DRAFT ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED UPGRADING OF THE EXISTING SEWAGE TREATMENT SYSTEM ON PART OF THE FARM ROERFONTEIN 161-LT, SENWAMOKGOPE, LIMPOPO PROVINCE

MARCH 2011

Contents

1. OBJECTIVES OF THE ENVIRONMENTAL MANAGEMENT PLAN

The purpose of the Environmental Management Plan (EMP) is to provide measures for the mitigation and management of potential negative impacts and the optimisation of potential positive impacts that may be associated with the proposed project during the construction, operational and potential de-commissioning phases.

In addition to recommending measures for impact prevention, mitigation and/or management, this EMP provides the structure according to which environmental monitoring must be done – not only over the short term during construction, but also over the long term during the operation of the filling station.

2. MANAGEMENT AND MITIGATION MEASURES: CONSTRUCTION PHASE

Responsibility: Impact prevention, mitigation and/or management measures during the construction phase are ultimately the responsibility of the applicant (Mopani District Municipality), although the lead contractor will be responsible for the day-to-day implementation of the EMP, and different components may be implemented by different sub-contractors, for instance erosion control measures will mostly be the responsibility of the contractor dealing with earthworks.

Timeframe: The measures specified in the following sections for minimisation and mitigation of construction-phase impacts will be limited to the construction phase, after which the recommended operational phase measures will become applicable.

Monitoring: Environmental compliance monitoring should be done by an independent Environmental Control Officer (ECO) on at least a monthly basis. Should any instances of non-compliance be found, this must be brought to the attention of the contractor or site foreman, along with recommended measures for rectifying the non-compliance. Monitoring reports, indicating the level of compliance with the specifications of the EMP, must be submitted to The Department of Environmental Affairs (DEA) by the ECO at monthly intervals and at the end of the construction phase.

Table 1: Mitigation measures applicable to anticipated construction-phase impacts

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
1. Soils			
1.1. Soil erosion	Clearing of vegetation during earthworks will make the site susceptible to soil erosion in case of rains during the period that bare soil is exposed.	1.1.1. Limit the risk of soil erosion.	It is recommended that, if possible, earthworks and site preparation be undertaken during the drier winter season.
			Storm water should be channelled away from the exposed area for the duration of construction.
			Soil stockpiles (if any) must not be placed in the natural flow path of storm water and must be protected from possible erosion, e.g. through covering of the stockpiles with tarpaulin or hessian, and limiting the height and angle of the stockpile. Soil stockpiles should not exceed 2 m in height.
		1.1.2. Effectively remediate erosion if it does take place.	Should any signs of erosion be found, remedial action such as backfilling, compaction and re-vegetation should be taken immediately to avoid exacerbation of the erosion.
			Any erosion channel(s) that may develop should be backfilled and compacted as soon as possible, and the area(s) restored to a proper condition. The contractor should ensure that cleared areas are effectively stabilised to prevent and control erosion.
			It is the responsibility of the Contractor to ensure that cleared areas are effectively stabilised to minimise erosion. The following are examples of methods that can be employed to this end: - mulch or chip cover; - straw stabilising; - watering (with or without added dust control substances such as soil binders and anti-erosion compounds); - planting/sodding; - hand seeding/ sowing; - hydroseeding; - mechanical cover or packing structures; - gabions; - hessian cover; - geofabric or shade net silt fences.
1.2. Soil contamination	Possible contamination of soil by wastewater during construction	1.2.1. Prevent infiltration of sewage into soil.	Please refer to 2.1.1.
		1.2.1. Prevent spillage of water potentially contaminated by cement or chemicals.	Please refer to 2.1.3.

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
		1.2.3. Efficiently respond to any spillage (e.g. fuel)	Please refer to 2.1.2.
2. Water			
2.1. Water quality (groundwater and surface water)	Possible spillage of sewage from existing oxidation ponds during the process of emptying the ponds and undertaking construction activities on them.	2.1.1. Prevent spillage of sewage.	Construction and lining of the secondary and tertiary ponds must take place first, so that the raw / semi-treated sewage which is currently held in the primary pond can be safely transferred to these ponds when construction work commences on the digesters which will take the place of the current primary pond.
			No pit latrines are allowed on the site. Workers must be provided with temporary chemical toilets.
			Sanitation facilities must be provided at a ratio of at least 1 toilet per 30 workers.
			There are no drainage lines on or directly surrounding the site, therefore is no risk of toilets being placed within the 1:100 year flood line of any drainage line.
			Workers must be discouraged from using the veld for sanitary purposes.
			Sufficient washing facilities must be provided for workers. Wash areas must be placed and erected in such a manner that the surrounding areas, including soil and groundwater, are not polluted.
			Any soil contaminated during construction must be removed to a suitable disposal site.
		2.1.2. Efficiently respond to any spillage	In case of any spillage, the ECO must be informed so that he/she can investigate the incident and recommend appropriate mitigation measures.
			Any significant spillage must be reported to the Department of Water Affairs (DWA), who may need to conduct a site visit to determine the significance of the spillage and to recommend mitigation measures. The incident must also be reported to the Limpopo Department of Economic Development, Environment and Tourism (LDEDET) by the ECO.
			Appropriate measures must be implemented to prevent a recurrence of a spillage event.
			Prolonged stockpiling of topsoil should be avoided in favour of returning the topsoil directly to an area to be landscaped.
	Possible leakage or spillage of sewage from portable toilets during construction phase, or contamination of water by	2.1.3. Prevent spillage of water potentially contaminated by cement, paint, turpentine, etc.	The Contractor must prevent the discharge of any pollutants, such as cement, concrete, lime, chemicals, fuels or contaminated water which might infiltrate into the ground, resulting in deterioration of groundwater quality.

