



The uMkhunya Phase 4 Bulk Water Supply Scheme

Environmental Management Programme

Prepared by:



Prepared for:



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GLOSSARY

Activity [Development] – an action either planned or existing that may result in environmental impacts through pollution or resource use.

Alternative – a possible course of action, in place of another, of achieving the same desired goal of the proposed project. Alternatives can refer to any of the following but are not limited to: site alternatives, site layout alternatives, design or technology alternatives, process alternatives or a no-go alternative.

Applicant – the project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.

Bench Wetland - an area of mostly level or nearly level high ground [relative to the broad surroundings], including hilltops / crests [areas at the top of a mountain or hill flanked by down-slopes in all directions], saddles [relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction], and shelves / terraces / ledges [relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction].

Biodiversity – the diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.

Construction – means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.

Cumulative Impacts – impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities to produce a greater impact or different impacts.

Direct Impacts – impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.

Ecological Reserve – the water that is necessary to protect the water ecosystems of the water resource. It must be safeguarded and not used for other purposes. The Ecological Reserve specifies both the quantity and quality of water that must be left in the national water resource. The Ecological Reserve is determined for all major water resources in the different water management areas to ensure sustainable development.

Ecosystem – a dynamic system of plant, animal [including humans] and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogeneous.

Environment – In terms of the National Environmental Management Act [NEMA] [Act No 107 of 1998] [as amended], “*Environment*” means the surroundings within which humans exist and that are made up of:

- a) *the land, water and atmosphere of the earth;*
- b) *micro-organisms, plants and animal life;*

- c) *any part or combination of [a] or [b] and the interrelationships among and between them; and*
- d) *the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.*

Environmental Assessment – the generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.

Environmental Authorisation [EA] – an authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.

Environmental Assessment Practitioner – the individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.

Environmental Impact – a change to the environment [biophysical, social and / or economic], whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.

Environmental Impact Assessment [EIA] – the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made.

Environmental Issue – a concern raised by a stakeholder, interested or affected parties about an existing or perceived environmental impact of an activity.

Environmental Management – ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental Management Programme – A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMP focuses on the construction phase, operation [maintenance] phase and decommissioning phase of the proposed project.

Expansion – means the modification, extension, alteration or upgrading of a facility, structure or infrastructure at which an activity takes place in such a manner that the capacity of the facility or the footprint of the activity is increased.

Fatal Flaw – issue or conflict [real or perceived] that could result in developments being rejected or stopped.

General Waste – household water, construction rubble, garden waste and certain dry industrial and commercial waste which does not pose an immediate threat to man or the environment.

Hazardous Waste – waste that may cause ill health or increase mortality in humans, flora and fauna.

Indirect Impacts – indirect or induced changes that may occur as a result of the activity. These types of impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Integrated Environmental Management – a philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy [and principles] is interpreted as applying to the planning, assessment, implementation and management of any proposal [project, plan, programme or policy] or activity – at local, national and international level – that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection

and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools [such as strategic environmental assessment and risk assessment], environmental management tools [such as monitoring, auditing and reporting] and decision-making tools [such as multi-criteria decision support systems or advisory councils].

Interested and Affected Party – for the purposes of Chapter 5 of the NEMA and in relation to the assessment of the environmental impact of a listed activity or related activity, means an interested and affected party contemplated in Section 24[4] [a] [v], and which includes – [a] *any person, group of persons or organisation interested in or affected by such operation or activity; and [b] any organ of state that may have jurisdiction over any aspect of the operation or activity.*

Mitigate – the implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.

No-Go Option – in this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.

Rehabilitation– a measure aimed at reinstating an ecosystem to its original function and state [or as close as possible to its original function and state] following activities that have disrupted those functions.

Sensitive Environment – any environment identified as being sensitive to the impacts of the development.

Significance – significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change [i.e. magnitude, intensity, duration and likelihood]. Impact significance is the value placed on the change by different affected parties [i.e. level of significance and acceptability]. It is an anthropocentric concept, which makes use of value judgements and science-based criteria [i.e. biophysical, social and economic].

Stakeholder Engagement – the process of engagement between stakeholders [the proponent, authorities and I&APs] during the planning, assessment, implementation and / or management of proposals or activities.

Sustainable Development – development which meets the needs of current generations without hindering future generations from meeting their own needs.

Watercourse – means:

- a] *a river or spring;*
- b] *a natural channel or depression in which water flows regularly or intermittently;*
- c] *a wetland, lake or dam into which, or from which, water flows; and*
- d] *any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 [Act No. 36 of 1998] and a reference to a watercourse includes, where relevant, its bed and banks.*

Wetland – means land, which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

ACRONYMS

BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BID	Background Information Document
CBA	Critical Biodiversity Area
CBAR	Consultation Basic Assessment Report
CDO	Community Development Officer
CLO	Community Liaison Officer
CMA	Catchment Management Agency
C-PLAN	Conservation Plan
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
KZN EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment [refers to environmental management tool]
EIA	Early Industrial Age [refers to historical era]
EIS	Ecological Importance and Sensitivity
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EMPr	Environmental Management Programme
GA	General Authorisation [refers to type of water use licence authorisation]
GA	General Arrangement [refers to drawing / illustration of structures]
GIS	Geographic Information System
GPS	Geographical Positioning System
HGDM	Harry Gwala District Municipality
I&AP	Interested and Affected Parties
IDP	Integrated Development Plan
KZN	KwaZulu-Natal
LLO	Local Liaison Officer
LSA	Later Stone Age
MAB	Modular Ablution Blocks
MSA	Middle Stone Age
NBSAP	National Biodiversity Strategy and Action Plans
NEMA	National Environmental Management Act [Act No. 107 of 1998] [as amended]
NEM:BA	National Environmental Management Biodiversity Act [Act No. 10 of 2004]
NEM:WA	National Environmental Management Waste Act [Act No. 36 of 1998] [as amended]
NEM:AQA	National Environmental Management Air Quality Act [Act No. 39 of 2004]
NFA	National Forests Act [Act No. 84 of 1998]

NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act
NWA	National Water Act
NGO	Non-Governmental Organisation
OHSA	Occupational Health and Safety Act [Act No. 85 of 1993]
PES	Present Ecological State
PPP	Public Participation Process
PU	Planning Unit
REC	Recommended Ecological Category
RISFSA	Road Infrastructure Strategic Framework for South Africa
SADC	South African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Internet System
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SAPS	South African Police Services
SARTSM	South African Road Traffic Signs Manual
SDF	Standard Design Flood
SWL	Static Water Level
SWMP	Storm water Management Plan
VEGRAI	[Riparian] Vegetation Response Assessment Index
WMA	Water Management Agency
WUL	Water Use Licence

1 INTRODUCTION

1.1 Project Background

At Gedezar Consulting were appointed by Emzansi Engineers Pty Ltd on behalf of the Harry Gwala District Municipality as the independent Environmental Assessment Practitioner (EAP) for the environmental authorisation application for the proposed construction of Mkhunya Bulk Water Supply Scheme and associated infrastructure.

The Harry Gwala District Municipality proposes to develop the Mkhunya Bulk Water Supply Scheme to produce potable water from the UMkhomazi River to consumers in villages within the immediate project area. The project will consist of the construction of an abstraction works, a 5000KI/day water treatment works and a 350mm diameter rising mains to existing command reservoir at Nkweletsheni. The proposed project is situated in the Ubuhlebezwe Local Municipality which is one of the five (5) local municipalities making up Harry Gwala District Municipality.

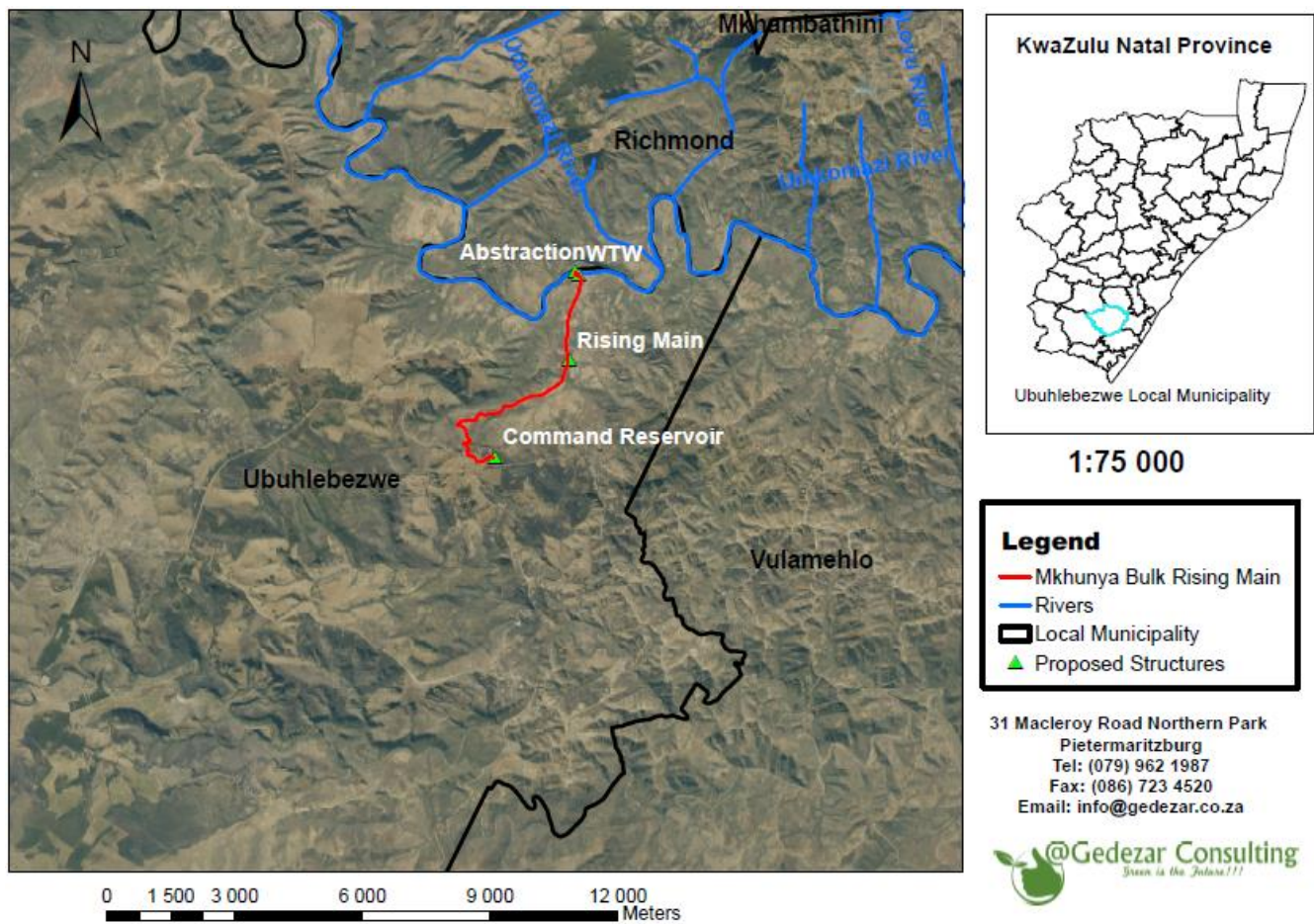


FIGURE 1: LOCALITY MAP SHOWING THE LOCALITY OF THE PROPOSED BULK WATER SUPPLY SCHEME

1.2 Technical Project Description of the development of the Mkhunya Bulk Water Supply Scheme

1.2.1. Design Criteria

The treated water is for human consumption and shall comply with SANS 241 class 1. The reservoirs shall have a 48 hour storage. Pipe lines will have a maximum velocity of 1.5m/s with pressures maintained between 3 and 6 bar where possible. Reticulation pipe lines will be sized to accommodate an 80l/c/d flow rate with a seasonal peak factor of 2.4 and an instantaneous peak factor of 1.5. No firefighting capacities will be considered. The system shall be designed for a 20 hour pumping time.

Water is abstracted from the UMKhomazi River and pumped via a rising main to the Water Treatment Plant. The water is treated using flocculation, clarification, filtration, chlorination and thereafter stored in reservoirs. The treated water is pumped to storage reservoirs situated at Nkweletsheni, Phumobala, Butateni, Nongegana, S'qandulweni and Springvale.

