² - 300 EYEN - 70 EYEN
 HIGH DENSITY UNITS: 2,44 Ha @ 80 UNITS / HA - 210 UNITS
TOTAL POTENTIAL - 380 UNITS
TOTAL POTENTIAL - 680 UNITS
GRAND TOTAL POTENTIAL - 2775 UNITS

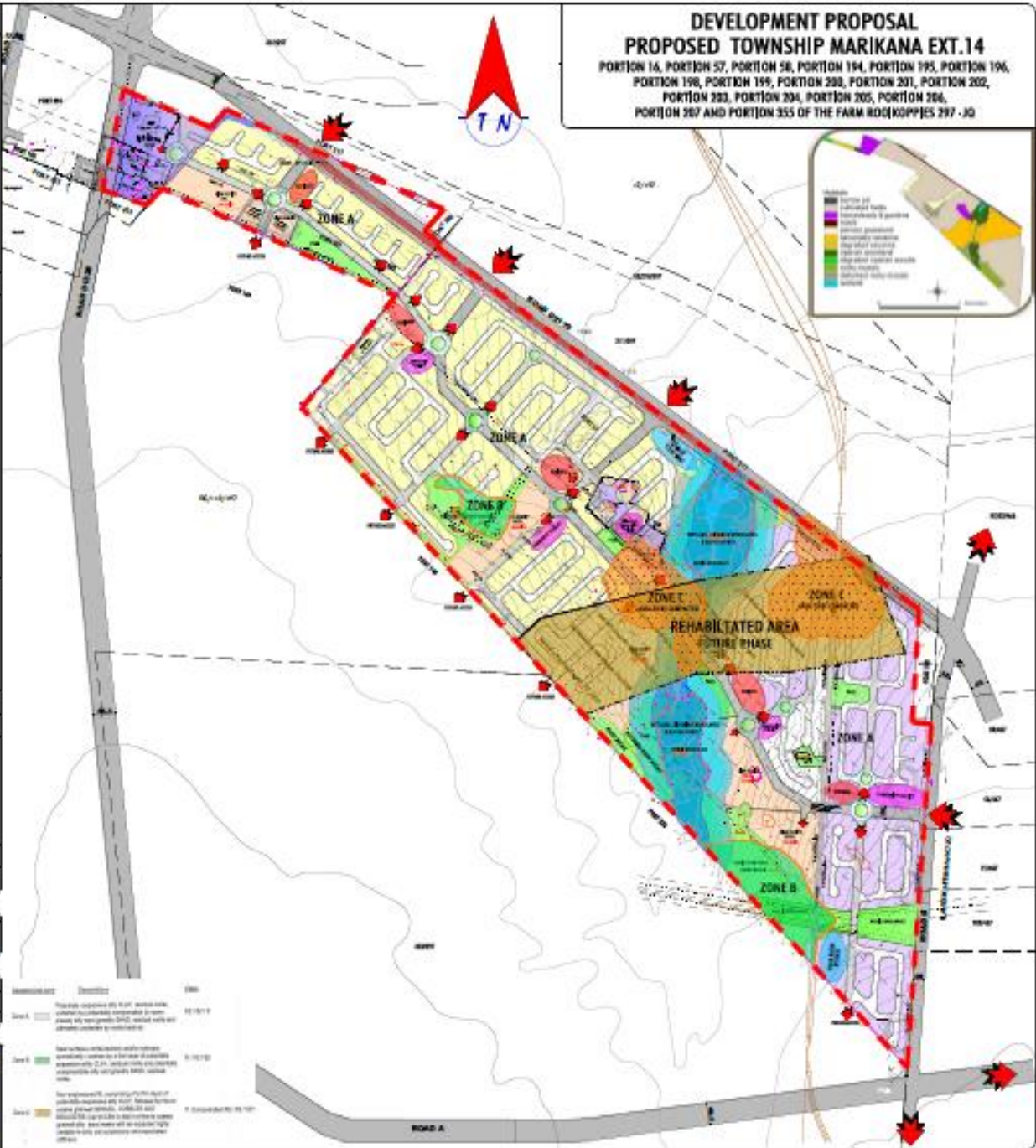
CLIENT

HOMES 2000 WICZ

DESIGN	HT	APPROVED	SCALE	DATE	DATE
DESIGN	CAT	DATE	NO. 200	DATE	DATE

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9. LEGISLATION AND POLICY

Management of the development during both the construction and the operational stages is subject to a suite of environmental law. Compliance with this legislation is an integral aspect of the EMP. Examples of the some of the relevant legislation:

National Environmental Management Act 107 of 1998 (as amended)
National Heritage Resources Act (Act No. 25 Of 1999)
National Environmental Management: Biodiversity Act (Act 10 of 2004)
National Environmental Management: Protected Areas Act (Act 57 of 2003)
Conservation of Agricultural Resources Act (Act 43 of 1983)
National Water Act 36 of 1998
Atmospheric Pollution Prevention Act 45 of 1965
Local Government Municipal Structures Act 117 of 1998
Hazardous Substances Act 85 of 1993
Fire Services Act 99 of 1956
Occupational Health and Safety Act 85 of 1993
Environmental Planning Act (Act No. 88 of 1967)
Forest and Veld Conservation Act (Act No. 13 of 1941)
Land Survey Act (Act No. 9 of 1921)
Minerals and Petroleum Resources Development Act (Act No. 28 Of 2002)
Soil Conservation Act (Act No. 76 of 1969)
Water Services Act (Act 108 of 1997)
Relevant building codes (e.g. SABS 089)
Provincial and Local Government Ordinances and Bylaws
Land Use Planning Policies
Provincial Environmental Management Framework

10. EMPR UPDATE

This EMPr must be updated upon:

- receipt of an Environmental Authorization (EA), and/or
- issues of any relevant environmental permit, licence, or authorisation with respect to the project