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
	runoff containing construction-related substances such as cement or paint.		Mixing of cement must take place on an impermeable surface (e.g. concrete slab or plastic tarpaulin) and not directly on bare soil.
			Potentially contaminated water may not be allowed to flow into the storm water drainage system or to infiltrate into the soil.
		2.1.4. Efficiently respond to any spillage	Refer to 1.2.3.
2.2. Storm water	Storm water may cause soil erosion on cleared construction site.	2.2.1. Minimize water-related soil erosion	Storm water should be channelled away from the exposed area for the duration of construction.
3. Flora and Fauna			
3.1. Fauna	Possible killing of fauna, e.g. killing snakes or spiders out of fear, or hunting small fauna for food.	3.1.1. Prevent killing of fauna	Educate labourers as to the importance of not simply killing all snakes and other fauna that is perceived as dangerous.
			Keep contact details in the site office for someone who can be called if catching and relocation of snakes, spiders or other unwanted species is needed.
			No snaring or hunting will be allowed on or around the site.
	Die-off of aquatic fauna (specifically catfish and marsh terrapins) as a result of draining of the primary pond which currently serves as their habitat.	3.1.2. Relocate or remove fish and terrapins before draining the primary pond	Drain excess water / sewage from the existing primary pond into the new secondary and tertiary ponds once these have been completed and lined during the first part of the construction phase. This water can then be re-cycled into the new bio-digester for treatment once the digester has been completed (in the position where the primary pond is currently situated).
			Mopani District Municipality should appoint one person or group to catch the catfish and terrapins (as well as other aquatic fauna if any is present). The bulk of the catfish can then be donated to the community for food, as the limnologist, Mr Cornell Vermaak of Endip Wildlife Laboratory, has indicated that the fish will not be toxic and is fit for human consumption. Some of the fish and terrapins should be relocated into the new secondary and tertiary ponds, where their populations will likely be maintained at sustainable levels by the availability of food and oxygen in the ponds.
4. Air quality			
4.1. Air quality	Possible air pollution in the form of emissions from construction vehicles and equipment.	4.1.1. Limit air pollution	It must be ensured that all vehicles entering the site and machinery used in construction activities are in good working order to prevent unnecessary emissions.
			Vehicles should not be allowed to idle for unnecessarily long periods of time.

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	Potentially high dust levels during earthworks and site establishment.	4.1.2. Limit levels of airborne dust	If necessary, exposed soil must be watered down at regular intervals to reduce levels of air-borne dust.
			The Contractor must take all reasonable measures to minimise the generation of dust resulting from construction activities.
			Where possible, soil stockpiles (if any) should be located in sheltered areas where they are not exposed to the erosive effects of the wind. Soil stockpiles should furthermore be covered if possible (e.g. hessian cover or tarpaulin).
			All exposed surfaces shall be re-vegetated or paved as soon as is practically possible after construction.
5. Waste management			
5.1. Solid waste management	General solid waste generated at the construction site must be disposed of at a licensed disposal site.	5.1.1. Safely dispose of all solid waste.	All solid waste must be disposed of at a licensed landfill site or another licensed waste disposal site.
			Waste may not be dumped on or near the site, nor may it be burned or buried.
			Any soil contaminated during construction (e.g. by cement) must be removed to a suitable disposal site.
			In the event of any hazardous waste being generated, this may not be disposed of with the general waste, but rather must be collected and disposed of by suitably licensed hazardous waste contractors.
		5.1.2. Provide sufficient refuse bins and discourage littering.	Sufficient refuse bins are to be provided across the construction area for disposal of general solid waste.
			Refuse bins must be emptied regularly.
			Workers must be instructed as to the importance of not littering.
			Litter, such as there may be, must be picked up on a daily basis and disposed of in the bins provided.
6. Visual impacts			
6.1. Visual impact of construction site	A construction site may present a negative visual impact due to removal of vegetation, a site that might not be neat, etc.	6.1.1. The construction site must be kept as neat and tidy as possible.	Construction workers should be alerted to the importance of not littering. Apart from the potential environmental impacts of littering, it is unsightly and has a negative visual impact.
			Sufficient waste bins must be provided onsite and must be emptied regularly.
			Litter must be picked up as and when necessary.
			Any building rubble should not be allowed to accumulate onsite, but must at regular intervals be removed to a licensed landfill site or other licensed disposal site, or to other construction