1.2.2. Abstraction works

The abstraction pump station shall comprise of three submersible pump sets housed in a pump station situated in the river. The walls of this pump station shall be constructed with gabions / concrete with the base of the pump station founded on rock. Each of the pump sets shall be capable of delivering 27.8 l/s @ 20m head. • When there is low flow in the river, one pump set is to be operating with the discharge (27.8 l/s) being utilized by the water treatment works. When there is high flow in the river, two pumps are to be operating with half the discharge being utilised by the water treatment works and the other half flowing into the off channel storage dam. The third pump set shall be the standby one. When there is no river abstraction, water from the off channel storage dam is to be utilised by the water treatment works. Immediately after the pump sets on the delivery side, there shall be a non return valve followed by an isolation valve.

1.2.3. Water treatment works

Grit channel and holding tank

Raw water abstracted from the river is pumped to a division box located on a high spot within the Treatment works. The water is divided between the Treatment Works and the off channel storage dam. Flow meters are to be installed on both of these branches. The raw water flowing into the treatment works then enters the grit channel where the grit settles into a scour chamber and the grit is removed by scouring. The channel is designed to maintain a velocity of 0.25m/s. The grit channel shall be cleaned manually on a daily basis.

Flash mixer and Flocculation chambers

The primary purpose of the coagulation/flocculation process is the removal of turbidity from the water. Turbidity is a cloudy appearance of water caused by small particles suspended therein. In the flash mixer, coagulant chemicals are added to the water and the water is mixed quickly and violently. The purpose of this step is to evenly distribute the chemicals through the water. Flash mixing typically lasts a minute or less.

Flash mixer

$Q = 1.39\text{m}^3/\text{min}$. The recommended time is 1 minute thus the volume for the flash mixing chamber = 1.40m^3

During flocculation, a process of gentle mixing brings the fine particles formed by coagulation into contact with each other. Flocculation typically lasts for about thirty to forty-five minutes. The flocculation basin often has a number of compartments with decreasing mixing speeds as the water advances through the basin.

Flocculation chambers

$Q = 1.39\text{m}^3/\text{min}$. The recommended time is 45 minutes (3 chambers of 15 minutes). Thus the volume for each chamber = 21m^3

Clarifier

From the flocculation chambers the effluent flows into the clarifier. The clarifier separates the liquids and solids by settling the solids. A slow rotating bridge with angle rake arms attached to the bottom of the bridge move the concentrated sludge to the centre of the tank from where it is removed. Clear liquid flows from the top of the tank via vee notch weirs into the collecting trough.

$Q = 83.3 \text{ m}^3/\text{hour}$. The recommended upward velocity is $1.2\text{m}/\text{hour}$. Thus the surface area = 70.0m^2 .

Thus use a 9.44m diameter x 3.0m deep clarifier

Filters

From the clarifier the effluent flows into the filters. The prime function of a filter is to remove suspended matter and thereby removing pathogenic organisms from the water.

Most of these organisms are bound up in the coagulated floc particles entering the filter. The conventional rapid sand filter uses one grade of sand ($0.45 - 0.55 \text{ mm}$ and a S.G. of 2.65) approximately 75 cm thick underlaid by graded layers of gravel as supporting media. Normally under these conditions, the actual entrapment of suspended matter is restricted to the top several centimetres of the sand bed. The remaining sand acts as insurance against a serious turbidity breakthrough. The normal design filter rate for a rapid sand filter producing potable water, was $80 - 160 \text{ lpm per sq. m}$ of filter bed-area.

1.2.4. Backwashing

Backwashing a filter is the exact opposite to filtration. When backwashing, the water rises up through the filter rather than passing down through it. The backwashing process removes the accumulated turbidity from the filter. The water is delivered to the filter either from an elevated tower or via a backwash pump (from the clearwell). Either method provides the necessary pressure and volume for carrying out the backwash process. A normal rate of flow during the backwash cycle for conventional filters is $610 \text{ lpm per sq. m}$

The backwash water enters through the underdrain. Rising up through the gravel bed, it enters the filter media.

1.2.5. Air Scour Wash

Cleaning the filter is accomplished by introducing compressed air into the backwash stream before it reaches the filter. Underdrain systems used for air scour usually have smaller holes, thereby creating a much diffused air-water mixture.

Number of filters = 2 with 1 on standby i.e. to be used when one is being backwashed

Backwashing of filters = time x surface area x filter rise rate (The filter rise rate is the speed at which water rises up through the filter during backwashing. This is another way of measuring the backwash rate.

Chlorine Contact Tank

From the filters the water flows into the Chlorine contact tank. The contact (retention) time in chlorination is that period between introduction of the disinfectant and when the water is used. A long interaction between chlorine and the microorganisms results in an effective disinfection process. Contact time varies with chlorine concentration, the type of pathogens present, pH, and temperature of the water.

Minutes required = $K / \text{Chlorine residual (mg/l)}$

If the highest pH anticipated is 7.5 and the lowest water temperature is $42 \text{ }^\circ\text{F}$, the "K" value is 15 . Therefore, a chlorine residual of 0.5 mg/l necessitates 30 minutes contact time. A residual of 0.3 mg/l requires 50 minutes contact time for adequate disinfection. Thus use a 100m^3 tank for 1 hour retention.

Pump Station

From the chlorine contact tank the water flows into the pump station. The pump station is to house the following pump sets:

- Pump sets for pumping to the two proposed break pressure tanks (TWL ±478m).
- Pump sets for filter backwashing
- Booster pump set for jet pump in abstraction pump station
- Pump sets for pumping to dam (to be confirmed)

All pump sets to have isolating vales on the suction and isolation and non-return valves on the delivery.

Reticulation to Nkweletsheni and Mahlubini.

Reticulation under this phase will be an extension to the existing reticulation network previously constructed. All household within these areas will be serviced under the 200m walking distance as recommended in the “Guidelines of Human Settlement and Planning” and a provisional amount has been allocated for in the bill of quantities to cover reticulation, associated fittings and standpipes.

Pipelines ranging from 200mm to 110mm diameter uPVC, and 75mm to 40mm diameter HDPE, including 43N° standpipes is required to complete the reticulation.

1.3. Property Details

1.3.1. Surveyor General Numbers / Property Descriptions

The proposed activity is situated on the following properties which are both state land. The 21-digit surveyor-general codes are provided in Table 1 below.

TABLE 1: SURVEYOR-GENERAL 21 DIGIT SITE [ERF / FARM / PORTION] REFERENCE NUMBERS

Structures	21 Digit Reference Number & Erf, Farm and Portion Number
Abstraction Point and Water Treatment Works	NOET00000000474800000
	Farm 4748 Lot 4 Umkonye
Rising Main	NOET00000001760600000
	Farm 17606 Lot 3 Umkonye
Rising Main to Command Reservoir	NOET00000001784400000
	Farm 17844 Alderley

1.3.2. Land Use Zoning

TABLE 2: LAND USE ZONING

The site is zoned	Rural Settlement
Is a change of land use or a consent use application required?	No
Must a building plan be submitted to the local authority?	Yes

1.3.3. Coordinates

The proposed development of the uMkhunya Phase 4 Bulk Water Supply Scheme is approximately 7km in total. Refer to Appendix A3 for coordinates at each 250 m of the rising main which will be constructed. The following coordinates are provided for the Water Treatment Works and Abstraction point.

TABLE 3: COORDINATES

Water Treatment Works

Latitude /Longitude	Degrees	Minutes	Seconds
South	30	05	34.44
East	30	24	24.45

Abstraction Works

Latitude /Longitude	Degrees	Minutes	Seconds
South	30	05	32.95
East	30	24	21.79

1.3.4. Access / Directions

The site can be accessed via the R612 east towards uMzinto from Ixopo. Travel approximately 31km then take the left turn towards Rydal. Travel 16km on a gravel road then turn right and drive 6,6km and proceed straight for another 8,3km towards Mkhunya. Take a left turn onto a concrete road and drive downhill for 6km until you reach the pump house on the banks of the UMkomazi River, which is where the proposed project will commence.

2. SITE DESCRIPTION

2.2. Geology and soils

The Mkhunya pump house and proposed water treatment works are underlain by alluvial deposits of the UMkomazi River. The geology of most of the pipeline’s footprint is formed by the Oribi Gorge Suite, which is composed of very coarse grained porphyritic granite and charnockite. The footprint then passes along terrain underlain by the Natal Group, comprising of basal conglomerate, red-brown, coarse to fine-grained arkose to subarkose, light grey quartzarenite, micaceous sandstone, grit, conglomerate, subordinate micaceous siltstone and mudstone. The footprint then passes along terrain underlain by the Dwyka Formation, which is composed of tillite, minor shale, varved shale and sandstone. Dolerite forms the geology of the final length of the pipeline’s footprint and the Nkweletsheni reservoir.

The level to gently sloping footprint of the Mkhunya pump house, water treatment works and initial length of pipeline occurs on soils with low to very high erodibility. The next length of the pipeline’s footprint is located on moderately sloping land with soils of very high erodibility. The following length of the moderately sloping pipeline’s footprint lies adjacent to steep and very steep downslopes that have soils with low to very high erodibility. The final length of the pipeline’s footprint ending at the Nkweletsheni reservoir occurs on land with soils of low to moderate erodibility.

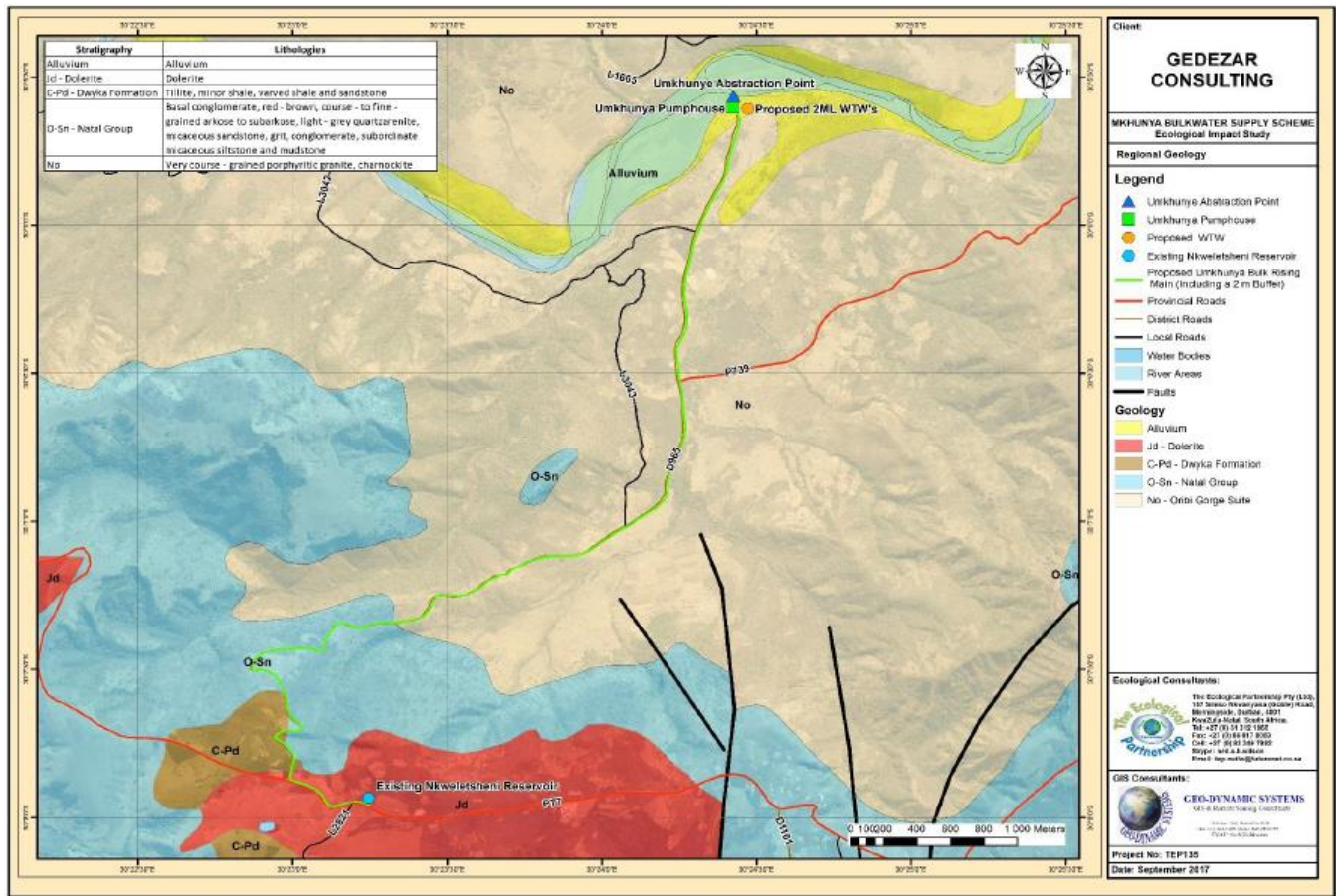


FIGURE 2: GEOLOGY OF THE STUDY AREA [TEP, 2017]

2.3. Vegetation

Most of the vegetation in the footprint of the proposed development is disturbed roadside vegetation. Upgrading of the Mkhunya pump house and construction of the water treatment works will take place in a grassland area dominated by *Sporobolus pyramidalis*. Starting near the Ukomazi River and ending at the Nkweletsheni reservoir, the proposed pipeline's five-metre wide construction footprint traverses roadside terrain with disturbed roadside vegetation. Alien plant invaders, dominated by *Lantana camara*, are prominent at the outer edge of the footprint. Historically, the footprint would have passed through Eastern Valley Bushveld, KwaZulu-Natal Hinterland Thornveld and KwaZulu-Natal Sandstone Sourveld vegetation types before transformation of the vegetation types occurred by various anthropomorphic factors, such as human settlement, road construction and over-burning and over-grazing of the veld. Important species belonging to these natural vegetation types still remain in, near and further away from the pipeline's footprint.