11. PLANNING, DESIGN AND PRE-CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
All planning and design aspects of the development	None	<p>Planning and design of all elements of the development to be in accordance with acceptable and approved standards as required by the relevant authorities and as stipulated in this EMP.</p> <p>Planning and design to take cognisance of localised conditions and circumstances, particularly in terms of any sensitive areas on the site, control of building operations, appropriate approved and registered contractors, access to the site, source of labour and transportation.</p>	Project planning team	Throughout planning phases, before construction commences
Contractual Issues	None	<p>All appointed contractors will be contractually bound to these conditions as well as the provisions of this EMP.</p> <p>The appointed contractors will undertake an induction process with all staff and workers on site and issue a written schedule of rules and work conditions specific to the site.</p>	Project planning team and developer as well as contractor	As required
Site Establishment and site infrastructure	Vegetation and soil disturbance	<p>The contractor and/ or developer must provide for the following:</p> <ul style="list-style-type: none"> • The construction site camp and plant laydown-yard is to be fenced off. • The construction site camp must be located where there is least impact to neighbours. • Adequate ablution facilities for all construction personal are to be provided. Abluting anywhere other than in the toilets provided is strictly forbidden. • Eating areas must be safe from animals, to avoid pests on the site and should encourage animals towards the construction camp. • Provide clean drinking water to all construction staff • Provide refuse bins and waste skips in the construction site office area as well as on the construction site • All roads and accesses to the site must be maintained. Vehicles may not leave the designated roads, tracks and/or turnaround points at any time 	Project planning team and developer as well as contractor	Before actual construction commences on the site

11. PLANNING, DESIGN AND PRE-CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> Provision, upgrading and installation of bulk services, especially water and sewerage, to be planned and implemented in accordance with recommendations contained in the specialist engineering report. The watercourse and buffer area to be avoided, except where infrastructure or services are authorised. 		
Demarcation of the Sites	Vegetation and soil disturbance, visual and noise	<ul style="list-style-type: none"> The Contractors shall demarcate the boundaries of the actual construction areas on the site in order to restrict their construction activities to the areas that are necessary for the installation of infrastructure Fence off and screen (using shade cloth) the all sides of the development site with 2.4m high fencing and shade cloth, alternatively construct the boundary wall at the commencement of the construction before any internal construction is started. Sandbags must be placed at the base of the down slope boundary fence to reduce stormwater flow off the construction site The watercourse and buffer area to be avoided, except where infrastructure or services are authorised. 	Contractor and developer	Before commencement of construction
Topsoil conservation	Loss of topsoil	<ul style="list-style-type: none"> Any topsoil which is to be stripped for the installation of services or for the construction on site must be stockpiled for use during rehabilitation and landscaping of the road verges, parking areas and general garden and landscaped areas within the development Sand bags are to be placed at the base of all topsoil stockpiles as soon as the topsoil is stockpiled, in order to limit erosion and washing away of the soil during any rain storms. No topsoil is to be stockpiled outside of the actual demarcated site area 	Contractor	Before construction
Movement of Construction Personnel and	Disturbance to traffic and	<ul style="list-style-type: none"> Movement of all construction personnel to and from the construction sites must be strictly controlled and monitored. No unauthorized movement of personnel is permitted. 	Contractor	Daily

11. PLANNING, DESIGN AND PRE-CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Equipment on and off site	residential areas area site	<ul style="list-style-type: none"> Construction personnel are only to move onto site and off site by means of official construction related vehicles and at the official entrance to the property The watercourse and buffer area to be avoided, except where activities are authorised. 		
Erosion Control	Loss of soils due to erosion	<ul style="list-style-type: none"> The Contractors shall take all reasonable measures to ensure that erosion does not occur as a result of any construction related activities. Measures such as cut off trenches, sand bags, hay-bales and berms must be installed in areas where erosion has or is predicted to take place. This must be done in conjunction with ECO and managed accordingly Soil is to be stockpiled around the sides of the site and on the higher ground so that it does not wash away off the site during heavy storms 	Contractors and ECO	As required
Legal compliance	Non-compliance	All relevant legislation must be adhered to before construction commences. The environmental authorisation as well as any licences or permits must be in place before construction commences, and any recommendations contained in these permits, licences and/or authorizations must be incorporated into the project design.	Project Manager and contractor	As required

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Monitoring and reporting	Compliance with the EMP and Environmental Authorisation.	<ul style="list-style-type: none"> Monitor site activities and compliance with EMP. Identify, propose, monitor and sign off on the implementation of rectification measures 	ECO/ developer	Monitor daily. Full report back monthly.

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Environmental Incidents	Environmental incidents during the construction phase	<ul style="list-style-type: none"> Should any environmental incidents occur which are likely to have detrimental effects on the environment, this should be reported to the appropriate authorities. A record of these incidents must be kept. 	Contractor and ECO	As required
Traffic	Degradation to access roads to the site	<ul style="list-style-type: none"> Schedule all construction related deliveries between certain times of the day, preferably NOT before 9am or after 3pm. Trucks and delivery vehicles must strictly obey speed limits on all residential roads within the area so as to not cause additional noise or dust from driving at high speed in the vicinity of the site Any damage to roads caused as a direct result of the construction vehicles must be fixed immediately. 	Contractor	Daily
Maintenance of vehicles and equipment	Oil, diesel, petrol leaks	<ul style="list-style-type: none"> Regularly check vehicles, machinery and equipment operating on site to ensure that none have leaks or cause spills of oil, diesel, grease or hydraulic fluid. No vehicles, machinery or equipment with leaks or causing spills may be allowed to operate on the construction site. These must be sent to the maintenance yard or workshop for repair, or must be removed from site. 	Contractor	Daily
Cultural, Historical and Archaeological Features	Loss of any potential Cultural, Historic and Archaeological Features	<ul style="list-style-type: none"> If any additional graves are discovered during construction processes, apart from those already known of, a qualified grave relocation specialist must be contracted to relocate the graves, if required. As the graveyard is to be retained, it must be protected. It is also recommended that the graves in the site be recorded in detail and a Graves Register be drafted and the site fenced-in properly Any process of grave relocation must be done in accordance with any traditional laws and ceremonies, and the family members of the deceased must be involved with the process from the outset. 	Contractor, ECO and project Manager/ Developer Grave relocation specialist – if necessary SAHRA	As required