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			sites where it may be used as fill.
			Stockpiles of soil or excavated material should be used for backfilling, rehabilitation or landscaping and may not be allowed to remain onsite after construction unless they are shaped to blend into the surrounding topography and re-vegetated.
7. Noise			
7.1. Noise caused by construction activities	Construction-related noise is expected to relate mostly to construction vehicles and machinery involved in earthworks and delivery of materials.	7.1.1. Minimize disturbance to neighbours, particularly Sekgosese Secondary School	Construction activities should be limited to daylight hours.
			No blasting is anticipated to be required for this site.
			Any complaints about noise must be attended to in a reasonable manner and the ECO informed of the complaint.
			A complaints register should be maintained, in which any complaints regarding noise are noted.
8. Socio-economic aspects			
8.1. Job creation and economic benefit to local community	Temporary employment opportunities are anticipated to be created during construction, both directly (construction workers) and indirectly (suppliers, service providers, informal traders alongside site).	Maximise local employment and economic benefit.	Where possible, construction workers should be sourced from the local community (Senwamokgope area).
			A Community Liaison Officer (CLO) may need to be appointed to manage the process of procurement of labour from the local community for construction work.
			Construction materials should, where possible, be sourced from within 50km of the site, in order to support the local economy and to reduce the environmental implications of long-distance transport of construction materials.
			Where possible, services required during the construction process, such as rental of chemical toilets, plant hire, etc. Should be sourced from the local area, i.e. from within approximately 50km of the site, in order to support the local economy.
			Informal traders should be allowed to trade alongside the site (outside the school grounds) during the construction phase in order to capitalise on the construction workers who will be likely to purchase food from these traders. However, it must be ensured that informal traders put up shop in safe positions, outside of the construction area itself. Furthermore, no alcohol may be allowed to be sold at these stalls.
8.2. Security	Risk of criminal elements being attracted to the site or construction workers becoming rowdy and violent.	Limit criminality and violence.	No fire-arms to be allowed onsite.
			No alcohol to be allowed onsite.
			Apart from pupils of Sekgosese Secondary School, only workers employed on the project may be allowed onto the school grounds.
			Workers will not be allowed to spend the night onsite, although possibly one security guard

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			may be allowed overnight.
9. Health and Safety			
9.1. Fire	Construction activities pose a risk of fire, particularly during "hot" activities such as welding, refuelling of equipment / machinery, and if there are open fires (for heating / cooking)	9.1.1. Prevent occurrence of fire.	Extreme caution should be exercised where open flames are used and/or where there is the potential for sparks, such as in the case of blow torches. These activities should only take place in designated areas which are clear of vegetation and other flammable material.
			Smoking to be restricted to designated smoking areas situated away from flammable materials.
			No open fires allowed on the site except in designated areas. This includes fires for purposes of cooking, warmth or any other purpose. Vessels should be provided for fires so that labourers do not need to make open fires.
		9.1.2. Effectively and efficiently respond to fire if it does occur.	Emergency numbers (e.g. fire station, doctor, ambulance service and local hospital) must be posted in a highly visible location at the site as well as being available in the safety file in the site office.
			Adequate fire fighting equipment must be available at the site at all times during the construction phase. Such equipment must be clearly visible and easily accessible. Equipment must be available in all areas where construction is taking place as well as in any construction camps and cooking areas.
			It must be ensured that fire-fighting equipment is in good order.
			At least one person trained in the use of the fire extinguishing equipment must be onsite at all times.
			If a site / construction camp is established, the camp must be situated in a position with a low fire risk, e.g. not close to any highly flammable substances (e.g. fuel) nor close to large amounts of dry vegetation, as activities will take place in the camp which may pose a fire hazard, e.g. workers spending the night onsite will use this camp to make fires for cooking and/or heating, and this will most likely also be the designated smoking area (safe for smoking).
9.2. Health and Safety	Workers may be injured onsite during construction.	9.2.1. Apply security measures and ensure that the specifications of the Occupational Health and Safety Act (1993) are adhered to.	The site must be fenced off and access restricted to those involved in construction. Unauthorized persons may be accidentally injured or may cause damage to the site, as they are not aware of the EMP and other relevant documents, e.g. in terms of safety.
			A first-aid kit should be available and readily accessible onsite at all times. At least one person trained in basic first aid should be onsite at all times when construction is taking place, in case of an accident during construction activities.
			Workers may not be forced to do dangerous work.

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			Any relevant necessary safety clothing / equipment must be provided to workers.
			Any trenches or holes that cannot be filled in directly, must be clearly cordoned off by means of danger tape (or similar) to reduce the risk of accident.
			Any relevant specifications forming part of the Occupational Health and Safety Act must be complied with.
10. Traffic			
10.1. Traffic disruption	Slow-moving construction-related vehicles may disrupt traffic and pose a risk of road accidents.	10.1.1. Minimize disruption of traffic by construction-related activities.	As far as possible, heavy vehicles associated with construction should not travel to and from the site during peak times (07:00 – 09:00 and 16:00 to 18:00), to minimise impacts on traffic.
			Vehicles associated with construction should as far as possible not be allowed to obstruct the road. They should not stop in the road (wholly or partially) but rather pull off the road or park on the site.
11. Construction camp (if applicable)			
11.1. If a construction camp is established, bio-physical and socio-economic impacts may be associated with it	Socio-economic impacts.	Minimize negative socio-economic impacts that may be associated with construction camp.	Workers will not be allowed to remain onsite overnight, apart from perhaps one tasked with security of the site and equipment. The majority of workers are anticipated to be hired from the local community.
			No alcohol to be allowed in the camp, whether by day or by night.
			No firearms to be allowed in the camp.
			No loud music will be allowed within the site / construction camp outside of working hours, so as not to disturb neighbours.
			Only workers with positive identification (proving that they are working on the site) may enter the construction / site camp or spend the night there. Friends or relatives (or any other acquaintances) of workers will not be allowed into the site camp at any time.
			The camp must be clearly fenced off and have a lockable gate in order to enforce entry control.
	Bio-physical impacts.	Minimize negative bio-physical impacts that may be associated with construction camp.	The site is not affected by any drainage line or flood line, therefore there is no risk of the site camp being established within any 1:100 year flood line.
			The camp must be situated in a position with a low fire risk, e.g. not close to any highly flammable substances (e.g. fuel) nor close to large amounts of dry vegetation, as activities will take place in the camp which may pose a fire hazard, e.g. workers spending the night onsite will use this camp to make cooking and/or heating fires, and this will most likely also be the designated smoking area.