In its natural state, Eastern Valley Bushveld is composed of semi-deciduous savanna woodlands in a mosaic with thickets, which are often succulent and dominated by species of *Euphorbia* and *Aloe* (Rutherford et al., 2010; Scott-Shaw & Escott, 2011). KwaZulu-Natal Hinterland Thornveld is composed of open thornveld, dominated by *Vachellia* species (Rutherford et al., 2010; Scott-Shaw & Escott, 2011). KwaZulu-Natal Sandstone Sourveld is a short, species-rich grassland with scattered low shrubs and geoxylic suffrutices (Rutherford et al., 2010; Scott-Shaw & Escott, 2011).

2.4. Hydrology

During rainfall, surface water drains towards the Mkhunya pump house and proposed water treatment works from more elevated areas and into the UMkomazi River. Surface water largely drains away from the pipeline's footprint towards the Mfulomubi River which lies immediately to the east of the footprint. Water will drain rapidly from the pipeline's footprint towards this river down the steep and very steep slopes which are present in its upper reaches.

The Mkhunya abstraction point is located in the UMkomazi River and the pump house and proposed water treatment works are situated close to this perennial river on its floodplain. One of the flood banks of the river lies adjacent to the pump house and proposed water treatment works making this floodplain area vulnerable to flooding when the UMkomazi River overtops its banks.

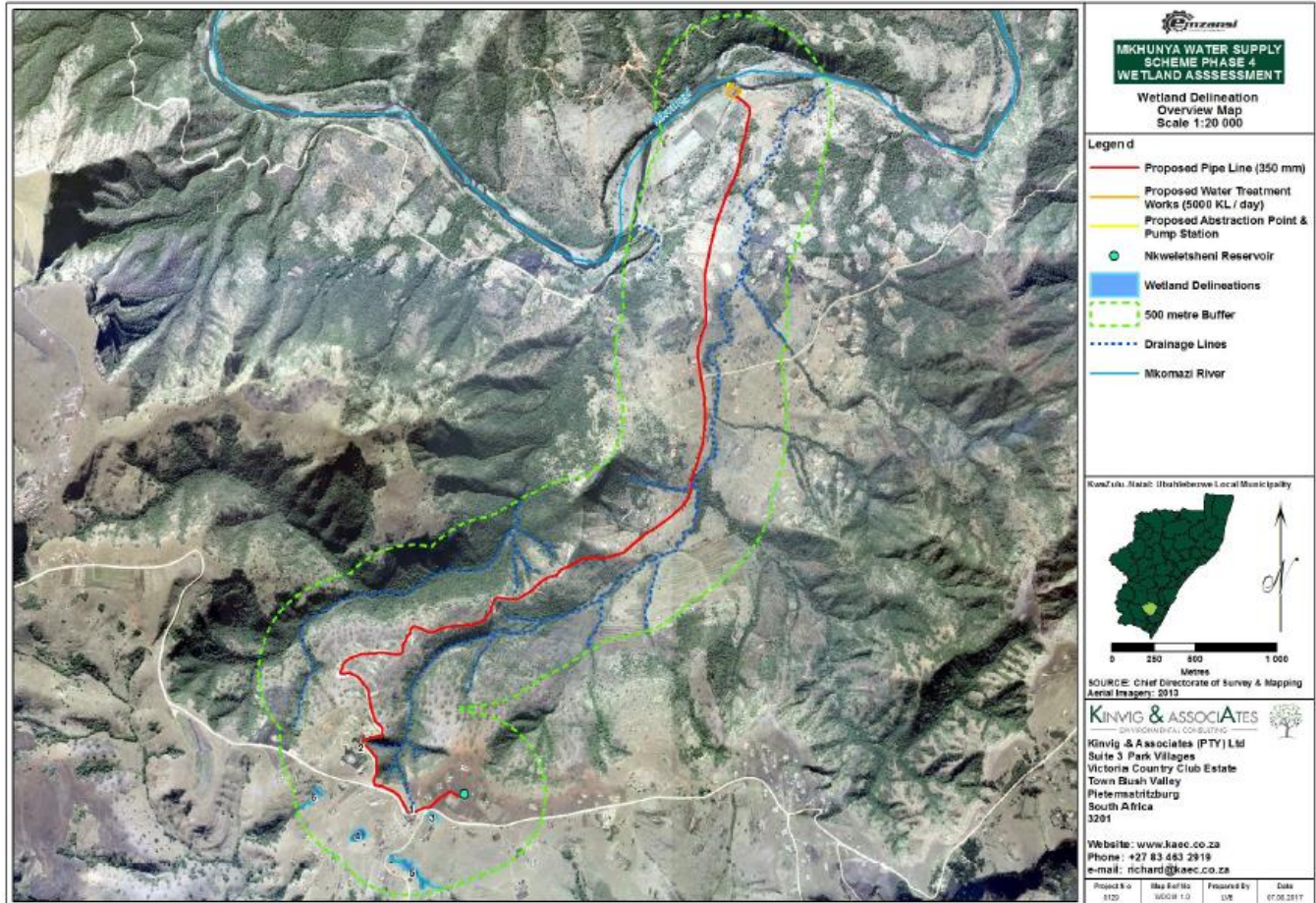


FIGURE 3: MAP OF THE STUDY AREA SHOWING THE 500 METRE BUFFER OF THE STUDY AREA

2.5. Socio-economic Environment

Rural houses dominate the area on both sides of the proposed pipeline route, along at the top section near the Nkweletsheni reservoir houses are on the left side as the right side is too steep however the number of houses increases towards the bottom section of the pipeline near the river.

The cultural landscape in the study area is strongly associated with rural living and subsistence farming. There is still a strong community feeling here with a dominance of traditional authority.

2.6. Heritage

This area is home to all three of the known phases of the Stone Age, namely: the Early-- (2.5 million – 250 000 years ago), Middle-- (250 000 – 20 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoekhoen cultural groups. Early to Middle Stone Age sites are uncommon in this area, however rock--art sites and Late Stone Age sites are much better known.

During the Middle Stone Age, 200 000 years ago, modern man or Homo sapiens emerged, manufacturing a wider range of tools, with technologies more advanced than those from earlier periods. This enabled skilled hunter--gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time.

The Middle Stone Age (MSA), as defined by Goodwin and Van Riet Lowe (1929), was viewed as a switch in technology from core tools to flake tools, and was thought to represent an intermediate technology between the Earlier and Later Stone Age (LSA). Triangular flakes with convergent dorsal scars and faceted butts distinguished the MSA, and radial and discoidal types, along with single and double platform examples, dominated cores. The 'type fossil' was considered to be the worked flake point. Due to both the relatively long time span encompassed by the MSA (c. 250 000--20 000BP) and the high degree of regional variation, it has proved difficult to include all MSA assemblages within Goodwin and Van Riet Lowe's criteria. More recent attempts have been made to revise the definition of the MSA (Klein 1970; Beaumont & Vogel 1972;; Volman1984) and to establish a cultural sequence but with limited success. As a result, identifying and understanding the end of the MSA is still difficult. Disagreement concerning the MSA/LSA transition in southern Africa centres on four issues: 1) the definition of what constitutes final MSA technology;; 2) the existence of a transitional MSA/LSA industry;; 3) the dating of the MSA/LSA transition; and 4) the existence of an Early LSA (ELSA) which represents a distinct industry that is not part of the earliest recognized LSA, the Robberg (Clark, 1997).

The 1985 excavation at Umhlatuzana rock shelter in Natal by Kaplan yielded a long Middle Stone Age (MSA) to the Later Stone Age (LSA), including the MSA/LSA transition, and early LSA microlithic bladelet assemblages. The change from the MSA to the beginning of the LSA took place between 35 000 and 25 000 BP. Robberg--like assemblages recovered from Umhlatuzana are the first to be positively identified in Natal. Pre--dating 18 000 BP and post--dating 12 000 BP, they show that assemblages of this nature were produced earlier and later in Natal than elsewhere in the country.

Changes in the Umhlatuzana stone artefact assemblages were not the result of the introduction from elsewhere of new types of tools, but took place locally, as the result of a single evolving cultural tradition in a trajectory of cultural and social change (Kaplan, 1986).

Recent research by Wadley on the Middle Stone Age of Sibudu Cave north of Durban indicated that distinctions between the Middle Stone Age and the Late Stone Age based on backed blades could be misleading (Wadley, 2005). Although research on MSA sites is limited, this research illustrates the potential value of investigating Stone Age sites in KZN closer.

The Late Stone Age, considered to have started some 20 000 years ago, is associated with the predecessors of the San and Khoi. Stone Age hunter--gatherers lived well into the 19th century in some places in SA. Stone Age sites may occur all over the area where an unknown number may have been obliterated by mining activities, urbanisation, industrialisation, agriculture and other development activities during the past decades.

A large representation of Rock--Art sites is located in this area. During 1981 Mazel completed a survey of the Drakensberg and Southern Natal and documented over 400 rock art sites with more than 20 000 paintings (Mazel, 1981).

3. SCOPE OF THE EMPR

In accordance with the requirements of the National Environmental Management Act (Act No. 107 of 1998, NEMA), this EMPr is to be implemented by the Developer as well as any employee, contractor, agent, or sub-contractor appointed to act on behalf of the Developer in the execution of the project, in order to ensure environmental compliance on site.

The specifications outlined in this EMPr are thus applicable to all activities undertaken by the Developer as well as their appointed contractors and all persons involved in the execution of the works, including sub-contractors, the workforce, suppliers, and volunteers, for the duration of construction, operation and future maintenance.

Included within the EMPr is guidance for on-going training with respect to the implementation of the conditions included therein, including induction by all new people coming onto site to carry out work, and 'top-up' activities such as regular 'toolbox talks' on specific key issues.

An Environmental Code of Conduct has also been developed that provides a simplified set of rules that must be adhered to by all persons involved with the project at all times. This is to be displayed at strategic points to ensure constant environmental awareness.

The effectiveness of the EMPr is limited by the level of adherence to the conditions set forth in the EMPr by the Developer, the Contractor and Sub-contractors. It is further assumed that compliance with the EMPr will be monitored and audited as set out in this EMPr and contractual clauses.

4. OBJECTIVES OF THE EMPR

The EMPr has the following objectives:

- Ensure compliance with regulatory authority stipulations and guidelines which may be local, provincial, national and/or international.
- To outline mitigation measures and environmental specifications which are required to be implemented for all phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the proposed project.
- To identify measures that could optimise beneficial impacts.
- To establish a method of monitoring and auditing environmental management practices during all phases of development.
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project.
- Ensure that the safety recommendations are complied with.
- Propose mechanisms for monitoring compliance with the EMPr and reporting thereon.
- Specify time periods within which the measures contemplated in the draft environmental management plan must be implemented, where appropriate.
- Provide rational and practical environmental conditions / requirements to:
 - Minimise disturbance of the natural environment;
 - Ensure water resource protection;
 - Prevent or minimise all forms of pollution;
 - Protect indigenous flora and fauna;
 - Prevent soil and sand erosion and facilitate the re-vegetation of affected areas;
 - Maintenance of newly re-vegetated areas;
 - Restrict noise disturbance; and
 - Ensure compliance with all applicable laws, regulations, standards and guidelines for the protection of the environment.
 - Adopt the best practical means available to prevent or minimise adverse environmental impacts.
 - Develop waste management practices based on prevention, minimisation, recycling, treatment or disposal of waste.
 - Train the Developer, its employees and contractors with regard to their environmental obligations.

