



ZN Geo Services

**DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE
PROPOSED BERGVILLE WATER TREATMENT WORKS UPGRADE,
UTHUKELA DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE, SOUTH
AFRICA**

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DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

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 (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Drainage line: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial and riparian vegetation may or may not be present.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Environment: the surroundings within which humans exist and that are made up of:

- i. The land, water and atmosphere of the earth;
- ii. Micro-organisms, plant and animal life;
- iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
- iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental Impact Assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

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 (EMPr): A plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

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.

General waste: Waste which does not pose an immediate hazard or threat to health or to the environment' and includes the following waste flows: domestic waste, construction and demolition waste, business waste, insert waste.

Habitat: The place in which a species or ecological community occurs naturally.

Hazardous waste: Waste that has the potential to cause a negative threat/impact to humans and/or the environment. It includes, but is not limited to, batteries, neon lights, fluorescent lights, printer cartridges, oil, paint, paint containers, oil filters, IT equipment etc.

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all 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.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Maintenance: means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Turbidity: A measure of the degree to which the water loses its transparency due to the presence of suspended particulates. The more total suspended solids in the water, the murkier it seems and the higher the turbidity. Turbidity is considered as a good measure of the quality of water.

Waste: As per National Environmental Management: Waste Act means-

- a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or
- b) disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or
- c) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste.

Wetland: 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 circumstance support vegetation typically adapted to life in saturated soil.

Watercourse: as per the National Water Act means -

- (a) a river or spring;
- (b) a natural channel 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, and a reference to a watercourse includes, where relevant, its bed and banks.

Waste: means any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 of the National Environmental Management: Waste Amendment Act, 2014.

ABBREVIATIONS

BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CRR	Comments and Response Report
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EO	Environmental Officer
EMPr	Environmental Management Programme
ESA	Ecological Support Areas
GN	Government Notice
HGM	Hydrogeomorphic
HIA	Heritage Impact Assessment
I&AP's	Interested and Affected Parties
IDP	Integrated Development Plan
KZN – EDTEA	Kwa-Zulu Natal Economic Development, Tourism and Environmental Affairs
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NHRA	National Heritage Resources Act (No. 25 of 1999)
NWA	National Water Act (No. 36 of 1998)
OLM	Okhahlamba Local Municipality
PES	Present Ecological Status
PHRA (Amafa)	Provincial Heritage Resource Agency (KZN – Amafa)
PIA	Palaeontological Impact Assessment
PPP	Public Participation Process
REC	Recommended Ecological Category
RoD	Record of Decision
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SMP	Stormwater Management Plan
uTDM	uThukela District Municipality
WMA	Water Management Area
WSS	Water Supply Scheme

WTW Water Treatment Works
WULA Water Use License Application

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1. INTRODUCTION AND BACKGROUND

1.1 Project Title

The Proposed Bergville Water Treatment Works Upgrade, uThukela District Municipality, Kwazulu-Natal Province, South Africa.

1.2 Project Background

The **uThukela District Municipality (uTDM)** is proposing the upgrading of the Bergville Water Treatment Works (WTW) in the Okhahlamba Local Municipality (OLM) within the uThukela District Municipality (uTDM). The Bergville Water Supply Scheme (WSS) provides water to Bergville town as well as to various rural communities in the surrounding area. The scheme currently abstracts raw water from the Tugela River which is then pumped to the Bergville Water Treatment Works (WTW). Treated water is pumped from the Bergville WTW to a set of command reservoirs on the outskirts of Bergville town before being distributed to the town itself and the various rural communities. The existing capacity of the WTW (approximately 2Ml/day) is insufficient to provide for the future water demand requirements of the Bergville WSS. A major upgrade of the works is therefore required.

1.3 Existing Infrastructure

The existing works consists of the following components:

- Raw water pump station (abstraction point) and rising main.
- Header tank / grit channels and flocculation channel (at WTW facility).
- Sedimentation tanks (at WTW facility).
- Auto-backwash gravity filters (at WTW facility).
- Clearwater pump station and rising main.
- Clearwater reservoir.

The existing works is estimated to have a design capacity of between 2 and 3Ml/day and therefore requires a substantial capacity upgrade to be able to cater for the projected water demands for the Bergville WSS.

Population vs Water Demands

The population estimates for this project are based on the Statistics South Africa information obtained from the 2011 census. A growth rate of 0.5% has been applied to the base population figures for the areas falling within the project footprint in order to determine the future projected design population. This is presented in Table 1 below.

Table 1: Projected population figures for Bergville WSS

Scheme	Projected Population Figures			
	2011	2020	2030	2040
Bergville WSS	23 613	24 697	25 960	27 288

The water demands for the Bergville WSS have been based on the average demands per capita and the projected population figures. The summer daily demands for the Bergville WSS are shown in Table 2 below.

Table 2: Projected summer daily demands for Bergville WSS

Scheme	Summer Daily Demands (Mℓ/day)			
	2011	2020	2030	2040
Bergville WSS	8.48	8.71	8.98	9.27

The various components of the existing works are described in further detail below.

1.3.1 Raw Water Pump Station

The raw water pump station currently houses three Gorman-Rupp T6A3S-B self-priming centrifugal pumps. The three pumps draw water directly from the Tugela River through a common steel manifold. Two of the pumps run simultaneously with the third serving as a backup pump.

The three pumps are controlled via a float switch installed in the clearwater reservoir. Pumps 1 and 2 are equipped with 18.5kW motors whilst Pump 3 is equipped with a 22kW motor. The existing pumps are not operating on curve and do not have sufficient capacity to meet the projected water demands of the Bergville WSS. The three pumps therefore need to be upgraded.

Further problems noted at the raw water pump station include:

- Flooding of the pump station by the Tugela River.
- Stormwater management measures around the pump station are required as the existing access road channels any stormflow directly towards the pump station entrance.
- The access road to the pump station has a very steep gradient and is in a poor condition.
- The sump pump in the pump station does not appear to be working as the pump station floor floods. Furthermore, the delivery pipe from the sump pump currently runs out of the pump station window.

Figure 1 below shows an external view of the raw water pump station. Figure 2 below shows the current pump/ pipework arrangement within the raw water pump station.



Figure 1: External view of raw water pump station



Figure 2: Raw water pump station pumps and pipework

1.3.2 Raw Water Rising Main

The existing raw water rising main is a 200mm diameter pipeline with an approximate length of 178m. The integrity of the existing pipeline is unknown but according to the works operators, it does not generally present a problem. The existing pipeline has however been assessed from a hydraulic perspective to determine whether or not it has sufficient capacity to cater for the future projected water demands of the Bergville WSS; but will be left in-situ. From the hydraulic calculations, the following has been identified:

- The velocity in the existing pipeline greatly exceeds the recommended 1.5m/s.

- Head loss in the pipeline is excessive and the pipeline would therefore not be operating efficiently at this flow.

The existing raw water rising main has insufficient capacity to cater for the projected future water demands of the Bergville WSS and therefore requires upgrading.

1.3.3 Header Tank, Grit Channels and Flocculation Channel

The raw water rising main discharges into the header tank at the head of the works. The header tank has three separate outlet weirs which allow flow into the three grit chambers/channels. Only one of the grit channels are usually utilised, however, sometimes two grit channels are used simultaneously when the turbidity of the raw water is high. There is therefore still spare capacity available within the header tank and grit channels. The header tank is shown in Figure 3 while a view of the three grit channels is depicted in Figure 4.



Figure 3: Header tank



Figure 4: Grit channels

A dosing room alongside the header tank houses the dosing tanks and dosing pumps. Coagulant is dosed at the head of the flocculation channel. The upper section of the flocculation channel is sloped with closely spaced baffles to ensure rapid mixing of the coagulant as depicted in Figure 5. Figure 6 assist in demonstrating the lower section of the flocculation channel has a much flatter gradient to slow down the water flow and promote the flocculation process.



Figure 5: Upper (sloped) section of flocculation channel



Figure 6: Lower section of flocculation channel

1.3.4 Sedimentation Tanks

Currently, sedimentation is carried out within the two existing circular sedimentation tanks that are fed from the flocculation channel depicted in Figure 7. Each clarifier has a diameter of 7.4m and an approximate depth of 3.2m. Assuming an upward flow of 1.5m/h, each tank can potentially accommodate a flow of approximately 1.4Ml/day (assuming 22 hours of operation).



Figure 7: Circular sedimentation tanks

The settled water enters a network of launder pipes installed approximately 500mm below water level (refer to Figure 8) and is then discharged into an outlet chamber before gravitating to the auto-backwash filters. Sludge/ overflow water from the sedimentation tanks gravitates to sludge drying beds. Please refer to section 1.3.6 which provided more details on the sludge drying beds.



Figure 8: Launder pipes installed within clarifier

1.3.5 Filters

Filtration at the works is carried out by two auto-backwash circular rapid gravity sand filters. The filters have an overall height of 4m and a diameter of 3.41m. Using a filtration rate of 7m/hr, each filter has a filtration capacity of approximately 1.47Ml/day (assuming 22 hours of operation). The filters backwash automatically when the filter operational head reaches its maximum operating level. Refer to Figure 9



Figure 9: Auto-backwash gravity filters

The filters are said to work well and generally produce good quality water. The auto-backwash filters require no electrical power and minimal operator input to operate which is seen as a significant advantage of this particular technology. Furthermore, the uTDM have advised that the auto-backwash technology is the preferred technology for the upgrading of the Bergville WTW.

1.3.6 Sludge Drying Beds

Overflow/ sludge from the sedimentation tanks and backwash water from the filters gravitate to two sludge drying beds which are used alternately. The sludge should then be dried and either buried or disposed of. However, the sludge drying beds appear highly silted up and have a significant amount of vegetation growing in them. It therefore does not appear that any sludge has been removed from these beds in some time.



Figure 10: Sludge drying bed

1.3.7 Chlorination System

The existing disinfection system comprises a gas chlorination system through which chlorine solution is proportionally dosed into the clearwater reservoir. However, the chlorination system is currently not working and a chlorine solution is currently being dosed manually into the reservoir. Engineering inspection of the existing chlorine dosing facilities suggests that they do not meet current health and safety requirements and the entire chlorination system therefore should be upgraded. The proposed upgrade includes new housing facilities for the chlorine gas dosing equipment with the requisite health and safety measures, such as the provision of safety and warning systems for working with chlorine, incorporated into the system.

1.3.8 Clearwater Reservoir

Treated water from the filters flow under gravity to a reinforced concrete clearwater reservoir with an estimated capacity of approximately 500kl. Refer to Figure 11 The clearwater reservoir provides buffer storage for the clearwater pumps and is sufficiently sized for the works.



Figure 11: Clearwater reservoir

1.3.9 Clearwater Pump Station

The clearwater pump station currently houses two KSB ETA 80-250 self-priming centrifugal pumps. The two pumps draw water directly from the clearwater reservoir through separate suction pipes. The pumps function as duty and standby and at this stage cannot be run simultaneously. The two pumps are controlled via a float switch installed in one of the bulk reservoirs located at the Bergville town reservoir site.

Both pumps are equipped with 55kW motors. According to the pump curve and an approximate total head of 72m from the pressure gauge in the pump station, one pump is capable of providing approximately 47l/s of flow (approximately 4ML/day assuming 24 pumping hours). Previous flow measurements undertaken at the works revealed that the pumps were producing similar flows to this. The pumps therefore seem to be operating well. However, even if both pumps were able to run simultaneously, they would only be able to produce 8ML/day of flow and therefore do not have sufficient capacity to meet the projected water demands of 8.71 ML/day for the Bergville WSS. This scenario would also not allow for any backup as both pumps will be required to operate simultaneously. The pumps within the clearwater pump station therefore need to be upgraded.

Figure 12 depicts an external view of the clearwater pump station. Figure 13 depicts the current pump/ pipework arrangement within the clearwater pump station.



Figure 12: External view of clearwater pump station



Figure 13: Clearwater pump station pumps and pipework

1.3.10 Clearwater Rising Main

The existing clearwater rising main is a 200mm diameter pipeline with an approximate length of 1134m. The integrity of the existing pipeline is said to be poor with regular shut-downs experienced. The existing pipeline has however been assessed from a hydraulic perspective to determine whether or not it has sufficient capacity to cater for the future projected water demands of the Bergville WSS. From the hydraulic calculations, the following has been identified:

- The velocity in the existing pipeline greatly exceeds the recommended 1.5m/s.
- Head loss in the pipeline is excessive and the pipeline would therefore not be operating efficiently at this flow.

The existing clearwater rising main has insufficient capacity to cater for the projected future water demands of the Bergville WSS and therefore requires upgrading.

1.3.11 Existing Package Treatment Plant

An existing package treatment plant with a capacity of 1Ml/day was installed at the works in 2011. The plant is supplied from the outlet of the flocculation channel and utilises a clarifier and a bank of pressure filters for the treatment process. However, the plant has not been in use for some time. Furthermore, the uTDM have since requested that this plant be decommissioned as they have no intention of utilising it further at the Bergville WTW. Refer to Figure 14 below.



Figure 14: Existing package treatment plant

1.3.12 Treatment Works Buildings

The existing treatment works building at the Bergville WTW (refer to Figure 15) consists of a control room, a bathroom, a storage room, two other small rooms that are currently used for accommodation and a chlorine cylinder storage area.



Figure 15: Existing treatment works building

Further to what is described above, a separate building, located alongside the existing treatment works building, is currently being upgraded and will become the office of the uTDM's Okhahlamba Area Engineer. A separate fabricated steel structure is also currently utilised for chlorine storage.

It is noted that the works does not have the following essential facilities:

- A separate laboratory for carrying out water quality testing.

- A storeroom for spares materials, equipment and tools. Spare pipelines, valves and fittings are strewn around the site and are uncovered and therefore at risk of damage from the elements.
- A workshop where repairs could be carried out.