3. MANAGEMENT AND MITIGATION MEASURES: OPERATIONAL PHASE

Responsibility: Responsibility for impact prevention, mitigation and/or management measures during the operational phase ultimately rests with Mopani District Municipality, but day-to-day implementation of mitigation / management measures will be the responsibility of the plant foreman or manager.

Timeframe: The measures specified in the following sections for minimisation and mitigation of operational-phase impacts, will be applicable for the entire duration of operation of the treatment plant.

Monitoring: Groundwater quality monitoring should be done directly upslope and down-slope of the site on a six-monthly basis, and the results reported to DWA. Should any groundwater contamination be detected, corrective measures will need to be implemented in consultation with relevant specialists and officials from DWA. Surface water quality monitoring at the nearby stream must similarly be done on a six-monthly basis, and the results reported to DWA. Mitigation measures must be implemented where required; suitable measures will be determined in consultation between the specialist, DWA and environmental officer (if any).

It would be advisable that the EMP be revisited at intervals of 5 years or less to ensure that changes in site conditions or operation are addressed, as well as to incorporate any new or amended legislation that may be applicable.

Table 2: Mitigation measures applicable to anticipated operational-phase impacts

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
1. Water					
1.1. Potential leakage or spillage of wastewater from treatment plant	Maintain a closed system to prevent leakage or spillage	1.1.1. Maturation ponds will be lined to prevent infiltration	Daily visual inspection of plant for signs of leakage or particular greening of grass in certain areas, which may be indicative of leakage	Onsite plant manager	Report to DWA within 24 hours in case of spillage
		1.1.2. Sludge drying beds will be paved to prevent infiltration			
1.2. Possible overflow of untreated or semi-treated wastewater	Accommodate peak flow to prevent overflow	1.2.1. Emergency anaerobic pond, facultative ponds and maturation ponds will be available for treatment during power failures or during times of peak flow.	Daily visual inspection to determine whether emergency ponds are nearing full capacity and whether there is any overflow	Onsite plant manager	Report to DWA within 24 hours in case of spillage
		1.2.2. A standby power source (e.g. generator) should be available to power the pumps during power failures	Monthly testing of generator to determine if it is still in working order and whether fuel is available.	Onsite plant manager	Report to MDM monthly
		1.2.3. A standby pump/s should be in place for in the event of failure of the primary pumps	Monthly testing of standby pump to determine if it is still in working order	Onsite plant manager	Report to MDM monthly
1.3. Possible pollution of streams or groundwater	Divert storm water away from treatment plant to prevent contamination thereof	1.3.1. Storm water will be diverted from the site to prevent ingress into open components of the system	Visual inspection during and/or after heavy rains to verify whether storm water diversion is successful.	Onsite plant manager	Report to MDM if diversion is not sufficient
	Intercept potentially contaminated storm water and return to the plant for treatment	1.3.2. Storm water and seepage collection drains will be in place to contain possibly contaminated storm water runoff.	Visual inspection during and/or after heavy rains to verify whether contaminated water overflows	Onsite plant manager	Report to MDM if overflow is detected
	Monitor water quality in Lebjelebore River and implement mitigation measures if necessary	1.3.4. A water quality monitoring programme must be in place to detect any contamination that may be linked with the treatment plant	Six-monthly water quality testing at two points in the Lebjelebore River: directly upstream and directly downstream of the sewage plant	MDM / GLM or designated service provider	Report to DWA on six-monthly basis
		1.3.5. Immediately institute appropriate mitigation measures if contamination is discovered			
	Monitor groundwater quality and implement mitigation measures if necessary	1.3.6. A groundwater quality monitoring programme must be in place to detect any contamination that may be linked with the treatment plant	Six-monthly groundwater quality testing at two boreholes: directly upslope and directly downslope of the sewage plant	MDM / GLM or designated service provider	Report to DWA on six-monthly basis
		1.3.7. Immediately institute appropriate			