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> Any additional archaeological sites exposed during construction must not be disturbed during or after the construction period prior to authorisation from SAHRA. The removal, exhuming, destruction, altering or any other disturbance of heritage sites must be authorised by SAHRA in terms of the National Heritage Resources Act (No 25 of 1999) Should any unusual features, artefacts, graves etc... be discovered on the site, during excavation and construction, apart from those discussed above, this must be brought to the immediate attention of the Contractor / Project Manager/ and ECO 		
Noise	Nuisance from excessive noise associated with construction	<ul style="list-style-type: none"> Keep any residents/ workers in the area surrounding the site informed of unusually noisy activities (i.e. blasting, but this is not likely). Noise suppression measures can be applied to all equipment. Equipment must be kept in good working order, and where appropriate fitted with silencers which are to be kept in good working order. The project contractor and developer must agree to specified work times during the week, to limit any noise disturbance. Fence off and screen (using shade cloth) the all sides of the development site with 2.4m high fencing and shade cloth, alternatively construct the boundary wall at the commencement of the construction before any internal construction is started. This fencing off and screening (or boundary wall) will assist to shield noise to neighbouring properties. 	Contractor and ECO	As required
Soil and geological conditions	Changes to Soil Structure as a Result of Disturbance Loss of topsoil due to erosion.	<ul style="list-style-type: none"> All geological and structural engineering standards must be adhered to in accordance with the terms, conditions and requirements of both the Geotechnical Soil Report, as well as NHBRC and Regulations pertaining to the construction industry, as well as the requirements for temporary fuel tanks at contractor laydown yards. 	Contractor, project engineer, site engineering geologist	Check daily

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> • Soil stripping should be limited to areas within the sites that the contractors and developers require for services or structures, so as to limit soil disturbance (as well as unnecessary removal of all vegetation). • All good topsoil exposed will be stockpiled for use in rehabilitation and landscaping. Stockpiles must be on already disturbed areas • All cement or mortar mixing shall be done in already impacted areas, and on trays or sealed areas (e.g. brick bunded areas), to prevent soil contamination • Measures such as cut off trenches, sand bags, haybales and berms must be installed in areas where erosion has or is predicted to take place. This must be done in conjunction with the ECO • All conclusions and recommendations contained in any further onsite Engineering Geological Investigations, as well as all of the final recommendations made must be adhered to before any construction is to commence on the site • The geotechnical conditions for the implementing of Phase 2 on the rehabilitated open cast mined area, should be further investigated prior to any construction taking place 		
Ground water pollution	Decrease in groundwater quality and quantity	<ul style="list-style-type: none"> • All cement or mortar mixing shall be done in already impacted areas around existing homesteads, and on trays or sealed areas, to prevent any water pollution. All excess cement must be disposed of at a registered landfill site. • Any hazardous substances (i.e. diesel or oil) that are spilled must be contained and removed immediately. • All hazardous storage vessels must be designed and managed in order to prevent pollution. All vessels to be bunded. • The main contractor will be responsible for ensuring that used oils/lubricants are not disposed of on or near the site, and that contractors purchasing these materials understand the liability under which they must operate. 	ECO and Contractor	Daily

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Surface water pollution	Decrease in surface water quality and/ or quantity	<ul style="list-style-type: none"> • The entire work site must be managed in order to prevent pollution of downstream drainage areas, due to suspended solids, silt or chemical pollutants that may enter to stormwater system. • All cement or mortar mixing shall be done in already impacted areas, and on trays or sealed areas, to prevent any water pollution. All excess cement must be disposed of off site, at a registered land fill site that accepts discard cement. • Measures such as cut off trenches, sand bags, haybales and berms must be installed in areas where erosion has or is predicted to take place. This must be done in conjunction with the ECO • Stormwater management must comply with the Local Authority stormwater bylaws and aim to minimise the generation of surface runoff with the adoption of, as far as possible, the principles of WSUDS and SUDS practises • The plan must control peak discharge, volume runoff, runoff frequency and water quality. • No water will be drawn from surface water for use by the development (during either construction or operation phases) • A number of source, local and regional SuDS controls are proposed for this particular development: <u>Source controls</u>: Rainwater harvesting; stone filled soakaways, Permeable brick paving for internal roads; Grass block pavers for all parking areas. <u>Local controls</u>: Bio-swales, grass-lined channels, stone filled infiltration ditches. <u>Regional controls</u>: detention pond 	Contractor and ECO	Daily
Dust, air and noise pollution	Air pollution due to dust, odours or fire and impact from neighbouring activities	<ul style="list-style-type: none"> • The Contractors will dampen exposed soil surfaces on the site, as well as the adjoining road access, with a water bowser or sprinklers, as necessary to minimise dust problems. • The Contractors will commence rehabilitation of exposed soil surfaces as soon as practical after completion of construction to limit any dust 	Contractor – ECO to monitor strictly	Daily

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> • Cooking will only be permitted at a designated area and the establishment of open fires will be strictly prohibited 		
Security	Crime	<ul style="list-style-type: none"> • The relevant policing and security forces that are responsible for the area must be approached and become involved in the monitoring of activities on the site during construction. • During construction, the developer is responsible for controlling access to the site and guards the site to reduce crime. • Construction personnel will only be allowed to live on the site under very controlled circumstances, in the demarcated construction camp area • There is to be 24 hour security at the construction camp/ laydown yard to control all access to this area • Fence off and screen (using shade cloth) the entire site, along the roads and all property boundaries using a 2.4m high fence and shade cloth, alternatively construct the boundary wall at the commencement of the construction before any internal construction is started. This fencing off and screening will assist to shield noise, as well as to keep construction personnel on the site at all times. 	Contractor and developer	Daily
Waste management	Littering, contaminated water runoff, hazardous spills	<ul style="list-style-type: none"> • All waste streams (general, solid, liquid, hazardous etc...) must be disposed of adequately by the contractor/ developer. • Provide general waste bins (and Waste skips) throughout the construction site camp and enforce the use of these by all construction personnel. Litter bins must be equipped with a closing mechanism to prevent their contents from blowing out or being overturned • Immediately clean any accidental oil or fuel spills or leakages, and clean up and dispose of all general or non-hazardous construction related waste immediately. • A dedicated waste contractor must be appointed to oversee the entire waste management process during construction 	Contractor – ECO to inspect Waste management consultant	Daily