It is also noted that there are a number of old disused concrete structures present at the works. Many of these structures are deep and unprotected and thus pose a significant health and safety risk. Therefore, these disused structures should preferably be demolished and the rubble either removed from site or used as backfill material, or where practicable, the disused structures should be converted into additional working or storage spaces.

1.3.13 Access Roads

A gravel road provides access to the works and is in a relatively poor state and requires upgrading. This falls outside the scope of the BA.

Internal access roads within the Bergville WTW are gravelled although many are in a poor state and require upgrading. The access road to the raw water pump station is in particularly poor condition and requires significant upgrading to enable vehicular access to this pump station. Refer to Figure 16 below.



Figure 16: Access road to raw water pump station is in a state of disrepair

There was also evidence of ponding in the parking area alongside the clearwater reservoir which would indicate that additional stormwater management interventions are required in this area as indicated in Figure 11.

1.3.14 Electrical Supply and Lighting

There is some floodlighting present at the existing works but it does not appear to provide adequate illumination at night. The incoming bulk power supply to the works is more than sufficient to cater for the power requirements of the existing infrastructure.

1.3.15 Fencing

The existing works is enclosed by a 1.8m high weld mesh fence with concrete posts and a layer of razor wire along the top. Sections of the fence are in a fair condition but a number of the concrete fence posts are damaged.

1.4 Project Description for Proposed Upgrade of the Bergville WWTW

The bulk infrastructure components providing supply to or forming part of the design of the WTW are described in the section above. The required upgrades to each of these components to cater for the projected future water demands of the Bergville WSS (up to a capacity of 9Ml/day) is described in detailed in the following sections. Note that these sections should be read in conjunction with the layout and site photographs attached as Appendix

1.4.1 Raw Water Pump Station

The existing raw water pump station requires significant refurbishment and upgrading. This will consist of:

- Replacement of the existing pumps with a set of two duty / standby Gorman Rupp T8 selfpriming pumps fitted with 45kW motors. The new pumps have been designed based on the following specifications:
 - Static head = 14m
 - Total head = 19.2m
 - Design flow (per pump) = 120l/s
- An additional floor is to be constructed above the existing pump station to reduce the likelihood of flooding of the electrical infrastructure. In conjunction with this, all walls of the pump station below the new floor will be waterproofed to reduce the potential of flooding of the pumps.
- The MCC for the new pump sets will be installed on the new upper floor level.
- A new sump pump and pipework will be installed in the existing sump with the sump pump pipework being routed through the pump station wall. The pipework will be fitted with a non-return valve to prevent water flowing through this pipeline into the pump station in the event of the lower section of the pump station becoming inundated during a flood.
- The existing crawl beam will be reinstalled just below the new roof height of the pump station to accommodate the new set of pumps.
- The access road leading to the pump station will be raised to tie into the new upper floor level.
- Stormwater drainage measures will be implemented alongside and across the new access road to prevent runoff from the road from flowing directly into the pump station.
- Erosion control measures will be implemented above and below the access road to the pump station.

1.4.2 Raw Water Rising Main

As indicated above, the existing raw water rising main does not have sufficient capacity to cater for the projected water demands of the Bergville WSS. As provided in Table 3, this pipeline will therefore be upgraded to a 400mm diameter uPVC rising main (approximately 186m in length).

Table 3: Details of New Raw Water Rising Main to Bergville WTW

Pipeline	Design flow (l/s)	Velocity (m/s)	Material	Diameter (mm)	Class (bar)	Length (m)
Raw Water Rising Main	120	1.10	uPVC	400	9	186

1.4.3 Header Tank, Grit Channels and Flocculation Channel

The existing header tank, grit channels and flocculation channel will be used with slight modifications to the existing structures. The header tank and grit channels will be retained without modification.

The flocculation channel will be modified to accommodate the new sedimentation tank. The modifications include the installation of a stainless-steel weir within the lower section of the flocculation channel to separate the flows to the existing sedimentation tanks and the proposed new sedimentation tank. A 400mm diameter pipeline will be constructed from the flocculation channel to feed the new sedimentation tank. All other portions of the existing flocculation channel will be retained without alteration.

1.4.4 Coagulant Dosing, Coagulation and Flocculation

Coagulant dosing presently takes place immediately after the grit removal tanks. The dosing position will be retained however the flocculant dosing equipment will be upgraded to meet the increased water demand.

In the design, the selected coagulant is polyelectrolyte for ease of operation and continuation of the existing system. The upgraded dosing system includes bulk storage tanks, transfer pumps, dosing tanks and dosing pumps. The positive displacement transfer pumps pump polyelectrolyte from the bulk storage tanks to the dosing tanks. The dosing pumps are then fed from the dosing tanks.

The dosing rate will vary from day to day and jar tests should be performed to determine the optimum dosing rate. The equipment specified can handle a wide range of dosing rates. The dosing pumps will be housed in the existing dosing room at the head of the works.

The polyelectrolyte shall be delivered to site by bulk tanker and stored in two 5000l storage tanks, located within the existing coagulant storage and dosing building. Two polymer transfer pumps (one duty and one standby) will then be utilised to transfer the polyelectrolyte to the two. 200l dosing tanks where it can be diluted if required. The two

dosing pumps (one duty and one standby) will pump polyelectrolyte feed solution from the dosing tanks to the dosing point in the header tank.

Design parameters for the polymer transfer pumps are provided in Table 4 below.

Table 4: Design Parameters for Polymer Transfer Pumps

Design Parameters	Pumps 1 and 2
Pump Type	Positive displacement
Design Flow (Minimum)	1 l/s
Total Pumping Head Required	10m

Design parameters for the coagulant dosing pumps are provided in Table 5 below.

Table 5: Design Parameters for Coagulant Dosing Pumps

Design Parameters	Pumps 1 and 2
Pump Type	Positive displacement
Design Flow Range	1 - 10 l/h

1.4.5 Sedimentation

A single sludge blanket sedimentation tank has been selected in the design for ease of operation and reduced maintenance costs. The sedimentation tank requires no mechanical equipment and is operated entirely under gravity flow. Water is fed into the tank at the top centre and flows down through the flocculation zone of the tank and then up through the sludge blanket and over the circumferential launder. Sludge settles to the bottom of the tank and is hydraulically scoured from the tank when required. De-sludging is required when the sludge blanket rises above a predetermined level in the sedimentation tank.

Design parameters for the sedimentation tank are provided in Table 6 below.

Table 6: Sedimentation Tank Design Criteria

Design Parameter	Units	Value
Type of sedimentation tank	Sludge blanket	
No of new tanks	No.	1
Minimum hydraulic retention time	hours	4
Maximum up flow rate	m ³ /h/m ²	1.25
Launder loading rate	m ³ /m/h	3.77
Desludging by gravity		

The sedimentation tank launder channel discharges into the filter feed pipeline.

1.4.6 Filters

To retain consistency of technology and performance, auto-backwash rapid gravity sand filters have been selected as the most appropriate technology for the upgrade. Auto-backwash filters do not require an external power source and require very little operator intervention. Four additional auto-backwash rapid gravity sand filters have been provided for in the upgrade. The upgraded works will therefore have a total of six auto-backwash filters of similar filtration capacity.

The filters each has dedicated filter feed pipes which are fed from the filter splitter box. The filter splitter box is fed from the filter feed pipeline from the sedimentation tanks. Each filter can be isolated for maintenance and repair when required.

The supply to the two existing filters will be rerouted through the new splitter box for improved control.

Design parameters for the rapid gravity sand filters are provided in Table 7.

Table 7: Rapid Gravity Sand Filter Design Criteria

Design Parameter	Units	Value
Type of filter		Rapid gravity sand
No of filters	No.	6
No of Duty Filters	No.	6
Maximum hydraulic capacity of filter	m ³ /m ² /h	8
Design filtration rate	m ³ /m ² /h	6.7
Filter media		Silica Sand
Depth of filter media	mm	TBA

Each filter should be backwashed automatically at least once within two days as required. However, more frequent backwashing may be required when the feed water turbidity is high for whatever reason and this shall occur automatically. Furthermore, the system has also been designed to allow for hydraulic scour only which will be triggered automatically when the filter reaches its maximum operating head. The filter specification also requires a forced backwash ability which means that the filters can be backwashed on demand if the auto backwash is too infrequent.

The backwash water will be discharged onto the sludge drying beds.

In filter mode, the filters discharge water through the filtered water discharge pipe to the filtered water pipeline which in turn discharges into the existing clearwater reservoir.

1.4.7 Sludge Drying Beds

Drying beds are the most widely used method of municipal sludge dewatering. The main advantages of sludge drying beds are as follows:

- Low capital cost
- Low energy consumption
- Low to no chemical consumption
- Low operator skill and attention required
- Less sensitivity to sludge variability
- Higher cake solids content than that of most mechanical methods.

Disadvantages include:

- Large space requirements
- The need for prior sludge stabilization
- Consideration of climatic effects
- Odour potential
- The fact that sludge removal is usually labour intensive.

Sludge drying beds may be classified as either conventional sand, paved, artificial media, and vacuum assisted.

As a result of the increase in capacity of the Bergville WTW infrastructure, additional sludge will be produced. The sediment present within the existing sludge drying beds will be removed and disposed of at an approved location.

1.4.8 Clearwater Reservoir

The existing clearwater reservoir will be utilized as is and will only require minor modifications to the existing inlet and outlet reservoir pipework.

1.4.9 Disinfection

The disinfection process chosen for this works is gas chlorination because of the quantity of chlorine required and the efficiency of the gas chlorination process. Two duty and standby chlorinators and chlorine gas cylinders have been provided in the design. The chlorine will be supplied in 1000kg cylinders. The chlorine will be dosed flow proportionally to maintain a residual chlorine level of 0.5mgCl₂/l. The small amount of chlorine added to disinfect drinking water in accordance with EPA regulations is safe for consumption.

Chlorine disinfection will take place at the end of the clearwater pipeline where it discharges into the clearwater reservoir.

Facilities provided for the chlorine disinfection include a chlorine storage room, 2 x 1000kg chlorine cylinders, vacuum room and 3 x gas chlorinators.

1.4.10 Clearwater Pump Station

The existing clearwater pump station requires the following upgrading:

- Replacement of the existing pumps with a set of 2 duty/ standby KSB Etanorm 200-150-400 centrifugal pumps fitted with 90kW motors. The new pumps have been designed based on the following specifications:
 - Static head = 49m
 - Total head = 52.3m
 - Design flow (per pump) = 136l/s
- The existing pump station is too narrow to accommodate the new pumps which are considerably larger than the existing pumps. The pump station therefore needs to be widened by 1m to accommodate this. Since the pump station is constructed up against the clearwater reservoir, the expansion of the pump station will be carried out in the direction of the existing treatment works building.
- The MCC for the new pump sets will be installed in the expanded section of the pump station.

1.4.11 Clearwater Rising Main

As indicated above, the existing clearwater rising main does not have sufficient capacity to cater for the projected water demands of the Bergville WSS. This will pipeline will therefore be upgraded to a 400mm diameter uPVC rising main (approximately 870m in length). It is noted that the pipeline will be routed along a different route than the existing pipeline follows which will shorten its required length. Details of the new clearwater pipeline for the Bergville WTW are provided in Table 8 below.

Table 8: Details of New Clearwater Rising Main to Bergville WTW

Pipeline	Design flow (l/s)	Velocity (m/s)	Material	Diameter (mm)	Class (bar)	Length (m)
Clearwater Rising Main	136	1.25	uPVC	400	9	870

1.4.12 Treatment Works Buildings

The footprint of the existing treatment works building will remain as is. However, the building will be modified internally to make better use of the available space in order to meet the needs of the treatment works from an operational perspective. The following internal modifications will be carried out under this project:

- The current control room will remain as is but will be refurbished internally. Two corner desks and chairs will be provided to create two separate workspaces for WTW operational staff.
- The existing bathroom footprint will also remain as is but will be refurbished internally.
- The existing storeroom is to be converted into a kitchen. Access to the kitchen will be provided from the existing verandah and the roller door will be bricked up. The kitchen will be internally fitted with counters / cupboards and a double sink.
- The two rooms currently used as accommodation are to be converted into a laboratory. The internal walls are to be removed and the room is to be internally fitted with counters/ cupboards, shelves and a double sink. The chlorine tank storage area is to be relocated and bricked up such that this space is incorporated into the laboratory.

In addition to the above, the existing package treatment plant, that is currently installed within one of the old disused slow sand filters, will be dismantled and relocated to a suitable location. The existing space occupied by the two slow sand filters will be converted into a workshop and a storage area by raising the existing walls, creating access from the south facing walls and erecting a steel roof structure.

Furthermore, the following new buildings will also be constructed:

- A chlorine building that will be constructed alongside the existing clearwater reservoir. The building will be split into a chlorine storage room that will house the chlorine gas cylinders, chlorine detectors, a safety shower etc. as well as a chlorine vacuum room that will house the chlorine flow regulators and dosing pumps.
- A guard house will be constructed at the entrance to the Bergville WTW and will be furnished with a desk, chair and filing cabinet.

1.4.13 Water Supply to Water Tanker Dispensing Unit

A domestic water supply to the water tanker dispensing unit is to be provided directly from the clearwater rising main. An off-take from the rising main is to be provided as well. The off-take to the water tanker dispensing unit will be metered.

A new dispensing unit will be installed at the same location as the existing unit and will be supplied by a 110mm uPVC pipeline fed from the off-take chamber on the clearwater rising main. The dispensing unit will be controlled by an isolating valve located inside the fenceline of the Bergville WTW.