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
		mitigation measures if contamination is discovered			
1.4. Possibly exceeding General Authorisation thresholds (DWA)	Treated effluent released into river must comply with the quality and quantity standards set by DWA	1.4.1. Treatment of wastewater must take place strictly according to the engineers' prescriptions in order to meet wastewater quality standards as set by DWA, and treated wastewater must be monitored on a regular basis to verify water quality.	Monthly wastewater discharge monitoring by grab sampling. Discharge to be tested for pH, electrical conductivity (mS/m), faecal colliforms (per 100ml), Chemical Oxygen Demand (mg/l), Ammonia as Nitrogen (mg/l), Nitrate/Nitrite as Nitrogen (mg/l), free Chlorine (mg/l), suspended solids (mg/l) and Ortho-Phosphate as Phosphorus (mg/l).	Daily operation of treatment system: Onsite plant manager Monthly sampling & analysis: MDM / GLM	Report to DWA every 6 months
		1.4.2. Wastewater discharge testing must be accurate and reliable.	Testing must be done by a laboratory accredited under the SA National Accreditation System i.t.o. SABS Code 0259 for that method, or as approved by the relevant authority	MDM to appoint service provider for testing	Report water quality test results to DWA every six months on DW903 and DW904 forms
	Discharge volume must remain below the threshold specified by DWA in the General Authorisation	1.4.3. No more than 2 000 m^3 of treated sewage may be discharged per day	Weekly monitoring of discharge volume	Onsite plant manager	
1.5. Contamination by irrigation with inadequately treated wastewater	Treated effluent used for irrigation must comply with the standards set by DWA: (a) faecal coliforms < 1000 per 100 ml; (b) Chemical Oxygen Demand (COD) < 75 mg/l; (c) pH over 5,5 but under 9,5 pH units; (d) Ammonia (ionised and un-ionised) as Nitrogen < 3 mg/l; (e) Nitrate/Nitrite as Nitrogen does not exceed 15 mg/l;	1.5.1. Treatment of wastewater must take place strictly according to the engineers' prescriptions in order to meet wastewater quality standards as set by DWA, and treated wastewater must be monitored on a regular basis to verify water quality.	Quality of wastewater irrigated must be monthly on the last day of the month by grab sampling, at the point where the wastewater enters the irrigation system. Wastewater must be tested for the parameters indicated in	MDM to appoint service provider for testing Testing must be done by a laboratory accredited under the SA National Accreditation System i.t.o. SABS Code 0259 for that method, or as approved by the relevant authority	Report water quality test results to DWA every six months on DW903 and DW904 forms

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
	(f) Phenol index < 0,1 mg/l; (g) Chlorine < 0,25 mg/l; (h) Suspended Solids < 25 mg/l; (i) Electrical Conductivity < 70 milliSiemens above intake to a maximum of 150 mS; (j) Ortho-Phosphate as phosphorus < 10 mg/l; (k) Fluoride < 1 mg/l; and (l) Soap, oil or grease < 2,5 mg/l; (m) Arsenic < 0,02 mg/l; (n) Cyanide < 0,02 mg/l; (o) Boron < 1 mg/l; (p) Cadmium < 0,005 mg/l; (q) Chromium (VI) < 0,05 mg/l; (r) Copper < 0,01 mg/l; (s) Iron < 0,3 mg/l; (t) Lead < 0,01 mg/l; (u) Mercury < 0,005 mg/l; (v) Selenium < 0,02 mg/l; (w) Zinc < 0,1 mg/l.	1.5.2. Certain components of the treated waste water may need to be re-treated before discharge to ensure compliance with effluent standards set by DWA	Treated effluent should be chlorinated to ensure that any remaining pathogens are eliminated before the effluent is released.	Onsite plant manager	Plant manager to report to managers at MDM / GLM on a monthly basis. Testing of effluent will be done as described in 1.5.1 above to verify effluent quality, and this will be reported to DWA on six-monthly basis
			Sludge and scum from the clarifier and chlorination contact channels will be redirected to the anaerobic digester for further treatment.		
			Hand screens and grit channels must be cleaned regularly and the waste disposed of at an appropriate dumping site together with the dried sludge from the drying beds.		
		1.5.2. A maximum of 2 000 m^3 of treated wastewater may be irrigated per day.	Volume of wastewater irrigated must be metered and the total recorded weekly	Onsite plant manager	Report to DWA every 6 months
		1.5.3. Should any spillage or leakage of untreated / semi-treated effluent occur, DWA must be notified. DWA may then undertake a site inspection to gauge the significance of the incident.	Record must be kept of any spillage or leakage of untreated / semi-treated effluent.	Onsite plant manager	DWA to be notified in case of leakage or spillage
		1.5.4. Irrigation with treated wastewater must take place above the 1:100 year flood line of any surface water body, and may not take place on land that overlies a Major Aquifer.	Six-monthly check-up (when water quality testing is done) to verify that irrigation has not been shifted to a location within any 1:100 year flood line and to verify whether it is still the sports fields at Sekgosese Stadium that are being irrigated.	MDM / GLM	Findings to be included in report to DWA every six months
		1.5.5. Irrigation should constitute 'beneficial use', e.g. for agriculture, and not simply disposal of treated effluent to land, e.g. veld.			
2. Operational Management					