12. CONSTRUCTION PHASE				
Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> At source recycling and waste sorting must be undertaken on at the contractors laydown site camp. 		
Visual	Negative visual impact of construction activities	<ul style="list-style-type: none"> The visual nature of the site will completely change, mostly due to vacant land now becoming developed. An aesthetically pleasing boundary wall should be built to shield the development from the surrounding sites and properties, or a ClearVu fence should be erected. Fence off and screen (using shade cloth) the entire site, along the roads and all property boundaries using a 2.4m high fence and shade cloth, alternatively construct the boundary wall at the commencement of the construction. This fencing off and screening will assist to shield noise to neighbouring properties and against passers-by, as well as to keep construction personnel on the site at all times 	Contractor	Daily
Fire	Destruction of properties surrounding site	<ul style="list-style-type: none"> The Contractor and developer shall take all the necessary precautions to ensure that fires are not started as a result of activities on site No open fires for heating or cooking shall be permitted anywhere but the designated site next to the site office/construction camp. Closed fires or stoves shall only be permitted at agreed designated safe sites at the site office. All firefighting equipment is to be onsite at all times Any fire started intentionally or unintentionally from the site during construction will be the responsibility of the contractors and site developers 	Contractor, ECO monitor	Daily
Watercourse and stormwater management	Direct impacts of development close to the wetland edge, as well as stormwater runoff	<ul style="list-style-type: none"> The early installation of stormwater attenuation facilities and stormwater water pipes during construction, will alleviate the potential for runoff and erosion on site and into the watercourse. The Contractors shall take all reasonable measures to ensure that erosion does not occur as a result of any construction related activities. Measures such as cut off trenches, sand 	Contractor, ECO monitor	Daily

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<p>bags, haybales and berms must be installed in areas where erosion has or is predicted to take place. This must be done in conjunction with ECO and managed accordingly</p> <ul style="list-style-type: none"> • A 30 meter buffer from the edge of the delineated wetland should be enforced on the site • The edge of the 30m buffer must be fenced off in some manner to prevent vehicles and structures entering the buffer and riparian area. • The Sustainable Stormwater Management principles must be implemented on the site to ensure that stormwater runoff from the development seeps into the ground and is not left as sheet flow runoff from hard surfaces and into the wetland and buffer area. • Specific attention must be given to the watercourse on the site to ensure that there is no erosion or sedimentation of the system as a result of the earthworks in close proximity to the buffer of floodline edge results. Sandbags and haybales are to be used along the buffer and floodline edge during construction to limit sediment load possibly entering the system • A number of source and local SuDS controls are proposed for this particular development and must be implemented, including but not limited to <u>Source controls</u>: Rainwater harvesting; stone filled soakaways, Permeable brick paving for internal roads; Grass block pavers for all parking areas. <u>Local controls</u>: Bio-swales, grass-lined channels, stone filled infiltration ditches. <u>Regional controls</u>: detention pon • 		
Vegetation (flora)	Reduction of biodiversity/ loss of flora as a result of the development	<ul style="list-style-type: none"> • The site has little remaining natural vegetation, which is not ecologically sustainable due to size and lack of connectivity and, therefore, not considered ecologically significant. • However, the sensitive areas identified are to be retained to serve as natural open areas within the development. 	Contractor and ECO	Monitor continuously

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> Landscaping within the development should be all indigenous and large trees should be planted as soon as construction of roads and services is complete. 		
Wildlife (fauna)	Disturbance to natural wildlife and/or loss of natural wildlife	<ul style="list-style-type: none"> No animals will be allowed to be trapped or killed during the construction phase of the development. Ensure that the Work Site is kept clean, tidy and free of rubbish that would attract animals. 	Contractor and ECO	Monitor continuously
Stormwater management	Increased runoff from the site	<ul style="list-style-type: none"> The Sustainable Stormwater Management principles and the engineering Stormwater Management Plan must, as far as possible, be implemented on the site A number of source, local and regional SuDS controls are proposed for this particular development: Source controls: Rainwater harvesting; stone filled soakaways, Permeable brick paving for internal roads; Grass block pavers for all parking areas. Local controls: Bio-swale. Regional controls: detention pond The Contractors shall take all reasonable measures to ensure that erosion does not occur as a result of any construction related activities. Measures such as cut off trenches, sand bags, haybales and berms must be installed in areas where erosion has or is predicted to take place. This must be done in conjunction with ECO and managed accordingly Soil is to be stockpiled around the sides of the site and on the higher ground so that it does not wash away off the site during heavy storms Ongoing management and maintenance of the stormwater facilities must be undertaken to prevent blockages, flooding, etc Stormwater management must comply with the Local Authority stormwater bylaws and aim to minimise the generation of surface runoff with the adoption of, as far as possible, the principles of WSUDS and SUDS practises 	Contractors and ECO	Monitor continuously