1.4.14 Domestic Water Supply

A domestic water supply to the treatment works buildings, raw water pump station and new chlorine building is to be provided directly from the clearwater rising main. An off-take from the rising main is to be provided as well. The off-take to the domestic water supply for the treatment works buildings will be metered. The off-take from the rising main will supply a plastic storage tank located at the top of the works behind the flocculation dosing building.

Water will gravitate from the plastic storage tank to the various supply points within the WTW. Provision has also been made for the installation of standpipes at certain locations around the WTW to assist with operation and maintenance practices.

1.4.15 Access Roads

The access roads around the Bergville WTW will require significant upgrading. The following upgrades are to be carried out to the existing access roads within the site:

- Upgrading of existing road subbase, base and surface. Interlocking brick pavers will be utilised for the road surface.
- A new paved parking area for light delivery vehicles will be created.
- The turning area for water tankers outside the works will be upgraded and paved.

1.4.16 Telemetry System

A telemetry and SCADA system will be installed at the works to control the raw water and clearwater pump stations and reservoirs (including the reservoirs located at the Bergville bulk reservoir site).

1.4.17 Electrical Supply and Lighting

The treatment works has sufficient bulk power to provide for the upgraded raw and Clearwater pump stations. External and internal lighting across the entire works will also be upgraded.

1.5 Water Treatment Works Specifications

Table 9 below provides a summary of the WTW Specifications.

Table 9: Water Treatment Works Specifications

Design Parameters	Specifications
Water Treatment Works	
Gross Treatment Capacity	10.35 Ml/day
Net Treatment Capacity	9 Ml/day
Raw Water Source	Surface water abstracted from Tugela River
Design of Sedimentation Tank	
Type of Sedimentation Tank	Sludge blanket
No. of Existing Tanks	2
No. of New Tanks	1
Minimum Hydraulic Retention Time	4 hours
Maximum Upward Velocity	1.25 m ³ /m ² /h
Launder Loading Rate	3.77 m ³ /m/h
Settled Water Quality	< 20 NTU
Design of Auto-Backwash Rapid Gravity Filters	
Type of Filter	Auto-backwash rapid gravity sand
No of Filters (Existing)	2 No.
No of Filters (Upgrade)	4 No.
No of Duty Filters	6 No.
Maximum Hydraulic Filtration Rate	6.7 m ³ /m ² /h
Design Filtration Rate	6.7 m ³ /m ² /h
Filtered Water Quality	< 1 NTU
Filter Media	Silica Sand
Depth of Filter Media	> 1000 mm
Disinfection	
Method of Disinfection	Gas Chlorination
Chlorine Residual	0.5 mg Cl ₂ /m ³
Bulk Pipelines	
Maximum Allowable Pipeline Velocity	1.5m/s

Min. Pipeline Pressure Rating	9 bar
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1.6 Development footprint

In terms of development footprint, the dimensions of the proposed upgrades are as follows.

- Clearwater Pipeline Length (WTW to Command Reservoir) = 720.99m
- Raw Water Pipeline Length (Abstraction to WTW) = 158.70m
- WTW area 1 Existing = 607.94m²
- WTW area 2 Upgrade = 1322.28m²
- Command Reservoir area = 3449.43m²

The total development footprint is 5370m².

1.7 Locality

The town of Bergville is located in the north-western section of the KwaZulu-Natal province. Bergville Town is located 22km west of Winterton Town, about 93km north-west of Moor River, approximately 53km west of Ladysmith, approximately 150km north-west of Pietermaritzburg and approximately 350km south south-east of Johannesburg. The Bergville Water Supply Scheme (WSS) provides water to Bergville town as well as to various rural communities in the surrounding area. The scheme falls under the jurisdiction of the uThukela District Municipality (uTDM) who are the Water Services Authority for the area. The proposed upgrade project falls within ward 11 of the Okhahlamba Local Municipality. Refer to Figure 17 which depicts the broader locality of where the proposed development is situated.

The Bergville WTW is located behind Ridge Road and adjacent to the Tugela River from which it feeds from via an abstraction pipeline. The command reservoir is located on an unnamed road off Kingsway Raod. The proposed upgraded pipeline route will start at the Bergville WTW, moving north crossing over Ridge Road and then in a westerly direction, crossing a wetland area until it reaches the command reservoir. Refer to Figure 18 which depicts the locality of the proposed development scope of works.

The coordinates are outlined in Table 10 as follows:

Table 10: Coordinates

Activity	Coordinates
Abstraction Point	28°44'12.22"S; 29°20'53.62"E
Bergville WTW	28°44'10.96"S; 29°20'57.57"E

Clear water pipeline (Start)	28°44'10.43"S; 29°20'58.30"E
Clear water pipeline (Turning Point 1)	28°44'07.51"S; 29°20'57.19"E
Clear water pipeline (Turning Point 2)	28°44'05.21"S; 29°20'53.06"E
Clear water pipeline (Turning Point 3)	28°44'05.62"S; 29°20'48.66"E
Clear water pipeline (Turning Point 4)	28°44'05.34"S; 29°20'46.06"E
Clear water pipeline (End)	28°44'03.09"S; 29°20'37.29"E
Command Reservoir	28°44'02.49"S; 29°20'36.44"E

The affected properties are listed in Table 11 below along with the SG Codes for each property.

Table 11: Property Details

Land Description	SG CODE
Erf 140	N0GS0022000001400000
Portion 2 of Erf 139	N0GS00220000013900002
Portion 1 of Erf 356	N0GS00220000035600001
Rem. of Erf 356	N0GS00220000035600000
Portion 67 of the Farm Kleine Waterval 1227	N0GS00000000122700067
Portion 1 of Erf 356	N0GS00220000035600013
Portion 0 of Kleine Waterwal 1227	N0GS00000000122700000

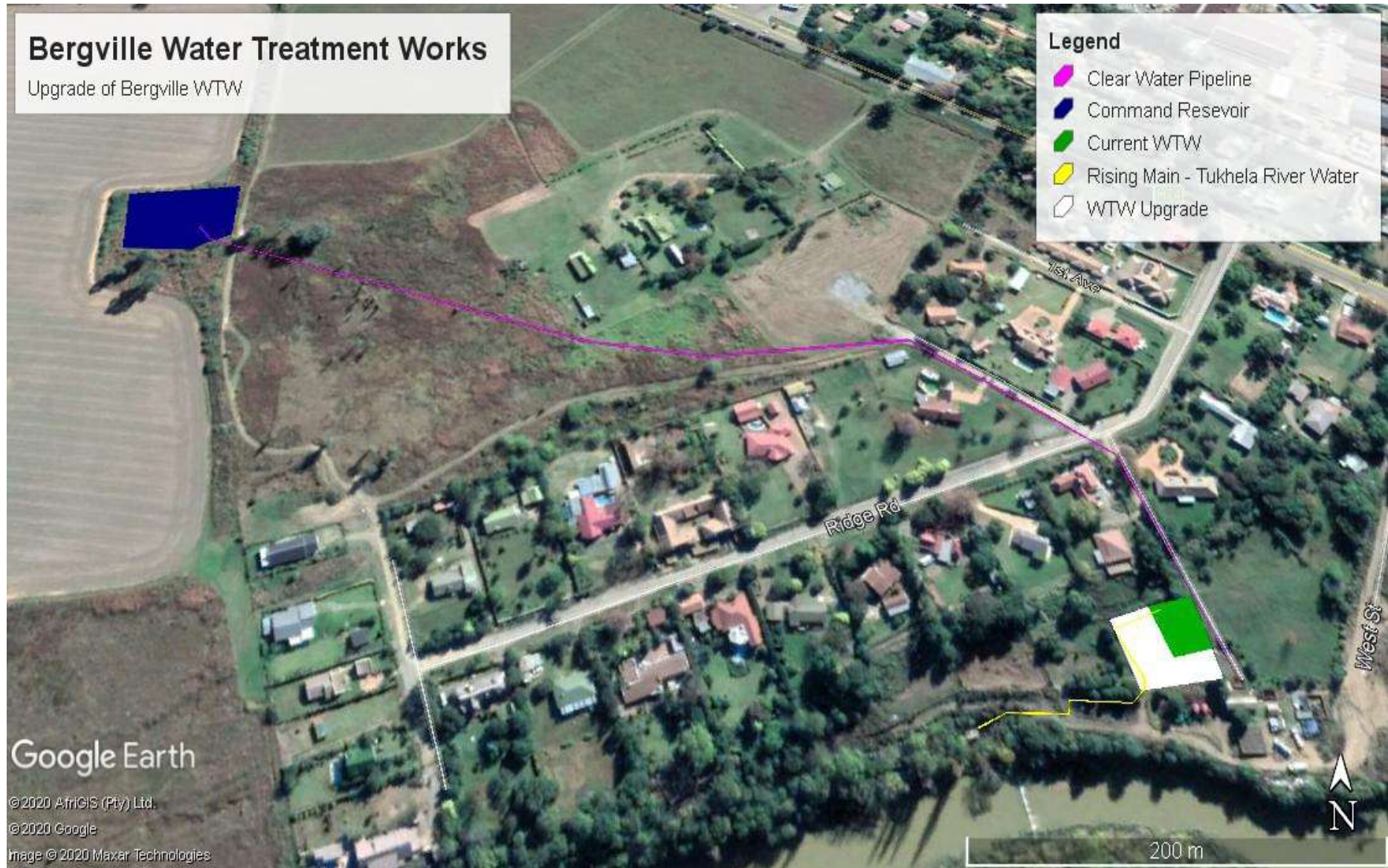


Figure 18: Locality Map

1.8 Aims and objectives the EMPr

It is understood that any development can pose various risks to the environment as well as the residents or businesses in the surrounding area. These possible risks should be taken into account during the planning phase of the development. The purpose of this EMPr is to provide an easily interpreted reference document that ensures that the project's environmental commitments, safeguards and mitigation measures from the environmental planning documents, project approvals and scope of works are implemented. It aims to minimise impacts associated with the proposed development. This includes ensuring that the mitigation measures described in the Basic Assessment Report are implemented, to ensure continued monitoring of the construction and operational phase and to ensure the involvement of interested and affected parties (IA&Ps) in a meaningful way. This EMPr is, therefore, a stand-alone document, which must be used on site during each phase of the development (planning, pre – construction, construction, operational and rehabilitation phases).

This document should be flexible so as to allow the contractor and developer to conform to the management commitments without being prescriptive. The management commitments prove that the anticipated risks on the environment will be minimised if they are adhered to consistently. The onus set out in the EMPr rests with the developer, main and subcontractors, which promotes responsibility and commitment. Any parties responsible for transgression of the underlying management measures outlined in this document will be held responsible of non-compliances and will be dealt with accordingly.

The objectives for the EMPr are:

- To develop, implement and maintain effective management systems for the environmental aspects of the maintenance works;
- To document details of environmental protection infrastructure and controls so that they are able to provide long term protection for the natural environment;
- To ensure compliance with relevant legislation (National, Provincial and Local), regulatory requirements and environmental documents;
- To maximise the value and outcomes of environmental monitoring activities so that the information can be applied to the planning and implementation of future projects;
- To ensure that all Environmental Management considerations are implemented during the operational and maintenance phases of the project.

The EMPr has been developed based on the findings of the on-site assessment undertaken by ZN Geo Services (Pty) Ltd and the following specialist studies undertaken during the basic assessment process of this project:

Specialist	Specialist Report	Date
The Biodiversity Company	Wetland Assessment	July 2020 (Updated November 2020)
Fundor Enviro Service	Vegetation Assessment	October 2020
Fundor Enviro Service	Animal Assessment	October 2020
Umlando: Archaeological Surveys and Heritage Management	Heritage Survey	July 2020

All the environmental specifications and the procedures discussed in this document were also developed in accordance with the relevant legislation applicable to the development.

2. PREPARATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

This Environmental Management Programme was compiled by:

EAP Details	
Company Name:	ZN Geo Services (Pty) Ltd
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Expertise of EAP that prepared the EMPr

Zama Sithole – The EAP for this project is a registered Professional Natural Scientist and holds a MSc. Degree in Environmental Management. She has over 10 years of experience within the field of environmental management with a key focus on environmental advice and solutions, environmental assessments, management of environmental projects and compliance reporting. She is currently an EAP at ZN Geo Services (Pty) Ltd responsible for several environmental management projects across KZN and the country.

3. DESCRIPTION OF THE IMPACTS

- **Wetland**

The site is situated in the Quaternary Catchments V11J. Nine Water Management Areas (WMA) were established by, and their boundaries defined in Government Gazette Nr. 40279, dated 16 September 2016. Quaternary Catchment V11J falls within the Upper Thukela Water Management Area (WMA). The affected watercourse is the Tugela River and other wetlands within the region. The proposed pipeline runs through sections of these wetland areas.

The pipeline will intersect wetland HGM 2 (as the other options; and HGM5 for the landowners recommended pipeline). With the exception of the water pipeline which traverses a wetland area, namely HGM 2, the risk assessment undertaken by the specialist concluded that the upgrade of the abstraction pump as well as the WTW would pose Low risks to the wetland systems based on the anticipated footprints remaining outside of the buffer zone, provided that the mitigation measures are implemented.

The pipeline upgrade will cross HGM 2 and the associated buffer. The remaining HGM units are not at risk. The pre-mitigation moderate risk impacts were identified as:

- Servitude clearing;
- Excavation of pipeline route; and
- Alteration of surface and sub-surface drainage.

- **Biodiversity (Fauna and Vegetation) Assessment**

The preferred route encounters the grassy hilltop vegetation only, whereas the abandoned Alternative 1 encounters two such vegetation types (grassy hilltop and tree-grassy). The specialist recommendation is as follows:

Since there are two pipeline route options on the Grassy-Hilltop Vegetation, option one (Grassy-Hilltop Vegetation 1) is recommended for this project as this is an already existing pipeline. This option will traverse on the single vegetation type, unlike option two that will traverse two vegetation types, the Grassy-Hilltop Vegetation 1 and the Tree-Grassy Vegetation.