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
2.1. Inadequate management if site operator is ill / on leave or resigns	An operator must be available even when one is not at the site on a particular day	2.1.1. At least two site operators must be fully trained in the operation of the site, so that one can stand in for the other in case of illness, leave, etc.	MDM / GLM Human Resources Division must ensure that there are always two operators employed	MDM / GLM Human Resources Division	None required
2.2. Lack of skills on the part of the plant operator	Sewage plant operators must be appropriately skilled and experienced, and must continually expand their relevant skills	2.2.1. Plant operators must be appropriate skilled and experienced for the task at hand	MDM / GLM Human Resources Division must ensure that persons with appropriate skills are appointed	MDM / GLM Human Resources Division	None required
		2.2.2. The type of system being proposed requires only a moderate level of skill and technical expertise, which lowers the risk of malfunction due to lack of highly trained staff.	Not applicable	Not applicable	None required
		2.2.3. Site operator/s must receive continuous training in all aspects of daily management of the plant (technical or administrative)	MDM / GLM Human Resources Division must arrange for regular training of sewage plant operator/s	MDM / GLM Human Resources Division	None required
	Technical support must be available to the plant operator so that he/she can be assisted in managing issues on which he/she is uncertain as well as possible emergency situations.	2.2.4. Technical support must be available to the sewage plant operator	MDM / GLM Technical Services division	MDM Technical Services division or if an appropriately qualified and experienced civil engineer should be contracted to assist where necessary.	None required
2.3. The sewage plant must be maintained regularly	Regular servicing and/or replacement of parts of the system is essential.	2.3.1. Refer to Section 3 regarding regular maintenance of the plant	Refer to Section 3	Refer to Section 3	Refer to Section 3
2.4. Document control and access to information	Onsite staff must always have access to the WUL, WML, EMP and monitoring reports. These reports must also be available if inspectors visit the site	WUL, WML, monitoring reports and water test results must be made available to any inspectors from DWA or DEA who may visit the site	Plant manager must ensure that all reports are available onsite and easily accessible	Onsite plant manager	None required
3. System Maintenance					
3.1. Irregular or inadequate	Perform regular maintenance as prescribed by the consulting	3.1.1. Regular checking of key components of the system to verify continuing	To be specified by Mošomo in operational manual (still being	MDM / GLM or designated contractor	To be specified by Mošomo in

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
maintenance could compromise functionality	engineers, even if the system appears to be in good working order.	functionality	compiled)		operational manual
		3.1.2. Regular replacement of key components as a preventative measure, even if components still appear to be functional			
		3.1.3. It must be ensured that monitoring systems and gauges are in good working order at all times in order facilitate informed management of the treatment system.	All gauges to be monitored by the onsite plant manager at regular intervals (monitoring interval still to be specified by engineer)	Onsite plant manager	Report to MDM / GLM technical division if any gauges are not fully functional
		3.1.4. A maintenance plan must be in place to ensure that planning, such as budget allocation or procurement of service providers, can be put into motion sufficiently ahead of time. Maintenance plan must take into account the lead times applicable to certain types of maintenance, e.g. long delivery times for certain components of the system.	Maintenance plan to be revisited annually and updated where necessary	Mošomo are compiling a maintenance plan. MDM / GLM technical division to ensure regular review and updating of maintenance plan	MDM / GLM technical division
3.2. Running the plant over its design lifetime could compromise functionality	The plant must not remain operational for longer than its 20 year design lifetime, unless relevant key components are replaced or upgraded, as approved by engineer.	3.2.1. The plant has been designed for an operational lifetime of 20 years, after which it may need to be replaced or upgraded.	Once the plant reaches 17 years of age, a study must be done or commissioned by MDM or GLM to determine whether the plant should be replaced, refurbished or closed down once its 20-year design lifetime is reached. This will allow sufficient time for planning and design in case of refurbishment or replacement before the 20-year mark is reached.	MDM / GLM may either undertake the investigation themselves, or contract appropriate civil engineers to investigate	Report to MDM / GLM once the plant reaches a lifetime of 17 years
		3.2.2. Suitable civil engineers must be consulted when the design lifetime is approached, in order to advise on the continuation or upgrading of the plant.			
4. Soils					
4.1. Leakage or spillage may result in pollution of surrounding soil.	Refer to Section 1.	Refer to Section 1.	Refer to Section 1.	Refer to Section 1.	Refer to Section 1.
4.2. Possible soil erosion	Prevent soil erosion and efficiently respond to instances	It must be ensured that storm water does not reach excessive speeds, as that would	Monthly monitoring.	Onsite plant manager	Report to MDM / GLM

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
	of soil erosion.	increase the potential for soil erosion. Storm water runoff must not be concentrated in any one place or channel where it flows over unpaved (erodible) surfaces. Storm water must be appropriately channelled away from erosion-prone areas such as bare / cleared areas. Should any signs of erosion be found, remedial action such as backfilling, compaction and re-vegetation should be taken immediately to avoid exacerbation of the erosion.			
5. Waste Management					
5.1. Improper waste disposal	Safely dispose of all waste at appropriately licensed site/s.	Dried sewage sludge will be used by nearby farmers as fertilizer for appropriate types of crops. Coarse material removed from the hand screen and grit channels must be disposed of at a licensed landfill site. No waste may be burned or buried. The small volume of general solid waste expected to be generated by the staff onsite (e.g. food packaging) must be kept in a closable refuse bin until such time as it is taken to the landfill site. Littering (both on and around the site) must be strongly discouraged.	Bi-monthly monitoring to verify whether waste is disposed of properly.	Onsite plant manager	Report to MDM / GLM
6. Air Quality					
6.1. Release of unpleasant odours associated with raw sewage and sludge, caused by methane and hydrogen sulphide	Minimize generation of unpleasant odours	Ensure that all components of the treatment plant are in good working order at all times. If the plant is functioning properly, the generation of odours should be minimized.	Bi-monthly monitoring. This does not need to be quantitative monitoring, but simply a qualitative note by the plant foreman / manager as to whether odour levels are low, medium or high.	Onsite plant manager	Report to MDM / GLM