12. CONSTRUCTION PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Plant collection	Unnecessary damage to Flora/ loss of valuable flora for the purposes of plant collection	<ul style="list-style-type: none"> No plant collecting for medicinal or other purposes to occur on the site or on the neighbouring sites or open areas 	Contractor and ECO	Daily
Alien invasive plants and weeds	Emergence of Invasive Weeds to the Detriment of Indigenous Plants	<ul style="list-style-type: none"> All invasive weeds and exotic plants on the site are to be identified and removed during the construction phase of the project. <p>According to the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared aliens that occur on the property must be effectively controlled. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories:</p> <ul style="list-style-type: none"> <u>Category 1</u>: Prohibited and must be controlled. <u>Category 2</u>: (commercially used plants – i.e. the Eucalyptus trees): <u>May be grown in demarcated areas</u> provided that there is a permit and that steps are taken to prevent their spread. <u>Category 3</u>: (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within flood lines of watercourses and wetlands 	Contractor and ECO	Daily
Socio-economic (positive)	Economic investment by the applicant in infrastructure as well as job creation	<ul style="list-style-type: none"> Jobs will be created during the construction phase of the development – for formal skilled jobs and informal jobs. <p>Additional actions to enhance the positive socio-economic impact are as follows:</p> <ul style="list-style-type: none"> Utilise Local Market - The labour force should largely be recruited from the local communities, where ever possible, including skilled and semi-skilled positions. The Contractors must indicate that recruitment will take place through formal procurement procedures, which will be implemented in conjunction with the local community. 	Contractor and developer	Continuous

12. CONSTRUCTION PHASE				
Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> • Training and Education - In order to facilitate training and education, it is recommended that the contractors, where possible, recruits its Employees from previously disadvantaged groups and from low income areas, and not only will they fill certain posts, but for those posts that they are inexperienced in, a mentorship process should be initiated. • Labour intensive construction methods - Where appropriate, labour intensive construction methods should be utilised to maximize the potential number of employment opportunities whilst mitigating impact on site of machinery 		

13. POST-CONSTRUCTION REHABILITATION PHASE				
Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Site clean-up		Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services, fixtures, waste and any other temporary construction works.	Contractor and developer. ECO and landscape architect	Once off after construction
Rehabilitation and landscape development plan		<ul style="list-style-type: none"> • The principle of progressive reinstatement must be followed wherever possible. This includes the reinstatement of disturbed areas on an ongoing basis, immediately after the specified construction activities for that area are concluded • All topsoil removed for any reason during construction must be used for landscaping or to rehabilitate any areas scarred by construction works, that will form a part of landscaping plans • Indigenous grass and shrubs should be planted in areas which are devoid of vegetation and within the landscaped gardens • Landscaping of gardens and all areas must be undertaken by qualified landscapers, and only indigenous trees, grasses and 	Contractor, developer and ECO.	Directly after construction, until such time as the ECO is satisfied with the rehabilitation

		other plants are to be used for landscaping purposes, and must be water-wise.		
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14. OPERATIONAL PHASE				
Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Legal requirements	Non-compliance	<ul style="list-style-type: none"> The EMP may need to be updated on a periodic basis to ensure that environmental legal requirements for the operational phase are adhered to. An on-site safety plan must be available and all staff must be trained in the appropriate emergency procedures. The conditions of this EMP must be implemented strictly by the Management and landscape maintenance team 	Contractor and developer/ management committees	Continuous
Services and Infrastructure	Inadequate maintenance will cause pollution	<ul style="list-style-type: none"> Ensure that the provision of all services (water and sewer) is in accordance with Council requirements and accommodates the needs of the site That any amendments, upgrading or changes to the infrastructure are approved by the relevant Councils and as contained in the specialist engineering report on water and sewerage Ongoing monitoring and maintenance of the sewer treatment plant, to ensure discharge meets required standards and is effectively recycled for irrigation purposes on open spaces and gardens and that there are no leakages or breakages that spill into the watercourse Regular water monitoring testing to be done to ensure water quality standards are met. 		
Vegetation and landscaping management	Loss of vegetation, positive reintroduction of indigenous vegetation	<p>Landscaping should be environmentally sensitive and should meet the following requirements:</p> <ul style="list-style-type: none"> Landscaping within the riparian zone and protective buffer should comprise of species indigenous to this habitat Limited irrigation through water-wise gardening (use local plants adapted to local conditions). 	management committees	Continuous

14. OPERATIONAL PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
		<ul style="list-style-type: none"> • Rainwater harvesting should be undertaken and used for garden watering • Strict fertiliser, pesticide and herbicide control (limited usage of biological friendly products). • Reduction of weeds and erosion control by minimum tillage gardening practices (use of groundcovers and mulching). • Strictly monitor for emergence of any exotic/invasive plants within the development, on the outside fringes of the development and along all road – particularly during early spring and summer. • Remove all exotic and invasive plants in the area (as required), as well as within the road reserves. • Re-vegetate/ plant area with indigenous plants where necessary. • Hydroseed any open areas devoid of vegetation. <p>Refer Appendix 1: Eradication Guidelines and Appendix 2: General Rehabilitation Guidelines</p>		
Waste Management		<ul style="list-style-type: none"> • All waste will be disposed of by the municipality, as agreed by the service agreements and bulk service contributions. • General waste generated by the development will be disposed of at a registered landfill site as agreed by the municipality • All general waste will be disposed of by the municipality, as agreed by the service agreements and bulk service contributions by the developer. General waste generated by the development will be disposed of at a registered landfill site as agreed by the municipality • General waste must be sorted on site into the various waste types and recycled accordingly 	management committees	Continuous
Air Quality	Implications of mining activities on health of residents	<ul style="list-style-type: none"> • A climate control system with a filter as part of the building design should be considered • Barriers of trees along the east and south boundaries of the proposed residential development to be planted. Higher trees can act as porous bodies which influence local dispersion of pollution and aid the deposition and removal of airborne pollutants 		