5. STRUCTURE OF THE EMPR

The EMPr addresses aspects of the project life-cycle from the point at which work on the ground begins, whereas the Basic Assessment Report (BAR) addresses impacts and mitigation thereof prior to the project commencing. This EMPr therefore covers the phases as per Figure 4 below:



FIGURE 4: PHASES OF THE EMPR

The implementable EMPr complies with Appendix 4 of the EIA Regulations 2017 (Government Notice Regulation – GNR 326, *Regulations for the contents of EMPs*) and is presented in tabular form in section **Error! Reference source not found.** and comprises the aspects as per below:

TABLE 4: TABULAR FORMAT OF THE EMPR

Aspect	Environmental Specification	Responsibility	Monitoring frequency
Meaning:	This section indicates the actions required to either prevent and/or minimise the potential impacts on the environment that is associated with the project.	This section indicates the party responsible for implementing the environmental measures and action plans laid out in the EMPr.	This section indicates when the actions for that specific aspect must be implemented and/or monitored.

5.2. The Dynamic Nature of the EMPr

The nature of environmental management is such that it deals with numerous disciplines and is applied to a myriad of study areas, each with its unique ecosystem functioning and requirements. Therefore, certain study areas may be considered to be pristine, whereas others may need to be more carefully observed as they are already significantly developed. This requires environmental management to develop tailor made solutions and responses to each and every project, through project specific tools within the Integrated Environmental Management (IEM) field, such as those of the BA, EIA and EMPr.

Part and parcel of ensuring these tailor made solutions, is flexibility and accommodation of what the natural environmental can sustain. Hence, as the BA is predictive in nature, in assessing likely impacts, once the project is implemented for construction, certain aspects may come to light, and there must be provision to allow for the EMPr to guide activities around these. Therefore, the EMPr is a “living” or dynamic document which must be duly updated and complied with. To ensure this, the **Deming Cycle** or continuous development cycle is adopted, as demonstrated below:

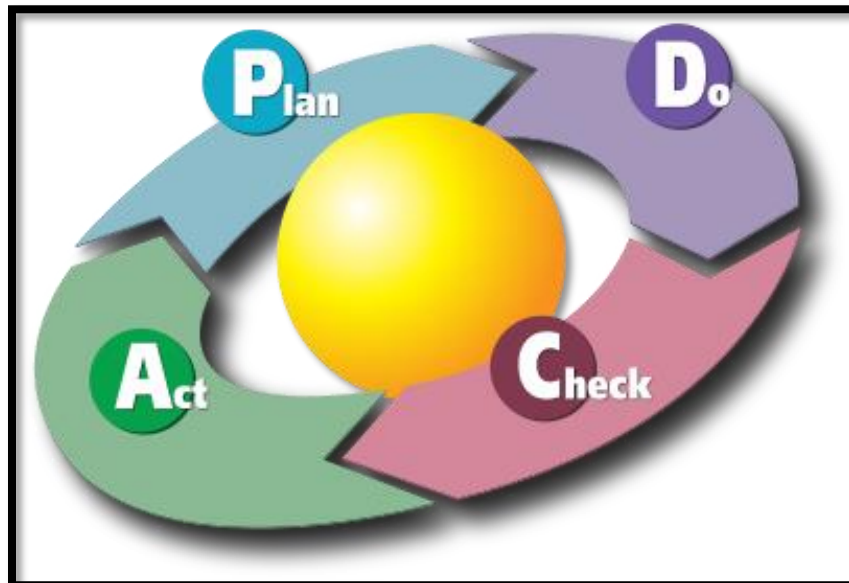


FIGURE 5: DEMING CYCLE OF CONTINUOUS IMPROVEMENT

With reference to Figure 6 above, the following interpretations are provided:

Plan: Project-specific planning for the proposed project involves consideration of the legal triggers, the specifics of the proposed development, and the nature of the receiving environment. This provides a starting point for targeted environmental management objectives. Environmental performance indicators are then determined with measurable targets prescribed to monitor the environmental performance of the project. Achieving the targets depends on compliance with this EMPr and the legislative requirements that underpin it.


Do: Throughout the development’s life-span, the Developer will be required to develop and maintain a Quality Management System (QMS) – designed to ensure that best management practices are implemented in day-to-day management. Such a QMS must at least include the following information: (a) Location and extent of associated infrastructure; (b) Associated activities, such as the transportation of people and equipment; (c) Resources and experience required (staffing); (d) Materials and equipment to be used; (e) Management actions; (f) Human resources used; (g) Construction-monitoring activities; (h) Emergency / disaster incident and reaction procedures; and (i) Rehabilitation procedures for the impacted environment.

Check: A system of assessing monitoring results has been developed to check the environmental management performance. Continuous assessment facilitates proactive management of the environmental issues. Mitigation measures can then be successfully implemented on an on-going basis to keep environmental indicators within their target thresholds. Moreover, the assessment system also enables the assessment of the efficacy of the EMPr. Regular auditing of environmental performance is prescribed to prove and preserve accountability.

Act: The assessments and monitoring of the results and findings of the regular audits must be documented within a reporting system. Precautionary mitigation measures and corrective actions will be prescribed and instructions will be given in order to implement these in the field. The findings of monitoring and auditing programmes can also be used to update the EMPr. Although the EMPr is a project-specific document, it is dynamic and must be updated regularly to address the changing circumstances of the scheme.

6. DETAILS OF THE DEVELOPER

TABLE 5: APPLICANT DETAILS

Applicant	KwaZulu-Natal Department of Transport	
Representative	Mr. D B Makwakwa	
Physical Address	40 Main Road, Ixopo	
Postal Address	Private Bag X501, Ixopo	
Telephone	039 834 8700	
Facsimile	039 834 1701	
E-mail	makwakwab@harrygwaladm@gov.za	

7. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

The environmental team of At Gedezar Consulting [hereafter referred to as At Gedezar] are appointed as the Environmental Assessment Practitioner [EAP] by the engineers on the project, Emzansi Engineers. At Gedezar is therefore undertaking the appropriate environmental studies for this proposed project.

TABLE 6: EAP DETAILS

Detail	At Gedezar Consulting
Contact Persons	Mr Andile Mnyandu [EAP]
Address	31 Macleroy Road Northern Park Pietermaritzburg 3201
Telephone	082 973 1291
Facsimile	086 723 4520
E-mail	andilemn@gedezar.co.za
Qualification	Bachelor's Degree in Geography and Environmental Management, University of KwaZulu- Natal IAIAsa
Experience	11 years

8. LEGAL REQUIREMENTS

The following is a summary of the environmental legislation applicable to the proposed project.:

TABLE 7: SUMMARY OF THE ENVIRONMENTAL LEGISLATION APPLICABLE

Legislation	Sections	Relates To
The Constitution (No 108 of 1996)	Chapter 2	Bill of Rights.
	Section 24	Environmental rights.
National Environmental Management Act (Act No. 107 of 1998 [as amended])	Section 2	Defines the strategic environmental management goals and objectives of the government. Applies through-out the Republic to the actions of all organs of state that may significantly affect the environment.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The Developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
EIA Regulations (2017)	GNR327	Activities requiring a Basic Assessment study to be undertaken.
	GNR325	Activities requiring a Scoping and Impact Assessment study to be undertaken.
	GNR324	Activities in special geographical areas requiring a Basic Assessment study to be undertaken.
National Waste Act (Act No. 59 of 2008) and List of		Provides for specific waste management measures and the remediation of contaminated land.

Legislation	Sections	Relates To
Waste Activities (November 2013)		
Norms and Standards for the Storage of Waste, 2013	GNR 926 – Sections 7 – 20	Provides specific guidelines for the operational procedures for a facility for the storage of waste.
National Heritage Resources Act (Act No. 25 of 1999) and regulations	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.
	Section 35	No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIAs), not already covered under the environmental law. Where covered under such law the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The HIA is thus approved under the environmental authorisation, which must take into account the provincial heritage resources authorities' comments prior to making a decision on the HIA.
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Section 34	Control of noise.
	Section 35	Control of offensive odours.
National Dust Control Regulations (GNR 827 of November 2013)		Control of dust.
	Section 8	General duties of employers to their employees.

Legislation	Sections	Relates To
Occupational Health and Safety Act (Act No. 85 of 1993)	Section 9	General duties of employers and self-employed persons to persons other than their employees.
National Water Act (Act No. 36 of 1998) and regulations	Section 19	Prevention and remedying the effects of pollution.
	Section 20	Control of emergency incidents.
	Section 21	Water uses.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Section 22	Application for a mining right.
	Section 39	Environmental management programme and environmental management plan.
Hazardous Substances Act (Act No. 15 of 1973) and regulations		Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.
National Environmental Management: Biodiversity Act (No. 10 of 2004)		Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.
	Section 53	Protection of threatened or protected ecosystems.
	Section 65	Control of alien species.
	Section 71	Control of invasive species.
National Forests Act (Act No. 84 of 1998) and Regulations	Section 7	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.
	Sections 12-16	These sections deal with protected trees, with the Minister having the power to declare a particular tree, a group of trees, a particular woodland, or trees belonging to a certain species, to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.
National Road Traffic Act (Act No. 93 of 1996)		Road safety.

Legislation	Sections	Relates To
Ordinance		Town Planning and Townships Ordinance 15 of 1986.
By-laws		<p>Promulgated by-laws:</p> <ul style="list-style-type: none"> ▪ Waste Management ▪ Property Rates by laws ▪ Legal Services ▪ Municipal Cemeteries ▪ Discharge of Industrial Effluent ▪ Electricity Supply
SANS 10103 (Noise Regulations)		The measurement and rating of environmental noise with respect to annoyance and to speech communication.
KZN Nature Conservation Ordinance (Ordinance 15 of 1974)		Sensitive species are protected under this Ordinance and must be considered.

9. MANAGEMENT AND MONITORING PROCEDURES

9.2. Project Structure

Below Gives an Indication of the Organisational and Team Structure for the Project.

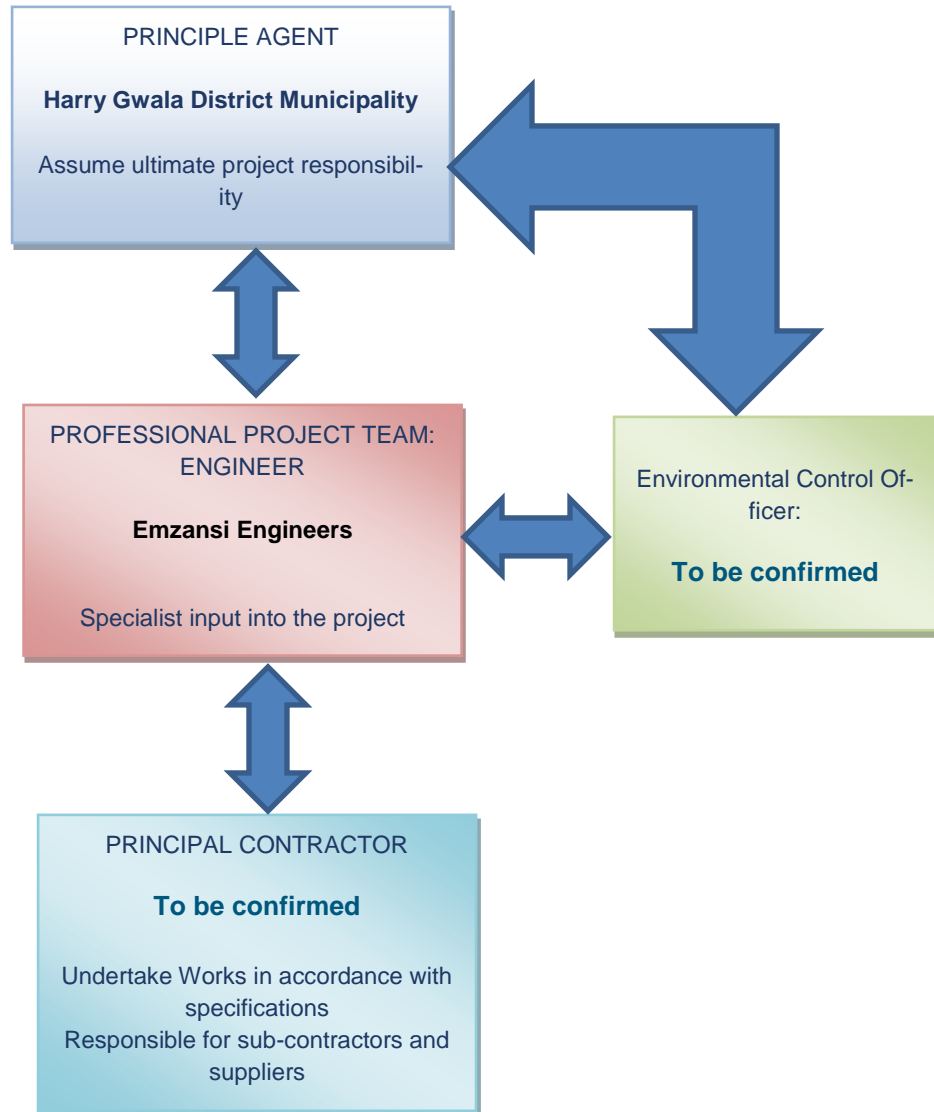


FIGURE 6: ORGANISATIONAL STRUCTURE AND RESPONSIBILITIES

9.3. The Project Proponent / Project Manager

- Ensure that the Site Manager/Engineer and the Contractor/Operator are aware of all specifications, legal constraints, standards and procedures pertaining to the project specifically with regard to the environment;
- Ensure that all stipulations within the EMPr are communicated and adhered to by the Site Manager/Engineer and the Contractor/Operator;
- Monitor the implementation of the EMPr throughout the project by means of regular site visits and meetings; and

- Order the removal of any person(s) and/or equipment in contravention of the specifications of the EMPr.