RISK	OBJECTIVE	MITIGATION MEASURES	MONITORING	RESPONSIBILITY	REPORTING
emissions from the sewage.					
7. Health and Safety					
7.1. Occupational Health and Safety Act	The conditions of the Occupational Health and Safety Act (OHSA, No 85 of 1993) must be complied with	A copy of the OHSA should be affixed in a visible position at the treatment plant.	Annual monitoring to verify whether the conditions are being complied with.	MDM / GLM	Report to MDM / GLM
		Workers must be supplied with the necessary protective gear, particularly when doing tasks that involve contact with raw or semi-treated sewage or sludge.			
		Workers must be trained in proper, safe procedures in relation to activities involving sewage or sludge so that they do not unwittingly engage in hazardous practices.			
7.2. Risk of falling into the ponds / drowning	Prevent people or livestock from entering the site	The fence around the plant must be kept in good shape at all times. Any holes or sagging portions must be fixed immediately to prevent ingress of people or livestock.	Weekly monitoring of the fence and the lock on the gate.	Onsite plant manager	Report to MDM / GLM
		Staff must be made aware of the risks around the ponds so that they can be careful especially in this area of the site.			
8. *General*					
8.1. Leakage along outfall sewer or reticulation pipelines **[does not form part of this EIA]**	Streamline leak detection through mobilising the community to report any leakages along the supply or reticulation pipelines	8.1.1. Residents should be encouraged to report any incidences of sewage leakage to the GLM Sekgosese sub-office			

4. MANAGEMENT AND MITIGATION MEASURES: DE-COMMISSIONING PHASE

It is not anticipated at this stage that the sewage treatment plant will be decommissioned within the foreseeable future. However, provision must be made for the event that decommissioning may take place at some time in the future. Should the plant be decommissioned, the measures recommended in the sections below (as well as other measures which may be recommended at that stage) will have to be implemented all through the process until rehabilitation of the site has been completed.

Decommissioning of a sewage plant would need to be conducted with great care and under supervision by a specialist in this field, as there may be risks in terms of leakage or spillage of fuel. Should the facility be decommissioned, the decommissioning should be planned in consultation with the relevant authorities, most importantly the environmental and water authorities (at this stage LDEDET and DWA, respectively).

The facility owner (at this stage Mopani District Municipality) must appoint an environmental consultant to advise on applicable legislation and appropriate measures for impact mitigation and management. Legislation in place at the time of decommissioning must be complied with. This will include environmental and water-related legislation, occupational health and safety legislation, and any other applicable legislation, by-laws and standards.

If decommissioning is planned, a detailed decommissioning EMP must be compiled, taking into account the conditions on and around the site at that time, as well as applicable legislation. The following sections contain generic measures that will need to be adhered to, but specific measures will have to be developed at that time to address any issues or conditions that may not be present at this stage.

Table 3: Impact mitigation and management measures to be implemented during the decommissioning phase

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
1. Soils			
1.1. Soil erosion	If structures are to be demolished and cleared, the site will be susceptible to soil erosion in case of rains during the period that bare soil is exposed.	1.1.1. Limit the risk of soil erosion.	If structures are to be demolished and the site cleared, it is recommended that this be undertaken during the drier winter season.
		1.1.2. Effectively remediate erosion if it does take place.	Should any signs of erosion be found, remedial action such as backfilling, compaction and re-vegetation should be taken immediately to avoid exacerbation of the erosion.
			Any erosion channel(s) that may develop should be backfilled and compacted as soon as possible, and the area(s) restored to a proper condition. The contractor should ensure that cleared areas are effectively stabilised to prevent and control erosion.
			The site must be re-vegetated directly after site clearing, using locally indigenous species.
1.2. Soil contamination	Possible contamination of soil by sewage (from components of the plant) or wastewater (generated by workers onsite).	1.2.1. Prevent spillage of raw or semi-treated sewage or wastewater.	All wastewater still contained in the system must be treated and discharged before dismantling of the system commences. If the system is no longer fully functional, the wastewater still in the system must be removed to an appropriately licensed treatment facility by means of a “honey sucker” or similar vehicle for treatment before work commences at the site.
		1.2.2. Safely dispose of possibly contaminated waste	Wastewater or any parts of the system which were in direct contact with sewage should be regarded as hazardous waste, and must be disposed of by suitably licensed hazardous waste contractors at a hazardous waste disposal site. It may not be disposed of with general waste at the local municipal landfill site or at any other dumping site not geared for hazardous waste, unless there is agreement between the local authority’s waste division and an appropriate specialist (e.g. environmental officer and/or engineer) that this waste can indeed be disposed of at a general landfill site.
		1.2.3. Prevent infiltration of sewage into soil.	If waterborne sewerage is not available, workers must be provided with portable chemical toilets which form a sealed, closed system. Sanitation facilities must be