14. OPERATIONAL PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Geology and soils	Erosion	<ul style="list-style-type: none"> • Implement Sustainable Stormwater Management Plan on the site • Permeable paving and grass block pavers should be used for all car parking areas and access roads on the premises. • Roof water may not cascade off the apron directly into soil. • Entire development to be landscaped to ensure that storm water is channelled away from structures and thus foundations. • The area of the rehabilitated open casing mining activities will require further geotechnical investigation to determine the suitability for various land use activities and what is required to adequately stabilise the land for such land use activities 	management committees	Continuous
Stormwater management	Erosion and stormwater management	<ul style="list-style-type: none"> • The Sustainable Stormwater Management principles and the engineering Stormwater Management Plan must be implemented on the site • A number of source, local and regional SuDS controls are proposed for this particular development: Source controls: Rainwater harvesting; stone filled soakaways, Permeable brick paving for internal roads; Grass block pavers for all parking areas. Local controls: Bio-swale. Regional controls: detention pond • The detention pond as prescribed by the engineers must be implemented to control stormwater. • Ongoing management and maintenance of the stormwater facilities must be undertaken to prevent blockages, flooding, etc • Stormwater management must comply with the Local Authority stormwater bylaws and aim to minimise the generation of surface runoff with the adoption of, as far as possible, the principles of WSUDS and SUDS practices, as set out above 	Management committees / appointed landscape contractor	Continuous
Security	Crime	<ul style="list-style-type: none"> • The relevant policing and security forces that are responsible for the area must be approached and become involved in the monitoring of the area, access control and general security. 	management committees	Continuous

14. OPERATIONAL PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Socio-economic (positive)	Economic investment by applicant and economic investment into the area.	<ul style="list-style-type: none"> Jobs will be created during the construction and operation phase of the development – for formal skilled jobs and informal jobs The “operation” of the development will need cleaning and domestic workers, landscapers, etc... This will also provide for longer term jobs to semi-skilled workers. 	management committees	Continuous

15. DECOMMISSIONING PHASE

Aspect/ activity	Impacts	Management and mitigation	Responsibility	Frequency
Permanent closure and decommissioning	N/A	This activity will not be decommissioned. This project has an extended lifespan period, and it is determined that decommissioning of the project will never happen. Due to this, no possible mitigation can at this stage be tabled, due to many environmental changes that will take place over time, which will subsequently render any mitigation discussed, void.	N/A	N/A

16. EAP DETAILS AND ABBREVIATED CURRICULUM VITAE

Judy Johnston		Brian Gardner	
Qualification:	B Sc (Town & Regional Planning) (Wits University) 1978	Qualification:	BTech Env Sci (Environmental Science) Tshwane University of Technology 2008, <i>cum laude</i> . NDip Env Sci (Environmental Science) Tshwane University of Technology 2006
Professional Specialisation:	Integrated environmental management policies and frameworks, environmental impacts assessments in terms of the NEMA legislation, environmental feasibility studies	Professional Specialisation:	Environmental Impact Assessment, Water Use Licencing, NEMA legislation, environmental feasibility studies, urban and rural environmental restoration and rehabilitation, GIS mapping, Sustainable stormwater design, ECO
Company:	Member: Seaton Environmental CC	Professional registration:	Registered Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). Registration number: 114006
Membership:	Environmental Assessment Practitioners Association of South Africa (EAPASA) Number 2019/849	Company:	Seaton Environmental CC
PROFESSIONAL BACKGROUND:	Judy Johnston is a registered Town and Regional Planner with in excess of 30 years' experience. She has a wide experience in all aspects of land use planning in urban and rural environments and has specialised experience with the management of environmental impact assessments in terms of the environmental legislation. Judy's experience also includes a diversity of Environmental impact assessments for proposed low cost and affordable housing projects, industrial, residential and mixed used townships, electrical substations & powerlines, residential golf course estates, tourism facilities etc...	Membership:	South African Wetland Society. IAIAAsa.
		PROFESSIONAL BACKGROUND:	Brian Gardner has 8 years of environmental management and impact assessment experience in South Africa. Primary responsibilities include the preparation of (including field surveys) and final submission of Basic Assessment Reports and Environmental Impact Assessment reports to the various Provincial Department's and the National Department of Environmental Affairs (DEA). Other tasks include analysing specialist reports for addition into EIA reports, on amongst others fauna, flora and archaeological. Other primary tasks included the preparing Environmental Management Plans, attending and managing Interested and affected parties (I&AP) public meetings and dealing with the public and clients on all matters related to environmental projects. Roles and responsibilities at Seaton include the compilation of Water Use Licence Applications (WULAs) for the submission to the Department of Water Affairs.

17. APPENDIX 1:– ERADICATION GUIDELINES

The control of alien invasive vegetation is important in order to prevent problems associated with the proliferation of these plants. Generally they tend to be problematic due to their high levels of proliferation and their tendency to take over a site. Invasions of alien vegetation causes:

- **A decline in species diversity:** Many alien plants are capable of creating a monospecific stand over large areas.
- **Changes in fauna in the area:** indigenous birds, insects and other animals are not adapted to feed on or nest in alien plants and consequently leave the area.
- Local and even total extinction of indigenous species.
- **Ecological imbalance:** Increased risk of catastrophic events like flooding due to excessive overgrowth of vegetation.
- **Increased fire hazard:** Many alien plants are flammable and may enhance runaway fires by increasing the fuel load. This creates hotter fires which can also sterilise the soil and kill deep growing roots. This can lead to ongoing problems with erosion.
- **Prevention of access:** Dense stands of aliens can form impenetrable barriers. Preventing access to streams, wetlands, emergency access points, entrances or exits.
- **Reduction in conservation value:** Monotonous stands of tall alien trees can obscure views of the scenery and natural species-rich vegetation.
- **Soil erosion and consequent siltation of dams and rivers:** Alien trees such as *Sesbania spp.* and Wattles are easily ripped out during floods, exposing bare soil. These can cause more damage if floods occur.
- **Depletion of water resource:** invasive plants usually use more water than the plants they replace. Gums and wattles that occur in catchment areas are often implicated in the drying up of rivers and lowering the water table.
- **Changing the natural soil composition:** These soil turn to sandy, nitrogen poor soils and vegetation cannot survive under changed conditions.

Alien (exotic) invasive plant species do occur within the wetland area. They grow and flourish where they do not belong. Alien plant infestations progressively invade the natural vegetation of their 'adopted' habitat, taking over from the indigenous plant species and often preventing their regeneration. Problems caused by alien invasive plant species include loss of biodiversity, the loss of topsoil and habitat deterioration. Invasive alien plants can completely alter the functioning of ecosystems.