The original pipeline route could have other heritage implications as it traverses through a building on portion 13 of Erf 356. As no information was available of the age of this building it could have been more than 60 years old. According to the National Heritage Resources Act

(NHRA) (Act No. 25 of 1999) and the KwaZulu-Natal Amafa and Research Institute (Act No. 05 of 2018), no structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.

- Palaeontology

The palaeontological assessment noted that the proposed development occurs in a very sensitive area. However, it also noted that the area was already disturbed and that the rock was highly weathered. The proposed upgrade to the existing Bergville WTW will take place on already transformed land. The proposed Clearwater pipeline infrastructure, that crosses less disturbed areas, is unlikely to affect palaeontological layers. Thus, no further mitigation is required, apart from a Chance Find Protocol to form part of the EMPr.

- Other potential impacts

Potential impacts that may occur during the construction will include soil erosion and sedimentation, surface water contamination due to hydrocarbon spillages from construction vehicles and machinery, noise, dust and traffic from construction equipment and vehicles. Waste management issues such as littering which can also cause visual nuisance. Traffic congestion in and around the area may offend property owners during the construction phase. Local security is also likely to be comprised during the construction phase by the presence of workers on site.

It is of utmost importance that the mitigation measures proposed in this EMPr be adopted and be monitored by an independent person throughout the construction phase.

4. APPLICABLE LEGISLATION

Several laws and regulations apply to the protection of the environment and contain environmental principles and standards that need to be applied and permits and licenses that need to be obtained. This EMPr will be subject to regulatory control under a range of State, Provincial and Local regulations. Such legislation largely embraces pollution prevention, resource use and conservation, and socio cultural (heritage) protection. This chapter reviews legislation pertaining to proposed development.

According to Section 2 (1, 2 & 3) of the National Environmental Management Act No. 107 of 1998 (NEMA), all organs of state have to apply certain principles set out in NEMA when taking decisions that may significantly affect the environment. The key principles of this Act include that all “actions” that they approve must be economically, socially and environmentally sustainable. It further states that “people and their needs” must be at the forefront of “its concern” and their interests must be served equitably. The intent of this EMPr is to ensure that the developer conducts all its activities related to the construction and maintenance of this erosion protection measure in accordance with the provisions of the NEMA, and has taken into account the provisions of the constitution and the principles of Integrated Environmental Management (IEM).

The legislative requirements include, but are not limited to, the following:

Table 12: Applicable Legislation

Title of legislation, policy or guideline (Promulgation Date)	Applicable Requirements	Administering Authority	Description of compliance
National Environmental Management Act (Act No. 107 of	NEMA requires, inter alia, that: <ul style="list-style-type: none"> ○ development must be socially, environmentally, and economically sustainable. 	National Department of Environment, Forestry and Fisheries (DEFF) KZN Department of	The Basic Assessment is undertaken in accordance with the requirements of Government Notice R326 of April 2017, as required in terms of the National Environmental Management, 1998

Title of legislation, policy or guideline (Promulgation Date)	Applicable Requirements	Administering Authority	Description of compliance
1998)	<ul style="list-style-type: none"> ○ disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. ○ risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions. <p>EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations.</p> <p>In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.</p>	Economic Development, Tourism and Environmental Affairs (EDTEA)	(Act No. 107 of 1998)
National Environmental Management Act (Act No. 107 of 1998)	<p>A project proponent is required to consider a project holistically and to consider the cumulative effect of potential impacts.</p> <p>In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with a project is avoided, stopped or minimised.</p>	National Department of Environment, Forestry and Fisheries (DEFF) KZN Department of Economic Development, Tourism and Environmental Affairs	<p>While no permitting or licensing requirements arise directly, the holistic consideration of the potential impacts of the proposed project has found application in the impact assessment phase.</p> <p>The implementation of mitigation measures is included as part of the Project EMPr and will continue to apply throughout the life cycle of the</p>

Title of legislation, policy or guideline (Promulgation Date)	Applicable Requirements	Administering Authority	Description of compliance
		(EDTEA)	project.
National Water Act (Act No. 36 of 1998)	<p>Section 21 water uses as per the NWA includes:</p> <p>21(a): Taking water from a water resource;</p> <p>21(b): Storing water;</p> <p>21(c): Impeding or diverting the flow of water in a watercourse;</p> <p>21(d): Engaging in a stream flow reduction activity;</p> <p>21(e): Engaging in a controlled activity;</p> <p>21(f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit;</p> <p>21(g): Disposing of waste in a manner which may detrimentally impact on a water resource;</p> <p>21(h): Disposing in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;</p> <p>21(i): Altering the bed, banks, course or characteristics of a watercourse;</p> <p>21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and</p> <p>21(k): Using water for recreational purposes.</p> <p>For wetland areas, development within a 500m buffer triggers the act. For rivers, development within a 100m buffer triggers the act.</p>	Department of Human Settlements and Water and Sanitation (DHSWS)	The proposed development requires a Water Use License as Section 21 a, c and i of the NWA are triggered as a result of the proximity to the wetland area. A Water Use License Application is currently being uploaded onto the DWS eWULAAS portal.

Title of legislation, policy or guideline (Promulgation Date)	Applicable Requirements	Administering Authority	Description of compliance
	<p>Any activity that triggers any of the above water uses will require a Water Use License.</p> <p>Given the sensitivity associated with a project, DWS will determine whether the project will follow a General Authorisation process or a Water Use License Application process.</p>		
<p>National Environmental Management: Biodiversity Act 2004 (Act No. 10 of 2004)</p>	<p>This Act provides management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act (Act No. 107 of 1998); the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.</p>	<p>National Department of Environment, Forestry and Fisheries (DEFF)</p>	<p>While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction phase of the project in proper management of the sensitive area (wetland) identified on site.</p>
<p>National Environmental Management: Waste Act (Act No. 59 of 2008)</p>	<p>The NEMA: WA came into effect on the on 1st July 2009. Section 20 of the Environment Conservation Act (Act No. 73 of 1989), under which waste management was previously governed, was repealed. In general, the act seeks to ensure that people are aware of the impact of waste on their health wellbeing and the environment, and in the process giving effect to Section 24 of the constitution, in ensuring an environment that is not harmful to health and wellbeing.</p>	<p>National Department of Environment, Forestry and Fisheries (DEFF)</p> <p>National Department of Environment, Forestry and Fisheries (DEFF) – lead authority for regulating hazardous waste.</p> <p>KZN Department of Economic Development,</p>	<p>No waste license activities are applicable to this project. The developer will however be required to store and manage waste in accordance with the requirements of this Act and associated Standards.</p>

Title of legislation, policy or guideline (Promulgation Date)	Applicable Requirements	Administering Authority	Description of compliance
		Tourism and Environmental Affairs (EDTEA) – for regulating general waste	
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	<p>Section 18, 19 and 20 of the Act allow certain areas to be declared and managed as “priority areas”.</p> <p>The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.</p> <p>Dust Control Regulation Control Regulations, R. No. 827 of 1 November 2013.</p>	National Department of Environment, Forestry and Fisheries (DEFF)	<p>While no permitting or licensing requirements arise from this legislation for the site, this Act will find application during the construction phase of the project.</p> <p>The implementation of dust mitigation measures are included as part of the project EMPr and will continue to apply throughout the life cycle of the project.</p> <p>Dust control regulations promulgated in November 2013 may require the implementation of a dust management plan.</p>
National Heritage Resource Act, 1999 (Act No. 25 of 1999)	<p>Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including the construction of a road, exceeding 300m in length.</p> <p>In accordance with the NHRA, an independent heritage consultant is to conduct a cultural heritage assessment to determine any impact on any sites, features or objects of cultural heritage significance. If</p>	<p>South African Heritage Resources Association (SAHRA)</p> <p>Provincial Heritage Resource Agency (KZN – Amafa)</p>	Should any heritage sites be unearthed during excavations, a permit would be required to be obtained from SAHRA/ Amafa.

Title of legislation, policy or guideline (Promulgation Date)	Applicable Requirements	Administering Authority	Description of compliance
	<p>none are identified, any archaeological sites or graves to be exposed during construction work must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.</p> <p>If a permit is required as per section 34 of the NHRA, no works are to commence before the permit is obtained.</p>		
Promotion of Access to Information Act, 2000 (Act No. 2 of 2000)	Legislation that allows the public access to information about activities that influence their well-being and to make contributions to decision making.	National Department of Environment, Forestry and Fisheries (DEFF)	No permitting is required. The act finds applicability during the public participation process phase of the Basic Assessment process.
Occupational Health and Safety Act (Act No. 85 of 1993)	The Occupational Health and Safety Act provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work, against hazards to health and safety arising out of or in connection with the activities of persons at work.	Department of Labour	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction phase of the project. Health and safety precautions measures must be put in place for the construction crew and the general public. E.g. Protection of workers on site through provision of Personal Protective Equipment's; Training and other health and safety amenities.

5. PHASES OF THE PROJECT

The point of departure for this EMPr is to take a pro-active route by addressing potential problems before they occur. This should limit corrective measures needed during the construction and operational phases of the development. Additional mitigation will be included throughout the project's various phases, as required and if necessary.

The EMPr deals with the following phases as detailed below:

5.1. The Planning and Design Phase

Overall Goal for Planning and Design: Undertake the planning and design phase of the development in a way that:

- Ensures that the design of the development responds to the identified environmental constraints and opportunities.
- Ensures that the best environmental options are selected for all components of the project.

The EMPr offers an ideal opportunity to incorporate pro-active environmental management measures with the goal of attaining sustainable development.

Pro-active environmental measures minimise the chance of impacts taking place during the construction and operational phase. There is still the chance of accidental impacts taking place; however, through the incorporation of contingency plans (e.g. this EMPr) during the planning phase, the necessary corrective action can be taken to further limit potential impacts. In order to meet this goal, action plans for the planning and design phase have been identified together with monitoring requirements.

5.2. The Construction Phase

The bulk of the impacts during this phase will have immediate effect (e.g. noise-, dust- and water pollution). If the site is monitored on a continual basis during the construction phase, it is possible to identify these impacts as they occur. These impacts will then be mitigated through the contingency plans identified in the planning phase, together with a commitment to sound environmental management from the developer.

5.3. Rehabilitation Phase

This phase will involve restoring the land impacted during the construction phase back to its original state. This process will focus mainly on rectifying the negative impacts that have been caused during construction by the removal of pollution or contaminants and other dangerous substances from groundwater, sediment, or surface water and improvement of the soil.

5.4. The Operational Phase

By taking pro-active measures during the planning and construction phases, potential environmental impacts emanating during the operational phase will be minimised. This, in turn, will minimise the risk and reduce the monitoring effort, but it does not make monitoring obsolete.

6. ROLES AND RESPONSIBILITIES

The implementation of this EMPr requires the involvement of several stakeholders, each fulfilling a different but vital role to ensure sound environmental management during the construction phase. The stakeholders are discussed below.

6.1. Developer

The Developer shall:

- Remain ultimately responsible for ensuring that the development is implemented according to the requirements of the EMPr.
- Be responsible for ensuring that sufficient resources (time, financial, human, equipment, etc.) are available to the other role players (e.g. the ECO, ELO and contractor) to efficiently perform their tasks in terms of the EMPr.
- Be liable for restoring the environment in the event of negligence leading to damage to the environment.
- Ensure that the EMPr is included in the tender documentation so that the contractor who is appointed is bound to the conditions of the EMPr.
- Ensure that the compliance with the conditions of the environmental authorisation and the EMPr is audited.
- Appoint an independent Environmental Control Officer (ECO) during the construction phase to oversee all the environmental aspects relating to the development.
- Submit an environmental audit report to the relevant competent authority (EC – EDEAT).

6.2. Contractors and Service Providers:

All contractors (including sub-contractors and staff) and service providers shall:

- The contractor, as the developer's agent on site, is bound to the EMPr conditions through his/her contract with the developer and is responsible for ensuring that he adheres to all the conditions of the EMPr.
- Thoroughly familiarise him/herself with the EMPr requirements before construction begins and must request clarification on any aspect of these documents, should they be unclear.
- Ensure that he/she has provided sufficient budget for complying with all EMPr conditions at the tender stage.

- Ensure adherence to the environmental management specifications.
- Ensure that Method Statements are submitted to the Site Manager and ECO for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMPr.
- Ensure that any instructions (whether verbal or written) issued by the site manager, project manager site engineer or ECO, in terms of the EMPr are adhered to.
- Ensure that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
- Ensure that an incidents register is kept in the site office which lists all transgressions issued by the ECO.
- Ensure that a register of all public complaints is maintained (Appendix 2).
- Ensure that all employees, including those of sub-contractors receive training before the commencement of construction so as to constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations).
- Appoint an Environmental Officer (EO).
- The ELO must have the appropriate experience and qualifications to undertake the necessary tasks.
- He/she must form part of the project team and be involved in all aspects of project planning that can influence environmental conditions on the site.

6.3. The Environmental Control Officer (ECO)

The Environmental Control Officer (ECO) will be responsible for monitoring, reviewing, and verifying compliance by the Contractor with the environmental specification of the EMPr and the conditions of the environmental authorisation (once issued). The ECO will:

- Attend relevant project meetings, conduct inspections to assess compliance with the EMPr and be responsible for providing feedback on potential environmental problems associated with the development. In addition, the ECO is responsible for:
- Be fully knowledgeable with the contents within the Basic Assessment.
- Be fully knowledgeable with the contents within the Environmental Authorisation.
- Be fully knowledgeable with the contents within the conditions of the Water Use Licence.
- Be fully knowledgeable with the contents within the Environmental Management Programme.
- Be fully knowledgeable with the contents within all relevant environmental legislation,

and ensure compliance to them.