The Project Manager should be fully conversant with the EMPr for the project, as well as all applicable environmental legislation.

9.4. The Site Manager/ Engineer

- Be fully conversant with the EMPr;
 - Be fully conversant with all environmental legislation and ensure compliance;
 - Have overall responsibility for the implementation of the EMPr;
 - Liaise with the Project Manager and Contractor/Operator on matters concerning the environment;
 - Prevent actions that will harm or may cause harm to the environment, and take steps to prevent pollution on the site;
 - Implement remedial measures in the event of pollution incidents or environmental impacts;
 - Monitor and verify that environmental impacts are kept to a minimum;
 - Review and approve construction methods where necessary; and
 - Order the removal of any person(s) and/or equipment in contravention of the specifications of the EMPr.
- Disturbed

9.5. The Contractor

- Be fully conversant with the EMPr;
- Be fully conversant with all environmental legislation and ensure compliance;
- Ensure that all the environmental specifications contained within this EMPr are adhered to at the site;
- Regularly liaise with the Site Manager on matters relating to the environment; and
- Confine activities to the demarcated construction site.

The above responsibilities listed for the Contractor will also apply to any appointed sub-consultants.

9.6. The Environmental Control Officer (ECO)

- Be fully conversant with the EMPr;
- Be fully conversant with all environmental legislation and ensure compliance;
- Ensure that all the environmental specifications contained within this EMPr are adhered to the site;
- Regularly liaise with the Site Manager on matters relating to the environment; and
- Compile monthly reports as to the progress of the construction phases and report to all parties involved (Site Manager, Project Proponent).

10. COMPLIANCE WITH THE ENVIRONMENTAL SPECIFICATION

Environmental management is concerned not only with the final results of the Contractor's operations to carry out the Works, but also with the control of how those operations are carried out. Tolerance with respect to environmental matters applies not only to the finished product but also to the standard of the day-to-day operation required to complete the works. It is thus required that the Contractor must comply with the environmental specifications on an on-going basis.

The EMPr forms part of the contract documentation and is thus a legally binding document. It is also necessary for the Contractor to make provisions as part of their budgets for the implementation of the EMPr. In terms of NEMA, an individual responsible for environmental damage must pay costs both to the environment and human health and the preventative measures to reduce or prevent additional pollution and/or environmental damage from occurring. This is referred to as the Polluter Pays Principle. Section 28 of the NEMA specifically embodies the polluter pays principle. Therefore, any failure on the Contractor's part to comply with the EMPr will entitle the Developer to certify the imposition of a penalty subject to the details set out.

The Contractor is deemed not to have complied with the Environmental Specification / EMPr if:

- There is evidence of contravention of clauses within the boundaries of the site, site extensions / access roads;
- Environmental damage ensues due to negligence;
- The Contractor ignores or fails to comply with corrective or other instructions issued by the Developer, ECO or Engineer within a specified time; and
- The Contractor fails to respond adequately to complaints from the public.

Failure to conform to the conditions set out in the following section (Section **Error! Reference source not found.**), the EMPr will result in the issuing of fines to the Contractor / Site Manager by the ECO. These fines will be paid by the Contractor and will be used in the rehabilitation or landscaping of the site.

The final amount, however, will be quantified by the Engineer and the appointed ECO prior to going on-site. The values below are thus deemed to be a useful point of departure from which site and task appropriate values can be quantified.

Note that the escalation factor in terms of repeat offences also needs to be determined (e.g. doubling to a maximum combined value for a set of activities), and the point at which on repeat offence the contractor / sub-contractor is required to move off site.

TABLE 8: FINE SYSTEM TO BE IMPLEMENTED

Offence	Amount
Failure to demarcate working areas	R10,000
Working outside of demarcated areas	R30,000
Failure to strip topsoil with intact vegetation	R50,000
Failure to obtain relevant permits	R50,000
Failure to relocate plant species and care for them once relocated	R50,000
Failure to stockpile topsoil correctly	R30,000
Failure to stockpile materials in designated areas	R10,000
Failure to take measures to prevent soil contamination	R10,000
Failure to take measures to control dust dispersion on-site	R10,000
Washing of vehicles on-site	R10,000
Pollution of water bodies and/or groundwater	R20,000
Failure to implement storm water management provisions during construction	R20,000
Failure to control storm water run-off	R30,000
Downstream erosion	R30,000
Failure to provide adequate sanitation	R10,000
Failure to erect temporary fences around trenches	R10,000
Failure to provide adequate waste disposal facilities and services	R50,000
Failure to reinstate disturbed areas within the specified time-frame	R30,000
Any other contravention of the project specific specification	R10,000

11. EMPR FOR THE DEVELOPMENT OF THE MKHUNYA BULK WATER SUPPLY SCHEME

The EMPr specifies the minimum requirements to be implemented by the Developer as per the scope of works and scope of the EA, in order to minimise and manage the potential environmental impacts and ensure sound environmental management practices. It also provides the framework for environmental monitoring throughout the construction phases.

The provisions of this EMPr are binding on the Developer during the life of the project. The EMPr must be binding to Harry Gwala District Municipality or any authority to which responsibility for the construction activities has been delegated to, until such time that the EDTEA or applicable environmental authority has formally absolved the Developer from its responsibilities in terms of this EMPr.

It is essential that the EMPr requirements be carefully studied, understood, implemented, and adhered to at all time.

To simplify the EMPr requirements, each aspect related to the EMPr has been addressed in the table below. Each action within the EMPr is supported by the priority of when the specific action will need to be implemented.

The proceeding tables constitute the The EMPr for the development of the Mkhunya Bulk Water Supply Scheme, together with the preceding sections, which are legally binding to the Developer and associated appointed Contractors / employees.

12. PRE-CONSTRUCTION PHASE

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
12.2. Authorisations, Permits and Licences and other General Considerations		
<p>All necessary authorisations, permits and licences must be obtained by the Developer prior to the commencement of construction.</p> <p>All activities must comply with the EA, EMPr and all permits/licences.</p> <p>The activity which is authorised may only be carried out at the premises listed in the authorisation.</p> <p>Construction activities must comply with the Final Layout Drawings.</p> <p>A written notice must be given to the EDTEA prior to the commencement of construction. The notice must include site preparation activities as well as a date on which it is anticipated that the activity will commence.</p>	Developer	Once-off
12.3. Appointment of Contractor		
<p>The Developer must ensure that this EMPr forms part of any contractual agreements with a Contractor(s) and sub-contractors for the execution of the proposed project. The Contractor must make adequate provision in their budgets for the implementation of the EMPr.</p> <p>The Principal Contractor (including sub-contractors and suppliers) must comply with the relevant provisions of the EMPr, applicable environmental legislation, by-laws and associated regulations promulgated in terms of these laws.</p> <p>Tender documents must include statements to include the use of local communities or local community organisation in supplying services and labour to the construction activities.</p> <p>Local labourers must be used for such methods.</p> <p>All Contractor employees must receive regular basic environmental awareness training and must be educated on the requirements of the EMPr and specialist studies.</p> <p>A copy of the EMPr, containing the mitigation and management procedures for working within terrestrial habitats, will need to be made available at the construction site offices/site camp at all times.</p> <p>It is vital that all personnel are adequately trained to perform their designated tasks to the accepted standards.</p>	Developer & Contractor	Once-off and On-going
12.4. Appointment of ECO		
<p>An Independent ECO must be appointed, at the developers cost, to monitor the implementation of the EMPr.</p>	Developer	Once-off

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>The nomination of the ECO must be given, in writing, at least fourteen days before the start of any work, clearly setting out reasons for the nomination, and with sufficient detail to enable the developer to make a decision. The developer will, within seven days of receiving the request, approve, reject or call for more information on the nomination.</p>		
<p>Once a nominated representative of the developer has been approved he/she will be the ECO and must undertake site inspections as per EA for the duration of appointment and provide monthly audit reports for the duration of the construction and rehabilitation phases. Each audit report must contain the results of the full audit. These audit results report must be agreed upon between developer, ECO and competent authority in terms of content and structure.</p>	ECO	Bi-Monthly or as specified in the EA
<p>12.5. Reporting Procedures and Site Environmental File (SEF)</p>		
<p>The following documentation must be kept on-site in order to record compliance with the EMPr: An Environmental File must be maintained by the Contractor which includes:</p> <ul style="list-style-type: none"> ▪ Environmental Authorisation once issued by the EDTEA; ▪ A copy of the Water Use Licence or General Authorisation; ▪ The Final BAR; ▪ Copy of the approved EMPr; ▪ Copy of all other licences/permits (including DAFF and Ezemvelo KZN Wildlife permits); ▪ Copy of all rehabilitation plans; ▪ Copy of the Storm water Management Plan; ▪ Environmental Policy of the Main Contractor; ▪ Environmental Policy of the Harry Gwala District Municipality; ▪ Environmental Method statements compiled by the Contractor; ▪ Non-conformance Reports; ▪ Environmental register; ▪ The Developer, together with the Contractor, must put in place a Complaints Register. 	Developer	Once-off and On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>A Non-Conformance Report (NCR) will be issued to the Contractor as a final step towards rectifying a failure in complying with a requirement of the EMPr. This will be issued by the ECO to the Contractor in writing. Preceding the issuing of an NCR, the Contractor must be given an opportunity to rectify the issue.</p> <p>Should the ECO assess an incident or issue and find it to be significant (e.g. non-repairable damage to the environment), it will be reported to the relevant authorities and immediately escalated to the level of a NCR. The following information must be recorded in the NCR:</p> <ul style="list-style-type: none"> ▪ Details of non-conformance; ▪ Any plant or equipment involved; ▪ Any chemicals or hazardous substances involved; ▪ Work procedures not followed; ▪ Any other physical aspects. ▪ Nature of the risk. ▪ Actions agreed to by all parties following consultation to adequately address the non-conformance in terms of specific control measures and must take the hierarchy of controls into account. ▪ Agreed timeframe by which the actions documented in the NCR must be carried out. <p>The ECO must verify that the agreed actions have taken place by the agreed completion date, when completed satisfactorily; the ECO and Contractor must sign the Close-Out portion of the Non-Conformance Form and file it with the contract documentation.</p>	Contractor	On-going
<h3>12.6. Environmental Training and Awareness</h3>		
<p>Construction staff must be adequately educated by the ECO, and the SHE Officer, as to the provisions included in the EMPr and general environmentally friendly practice.</p>		
<p>The EA and EMPr forms part of the formal site induction for all contractors, sub-contractors and casual labourers, preferably in their native language. The induction training will, as a minimum, include the following:</p> <ul style="list-style-type: none"> ▪ the importance of conformance with all environmental policies; ▪ the environmental impacts, actual or potential, of their work activities; ▪ the environmental benefits of improved personal performance; ▪ their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirement of the Consultant’s environmental management systems, including emergency preparedness and response requirements; and ▪ the mitigation measures required to be implemented when carrying out their work activities. <p>All contractors, sub-contractors and casual labourers must acknowledge their understanding of the EMPr and environmental responsibilities by signing an induction attendance record.</p> <p>The Contractor is expected to have “tool box” talks. These talks must be in accordance with the risks and trends associated with the project. All records of environmental induction and training (including toolbox talks) must be kept on-site within the Site Environmental File (SEF).</p>	ECO Contractor	On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
All operators of excavation equipment should be made aware of the possibility of the occurrence of sub-surface heritage features and the following procedures should they be encountered.		
12.7. Site Preparation		
Prior to the establishment of the site area, the Contractor must produce a site layout plan showing the positions of all equipment storage, waste stockpiling, fuel storage areas and other infrastructure for consideration of the ECO and Developer. Choice of location for construction item storage must take into account location of local residents and environmentally sensitive areas (no-go areas) where applicable.	Contractor	Once-off and On-going
The construction area must be clearly demarcated on the layout plan, and all other areas must be considered no-go areas for the construction personnel. All sensitive areas such as the wetlands must be protected by appropriate temporary fencing and 'no-go' signage during construction, and vehicular access into these sensitive areas must be restricted.		
No-go areas must be agreed to in consultation between the ECO, EO, and, Developer prior to construction.		
Adequate signage must be placed in the area where construction will take place informing the public of the activities taking place.		
The site camp must be secured.		
All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Contractor must provide the following equipment for dealing with spills on site: <ul style="list-style-type: none"> ▪ Spill kits; and ▪ Drip trays; 		
The Contractor must take responsibility for the site to conform to all contractual aspects and environmental standards applicable.		
Vegetation removed for any additional construction camp establishment must to be kept to a minimum. No trees are to be removed with the exception of alien weeds and invader plants identified and approved by the EO and ECO.		
No persons, other than a night-watchman / security guard, may stay overnight at the construction camp.		
The size of the construction camp must be minimised.		
Adequate yet not extensive parking must be provided for site staff and visitors at the Construction camp with the intention to disturb as little grassland as possible.		
The Contractor must provide adequate refuse bins that must be cleaned / emptied and the waste removed from site on a regular basis.		
12.8. Ablution / Sanitation		
Where waterborne sewerage is not available, temporary chemical toilets must be provided by a company that has been approved by the Developer. Such toilets must be available for all site staff, both at the construction camp, and on-site as agreed by the Developer.	Contractor	Once-off and On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>The SHE Officer and ECO must be consulted on the location of any temporary chemical toilets.</p> <p>Temporary toilets must be located outside of the 1:100 year flood line and at a suitable buffer away from the streams and any other tributaries.</p> <p>In cases where facilities are linked to existing sewage structures, all necessary regulatory requirements concerning construction and maintenance must be adhered to.</p>		
<p>12.9. Access</p>		
<p>The Contractor is only permitted to make use of the existing road entrances to the site as well as those agreed to with by the relevant authorities prior to construction commencing.</p> <p>The construction-site must have strict access control to reduce the risks associated with vehicular transportation and pedestrian access on the site.</p> <p>Watercourses and steep gradients must be avoided as much as possible.</p> <p>No vehicles may drive onto the retained wetland or other sensitive sites and no-go areas.</p> <p>All no-go areas will be indicated as such with warning signs in all relevant languages.</p>	<p>Contractor, Engineer & Developer</p>	<p>On-going</p>
<p>12.10. Equipment, Vehicles and Storage Areas</p>		
<p>Washing of vehicles on-site is prohibited.</p> <p>Note that vehicle maintenance is not permitted on-site. If emergency repairs are required to vehicles or construction plant then the conditions as specified below must be implemented.</p> <p>Fire prevention facilities must be present at all storage facilities.</p> <p>Material Safety Data Sheets (MSDSs) must be readily available on-site for all chemicals and hazardous substances to be used on-site. Where possible and available, MSDSs must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes.</p> <p>An oil balance must be implemented to demonstrate appropriate management of hydrocarbons.</p> <p>Plant and equipment must be adequately maintained to prevent spillage of oil, diesel, fuel or hydraulic fluid. The Contractor must repair or withdrawn equipment or machinery from use if they consider these to be polluting and irreparable.</p> <p>Suitably covered receptacles must be available at all times and conveniently placed for the disposal of waste oils and greases. All used oils, grease or hydraulic fluids must be placed therein and these receptacles must be removed from the construction camps on a regular basis for recycling.</p> <p>A procedure for the management of oils spills must be introduced. This must address the cleaning of spillage from hard surfaces, utilising environmental friendly cleaning materials as well as the removal and disposal of polluted sand.</p> <p>Fuel must be stored in tanks with lids, which will be kept firmly shut and under lock and key at all times, within a secondary containment facility.</p> <p>Fuel decanting and refuelling must take place within the construction camp. 50 kg of hydrocarbon absorbent to be placed at the construction camp.</p>	<p>Contractor</p>	<p>On-going</p>