Alien invasive plants may be trees, shrubs, creepers, grasses, herbs or even water plants and are called 'invaders' to draw attention to their ability to spread aggressively and cause rapid and often irreversible changes in the landscape.

Alien plant invaders must not be confused with indigenous plants that become invasive. Local plants can become invasive as a result of habitat disturbances such as **over-frequent fires**. These local invaders, however, do not have the capacity to invade undisturbed vegetation, as is the case with invasive alien plants.

One of the reasons why many alien plants are such successful invaders is that they produce large amounts of long-lived seed. Many species have seeds that can remain dormant for as long as 50 years or more in the soil under the canopy of the parent plant. This means that when the dominant parent plant is removed, the large and highly viable soil-stored seed base will quickly develop into a dense infestation, consisting of hundreds of plants on a site formerly occupied by a single mature tree. This is especially pertinent to Black Wattle (*Acacia mearnsii*).

Note:

The long term maintenance for the area must cover the following:

1. Eradication Plan – removal of all exotic trees / grass and weeds
 - a. **Roundup™** is an effective herbicide to use on large areas of Kikuyu
 - b. **Garlon / Diesel** is effective against small trees and shrubs when painted onto the stem from ground to 30-45cm above.
2. Cutting of thick Khakibos, blackjacks, Pom-pom weeds, *Datura spp*, other annual plants which are growing in dense thickets. Regular cutting will allow for indigenous grasses to grow through but do not brush cut the entire open space area monthly or too regularly. Long grass is required for Owls, Snakes and other predators.
3. A fire program (burn the open area every 3 or 4 years) is necessary for the open space and wetland area to thrive as certain grass and plant species require heat and fire to seed and germinate. The open space must be burnt every few years to allow for new germination of plants, burn off the build-up of dead material and reduce the risk of big wild fires occurring.

Objectives for Alien Vegetation Control

The aim, in the short and medium term, for the **complete eradication** of alien plants is **unrealistic**. The objective should rather be to prevent the further spread of invasive alien plants into un-infested areas and to isolate the dense infestations within a landscape that is otherwise maintained free of alien plants:

- Establishing realistic goals for controlling alien plants on the site especially around a wetland area.
- Sparse infestations or occasional plants are the real threat because they can mature, reproduce and increase in number, eventually becoming dense enough to have a negative impact on the natural vegetation.
- A practical objective for any area infested with alien plants is therefore to control or clear the plants starting with the least infested areas and working through the various degrees of infestation, starting with light and ending with dense.

A Strategy for Control of Alien Vegetation

Many attempts to control invasive alien plants are not successful or yield disappointing and discouraging results. The reasons for this are varied but generally include the following:

- **Poor planning:** Treatments are done occasionally when some spare time or workers are available. Control is thus a low priority and receives little attention.
- **Impractical approach:** Starting clearing operations in densely infested areas rather than working from light to dense.
- **Inflexible approach:** Not adapting control methods to local conditions. The response of the plants to treatment is not monitored with a view to adaptation and there is a lack of improvisation.
- **Incorrect use of control methods:** Plants are treated but not killed, insufficient herbicide is used or ineffectively applied, control is attempted in the wrong season and many more similar practical problems.
- **Control work is not followed up:** Treated areas are not diligently and timeously revisited to treat re-sprouting stems and new plants that germinate from seed. The great expense of initial control is wasted if follow-up control, which is considerably cheaper, is not done.
- **Lack of guidance:** People who attempt to rid their land of alien plants receive little guidance from experts. Similarly, the workers who must carry out the control are seldom trained and receive little guidance.
- **Lack of information about the costs of control:** Inexperience with alien plant control often results in poor financial planning, which stems from a lack of appreciation for the complexities of the fieldwork.

Any of the above or any combination of them can result in Control projects being discontinued and the money invested in the project is lost due to the failure to control the alien plants. Planning must ensure that the most efficient use of available funding is guaranteed and that alien plants are effectively controlled.

A long-term maintenance plan should be implemented as part of the property management and this must include a budget of estimated costs of labour, equipment, transport and chemicals. Alien plant control can be expensive, labour-intensive and time consuming. It is imperative that the planning and cost estimates are done correctly to ensure that limited funding is effectively used. Alien vegetation control must be viewed as a long-term programme and must also be fully incorporated into the other landscaping practices on the Estate. This is particularly applicable to the follow-up stages of control. It is almost impossible to totally eradicate invasive alien plants from a property. The **ultimate goal** must be to reach a level of control where the annual input is low and the impact of the alien plants on the environment is low or negligible. This is known as the maintenance level of control.

There are **two levels of control**, namely Initial control and follow-up control. Initial control is usually the most costly, with costs reducing progressively through the follow-up controls until a minimal cost is reached at the maintenance level of control. To make any real progress with alien plant control, the follow-up operations must be seen as all-important. If the follow-up control phases are neglected, it is certain that the invasive situation will revert to the original condition, or sometimes worse

Control Methods

The control of invasive alien plants can be mechanical, chemical or by means of natural biocontrol. Whatever method is used, an important aim must be to kill the plant the first time. Ineffective methods or inefficiently applied methods simply necessitate revisiting the site to retreat the plants at double the cost of transport, labour and chemicals. The cheapest control method that effectively kills the alien plants should be used. The use of chemical treatments, for example, is expensive and often the same result can be achieved using a little more time and skill and no chemicals at all. Workers who do the alien control fieldwork should be fully trained, irrespective of the methods used. With adequate training, the application of control methods will be more effective, chemicals will be used more sparingly and efficiently and funds will therefore be spent more effectively.

The ecology of the alien plant concerned must be clearly understood for the control methods to be successful. Some plants readily **coppice** (including Eucalyptus) from the stems when cut down. Others **sucker from the roots** when the main stem is cut. Many plants have **invasive soil-stored seed reserves** (Black Wattle *Acacia mearnsii*) which germinate when the parent plant is removed.