- Ensure that the contents of the EMPr are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- Assist in ensuring that the necessary environmental authorisations and permits have been obtained prior to construction commencing.
- Review the Contractor's construction Method Statements.
- Undertake site inspections of all construction areas with regard to compliance to the EMPr.
- Monitor and verify adherence to the EMPr, the EA and approved Method Statements at all times.
- Monitor and verify that environmental impacts are kept to a minimum.
- Taking appropriate action if the specifications are not followed.
- Advise on the removal of person(s) and/or equipment not complying with the specifications.
- Audit the implementation of the EMPr and compliance with the EA on a monthly basis or at intervals specified in the environmental authorisation once issued.
- Compile a final audit report regarding the EMPr and its implementation during the construction period after completion of the contract and submitting this report to the Employer and the authorising authority.
- Have the right to enter the site and do monitoring and auditing at any time, subject to compliance with health and safety requirements applicable to the site (e.g. wearing of safety boots and protective head gear).

(a) Liaison with Authorities

The ECO will be responsible for liaising with the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (EC – EDEAT). The ECO must submit monthly environmental audit reports to the authorities. These audit reports must contain information on the contractor and the developer levels of compliance with the EMPr. The audit report must also include a description of the general state of the site, with specific reference to sensitive areas and areas of non-conformance. The ECO must indicate suggested corrective action measures to eliminate the cause of the non-conformance incidents. In order to keep a record of any impacts, an Environmental Log Sheet (refer to Appendix 1) is to be kept on a continual basis.

(b) Liaison with Contractors

The ECO is responsible for informing the contractors of any decisions that are taken concerning environmental management during the construction phase. This would also include informing the contractors of the necessary corrective actions to be taken.

6.4. Resident Engineer

The Resident Engineer (RE) will be appointed by the 'Consultant' and will be required to oversee the construction programme and construction activities performed by the Contractor. The RE is expected to liaise with the Contractor and ECO on environmental matters, as well as any pertinent engineering matters where these may have environmental consequences. He/she will oversee the general compliance of the Contractor with the EMPr and other pertinent site specifications. The RE will also be required to be familiar with the EMPr specifications and further monitor the Contractor's compliance with the Environmental Specifications on a daily basis, through the site diary, and enforce compliance.

6.5. Environmental Officer

The contractor must appoint an Environmental Officer (EO) to assist with day-to-day monitoring of the construction activities. Any issues raised by the ECO will be routed to the ELO for the contractors' attention. The EO shall be permanently on site during the construction phase to oversee the Contractor's internal compliance with the EMPr requirements and ensuring that the environmental specifications are adhered to. The EO should ideally also be a senior and respected member of the construction crew.

The EO will be responsible for keeping detailed records of all site activities that may pertain to the environment and include all these aspects in an environmental register. This register must be presented at each EMC meeting and be made available to the ECO during his/her monthly audits. In addition to the environmental register the EO must keep a register of complaints from any community members on environmental issues. Finally, the EO will be required to keep a record of all on-site environmentally related incidents and how these incidents were dealt with. Past experience has revealed that, EO's that can relate to the work force are the most effective for information transfer and ensuring compliance with the EMPr.

7. ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

The following tables form the core of this EMPr for the construction and operational phases of the development. This table should be used as a checklist on site, especially during the construction phase. Compliance with this EMPr must be audited monthly during the construction phase and once immediately following completion of construction and rehabilitation. This must be followed up with annual audits for a period of two years during the operational phase if rehabilitation was not successful in the first year.

Table 13: Planning and Design Phase

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Appointment and Duties of ECO	The developer must appoint an independent Environmental Control Officer (ECO) who must monitor the contractor's compliance with the EMPr.	Developer	Once-Off
	The developer must provide the ECO and contractor with a copy of the EMPr.	Developer	Once-Off
	The priority of the ECO is to maintain the integrity of the development conditions outlined in the EMPr.	ECO	Continuous
	The ECO must form part of the project management team and attend all project meetings.	ECO	Continuous
	The contractor must ensure that the construction crew attend an environmental briefing and training session presented by the ECO prior to commencing activities on site.	ECO, Contractor	Once-Off
	Report on environmental compliance at the monthly site meetings.	ECO, EO	As necessary
	An Environmental Completion Statement will be prepared by the ECO for submission to developer indicating completion of the project and compliance with the EMPr and conditions. This statement will be prepared after the final audit during the rehabilitation phase.	ECO	Once-Off
Appointment and Duties of EO	The contractor must appoint an Environmental Liaison Officer (EO). This person will be required to monitor the situation with a direct hands-on approach, and ensure compliance	Contractor	Once-Off

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	and co-operation of all personnel. He should be fluent in the languages of the employees.		
Permitting	The relevant authorisations and water use licenses must be obtained from Department of Human Settlement and Water and Sanitation (DHSWS) prior to the commencement of construction activities. No activities may proceed within or in proximity to watercourses without a Water Use License permitting the activity.	Developer, ECO	Once-Off
EMPr	This EMPr must be made binding to the main contractor as well as individual contractors and should be included in tender documentation for the construction contract.	Developer, ECO	Once-Off
Training for Site Personnel	All Contractor teams involved in construction work are to be required to undergo some form of environmental induction on their obligations towards environmental controls and methodologies in terms of this EMPr, prior to commencing of the works.	Developer, ECO	Once-Off
	<p>The Contractor shall ensure that all site personnel have a basic level of environmental awareness training. Topics covered should include:</p> <ul style="list-style-type: none"> • What is meant by “Environment” • Why the environment needs to be protected and conserved • How construction activities can impact on the environment • What can be done to mitigate against such impacts • Awareness of emergency and spills response provisions <p>It is the Contractor’s responsibility to provide the site foreman with environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff.</p> <p>Training should be provided to the staff members in the use of the appropriate fire-fighting</p>	Contractor	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	<p>equipment. Translators are to be used where necessary.</p> <p>Use should be made of environmental awareness posters on site.</p> <p>The need for a “clean site” policy also needs to be explained to the workers.</p> <p>Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks.</p> <p>The Contractor must monitor the performance of construction workers to ensure that the points relayed during their introduction have been properly understood and are being followed.</p>		
	<p>Environmental inductions may take the form of onsite talks and demonstrations by the Contractor and the ECO. Induction report will be signed by the Contractor as well as the Employee undergoing Induction, and records kept for auditing purposes and copies given to the ECO for filing. The education/ awareness programme should be aimed at all levels of management and staff within the Contractor’s team, and particularly labour drawn from surrounding communities.</p>	EO, ECO, Contractor	Continuous
Record Keeping	<p>It is recommended that photographs are taken of the site prior to, during and immediately after construction as a visual reference. These photographs should be stored with related documents and other records related to this EMP.</p>	Developer, Contractor	As necessary
	<p>All specialist reports.</p>	Developer, Contractor	Continuous
	<p>The Contractor shall ensure that all pertinent permits, certificates and permissions have been obtained prior to any activities commencing on site and ensure that they are strictly enforced/</p>		

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	adhered to.		
	All records related to the implementation of this management plan (e.g. site instruction book, ECO reports, induction records, method statements, incident register must be kept together in an office where it is safe and can be retrieved easily.	Developer, Contractor, EO	As necessary
	All relevant records should be kept for a minimum of two years after construction and should at any time be available for scrutiny by any relevant authorities or stakeholder.	Developer, Contractor	As necessary
Layout Plan	The extent of the construction sites and access roads should be demarcated on site layout plans and should be restricted to disturbed areas or those identified with low conservation importance. Therefore, no construction personnel or vehicle may leave the demarcated area except those authorised to do so. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as “no-go” areas for employees, machinery or even visitors.	Developer, Contractor	Once - off
Existing Services and Infrastructure	The Contractor shall ensure that existing services (e.g. roads, pipelines, power lines and telephone services) are not damaged or disrupted unless required by the contract and with the permission of the RE.	Contractor, RE, ECO	Continuous
	The Contractor shall be responsible for the repair and reinstatement of any existing infrastructure that is damaged or services which are interrupted.	Contractor	As necessary
	Such repair or reinstatement will be to the Contractor’s cost and shall receive priority over all other activities.	Contractor	Continuous
	A time limit for the repairs may be stipulated by the RE in consultation with the Contractor.	Contractor, RE, ECO	Continuous
Communication	Notify relevant stakeholders in writing, at least 10 days prior to commencement of site	Contractor, EO	Once - Off

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Mechanisms	preparation. Develop grievance mechanisms for the recording and management of complaints and grievances specifically including (but not limited to) grievances from those living in the area.	Contractor, EO	Once - Off
Emergency Preparedness	If chemicals in sufficient quantity and toxicity have the potential to be released on the construction sites, emergency contingency plans should be prepared as safety measures (bunded areas). These safety measures should be communicated to the relevant personnel on the construction site. All hazardous installations require a Risk Assessment in terms of the Occupational Health and Safety Act, (Act No.85 of 1993) for construction sites.	Contractor, ELO	Once - Off
Method Statements	<p>The Contractor shall submit written Method Statements to the RE for the activities identified by the RE or ECO. Activities that will require method statements include:</p> <ul style="list-style-type: none"> • Logistics for the Environmental Awareness Training Course • Location and Layout of Construction camp • Construction procedures • Cement and concrete batching • Solid and Hazardous Waste Management • Drainage and stormwater planning • Dust control • Stockpiling area • Vegetation removal • Materials and equipment to be used • Getting the equipment to and from the site • How the equipment material will be moved while on site 	Contractor	As necessary

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	<ul style="list-style-type: none"> • How and where material will be stored • The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur • Timing and location of activities • Compliance/non compliance with Specifications • Site camp establishment • Concrete pre-cast and batching operation • Emergency procedures • Materials, equipment and staffing requirements • Transporting the materials and/or equipment to, from and within the site • Stockpiling of rubble • General and Hazardous waste management on site • The storage provisions for the materials and/or equipment • The proposed construction procedure designed to implement the relevant environmental specifications • Other information deemed necessary by the RE and/or ECO. <p>Method Statements shall be submitted at least ten working days prior to the proposed commencement of work on an activity to allow the RE (and/or ECO) time to study and approve the method statement.</p>		
	Contractor shall not commence work on that activity until such time as the Method Statement has been approved in writing by the RE contract.	Contractor, RE, ECO	Continuous
	The Contractor shall carry out the activities in accordance with the approved Method		

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Statement.		
	Under certain circumstances, the RE may require changes to an approved Method Statement. In such cases the proposed changes must be agreed upon in writing between the Contractor and the RE, and appropriate records retained.	Contractor, RE	Continuous
	Approved Method Statements shall be readily available on the site and shall be communicated to all relevant personnel. Approval of the Method Statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the EMPr specifications.	Contractor, Developer	Continuous
Site Establishment	The contractor shall establish his construction camp, office/s and any other infrastructure as per the agreed site layout plan in a manner that does not adversely affect the environment.	Contractor, ECO	Once-Off
	The contractor shall submit a method statement for site clearance for approval by the RE in consultation with the ECO. Site establishment shall take place in an orderly manner and all required amenities shall be installed at site camp before the main workforce move onto site.	RE, Contractor, ECO	Once-Off
	Designate access roads during the planning phase.	Contractor, ECO	Once-off
	The Construction camp shall have the necessary ablution facilities with chemical toilets at commencement of construction activities to the satisfaction of the Project Manager. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed other than in supplied facilities.	Contractor, ECO	Continuous
	Safe drinking water for human consumption shall be available at the site offices and at other convenient locations on site. All water used on site must be taken from a legal source and comply with the recognised standards.		

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	No fires on site will be allowed. Activities which may pose a risk of fire must be identified and suitable measures must be put in place to prevent any possible damage by fire. Contractors must inform the staff of the risk of fires, fire prevention and emergency procedures in the event of a fire. Fire fighting equipment shall be supplied by the Contractor at suitable locations.		
	The construction camp must preferably be positioned where it will not visually impact on adjacent landowners and should not be located in an environmentally sensitive area.	Contractor, ECO	Once off
	All sensitive areas (i.e. heritage, ecological, wetland) should be demarcated and fenced off before development commences. These areas should be treated as “no go” areas.	Contractor, ECO, EO	Continuous
	Invasive alien plant species should be treated in an appropriate manner.	EO, Contractor	Continuous
	Alien plant eradication and follow-up control activities prior to construction, to prevent spread into disturbed soils, as well as follow-up control during construction.		
Environmental Impacts	<ul style="list-style-type: none"> • No activities may proceed within or in proximity to watercourses without a Water Use License permitting the activity. • The final route and watercourse crossing methods should impact on as little portion thereof as possible. • No construction camps or related activities should be situated in any vegetation of medium or high sensitivity. • The approved method statement must be available on site for reference purposes. • Appropriate design and mitigation measures must be developed to minimise impacts on the natural flow regime of the watercourse i.e. through placement of structures/supports and to minimise turbulent flows in the watercourse. • Where possible plan construction to take place during the drier winter months. • Where possible plan construction activities to have the smallest possible footprint. 	Developer, ECO, EO	Once-Off

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	<ul style="list-style-type: none"> • Minimise the width of the construction servitude (including running tracks) across a wetland zone. • Consider the various methods material and equipment available to install the pipeline and select whichever method(s) that will have the least impact on watercourses. • Demarcate the construction footprint prior to commencement of construction and ensure that all workers and contractors are aware that access beyond the demarcated areas are not allowed Where the pipeline will affect a wetland, the edge / boundary of this wetland must be clearly demarcated in the field with poles, sticks, or any solid structure that will last for the duration of the development. • Ensure that a copy of this and other applicable documents are available on site and that all workers and contractors are aware of it. Implementation thereof should be monitored by the appointed Environmental Officer (EO) or Environmental Control officer (ECO). • Plan construction activities that necessitate water crossings to only cross watercourses at designated points. • The height, width and length of structures must be limited to the minimum dimensions necessary to accomplish the intended function. • Make use of existing roads in such a way as to minimise impact on the wetlands. • Plan construction activities that necessitate water crossings to only cross watercourses at designated points. • Plan construction camps to be placed outside of watercourses and their associated buffer zones. • Designate access roads during the planning phase allowing only wetland crossing at designated points. • The approved method statements must be available on site for reference purposes. • Activities must be conducted in a manner that does not negatively affect catchment 		