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
12.11. Waste Disposal Facilities		
<p>General waste produced on-site includes:</p> <ul style="list-style-type: none"> ▪ Office waste (e.g. food, waste, paper, plastic); ▪ Operational waste (clean steel, wood, glass); and ▪ General domestic waste (food, cardboards, paper, bottles, tins). <p>An adequate number of general waste receptacles, including bins must be arranged around the Construction area, on-site to collect all domestic refuse, and to minimise littering.</p> <p>Different waste bins, for different waste streams must be provided to ensure correct waste separation and subsequent recycling, where applicable.</p> <p>Bins must be clearly marked and lined for efficient control and safe disposal of waste.</p> <p>A fenced area must be allocated for waste sorting and disposal on the site.</p>	Contractor	On-going
12.12. Security and Safety		
<p>A security guard must be appointed for guard the site at all times.</p> <p>Potentially hazardous areas such as trenches are to be demarcated and clearly marked.</p> <p>Lighting on-site is to be set out to provide maximum security and to enable easier policing of the site, without creating a visual nuisance to local residents or businesses.</p> <p>Material stockpiles or stacks, such as pipes, must be stable and well secured to avoid collapse and possible injury to site workers/ local residents.</p> <p>Flammable materials must be stored as far as possible from adjacent residents/ businesses.</p> <p>Firefighting equipment must be present on-site at all times.</p>	Contractor	On-going
12.13. General and Hazardous Substances and Materials		
<p>Storage areas must not be within any watercourses or within 100 m of any drainage lines.</p> <p>Storage areas must be designated, demarcated and fenced. Storage areas must be secure, under lock and key, so as to minimise the risk of crime.</p> <p>Fire prevention facilities must be present at all storage facilities.</p> <p>Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and ground-water regime around the storage area(s). These pollution prevention measures for storage must include a bund wall high enough to contain at least 110% of any stored volume. Such a facility must be on an impervious surface. The storage area must be securely fenced and all hazardous substances such as fuel, oils, chemicals, etc., must be stored therein. Drip trays, a thin concrete slab or a facility with PVC lining, must be installed in such storage areas with a view to prevent soil and water pollution.</p> <p>All fuel storage tanks and associated facilities must be designed and installed in accordance with the relevant oil industry standards, SANS codes and other relevant requirements.</p>	Contractor	On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
Symbolic safety signs depicting “No Smoking”, “No Naked Flames” and “Danger” are to be prominently displayed in and around the fuel storage area.		
The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified.		
Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected.		
If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used.		
MSDSs must be readily available on-site for all chemicals and hazardous substances to be used on-site. Where possible the available, MSDSs must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or spillages.		
Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures.		

13. CONSTRUCTION PHASE

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
13.2. Worker Conduct on Site		
<p>A general regard for the social and ecological wellbeing of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules:</p> <ul style="list-style-type: none"> ▪ No alcohol / drugs to be present on the site. ▪ No firearms allowed on-site or in vehicles transporting staff to and from site, unless used by security personnel. ▪ Prevent excessive noise. ▪ Prevent unsocial behaviour. ▪ Bringing pets onto the site is forbidden. ▪ No harvesting of firewood from the site or from the areas adjacent to it. ▪ Construction staff are to make use of the facilities provided for them, as opposed to adhoc alternatives (e.g. fires for cooking, the use of surrounding bush for toilet facilities). ▪ Trespassing on private properties adjoining the site. ▪ Driving under the influence of alcohol is prohibited. 	Contractor	On-going
13.3. Health and Safety		
<p>All Procedures and equipment must be in accordance with the Occupational Health and Safety Regulations (OHSA) of South Africa, Act No. 85 of 1993.</p> <p>The Contractor must familiarise himself and his employees with the contents of the aforementioned legislation.</p> <p>First Aid kits must be on hand at all times.</p> <p>The Contractor must implement adequate and mandatory safety precautions relating to all aspects of the deconstruction. Such safety measures and work procedures / instructions must be communicated to construction workers.</p> <p>The wearing of Personal Protective Equipment (PPE) on-site is mandatory for all personnel and construction team members. Minimum requirements must include the wearing of an approved safety helmet, safety boots, safety eyewear, safety reflective jackets and dust masks, ear plugs, etc. where appropriate.</p> <p>PPE signs must be erected on-site at the areas where it is required and the integrity and availability of the signs must be maintained.</p> <p>No person is to be allowed on-site unless they are wearing approved safety equipment.</p> <p>Casual visitors must be required to sign a register at the security checkpoint and undergo a site induction by the SHE Officer. The responsible person must then be contacted before the visitor is allowed access to site. No unauthorised visitors are to be allowed on-site.</p>	Contractor	On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
Workers' right to refuse work in unsafe conditions must be respected. All personnel must be trained in basic site safety procedures.		
13.4. Traffic and Safety		
Implement proper road signs to warn motorists of construction activities ahead. Ensure that there are flag men and signs in place at access points to the construction site. Road signs for all lane closures to be done in accordance to the South African Road Traffic Signs Manual (SARTSM, 1999). Construction routes must be clearly defined. Disruption to the peak traffic periods 06h00 – 09h00 and 15h00 – 18h00 to be minimised or if possible avoided. For any planned night closures, the community must be notified a minimum of three days in advance. Pedestrians to be protected from construction activities at all times. Pedestrian conflict with site access and construction vehicles to be managed by traffic officer. The active construction areas within the site must remain fenced (where needed) for the entire maintenance period.	Contractor	On-going
13.5. Fires		
No open fires or uncontrolled fires will be permitted on-site. Firefighting measures such as fire extinguishers must be located on-site. No open fires to be permitted within the construction footprint. Ensure that no refuse waste is burnt on the site or on surrounding premises. Ensure that all workers on site are aware of the proper procedure in case of a fire occurring on site. Ensure adequate fire-fighting equipment is available and train workers on how to use it. The workforce must be made aware of fire prevention and firefighting measures.	Contractor	On-going
13.6. Pollution Control Measures		
Cement / concrete must not be mixed directly on the ground. Dagga boards, mixing trays and impermeable sumps must be used at all mixing and supply points. Unused cement bags are to be stored so as not to be effected by rain or run-off events. The washing of concrete trucks on-site is prohibited. Used cement bags must be stored in weatherproof containers to prevent windblown cement dust and water contamination. Used cement bags must be disposed of on a regular basis via the solid waste management system, and must not be used for any other purpose. The washing of concrete trucks on-site is prohibited.	Contractor	On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
Used cement bags must be stored in weatherproof containers to prevent windblown cement dust and water contamination. Used cement bags must be disposed of on a regular basis via the solid waste management system, and must not be used for any other purpose.		
All visible remains of excess concrete must be physically removed on completion of the plaster or concrete pour section and disposed of.		
Washing the remains into the ground is not acceptable as groundwater contamination could occur.		
Concrete mixing must be confined to as few areas as possible and ad hoc mixing is to be avoided.		
Concrete mixing is to be undertaken on an impervious surface.		
Areas where concrete was mixed must be cleaned up after use.		
No paint products may be disposed of on-site.		
Storage areas must not be within any watercourses or buffer areas.		
Any spill incident, which may occur, must be investigated and immediate action must be taken.		
This must also be reported to the ECO and SHE Officer. In the case of a spill of hydrocarbons, chemicals or bituminous material in the construction camp or on the construction-site / bunding area, the spill must be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk and reduce bunding capacity.		
Contractor must provide drip trays and must be utilised at all dispensing areas.		
No vehicles transporting concrete, asphalt or any other bituminous product may be washed on-site.		
Vehicle maintenance must not take place on-site unless a specific bunded area is constructed for such a purpose.		
Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed.		
Correct emergency procedures and cleaning up operations must be implemented in the event of accidental spillage.		
If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage of fuel and limit the risk of soil/water contamination. The drip tray will need to be lined with absorbent pads and checked daily while in use.		
All equipment to be used within the sensitive working areas (within the channel) must be checked daily for oil and diesel leaks before gaining access to these working areas.		
Subsoil and construction material stockpiles are to be bermed to prevent leachate and polluted run-off. In the event of a spill incident, the Emergency Response developed by the contractor must be followed.		
An emergency spill response procedure must be formulated and staff are to be trained in spill response. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site, 44-gallon drums must be kept on-site to collect contaminated soil. These must be disposed of at a registered hazardous waste site.		