It may be necessary to adapt the control method slightly to accommodate local conditions and this should be done before too much time is spent on a particular control block using an ineffective method. Similarly, the general progress of the control programme should be carefully monitored. This has more to do with the motivation of the workers than the methods used but is nevertheless important for the eventual success of the programme.

To be completely successful, one should always remember that alien invasive plants most often reach habitats by means of seeds which can move over long distances or survive for many years in the soil. So whatever control method is used for mature alien plants, one must not forget the potential for re-infestation from seed, which can be soil-stored, wind-transported, water-transported or animal-dispersed. Reducing the potential to re-infest from seed should therefore be an important part of every control method.

Methodology

The following commonly used methods for controlling a variety of invasive alien plants, but the decision of which method to use for a particular alien plant infestation must be based on, or include, some of the following:

- The method used must be based on the ecology of the plant, the density of the infestation, the terrain, the climate and available resources.
- Train all staff who are to apply the control methods.
- Use the cheapest method that effectively kills the plants.
- Make sure that the plants are killed first time around.
- Monitor the motivation of the staff applying the control method.
- Try to use 'species-specific' chemicals and use sparingly.
- Ensure that the available funding can sustain the chosen method.
- Try to restrict re-infestation from seed with the method used.
- Always incorporate follow-up control methods in the planning phase.

An identification guide can be found in **Appendix A** of this document. This will outline proper eradication and control measures for each species or plant type. This should be followed accordingly on site in order to ensure success. Below is a general guideline on eradicating different plant types using different methods of control.

Follow-up Control

Follow-up control should be systematically done. It is recommended that alien eradication should be done at least every month during the growing season. In the winter months, eradication can be every 2-3 months, with focus on the manual removal / digging out of plants/trees.

Hand-pulling: Follow-up clearing (and initial clearing of seedlings) is most effectively done by hand-pulling. This method is labour intensive but is still cost effective when compared to the cost of herbicide spraying. Pulling should be done when plants are still smaller than 500 mm in height and the best results can be achieved when the ground is wet after rain.

Spraying with herbicide: Plants that re-sprout from cut stems as well as bigger saplings can be treated by spraying with a foliar contact herbicide. The disadvantage of using chemicals is that they are expensive and the spray application can be wasteful. There is a great variety of herbicides available for alien plant control. These include foliar-absorbing, bark-absorbing and root-absorbing types. Care must be taken to preferably use selective herbicides that are known to be effective for the plants that must be killed.

18. APPENDIX 2 – GENERAL REHABILITATION GUIDELINES

The following procedure provides a guideline and information required to manage the rehabilitation of disturbed areas:

- Ensure all areas that were disturbed are rehabilitated, especially access roads, attenuation ponds, eroded areas
- Ensure rehabilitated areas are based on correct levels and have appropriate contours;
- Ensure adequate topsoil is used on barren soils or areas with poor soil types (preferably 100mm thick);
- Ensure the rehabilitated areas are free draining with contour berms or other erosion control measures as needed;
- Revegetate all rehabilitated areas as soon as possible, with area specific local indigenous vegetation.
- Monitor rehabilitated areas.

If artificial wetlands are established on site, then water will be diverted through these prior to release into the surrounding environment. The disturbed areas must be loosened to a depth of 50mm

- 30mm Mulch should be spread over the topsoil and worked in to a depth of 50mm
- Hydroseeding of exposed areas must be with indigenous veldgrass mix, see lists below.
- Re-seeding where germination is not being established and continued maintenance of these areas.
- The rehabilitation must be undertaken under supervision of a qualified ecologist and all engineering elements should be refined by in conjunction with an environmental specialist to ensure a natural outcome.

Revegetation

- Where vegetation, especially trees are lost to the alien vegetation removal programme they should be replaced with suitable **indigenous trees**:
 - Sweet Thorn Acacia - *Acacia karroo*
 - River Bush-willow - *Combretum erythrophyllum*
 - Ouhout - *Leucosidea sericea*
 - Shiny leaf Buckthorn - *Rhamnus prinoides*
 - Cape Silver-willow - *Salix mucronata*
 - White Stinkwood – *Celtis africana*
- Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation. The grass mix should consist of indigenous grasses adapted to the local environmental conditions.
- Re-vegetated areas should be monitored every 3 months for the first 12 months and twice a year thereafter.
- Re-vegetated areas showing inadequate surface coverage should be prepared and re-vegetated from scratch.
- Damage to re-vegetated areas should be repaired promptly.
- Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish.
- Remaining indigenous bulbous geophytes should be retained or replanted wherever possible.
- The use of the exotic invader Kikuyu Grass (*Pennisetum clandestinum*) is not permitted.
- Rather the use of an indigenous species such as **Cynodon dactylon is recommended**. It occurs naturally in the area as well as being non-invasive and requiring less water than exotic species.

The use of a veld mix for the Highveld region as mentioned above is suitable for the re-establishment of the site. Seed his seed mix can be obtained from Sakata™ and contains the following **grasses for hydroseeding** the site:

- Weeping Lovegrass - *Eragrostis curvula*
- Teff - *Eragrostis tef*
- Bermuda Grass - *Cynodon dactylon*
- Pangola Grass - *Digitaria eriantha*
- Guinea grass - *Panicum maximum*
- Buffel Grass - *Cenchrus ciliaris*

- Rhodes Grass - *Chloris gayana*
- Red Grass – *Themeda triandra*
- Any other indigenous grasses from SA

There are also a number of **wetland shrubs** that can be planted within the open space areas and water features:

- Water celery - *Berula erecta*
- Sedge - *Cyperus* spp
- Otterbossie - *Gomphostigma virgatum*
- Common rush - *Juncus effuses*
- Salt Marsh Rush - *Juncus kraussii*
- Honey Bush - *Melianthus major*
- Bulrush - *Typha capensis*
- Bloodroot - *Wachendorfia thyrsiflora*
- Nile grass - *Acroceras macrum*