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	<p>yield, hydrology and hydraulics (DWAF, 2014).</p> <ul style="list-style-type: none"> Plan excavation to take place only once the required materials are on site. This facilitates the immediate laying of the pipeline and minimises open trench time. Plan for necessary erosion protection measures to ensure the sustainability of all structures. Structures must be non-erosive, structurally stable and must not induce any flooding or safety hazards. Compile a comprehensive stormwater management plan for hard surfaces as part of the final design of the project. This must include appropriate means for the handling of stormwater within the site, e.g. separate clean and dirty water streams around the plant, install stilling basins to capture large volumes of run-off, trapping sediments, and reduce flow velocities (i.e. water used when washing the mirrors), as well as appropriate drainage around the site. 		
Loss of Heritage Resources	<ul style="list-style-type: none"> The contractors and workers should be notified that archaeological sites might be exposed during the construction activities. Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible. All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken. Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site. Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. 	Developer, ECO, EO	Once-Off

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	(1).		
Safety Planning	<ul style="list-style-type: none"> • Site should have access control planned prior to construction commencing. • A security must be appointed for the construction site camp. • Safety must be ensured for affected and neighbouring properties by means of adequate temporary fencing during construction on the affected properties. 	Developer, ECO, EO	Once-Off for Continuous

Table 14: Pre – Construction Phase

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Site Establishment	Plan construction activities to have the smallest possible footprint.	Contractor, Developer	Continuous
	The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.	EO, Contractor, ECO	Continuous
	The site must be inspected by a botanist during the summer season to identify all protected tree species of conservation concern in order to record their existence for permitting purposes.	Contractor	Continuous
	Only necessary traffic should be allowed within these demarcated areas.	Contractor, EO	Continuous
	Contractors should refrain from impacting areas beyond the demarcated construction area.	Contractor, EO	Continuous
	Minimise disturbance and loss of soil.	Contractor, EO	Continuous
	The contractor must avoid traffic or storing of equipment and material in vegetated areas that will not be cleared.	Contractor, EO	Continuous
Drilling at localised areas for geotechnical surveys	Keep disturbance of soil to a minimum.	Contractor, EO	Continuous
	No drilling should be undertaken within areas demarcated as “no – go” areas (highly sensitive).	Contractor, EO	Continuous
	Do not remove vegetation outside the construction footprint.	Contractor, EO	Continuous
Social	Local individuals should be employed for work components that do not require a substantial	uTDM	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	amount of skill, e.g. foundation excavation, vegetation clearance, cleaning services, and security guards.		
	Individuals with the potential to develop their skills should be afforded training opportunities.	uTDM	Continuous
	Identify targets for BEE and local employment.	uTDM	Once off
	Younger people tend to have higher levels of education and may stand in line for higher levels of employment. Opportunities for the employment of younger people should be maximised.	uTDM	Once off
	Equal opportunities for employment should be created to ensure that the local female population also has access to these opportunities.	uTDM	Once off
	Payment should comply with applicable Labour Law legislation in terms of minimum wages.	uTDM	Continuous
	Contractor to develop jobsite security plan to curtail theft and crime as a result of the construction site.	uTDM, Contractor	Once off

Table 15: Construction Phase

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Excavation	All excavation (if not working in the area) should be barricaded/covered to prevent safety and environmental accidents. Erect signs and/or danger tape around the exposed excavations to warn the public of the inherent dangers.	EO, Contractor	Monitor daily
	Minimise the time taken to complete each operation that is causing inconvenience or disruption in this area.	Contractor	Continuous
	Make a temporary access ways over any excavations.	Contractor	Continuous
	To inform property owners of the extent of the exact time and duration of closing entrances to any properties at any one time.	Contractor	Continuous
	<ul style="list-style-type: none"> • No excavation is to commence without an excavation method statement, agreed to by the geologist, site engineer and developer. • No excavation to commence on site without the lateral shoring / stabilisation methods signed off by the geologist, site engineer and safety officer. • No excavation of river banks to commence without the necessary indemnity forms/agreement/memorandum of understanding being signed off with the adjacent property owners. • No excavation of the river banks to commence without the contractor, professional consultants and developer having adequate insurance in place. • No excavation to commence or continue during any rain or wet spell. • Excavations to be done in an incremental fashion without exposing large areas of the river banks. 	Developer, Contractor, ECO, ELO, Safety Officer	Continuous
	Trucks removing excavated material can cause compaction of soil if new pathways are created. Vehicles should, therefore, use existing roads. If the creation of new roads is unavoidable,	ECO, Contractor	Monitor weekly

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	these temporary roads should be ripped and re-vegetated after use.		
Site Housekeeping	The construction site and surrounds are to be maintained in a clean orderly and presentable condition at all times.	Contractor	Monitor daily
	Regular inspections by the Contractor (and ECO) will be undertaken using checklists to ensure a minimum standard of orderliness is maintained.	Contractor, ECO	Weekly
	Construction activities shall avoid causing unnecessary disruption and nuisance to adjacent landowners and the public as a whole.	Contractor	Continuous
Fire Prevention and Control	The Contractor shall ensure that there is basic fire-fighting equipment available on site as per requirement of the local Emergency Services.	Contractor, ECO	Continuous
	<p>The Contractor shall ensure that all site personnel are aware of the fire risks and how to deal with any fires that occur. This shall include, but not be limited to:</p> <ul style="list-style-type: none"> • Regular fire prevention talks • Posting of regular reminders to staff 	Contractor, ECO	Continuous
	Any fires, which occur, shall be reported to the Environmental Officer immediately and then to the relevant authorities.	Contractor, ECO	Continuous
Emergency Procedures	<p>The Contractor shall submit Method Statements covering the procedures and response plan for the main activities, which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to:</p> <ul style="list-style-type: none"> • Accidental fires • Vehicle and plant accidents 	Contractor	As Necessary
	The contractor shall assemble and clearly list the relevant emergency telephone contact numbers for staff and brief staff on the required procedures.	Contractor	Weekly

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Social	Inform local businesses about the expected influx of construction workers so that they can plan for the extra demand.	uTDM	Once off
Mobilisation of pollutants	If concrete batching will be required on site. The contractors must provide and maintain a method statement for “cement and concrete batching”. The method statement must provide information on proposed location, storage, washing & disposal of cement, packaging, tools and plant storage.	Contractor, Resident Engineer (RE), ECO	Once off
	Cement, asphalt and plaster should only be mixed within mixing trays. Washing and cleaning of equipment should also be done within a bermed area (outside of the wetland buffer), in order to trap any cement, asphalt or plaster and avoid excessive soil erosion. These sites must be rehabilitated prior to commencing the operational phase.	Contractor, EO, ECO	As necessary
	The mixing of concrete should only be done at specifically selected sites on mortar boards or similar structures to contain run-off into drainage lines, streams and natural vegetation.	Contractor, EO, ECO	As necessary
	Where access cannot be avoided into sensitive areas (wetland), the amount of vehicle and personnel traffic should be kept to a minimum and should make use of only one route.	Contractor, EO, ECO	As necessary
	Materials such as fuel, oil, paint, herbicide and insecticides must be sealed and stored in bermed areas or under lock and key, as appropriate, in well-ventilated areas. These substances must be confined to specific and secured areas within the contractor’s camp, and in a way that does not pose a danger of pollution even during times of high rainfall.	Contractor, EO, ECO	Continuous
	Storage of materials as described above may not be within the 1:100 floodline, watercourses or associated buffer areas.	Contractor, EO, ECO	Continuous
	In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Human Settlement and Water and Sanitation (DHSWS) must be informed immediately.	Contractor, EO	As necessary

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Hydrocarbons spillages and dirty water from site must not be allowed to flow into the watercourse.	Contractor, EO, ECO	Continuous
	All equipment should be parked overnight and/or fuelled at least 80 meters from the wetland.	Contractor, EO	As necessary
	Spill kits must be available on site for the cleanup of any hydrocarbon spillages. In the event of oil, fuel or chemical spillage, appropriate bio-friendly detergents must be applied (Terrasorb or similar). Impacted soil must be removed and placed in an impermeable container for disposal at an appropriate hazardous waste site.	Contractor, EO, ECO	Continuous
	Drip trays must be placed under all leaking vehicles and machinery under repair and maintenance. Vehicles suspected of leaking must not be left unattended, drip trays must be utilised. The depth of the drip tray must be determined considering the total amount / volume of oil in the vehicle. The drip tray must be able to contain the volume of oil in the vehicle.	Contractor, EO, ECO	Continuous
	Construction vehicles are to be maintained in good working order so as to reduce the probability of leakage of fuels and lubricants.	Contractor, EO, ECO	Continuous
	Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone.	Contractor, EO, ECO	Continuous
	Construction must be restricted to the dryer winter months where possible.	uTDM, Contractor	Continuous
	Remove all construction equipment and material on completion of construction.	Contractor, EO	Once off
Sedimentation	Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced; this must be done in consultation with the ECO.	Contractor, EO, ECO	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter watercourses. Appropriate measures, e.g. erection of silt traps, or drainage retention areas to prevent silt and sand entering drainage or watercourses must be taken.	Contractor, EO	Continuous
	Silt trenches between the works area and downstream wetland could be used to trap any sediment washing off the works area and to prevent scouring of the stream line in case of heavy flows. This will provide protection for the downstream section of the wetland.	Contractor, EO	Continuous
	Where wetlands are adjacent to the construction areas and these areas slopes toward the wetland, install sediment barriers along the edge of the construction areas as necessary to prevent sediment flow into the wetland.	Contractor, EO	Continuous
	Where applicable, sediment barriers must be properly maintained throughout construction and reinstalled as necessary until replaced by permanent erosion controls or restoration of adjacent wetland areas is complete.	Contractor, EO	Continuous
	Should water need to be pumped around the works area and discharged back into the wetland, care must be taken to ensure that the water is discharged in a manner that does not cause siltation or erosion downstream. As such it is recommended that any water to be discharged from pumping around the construction area or from dewatering operations be first discharged into a structure that allows the settlement of all suspended material, and which allows the diffuse discharge of water into the wetland. The water must be dissipated on re-entry into the wetland, to reduce the changes of erosion.	Contractor, EO	As necessary
	Where applicable, sediment barriers must be properly maintained throughout construction and reinstalled as necessary until replaced by permanent erosion controls is complete.	Contractor, EO	Continuous
	It is important that topsoil should be conserved in areas where bedrock is shallow to avoid sedimentation.	Contractor, EO	As necessary

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Wetland Degradation	Where any hard structures (concrete, gabion or otherwise) are used, it should be well keyed into the surrounding bank walls and secured to the ground.	Contractor, EO	As necessary
	Flood protection berms should be installed in such a way that the river doesn't cause it to capsize.	Contractor, EO	As necessary
	A temporary fence or demarcation must be erected around the works area to prevent access to wetland and buffer areas.	Contractor, EO, ECO	Continuous
	Prevent pedestrian and vehicular access into the wetland and buffer areas as well as riparian areas.	Contractor, EO, ECO	Continuous
	Consider the various methods of construction and take cognisance of that which will have the least impact on watercourses.	Contractor, EO, ECO	Once off
	No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only authorised activities should be undertaken. This is subjected to authorisation by means of a water use license.	Once off	Once off
	No materials must be dumped in the wetland and buffer zones.	Contractor, EO, ECO	Continuous
Vegetation	An on-going monitoring and eradication programme for all invasive and weedy plant species growing within the servitude must be implemented.	uTDM, ECO	Continuous
	The clearing, cutting and removal of trees and areas of natural vegetation must be done in consultation with the ECO and the EO and a relevant permit if applicable must be obtained and kept on site.	Contractor, EO, ECO	Continuous
	The contractor should inform affected landowners prior to the removal of vegetation where required; especially the larger trees, on affected properties. Where required, vegetation is to be	Contractor	As necessary

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	replaced with indigenous species.		
	Construction workers may not tamper or remove plants of conservation concern; neither may anyone collect seed from the plants without permission from the local authority.	Contractor, ECO, Construction workers.	Continuous
	Indigenous trees removed during construction must be replaced with the same species at a ratio of 1:2 (2 trees must be planted for every 1 tree removed).	Contractor, EO, ECO	Continuous
	Protected trees removed during construction must be replaced with the same species at a ratio of 1:5 (5 trees must be planted for every 1 tree removed).	Contractor, EO, ECO	Continuous
	Disturbed areas must be rehabilitated immediately after construction has been completed in that area by planting appropriate indigenous plant species.	Contractor, EO, ECO	Continuous
	During the construction phase workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled.	Contractor, EO, ECO	Continuous
	All construction and maintenance activities must be carried out according to the generally accepted environmental best practice and the temporal and spatial footprint of the development must be kept to a minimum.	Contractor, EO, ECO	Continuous
	The working strip required for the construction of the proposed development must be effectively monitored to prevent excessive vegetation removal. By maintaining the maximum amount of stabilising vegetation, the extent of erosive action will be contained. The clearing of vegetation must be kept to a minimum.	Contractor, EO, ECO	Continuous
	Should the construction phase occur in the rainy season, the erection of berms may be necessary in areas prone to erosion (e.g. steep slopes or erosive soils) These bermed areas must be monitored frequently for signs of erosion.	EO, Contractor	Once off, monitor weekly