13.7. Noise

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Neighbouring landowners must be notified about construction activities three days in advance.</p> <p>All construction vehicles and equipment are to be kept in good repair and must be fitted with standard silencers prior to construction.</p> <p>Where possible, stationary noisy equipment (for example compressors, generators etc. must be encapsulated in acoustic covers, screens or sheds. Portable acoustic shields must be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers).</p> <p>Construction activities, and particularly the noisy ones, are to be contained to reasonable hours (between 07h00 and 17h00 only).</p> <p>Machines in intermittent use must be shut down in the intervening periods between work or throttled down to a minimum.</p> <p>In general, operations must meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993).</p> <p>Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA must wear ear protection equipment.</p> <p>Noise levels must be kept within acceptable limits. No pure tone sirens or hooters may be utilised except where required in terms of SANS standards or in emergencies.</p> <p>Noisy operations must be combined so that they occur where possible at the same time.</p> <p>Noise from labourers must be controlled.</p> <p>Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order. Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site?</p> <p>The Contractor must take measures to discourage labourers from loitering in the area and causing noise disturbance. Where possible labour must be transported to and from the site by the Contractor or his sub-contractors by the contractors own transport.</p> <p>Construction activities are to be contained to reasonable hours during normal working hours (between 07h00 and 17h00 only).</p> <p>Neighbours are to be given at least three days warning prior to any blasting, piling or other 'noisy' activities.</p>	Contractor	On-going
13.8. Air Quality		
<p>Any oil containing equipment or containers must be managed in a manner to avoid oil exposure to atmosphere to limit evaporation of volatiles to atmosphere.</p> <p>Odours from chemical toilets and waste must be managed. Removal and disposal of litter and debris must be undertaken during periods of high ventilation. Chemical toilets must be cleared and cleaned at least weekly.</p>	Contractor	On-going

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>No fires are to be allowed on site.</p> <p>Vehicles must be maintained to avoid excessive emissions and smoke. Similarly equipment must be serviced.</p> <p>Dust track-on from disturbed areas to paved road surfaces must be avoided by making use of one of the following measures to:</p> <ul style="list-style-type: none"> ▪ Road sweeping. ▪ Chemical dust suppression of disturbed areas to reduce the amount of dust which can be lifted by the wheels of trucks. ▪ Wet suppression to the roads using a light spray. ▪ The washing down of the wheels of trucks before they exit only paved road surfaces. <p>Water for dust suppression must not be sourced from the UMkhomazi River or any other watercourse on site without a Water Use Licence.</p> <p>Dust liberated to atmosphere must not reduce the visibility for private vehicles making use of the road passing by the site.</p> <p>All construction vehicles and equipment are to be kept in good repair.</p> <p>Speed limits of a maximum of 40 km/hr are to be implemented on site and enforced by the Contractor.</p> <p>Construction activities are to be contained to reasonable hours during the day (between 07h00 and 17h00) avoiding periods of sunrise and sunset.</p> <p>In areas where there is a large potential for dust liberation (high wind days) wet suppression using a light spray must be applied to the areas in question.</p> <p>A dust suppression register as well as a complaints register needs to be kept.</p> <p>All complaints received need to be investigated with remedial action taken communicated to the affected party within 14 days.</p>		
<h3>13.9. Clearing and Protection of Fauna and Flora</h3>		
<p>No natural vegetation is to be collected for use as firewood.</p> <p>No animals are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason.</p> <p>Any wildlife that is injured or killed on the site by accidental means i.e. hit by a vehicle, are to be reported to the Developer, who must take appropriate action to facilitate the recovery of the animal where possible i.e. take the animal to the SPCA.</p> <p>Indigenous vegetation and topsoil cleared for the construction servitude/working area must be rescued and stored at the designated vegetation and soil stockpile area outside of the wetland/aquatic zone for use later in rehabilitation. In this regard, vegetation will need to be cleared in-situ (with sods/topsoil).</p> <p>All alien invasive found must be immediately removed and disposed of responsibly in accordance with the requirements of the ECO. No artificial plants are permitted to be brought to site.</p>	<p>Contractor</p>	<p>On-going</p>

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Alien plant invaders must be removed from disturbed or damaged areas or from the vicinity of these areas regularly during the construction phase.</p> <p>All bare surfaces across the construction-site must be checked for alien invasive plants at the end of every month and alien plants removed by hand pulling/uprooting and adequately disposed.</p> <p>Herbicides must be utilised where hand pulling/uprooting is not possible. ONLY herbicides which have been certified safe for use in wetlands by independent testing authority to be used. The ECO must be consulted in this regard.</p> <p>Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas.</p> <p>Where alien plants have been introduced on to the site during clearing and infilling, they must be removed.</p> <p>The Contractor must develop an Action Plan for the removal of alien invasive species and submit it to the ECO for approval.</p> <p>Invader species and weeds must be removed and disposed of in accordance with existing legislation on a regular basis.</p> <p>The removal of indigenous/endemic shrubs and small trees must be kept to a minimum and only be removed if absolutely necessary and where authorisation has been received where applicable.</p>		
<h3>13.10. Heritage</h3>		
<p>If an artefact on site is uncovered, work in the immediate vicinity must be stopped immediately.</p> <p>The contractor must take reasonable precautions to prevent any person from removing or damaging any such article and must immediately, upon discovery thereof, inform the Construction Engineer of such discovery which in turn must contact a registered archaeologist and AMAFA.</p> <p>Work may only resume once clearance is given in writing by the archaeologist and AMAFA.</p> <p>All construction in the immediate vicinity (50 m radius of the Paleontological site) should cease and the heritage practitioner should be informed as soon as possible.</p> <p>In the event of obvious human remains the South African Police Services (SAPS) should be notified.</p> <p>Mitigation measures (such as refilling etc.) should not be attempted.</p> <p>The area in a 50 m radius of the find should be cordoned off with hazard tape and public access should be limited.</p> <p>The area should be placed under guard.</p> <p>No media statements should be released until such time as the heritage practitioner has had Sufficient time to analyse the finds.</p>	<p>Contractor</p>	<p>On-going</p>
<h3>13.11. Topsoil</h3>		
<p>The Contractor must strip and stockpile all topsoil within the work area for subsequent use at a later stage.</p>	<p>Contractor</p>	<p>On-going</p>

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>The removal of any topsoil from site is prohibited and this must be stockpiled and used solely in the rehabilitation of the works area.</p> <p>The topsoil and spoil material must be used to create storm water attenuation berms and contour the topography accordingly, where required, rather than be spoiled.</p> <p>Noxious weeds must be eradicated from topsoil stockpiles.</p> <p>If pollution of any surface or groundwater occurs, it must immediately be reported to the EDTEA and appropriate mitigation measures must be employed.</p> <p>Topsoil must be kept separate from overburden and must not be used for infilling.</p>		
<p>Management of Stockpile on site:</p> <ul style="list-style-type: none"> ▪ No soil stockpile areas must be located within 50m of any watercourse (includes delineated riparian areas or rivers/streams). ▪ All stockpile areas must be established well within the road reserve. The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. The Contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. ▪ Erosion/sediment control measures such as silt fences, concrete blocks and/or sand bags must be placed around soil/material stockpiles to limit sediment runoff from stockpiles. ▪ Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled topsoil must be kept moist and this can be achieved through irrigation of topsoil stockpiles on a weekly basis. ▪ The slope and height of stockpiles must be limited to 2m and are not to be sloped more than 1:2 to avoid collapse. ▪ Spoil material must be hauled to a designated spoil site or landfill site. No spoil material must be pushed down slope or discarded on site. 		
<h3>13.12. Spoil</h3>		
<p>Litter and general waste is to be removed from the topsoil and spoil material before stockpiling.</p> <p>Spoil sites must be shaped to fit the natural topography.</p> <p>Erosion/sediment control measures such as silt fences, low soil berms or wooden shutter boards must be placed around the stockpiles to limit sediment run-off from stockpiles.</p> <p>Subsoil and topsoil is to be stockpiled separately. Stockpiled soil must be replaced in the reverse order as to which it was removed (subsoil first followed by topsoil).</p> <p>Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils.</p> <p>The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. The Contractor must, where possible, avoid stockpiling materials in vegetated areas that will not be cleared.</p>	<p>Contractor</p>	<p>On-going</p>

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled soil must be kept moist using some form of spray irrigation on a regular basis as appropriate and according to weather conditions.</p>		
<p>The slope and height of stockpiles must be limited to 2m to avoid collapse.</p>		
<p>Slopes must not exceed a vertical: horizontal ratio of 1:3.</p>		
<h3>13.13. Soil Erosion</h3>		
<p>Soil erosion on site must be prevented at all times, i.e. pre, during and post construction activities. Suitable erosion control measures must be implemented in areas sensitive to erosion such as near water supply points and edges of slopes. These measures could include:</p> <ul style="list-style-type: none"> ▪ The suitable use of sand bags or Hessian sheets. ▪ The prompt rehabilitation of exposed soil areas with indigenous vegetation to ensure that soil is protected from the elements. ▪ The removal of vegetation, only as it becomes necessary for work to proceed. ▪ Preventing the unnecessary removal of vegetation especially on steep areas. Taking necessary precautions in terms of design and construction and earthworks, cuts and fills must be taken. 	Contractor	On-going
<p>Constant cognisance of the inherent high erosion risk potential of all soils and sites on the property should be taken and appropriate control and preventative measure put in place.</p>		
<p>The stockpiling of soil or any other materials shall not be allowed near a watercourse or water body to prevent pollution or impediment to surface runoff. The contractor must control and establish suitable mitigation measures to prevent the erosion of the stockpiles.</p>		
<h3>13.14. General Waste Management</h3>		
<p>General waste produced on-site is to be collected in skips for disposal at a registered landfill site. Hazardous waste in not to be mixed or combined with general waste earmarked for disposal at the municipal landfill site.</p>	Contractor	On-going
<p>Under no circumstances is waste to be burnt or buried on-site.</p>		
<p>The excavation and use of rubbish pits on-site is forbidden.</p>		
<p>Waste bins must be cleaned out on a regular basis (weekly) to prevent any windblown waste and/or visual disturbance.</p>		
<p>All general waste must be removed from the construction areas on a daily basis and disposed of in suitable waste receptacles.</p>		
<p>No general waste is to be disposed of on-site.</p>		
<p>Eating areas must not be located within 15m of the channel and/or riparian habitats.</p>		
<p>Provide adequate rubbish bins and waste disposal facilities on-site and educate/encourage workers not to litter or dispose of solid waste in the natural environment but to use available facilities for waste disposal.</p>		

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Clear and completely remove from site all general waste, constructional plant, equipment, surplus rock and other foreign materials once construction has been completed.</p> <p>Recycling/re-use of waste is to be encouraged.</p> <p>Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly at registered sites by a registered waste management company.</p> <p>No litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties during or after the construction period, but disposed of at an approved site. The construction site must be kept clean and tidy and free from rubbish.</p> <p>Management of construction material/building rubble:</p> <ul style="list-style-type: none"> ▪ No building material, soils or rubble is to be disposed of within any watercourse, including rivers, streams and riparian habitats. ▪ Rubble generated from demolishing of existing infrastructure must be loaded onto a dump truck as soon as it is generated. A dump truck must be on standby while any structures are being demolished. ▪ Once loaded onto the truck, the rubble must be taken to a landfill site and a waybill must be retained as proof of safe disposal. ▪ Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area – which must be approved by the ECO and located outside of sensitive wetland/river areas designated as ‘No-Go’ areas. <p>Any form of waste material and rubble generated during construction must be removed from the site and disposed of at a facility registered in terms of section 20(b) of the NEM:WA (Act No. 59 of 2008), if it cannot be responsibly reused or recycled on-site.</p> <p>No waste material may be buried (for the sole purpose of final disposal) or burnt.</p> <p>The Contractor is responsible for the removal of the rubble and waste must supply the applicant with a certificate indicating safe disposal.</p>		
<h3>13.15. Hazardous and Industrial Waste Management</h3>		
<p>Hazardous waste produced on-site includes:</p> <ul style="list-style-type: none"> ▪ Oil and other lubricants, diesel, paints, solvent; ▪ Containers that contained chemicals, oils or greases; and ▪ Equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen). <p>Hazardous waste is to be disposed of at a licenced hazardous waste landfill site. The ECO must approve a licenced waste disposal site at the inception of the project.</p> <p>Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid).</p> <p>Safe disposal Certificates (SDCs) must be obtained from the waste removal company as evidence of correct disposal and kept on-site within the Site Environmental File (SEF).</p>	<p>Contractor</p>	<p>On-going</p>