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.	Contractor, EO, ECO	Continuous
	Any natural areas beyond the development footprint, which have been affected by the construction activities, must be rehabilitated using indigenous plant species.	Contractor, EO, ECO	Continuous
	Vegetation to be retained during the construction phase must be clearly demarcated with danger tape.	EO, Contractor	As necessary
	Collection of firewood from neighbouring properties is strictly prohibited.	Contractor, EO, ECO	Continuous
	No fires may be ignited with the intent to destroy the flora on site and surrounding properties.	Contractor, EO, ECO	Continuous
	Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas.	Contractor, EO, ECO	Continuous
	Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which will affect faunal habitats adjacent to the development area, need to be strictly managed.	Contractor, EO, ECO	Continuous
Fauna Management	Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors.	Contractor, EO, ECO	Continuous
	Where possible, work should be restricted to only one area, to give smaller fauna species the opportunity to move into undisturbed natural habitat.	Contractor, ECO	Continuous
	The feeding or leaving of food for stray or wild animals in the area is strictly forbidden.	Contractor, ECO	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	No animals may be hunted, trapped or disturbed nor is fishing allowed.	Contractor, ECO	Continuous
	Nesting and breeding sites for birds and mammals must be avoided at all costs.	Contractor, ECO	Continuous
	Should fauna be encountered during site clearance or during construction activities, earthworks shall cease immediately, until such fauna have been safely relocated.	Contractor, ECO	Continuous
	No animal will be killed, unless an immediate threat to human health is perceived. In such an instance, the incident must be reported to the ECO and PM immediately.	Contractor, ECO	Continuous
	Photographs of fauna encountered on site must be displayed in the construction camp to heighten awareness of these creatures.	Contractor, ECO	Continuous
Proliferation of alien invasive species	Manual removal methods are preferred to chemical control.	Contractor, EO	As necessary
	Alien invasive species that were identified within study area should be removed prior to construction related soil disturbances. This will prevent seed spreading into disturbed soils.	Contractor, ELO, ECO	As necessary
	Appointment of alien plant working group / assign this duty to specific staff. A vegetation specialist must be consulted where there is uncertainty between alien, invasive and indigenous vegetation.	Developer	As necessary
	If herbicide must be used it should be registered for aquatic use.	Contractor, EO, ECO	As necessary
	Acquire the necessary equipment for removal and control.	Developer, Contractor, EO	As necessary
	Planned sequence of areas to be cleared of invasive plants.	Contractor,	As

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
		EO, ECO	necessary
	A register of the methods used, dates undertaken, as well as herbicides and dosage used must be kept and available on site. The register must also include incidents of poisoning or spillage.	Contractor, EO	As necessary
	Ensure that contractors can identify the relevant plants and are aware of the removal procedures.	Developer	As necessary
	Construction equipment must be cleaned prior to site access. This will prevent alien invasive seed from other sites to spread into disturbed soils.	Contractor, EO	Continuous
Environmental incidents	The contractor must take corrective action to mitigate an incident appropriate to the nature and scale of the incident and must also rehabilitate any residual environmental damage caused by the incident or by the mitigation measures themselves.	Contractor , EO,	Continuous
Hazardous materials storage	If potentially hazardous substances are to be stored on site, the contractor shall provide a Method Statement detailing the substances/materials to be used together with the procedures for the storage, handling and disposal of the materials in a manner which will reduce the risk of pollution that may occur from day to day storage, handling, use and/or from accidental release of any hazardous substances used.	Contractor	Monitor daily - weekly
	The waste, resulting from the use of hazardous materials, shall be disposed of at a hazardous waste disposal site as approved by the RE. Storage and disposal of waste is regulated through other legislation, which should be complied with i.e. the Occupational Health and Safety Act. Records for disposal must be kept in the environmental file.	Contractor, RE	Monitor daily - weekly
	Surface water draining of contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils.	Contractor, RE	Monitor daily - weekly
	Oil residue shall be treated with oil absorbent such as Drizit or similar and this material	Contractor, RE	Monitor daily

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	removed to an approved waste site.		- weekly
	Materials storage areas will not be allowed in close proximity to ecologically sensitive areas.	Contractor	Continuous
	Materials storage areas should be sited outside the 1:100 year flood line of watercourses.	Contractor, ECO	Continuous
	The areas around fuel tanks are to be bunded in accordance with SANS 1089:1999: Part 1.	EO, Contractor	Once off
	Hazardous chemicals or potentially hazardous chemicals used during construction shall be stored in secondary containers and all relevant Material Safety Data Sheets (MSDSs) shall be available on site.	Contractor	Continuous
	The relevant emergency procedures relevant to particular chemicals used on site, as per the MSDSs and suppliers guidelines, will be followed in the event of an emergency.	Contractor	Continuous
	The contractor shall prevent discharge of any pollutants such as cement, concrete, lime, chemicals, fuels and oils into any water sources and adequate storm water control measures will be implemented where these substances are handled.	Contractor	Continuous
Handling and disposal of contaminated water	No discharge of pollutants such as cement, concrete, lime, chemicals, fuels or oils will be allowed into any water resource.	EO, Contractor	Continuous
	Only above ground temporary storage tanks will be allowed on site.	EO, Contractor	Continuous
	Contaminated or potentially contaminated water will be kept separated from unpolluted stormwater and no unpolluted stormwater will be allowed into the conservancy tank.	EO, Contractor	Continuous
Lighting	Working hours shall generally be restricted to daylight hours. If working hours are required outside of daylight hours, the contractor shall provide notification to all landowners (direct and adjacent). Should overtime/night work be authorised, the contractor shall be responsible to ensure that lighting does not cause undue disturbance to neighbouring residents.	EO, Contractor	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Security lights shall be directed from the perimeter wall towards the centre of the camp with a down angle.	EO, Contractor	Continuous
Waste management	Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly at registered waste disposal sites.	EO, Contractor	Weekly
	All building rubble, solid and liquid waste etc must be disposed of as necessary at an appropriately licensed refuse facility.	EO, Contractor	Once off, as necessary
	Ensure that no refuse wastes are burnt on the premises or on surrounding premises. No fires will be allowed on site.	EO, Contractor	Monitor daily
	Waste is not to be buried on site.	EO, Contractor, ECO	Monitor daily
	The construction site must be kept in a clean and orderly state at all times.	Contractor, Construction crew	Monitor daily
	Recycling must be encouraged on site and recycling bins must be provided at the contractor's camp and clearly marked.	Contractor, Construction crew	Monitor daily
	Ensure that 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 of the project are disposed of at an approved dumping site.	EO, Contractor	Monitor daily - weekly
Stormwater Management	Should a freak storm displace the temporary earth embankments or other erosion control structures, a visual inspection of the site must be made and any damage be recorded. Any damage and loss of soil resulting from a storm is to be remedied immediately. Should the	Contractor, EO, ECO	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	temporary walls collapse due to construction error, the contractor is to fund the remediation process.		
	Storm water at the site camp must be managed so as to reduce the silt loads into the ecological environment. Measures must be implemented to distribute storm water as evenly as possible to avoid point sources of erosion.	Contractor, EO, ECO	Continuous
	The site must be managed in a manner that prevents pollution of drains, downstream watercourses or groundwater, due to suspended solids, silt or chemicals.	Contractor, EO, ECO	Continuous
	No stockpiles or construction materials may be stored or placed in close proximity to storm water drains.	Contractor, EO, ECO	Continuous
	Temporary cut-off drains and berms may be required to capture storm water and promote infiltration.	Contractor, EO, ECO	Continuous
Noise management	Construction and the use of construction machinery should be limited between 06h00 and 18h00 on weekdays only.	Developer, Contractor	Monitor daily
	Institute noise control measures throughout the construction phase for all applicable activities, including the construction times.	EO, Contractor	Once off, as necessary
	Ensure that noise licensers are installed on the construction vehicles and machineries to reduce the noise level.	ECO, EO, Contractor	Continuous
	Inform residents of nearby residential areas of planned noisy activities outside the timeframes stated above.	ECO, EO, Contractor	Once off, as necessary
	No construction should occur during weekends, unless the adjacent residents have been notified in writing at least three days in advance.	EO, Contractor	Once off, as necessary
	Construction activities must abide by the national noise laws and the municipal noise by-laws	Developer,	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	with regard to the abatement of noise caused by mechanical equipment.	EO, Contractor	
Dust control	All forms of dust/air pollution must be managed in terms of the NEMA Air Quality Act (AQA) 2004, (Act 39 of 2004); this includes the control of noxious and offensive gases, smoke, dust and vehicular emissions. Under no circumstances may heavy smoke be released into the air.	Developer, Contractor	Daily
	Wet all unprotected cleared areas and stockpiles with water to suppress dust pollution during dry and windy periods.	ECO, EO	As necessary
	Exposed stockpile materials (e.g. topsoil or building sand) must be adequately protected against wind (covered), and should be sited taking into consideration the prevailing wind conditions.	ECO, EO	As necessary
	Ensure proper rehabilitation of disturbed areas in order to minimise bare patches.	EO, Contractor	Continuous
Crime, safety and security	Ensure that the construction vehicles are under the control of competent/ suitably qualified personnel and are in proper working order.	Contractor	Continuous
	Ensure that the contact details of the police or security company and ambulance services are available on site.	Contractor	Continuous
	All incidents of theft or other crime should be reported the South African Police Service, no matter how seemingly insignificant.	uTDM, Contractor, ECO, EO	As necessary
	Limit access to the construction crew camp to construction workers through access control.	EO, Contractor	Continuous
	Construction workers should be clearly identifiable. Overalls should have the logo of the construction company on it and construction workers should wear identification cards.	Contractor, Construction crew	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Equipment and materials must be handled by staff that have been supervised and adequately trained.	EO, Contractor	Continuous
	Vehicular traffic during construction activities must be limited to a maximum speed limit of 30 km/hr.	EO, Contractor	Continuous
	Site notices informing the public of the planned activities must be placed at visible locations a few days prior to any blasting.	EO, Contractor	As necessary
	The security fence around the development site must be completed before construction commences internally.	EO, Contractor	Once-off
	Security fence is to be inspected daily to ensure no illegal entry points are created.	EO, Contractor	Daily
	The contractor must supply his own security arrangements for the construction camp within the framework of the EMP.	Contractor, EO	Continuous
	Staff must be regularly updated about the safety procedures.	Contractor, EO	Continuous
	Emergency facilities must be available and adequately supplied for use by staff and customers.	Contractor, EO	Continuous
	Do not allow the movement of public within the development site by posting notices at the entrance gates, and where necessary on the boundary fence.	Contractor, EO	Once-off, monitor daily
	Appropriate notification signs must be erected, warning the residents and visitors about the hazards around the construction site and presence of heavy vehicles/ machinery.	Contractor, EO	Once-off, or as necessary
Stockpiling soil	Topsoil and subsoil must be placed on opposite sides of the trench and must be kept separate throughout construction and rehabilitation.	Contractor, EO, ECO	As necessary
	Topsoil must not be stockpiled for an extensive period (> 3 months). This is to prevent the	EO, ECO,	As

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	redundance of the existing seed bank as well as the alteration of the soil characteristics (permeability, bulk density etc.).	Contractor	necessary
	Ensure that excavated and stockpiled soil material is stored and bermed on the higher lying areas of the site and not in any storm water run-off channels or any other areas where it is likely to cause erosion or where water would naturally accumulate.	ECO, Contractor	As necessary
	The areas where excavated soil will be stockpiled must be bordered by berms to prevent soil loss caused by rain.	EO, ECO, Contractor	As necessary
	Topsoil must be reinstated or imported where necessary for vegetation to be re-established.	EO, ECO Contractor	As necessary
	All excavated material to be stockpiled more than 80m from the river area and marked for spoil elsewhere as stipulated by the geologist/geological engineer.	Contractor, EO ECO	Continuous
Heritage resources	Should any archaeological artefacts be exposed during excavation, work on the area where the artefacts were found, shall cease immediately and the ECO shall be notified as soon as possible.	EO, Contractor	As necessary
	Upon receipt of such notification, the ECO will arrange for the excavation to be examined by an Archaeologist as soon as possible.	ECO, Contractor	As necessary
	Under no circumstances shall archaeological artefacts be removed, destroyed or interfered.	EO, Contractor	Continuous
	Any archaeological sites exposed during construction activities may not be disturbed prior to authorisation by the South African Heritage Resources Agency.	ECO, Contractor	As necessary
Palaeontology impacts	While it is possible that significant fossils could be found on site, it is unlikely. This is due to the disturbed area and that the rocks are highly weathered. A Chance Find Protocol must be implemented if the need arises. Refer to Appendix 3.	uTDM, Contractor, ECO	As necessary

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Should excavations >2m deep take place and expose fresh rock, a field visit by a competent Palaeontologist should be arranged.	uTDM, Contractor, ECO	As necessary
Aesthetic / visual	Prevent unnecessary removal of vegetation outside the width of the working area by clearly demarcating the working area.	EO, Contractor	Continuous
	Remove spoil material from the area once the trench has been filled.	Contractor	Continuous
	Remove vegetation and topsoil and stockpile separately from subsoil prior to excavation of the trench.	EO, Contractor	Continuous
	Revegetate disturbed ground in the working area by seeding and spreading of vegetation that has been removed from the trench at the start of construction.	EO, Contractor	Continuous
	It is suggested that large indigenous and fast-growing vegetation could be planted to screen affected properties from the upgraded water plant once construction is complete.	uTDM, Contractor, ECO	Once off for Continuous
Traffic impact	Access to the site must follow current and established routes The contractor should be responsible for any damage caused to the road or road curb/verges.	Developer, Contractor	Continuous
	It is recommended that a speed limit of 30km/h is implemented on all roads running through the study area during all phases in order to minimise risk to fauna from vehicles.	Developer, Contractor	Continuous
	No unnecessary vehicles will be allowed within the 100 m buffer of sensitive environments (wetland, pans, drainage lines)	Developer, Contractor	Continuous
	All road safety and warning signs must be as stipulated by the Roads and Traffic Act (Act 93 of 1996).	Developer, Contractor	Continuous
	Points-men with access boom and warning flags for traffic to be on site.	Developer,	Continuous