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>It may be feasible for the waste to be transported to a central point where it can be collected in bulk by the waste disposal company. It must however be noted that:</p> <ul style="list-style-type: none"> ▪ Transport of hazardous materials must be done in accordance with legislative control; and ▪ Relevant SABS Codes of Practice must be adhered to. 		
<p>13.16. Wastewater</p>		
<p>All wastewater generated at the proposed development must be disposed of in a suitable manner so as not to cause any surface or subsurface water pollution or health hazard.</p>		
<p>Wastewater, including cement-contaminated water, must not enter any water course or the sea and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by activities emanating from the above development.</p>		
<p>Contaminated wastewater including cement-contaminated water must not enter any watercourse and must be managed by the Contractor to ensure that the existing water resources on and off site are not polluted by activities emanating from the above development.</p>	Contractor	On-going
<p>Used oil and wastewater must be disposed of to a registered facility.</p>		
<p>A SDC is to be obtained by the Contractor and kept on-site within the SEF.</p>		
<p>Water containing waste must not under any condition be discharged into the natural environment. Measures to contain water containing waste and safe disposal of such must be implemented.</p>		
<p>13.17. Watercourse and Wetland Management</p>		
<p>No clearing or infilling of the adjacent wetland is permitted.</p>		
<p>Under no circumstances may any of the construction workers or staff access the wetland. All staff must be informed of this requirement.</p>		
<p>No stockpiling of construction materials or spoil material or any construction activities whatsoever are allowed to take place within this fenced off area.</p>		
<p>No batching or chemical / fuel storage areas to be located within 50 m of the area of residual hydro-morphic soils or the stream and associated riparian corridor.</p>		
<p>Adequate measures must be put in place to protect the water resources, including the wetland which flow in close proximity to the site. Visible markings showing the buffers demarcated must be provided during the construction phase.</p>	Contractor	On-going
<p>Eating areas must not be located within 20 m of the wetland/riparian habitats. Provide adequate rubbish bins and waste disposal facilities on-site and educate/encourage workers not to litter or dispose of solid waste in the natural environment but to use available facilities for waste disposal. Clear and completely remove from site all general waste, constructional plant, equipment, surplus rock and other foreign materials once construction has been completed. Recycling/re-use of waste is to be encouraged.</p>		

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Temporary River/Flow Diversions:</p> <ul style="list-style-type: none"> ▪ Where construction is to take place within a watercourse (river/stream), temporary diversions may need to be put in place to temporarily divert water away from activities and ensure a dry work area; ▪ Construction within/across watercourses must progress as quickly as practical to reduce the risk of exceeding the temporary diversion capacity. Diversions shall be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse; ▪ Only one diversion is to be made at a time for each watercourse affected; ▪ Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities; ▪ Re-directed flow must not be channelled towards stream/river banks which could cause bank erosion; ▪ Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse; ▪ Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns, and the channel and riparian zone rehabilitated/restored to their original configurations as soon as practically possible; <p>Options for temporary flow diversion when working within channels may include:</p> <ul style="list-style-type: none"> ▪ diversion of the entire watercourse through use of a bypass large diameter pipe; and use of removal sandbags. 		
<p>Compilation of Method Statements for Working within Watercourses:</p> <p>As part of the finalisation of the EMP, detailed method statements must be compiled for all construction activities confirmed to occur within the watercourses.</p> <p>The method statements must provide detail on the following, where applicable:</p> <ul style="list-style-type: none"> ▪ Working area extent and demarcation. ▪ Vegetation and soil clearing / grubbing / stripping and stockpiling. ▪ Access and running track establishment and decommissioning. ▪ Method of excavation. ▪ Temporary flow diversion measures. ▪ Infrastructure placement measures. ▪ Rehabilitation – reshaping, soil preparation, stabilisation / erosion control and re-vegetation. <p>Detailed method statements should be compiled by competent environmental specialist in conjunction with the Project Engineer / Civil Contractor, prior to any construction commencing.</p>		
<p>The Storm water Management Plan must be implemented to ensure proper management of storm water on the site during and after construction to ensure that pollutants and sediment are not released into any water resources.</p>		
<p>Storm water drainage must be via open drains/swales adjacent to the road with energy check structures rather than concrete drains. Under no circumstances must drop inlets and concrete pipes be utilised.</p>	Contractor & Engineer	On-going
<p>Wherever possible, the temporary chutes/berms must not be aligned perpendicular to the slope.</p>		
<p>Outlet erosion protection structures must be designed to reduce outflows to energy levels that do not pose an erosion risk to downslope soils.</p>		

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Outlet erosion structures must be properly installed along the grade and elevation of the slope.</p> <p>Under no circumstances must the structures be placed higher than the ground surface thereby creating a drop off that may cause erosion.</p> <p>Temporary storm water management facilities / silt fences and traps are to be formalised prior to bulk earthworks commencing. These attenuation ponds / silt traps can help considerably with storm water attenuation as well as sediment trapping and erosion prevention during the construction phase.</p> <p>This earth berm must be located immediately down slope of the toe of all cut or fill embankments, must be grassed and must be used to trap sediment transported down slope during rainfall events during the construction phase and must drain to temporary storm water attenuation ponds at a gradient of no steeper than 1:125 to prevent the creation of an erosion donga.</p> <p>Designs for the site development in general must avoid concentration of storm water run-off both spatially and in time and may be required to provide for on-site attenuation of storm water run-off to limit peak flows to pre-development levels.</p> <p>Detailed plans to control and prevent erosion by water must be agreed prior to the commencement of any works, including site clearance, on any portion of the site.</p> <p>Removal of vegetation cover must be carried out with care and attention to the effect, whether temporary or long-term, that this removal will have an erosion potential.</p> <p>Precautions must be taken at all times on building sites to contain soil erosion and prevent any eroded material from being removed from the site.</p> <p>Landscaping and re-vegetation of areas not occupied by buildings or paving must be programmed to proceed immediately after building works have been completed, or have reached a stage where newly established ground cover is not at risk from the construction works.</p>		
<h3>13.18. Social Considerations</h3>		
<p>The construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents.</p> <p>Firearms or any other hunting weapons must be prohibited on site.</p> <p>Members of the public adjacent to the active areas of construction within the site must be notified of construction activities in order to limit unnecessary disturbance or interference.</p> <p>Construction activities will be undertaken during daylight hours and not on Sundays.</p> <p>Consult with local communities regarding the location of construction camps, access and hauling routes and other likely disturbance during and after construction.</p> <p>Provide clear and realistic information regarding employment opportunities and other benefits for local communities.</p> <p>Implement proper road signs to warn motorists of construction activities ahead;</p> <p>People of the homesteads targeted for expropriation or construction through their land must be met with to have discussions with the intention to reach a resolution which is mutually satisfactory and beneficial.</p>	<p>Contractor</p>	<p>On-going</p>

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
Working hours are restricted to 07:00 – 17:00 during weekdays and 08:00-16:00 over weekends if necessary. Should work be required after these hours, the ECO must be notified and any person who resides in close proximity to the site and who may be impacted upon by the disturbance must also be notified.		

14. POST CONSTRUCTION AND REHABILITATION

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
14.2. Construction areas		
All structures comprising the construction affected areas are to be removed from the site and surrounding areas.	Contractor/Developer	Post-Construction
The area that previously housed the construction materials is to be checked for spills of substances such as oil, paint, diesel, etc. and these must be cleaned up.		
All hardened surfaces within the construction affected area must be ripped, all imported materials removed, and the area must be top soiled and re-grassed accordingly with indigenous species.		
The Contractor must arrange the cancellation of any temporary services.		
14.3. Disturbed Areas		
All areas that have been disturbed by construction activities (including the construction affected areas) must be cleared of alien vegetation.	Contractor	Post-Construction
All vegetation that has been cleared during construction is to be removed from site or used as mulch, (except for vegetation which may result in inadvertently seeding alien vegetation).		
Moderately steep and steep slopes should be covered with wide mesh hessian to prevent soil erosion and allow the planted grass seeds to germinate and develop		
If plant invaders cannot be removed physically, they must be cut just above ground level and then poisoned with the specific poison for the particular plant invader.		
14.4. Waste Management		
The site must be kept void of litter.	Contractor	Post-Construction
Solid waste must be removed from the aquatic, wetland and riparian environments and damaged, smothered vegetation will have to be replaced.		

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Waste management at the site should subscribe to the principles of sustainable waste management.</p> <p>This includes:</p> <ul style="list-style-type: none"> ▪ Waste prevention - the prevention and avoidance of the production of waste at source; ▪ Waste reduction - the reduction of the volume or hazardous nature of the waste during production; ▪ Resource recovery - recycling or re-use of the waste; ▪ Waste treatment - the treatment of waste to reduce volume or risk to human and environmental safety and health to reduce the degree of hazard when waste is disposed of in a landfill or discharged into a water source; and ▪ Waste disposal - the environmentally acceptable and safe disposal or discharge of waste, (e.g. encapsulation, incineration, landfill or discharge to a water source). <p>These principles must be practiced to the greatest extent</p>		
<p>14.5. Materials and Infrastructure</p>		
<p>All residual stockpiles must be removed to spoil or spread on-site as directed by the Developer and/or Engineer.</p> <p>All leftover building materials must be returned to the depot or removed from the site.</p> <p>The Contractor must repair any damage that the construction works has caused to neighbouring properties.</p> <p>Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Developer.</p>	Contractor	Post-Construction
<p>14.6. Rehabilitation</p>		
<p>At the end of the construction phase, the site and vicinity of the development should be thoroughly checked for invader plants, especially the nearby wetlands. Any invader plants that are found must be destroyed.</p> <p>Any alien plant invaders in and near the damaged wetlands should be removed and destroyed. The soil substrate of the nearby wetlands should be repaired and then the following wetland plants which are present in the area should be planted: <i>Cyperus latifolius</i>, <i>Cyperus textilis</i>, <i>Ischaemum fasciculatum</i>, <i>Phragmites australis</i>, <i>Pycnus polystachyos</i> and <i>Typha capensis</i>.</p> <p>Existing wetland plant species: (<i>Cyperus latifolius</i>, <i>Cyperus textilis</i>, <i>Ischaemum fasciculatum</i>, <i>Phragmites australis</i>, <i>Pycnus polystachyos</i> and <i>Typha capensis</i>). can be used for rehabilitating damaged wetland habitat</p>	Contractor	Post-Construction
<p>14.7. Ablution / Sanitation</p>		

ENVIRONMENTAL MEASURES AND ACTION PLANS	AREA APPLICABLE	PRIORITY
<p>Where waterborne sewerage is not available, temporary chemical toilets must be provided by a company that has been approved by the Developer. Such toilets must be available for all site staff, both at the construction camp, and on-site as agreed by the Developer.</p> <p>The SHE Officer and ECO must be consulted on the location of any temporary chemical toilets.</p> <p>Temporary toilets must be located outside of the 1:100 year flood line and at a suitable buffer away from the streams and any other tributaries.</p> <p>In cases where facilities are linked to existing sewage structures, all necessary regulatory requirements concerning construction and maintenance must be adhered to.</p>	Contractor	Post-Construction
14.8. End of Contractor Services		
<p>A meeting is to be held on-site between the Developer and the ECO to approve all remediation activities and ensure that the site has been restored to a condition acceptable to the ECO and the Developer.</p> <p>A site close-out audit is to be undertaken by the ECO prior to handover of the site by the Contractor.</p>	Contractor	On-going

15. ENVIRONMENTAL CODE OF CONDUCT

One of the objectives of the EMP is to ensure that all the workforce, contractors, sub-contractors and construction staff have an understanding of environmental issues and potential impacts on site activities. This environmental code of conduct provides the basic rules that should be strictly adhered to. It is the responsibility of the Contractor to ensure that each contractor, sub-contractor and workforce understand and adhere to the Code of Conduct.

ENVIRONMENTAL CODE OF CONDUCT

ALL PERSONS ARE OBLIGED TO KEEP TO THE RULES OF THIS CODE OF CONDUCT

Ignorance, negligence, recklessness or a general lack of commitment resulting in environmental degradation or pollution shall not be tolerated!

ENVIRONMENTAL RULES

- Do not waste electricity, water or consumables;
- Only use authorised accesses;
- Do not litter;
- Dispose solid waste to the correct waste containers provided;
- Prevent pollution;
- Use the toilet facilities provided;
- Do not dispose contaminated waste water to the stormwater or the environment;
- Immediately report any spillage from containers, plant or vehicles;
- Do not burn or bury any waste in the sand;
- Do not trespass onto private properties;
- Strictly leave all animals alone. Never tease, catch or set devices to trap or kill any animal.
- Never damage or remove any trees, shrubs or branches unless it forms part of working instructions and authorisation has been received where necessary;
- Do not deface, draw or cut lettering or any other markings on trees, rocks or buildings in the area;
- Know the fire fighting procedure and locations of fire fighting equipment; and
- Know the environmental incident procedures.

**APPENDIX A:
REHABILITATION PLAN FOR WETLAND AND WATER-
COURSE**

Please Refer to Appendix D2 of this CBAR.

This report will however, be appended to the final stand-alone EMPr