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Construction and traffic warning signs to be placed.	Contractor	
Sewage	Onsite treatment will be undertaken through the use of chemical toilets. The toilets will be serviced periodically by the supplier.	Developer, Contractor	Continuous
Electricity	Diesel generators will be utilised for the provision of electricity if connections are unavailable.	EO, Contractor	Continuous
Completion of Construction	The ECO must ensure that all construction equipment and all foreign material are removed on completion of construction.	ECO	After completion of construction
	It must be ensured that all access roads utilised during construction (which are not earmarked for closure and rehabilitation) are returned to a usable state or at least to its condition prior to construction.	uTDM, Contractor	After completion of construction
	All excavations and borrow pits (where applicable) associated with the proposed construction works must be made safe through backfilling with in situ material followed by grading.	Contractor	After completion of construction
	Backfilling must be followed with the deposition of subsoil, followed by topsoil, with compaction taking place in layers. If backfill is deficient, additional fill may only be imported from approved borrow areas as indicated by the ECO. Backfilled areas must be monitored for subsidence as the backfill settles and any depressions must be filled using available material.	Contractor	After completion of construction

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Topsoil application must take place prior to the rainy season to avoid washing away of soils.	Contractor	After completion of construction
	All disturbed areas are to be shaped to blend in with the surrounding landscape.	Contractor	After completion of construction
	No slopes steeper than 1(V):3(H) should be permitted, unless otherwise specified and approved by the ECO. New slopes must mimic the natural slopes and topography.	Contractor, ECO	After completion of construction
	On completion of construction activities, monitoring should be done in order to record compliance with the targets set out in the EMPr and to highlight any areas where further action are required in terms of rehabilitation or routine monitoring (refer to monitoring plan).	EO, Contractor, ECO	As necessary

Table 16: Operational Phase

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Compliance with legislation, policies and procedures	<p>All legislation, policies and procedures applicable to the development must be strictly enforced, including but not limited to, the following:</p> <ul style="list-style-type: none"> • National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA); • Nation Water Act (Act No. 36 of 1998); • Hazardous Substances Act, 1973 (Act No. 15 of 1973); • Fire Brigade Services Act, 1987 (Act No. 99 of 1987); • Occupational Health and Safety Act, 1993 (Act No. 85 of 1993); and • Operational Phase EMPr. 	RPE	Continuous
Site Monitoring, Auditing and Reporting	<ul style="list-style-type: none"> • All records relating to monitoring and auditing shall be made available for inspection to any relevant authority. • EC – EDEAT reserves the right to monitor and audit the development throughout its full life cycle to ensure compliance with the RoD as well as mitigation measures in the final basic assessment report and the EMPr. • The adjacent property owners shall always be kept informed about any changes to the operation. 	RPE/PM	Continuous
Protection of Sensitive Environments and Natural Features	<p>Alien species of vegetation should be removed from any working areas and the site camp(s). Alien vegetation species should also be eradicated when they begin to establish themselves in disturbed areas (disturbance of the natural vegetation will encourage the establishment of invasive species). In order to discourage the spread of alien species, soil should not be moved from one part of the site to another without the consent of the ECO.</p>	EO, Contractor, ECO	As necessary
	Checks must be carried out at regular intervals to identify areas where erosion is occurring.	uTDM	As

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Appropriate remedial actions, including the rehabilitation of the eroded areas are to be undertaken.		necessary
	Checks must be carried out at regular intervals to identify any avian mortalities.	uTDM	As necessary
Vegetation	Re-vegetated sites should be monitored for invasion by alien seedlings on a regular basis. Such seedlings should be removed by hand.	uTDM	Continuous
Health & Safety	An emergency plan (including fire management) must be developed and implemented; the relevant authority must approve this plan. Ensure that all fire extinguishers are replaced on or before their expiry dates.	uTDM	Continuous
	Site Safety checks should be carried out in accordance with the pertinent Occupational Health and Safety requirements prior to site closure.	uTDM	Continuous
	Telephone numbers of emergency services shall be posted conspicuously in the office for use in emergency situations	uTDM	Continuous
Social	Where local skills are not available for the operation and maintenance of the development, uTDM should consider capacity building and training to ensure that locals are employable.	uTDM	Continuous
Erosion control	Stormwater should be adequately managed.	uTDM	Continuous
Pollution of the wetland	During maintenance, activities should be limited to the areas where maintenance has to be undertaken.	Developer	Continuous
	In the event that maintenance must be carried out, all equipment should be parked overnight and/or fuelled at least 30 meters from the wetland	Developer	As necessary

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
	Storage of maintenance materials/ chemicals may not be within the 32m of wetland or associated buffer areas.	Developer	As necessary
	The SHE must ensure that all maintenance equipment and material are removed on completion of maintenance.	Developer	As necessary
	Removal of vegetation during maintenance should be limited to the area of operation only.	Developer	As necessary
Prevent/limit sedimentation	The contractor shall ensure that a method statement is prepared prior to maintenance work to ensure that excessive quantities of sand, silt and silt-laden water do not enter watercourses. Appropriate measures, e.g. erection of silt traps, or drainage retention areas to prevent silt and sand entering drainage or watercourses must be taken.	uTDM	As necessary
Preventing spread of alien invasive	Plan an alien invasive plant work group that can carry out follow-up alien plant control for at least three years after construction.	Developer	As necessary
	Ensure that contractors can identify the relevant plants and are aware of the removal procedures.	Developer	As necessary

Table 17: Rehabilitation Phase

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Erosion	The contractor shall be responsible for rehabilitating all eroded areas in such a way that the erosion potential is limited after construction has been completed.	Contractor, EO	During and immediately after construction
	All slopes that are disturbed during construction should be stabilised immediately to prevent erosion.	Contractor	During and immediately after construction
	Re-vegetation should be done immediately after construction, especially in sloped areas.	Contractor	During and immediately after construction
	Disturbed areas that require rehabilitation should be mulched to encourage vegetation re-growth.	Contractor	As necessary
	Bare ground exposed after vegetation removal must be rehabilitated as soon as possible.	Contractor, EO, ECO	As necessary
	Monitor rehabilitation and occurrence of erosion and take immediate corrective action where needed.	Developer	Twice during the rainy season for at least two years

ACTIVITY / ISSUE	ACTION REQUIRED	RESPONSIBLE PARTY	MONITORING FREQUENCY
Mobilisation of pollutants	Remove all project-related material used to support equipment on completion of construction.	Contractor, EO	Once off
	Any contaminated soil from the onsite needs to be removed and properly disposed off.	Contractor, EO,ECO	As necessary
	Materials such as fuel, oil, paint, herbicides and insecticides must be sealed and stored in bermed areas or under lock and key, as appropriate, in well-ventilated areas.	Contractor, ECO, EO	Continuous
	These substances must be confined to specific and secured areas within the contractor's camp, and in a way that does not pose a danger of pollution even during times of high rainfall.	ECO, Contractor, EO	Continuous
	Drip trays must be utilised during repairs and maintenance of all machinery. The depth of the drip tray must be determined considering the total amount / volume of oil in the vehicle. The drip tray must be able to contain the volume of oil in the vehicle.	Contractor, EO	As necessary
	Any water discharged must comply with the relevant Water Quality limits/guidelines specified by DWS.	Contractor, EO	As necessary
	Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.	Contractor, EO	Continuous
Vegetation	Rehabilitation of natural vegetation must proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (Act No. 27 of 2003) in the field of Ecological Science.	uTDM, ECO	As necessary

8. ENVIRONMENTAL AWARENESS PLAN

OBJECTIVE: Ensure all operation personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm (Environmental Awareness Plan).

To achieve effective environmental management, it is important that Contractors and site employees are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The developer is responsible for informing its employees and contractors (transportation contractor) of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The developer's obligations in this regard include the following:

- Employees must have a basic understanding of the key environmental features of the depot and its surrounding environment.
- Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees must be familiar with the requirements of the EMPr and the environmental specifications as they apply to the operation of the facility.
- Ensuring that, prior to commencing any new site works, all employees have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Awareness of any other environmental matters, which are deemed to be necessary by the depot manager.
- Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimise of disturbance to sensitive areas (wetland), management of waste and prevention of water pollution.
- Records must be kept of those that have completed the relevant training.
- Training should be done either in a written or verbal format but must be in an appropriate format and language for the receiving audience.
- Refresher sessions must be held to ensure the operating staff are aware of their environmental obligations.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMP. This training and awareness will be achieved in the following ways:

8.1. Environmental Awareness Training

Environmental Awareness Training must be undertaken by the Environmental Control Officer and must take the form of an on-site talk and demonstration by the Environmental Control Officer before the commencement of construction activities on site. A record of attendance of this training must be maintained by the Environmental Officer on site.

8.2. Induction Training

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations – contractors or engineering staff; site staff, sub-contractors or visitors to site.

This induction training should include discussing the developers' environmental policy and values, the function of the EMP and the importance and reasons for compliance to these. The induction training must highlight overall do's and don'ts on site and clarify the repercussions of not complying with these. The reporting procedure must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE officer on site.

8.3. Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least once a month) where the foreman/site supervision manager, environmental and safety representative and all employees on site hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

9. MONITORING PROGRAMME

OBJECTIVE: Monitor the performance of the control strategies employed against environmental objectives and standards.

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the environmental authorisation (once issued). Where this is not clearly dictated, uTDM will determine and stipulate the frequency of monitoring required in consultation with the relevant authority. The contractor project manager will work with the site manager of the contractor to ensure that monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

- Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
- Ensure adequate and appropriate interventions to address non-compliance.
- Ensure adequate and appropriate interventions to address environmental degradation.
- Provide a mechanism for the lodging and resolution of public complaints.
- Ensure appropriate and adequate record keeping related to environmental compliance.
- Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site.
- Aid communication and feedback to authorities and stakeholders.

9.1 Method of Monitoring

The independent ECO will ensure compliance with the EMPr, and will conduct monitoring activities. The ECO will undertake site inspections on a monthly basis or as specified in the environmental authorisation once issued. The ECO will report all non-compliances to the Site Manager and submit such reports to EC – EDEAT.

9.2 Non Conformance Report

All supervisory staff and ECO must be provided a means to be able to submit a non-conformance report to the site manager. The non-conformance report will describe in detail, the cause and effect of any environmental non-conformance by the contractor. Records of penalties may be required by the Authorities within 48 hours. The non-conformance report will be updated upon completion of the corrective measures indicated on the findings sheet. The report must indicate that remediation measures have been implemented timeously and that the non-conformance can be closed out to the satisfaction of the site manager and ECO.

9.3 Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to EC – EDEAT as deemed practical or with the Final audit report. The report should include details of the activities undertaken in the reporting period, any non-conformances or incidences recorded, corrective action required and details of these non-conformances or incidents which have been closed out.

9.4 Internal Audits and Reporting

Internal audits must be undertaken by the developer. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMPr. Findings of the audit must be made available to the external auditor.

9.5 Final Audit Report

A final environmental report must be compiled by the ECO and submitted to EC – EDEAT upon completion of construction and rehabilitation activities within 30 days of completion of the construction phase (i.e. within 30 days of the site handover and within 30 days of completion of rehabilitation activities). This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance of the environmental authorisation conditions once issued and the requirements of the EMPr.

10. CONCLUSION

Provided this project is mitigated, as per the EMPr, the project will result in limited negative environmental impacts that can be mitigated through implementation of this EMPr. It is the applicant's responsibility to ensure that this EMPr is made binding on the contractor by including the EMPr in the contract documentation. The contractor should thoroughly familiarise himself with the requirements of the EMPr and appoint an environmental officer (EO) to oversee the implementation of the EMPr on a day-to-day basis.

Parties responsible for transgression of this EMPr should be held responsible for any rehabilitation that may need to be undertaken. Parties responsible for environmental degradation through irresponsible behaviour/negligence should receive penalties.

10.1 Key issues

- Construction should take place in the dry season, leaving enough time for the germination of seeds and revegetation of barren areas before the onset of the rainy season.
- Warning tape must be erected to inform public of the inherent dangers.

APPENDIX 1: INCIDENT AND ENVIRONMENTAL LOG				
ENVIRONMENTAL INCIDENT LOG				
Date	Env. Condition	Comments <i>(Include any possible explanations for current condition and possible responsible parties. Include photographs, records etc. if available)</i>	Corrective Action Taken <i>(Give details and attach documentation as far as possible)</i>	Signature

APPENDIX 2: COMPLAINTS SHEET		
COMPLAINTS RECORD SHEET	File Ref:	DATE:
	Page of
COMPLAINT RAISED BY:		
CAPACITY OF COMPLAINANT:		
COMPLAINT RECORDED BY:		
COMPLAINT:		
PROPOSED REMEDIAL ACTION:		
ECO: _____ Date: _____		
NOTES BY ECO:		
ECO: _____ Date: _____ Site Manager: _____ Date:		

APPENDIX 3: CHANCE FIND PROTOCOL

As this site includes areas flagged red on the SAHRIS PalaeoSensitivity Map, a “Chance Find Protocol” is Recommended.

In the case of any unusual finds, a Palaeontologist must be notified immediately by the ECO and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material:

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.
- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.
3. Facilitate systematic recording of the stratigraphic and palaeoenvironmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.
6. Costs of basic curation and storage until collected. Documentary record of palaeontological occurrences must be done.
7. The contractor will, in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist.
8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.
9. Locations of samples and measured sections are to be pegged, and routinely and accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation.

APPENDIX 4: SITE PHOTOGRAPHS

Command Reservoir







Water Treatment Works