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
			provided at a ratio of 1 toilet per 30 workers, and the contents must be disposed of at a licensed sewerage works.
			Sufficient washing facilities must be provided for workers. Wash areas must be placed and erected in such a manner that the surrounding areas, including soil and groundwater, are not polluted.
		1.2.4. Efficiently respond to any spillage	In case of any spillage, the ECO must be informed so that he/she can investigate the incident and recommend appropriate mitigation measures.
			Any significant spillage must be reported to DWA, who may need to conduct a site visit to determine the significance of the spillage and to recommend mitigation measures. The incident must also be reported to LDEDET by the ECO.
			Measures must be implemented to prevent a recurrence of a spillage event.
2. Water			
2.1. Water quality	Possible leakage or spillage of sewage from portable toilets during construction phase, or contamination of water by runoff containing construction-related substances such as cement or paint.	2.1.1. Prevent spillage of sewage.	Refer to 1.2.1. and 1.2.3.
		2.1.2. Safely dispose of possibly contaminated waste	Refer to 1.2.2.
		2.1.3. Efficiently respond to any spillage	Refer to 1.2.4.
2.2. Storm water	Storm water may cause soil erosion on cleared construction site.	2.2.1. Minimize water-related soil erosion	Storm water should be channelled away from the exposed area for the duration of the decommissioning phase.
3. Flora and Fauna			
3.1. Rehabilitation of site	If the facilities are to be demolished and the site cleared, rehabilitation of the site will be required.	3.1.1. Rehabilitate the site to a state approximating the pre-development state or a condition similar to	Prepare soil for re-vegetation, e.g. by removing potentially contaminated soil (for disposal at a suitable site), “ripping” compacted soil and adding organic material.
			Re-establish locally indigenous vegetation under the guidance of an ecologist. Re-vegetation can take the form of seeding (or hydro-seeding) broad areas with

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
		undeveloped areas nearby.	a mix of indigenous grass seeds, and planting of individual indigenous trees and shrubs. Methods and timing of rehabilitation must be prescribed by an ecologist based on site conditions at the time, and species composition should be dictated by the vegetation communities in open areas in the vicinity.
		3.1.2. Prevent colonisation by alien invasive species	No alien plant species may be established on the site during rehabilitation.
			Any alien vegetation on the site must be eradicated before seeding / planting of indigenous vegetation.
			The site must be regularly monitored for re-growth of alien invasive species, and any new seedlings etc eradicated using methods appropriate for the particular species, whether mechanical, chemical or biological.
4. Waste management			
4.1. Solid waste management	Solid waste generated at the site must be disposed of at a suitably licensed disposal site.	4.1.1. Remove general solid waste to a landfill site.	General solid waste must be disposed of at the Tzaneen landfill site or another licensed waste disposal site.
			General rubble resulting from demolition (if structures are to be demolished) can be used as fill at nearby construction sites (if any), or otherwise disposed of at a licensed landfill site. However, an engineer and environmental consultant will have to be consulted regarding the disposal of oxidation pond linings and other components of the system which were directly in contact with untreated sewage.
			Waste may <u>not</u> be dumped on or near the site.
		4.1.2. Dispose of hazardous waste at a suitable disposal site	Refer to 1.2.2.
			Any soil that might be contaminated by fuel or other hazardous substances must be removed and disposed of at a hazardous waste disposal site by suitably licensed contractors. Contaminated soil may <u>not</u> be disposed of at the general landfill site.
5. Health and Safety			
5.1. Fire	Demolition-related activities may pose a risk of fire, particularly	5.1.1. Prevent occurrence of fire.	Extreme caution should be exercised where open flames are used and/or where there is the potential for sparks, such as in the case of blow torches. These

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
	during "hot" activities such as welding, refuelling of equipment / machinery, and if there are open fires (for heating / cooking)		activities should only take place in designated areas which are clear of vegetation and other flammable material.
			Smoking to be restricted to designated smoking areas situated away from flammable materials.
			No open fires allowed on the site except in designated areas. This includes fires for purposes of cooking, warmth or any other purpose. Vessels should be provided for fires so that labourers do not need to make open fires.
		5.1.2. Effectively and efficiently respond to fire if it does occur.	Emergency numbers (e.g. fire station, doctor, ambulance service and local hospital) must be posted in a highly visible location at the site as well as being available in the safety file in the site office (if any).
			Adequate fire fighting equipment must be available at the site at all times during the decommissioning phase. Such equipment must be clearly visible and easily accessible. Equipment must be available in all areas where construction is taking place as well as in any construction camps and cooking areas.
			It must be ensured that fire-fighting equipment is in good order.
			At least one person trained in the use of the fire extinguishing equipment must be onsite at all times.
			If a site camp is established, the camp must be situated in a position with a low fire risk, e.g. not close to any highly flammable substances (e.g. fuel) nor close to large amounts of dry vegetation, as activities will take place in the camp which may pose a fire hazard, e.g. workers spending the night onsite will use this camp to make fires for cooking and/or heating, and this will most likely also be the designated smoking area (safe for smoking).
5.2. Health and Safety	Workers may be injured onsite during demolition activities.	5.2.1. Apply security measures and ensure that the specifications of the Occupational Health and	A first-aid kit should be available and readily accessible onsite at all times. At least one person trained in basic first aid should be onsite at all times when construction is taking place, in case of an accident during construction activities.
			Workers may not be forced to do dangerous work.

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
		Safety Act (1993) are adhered to.	Any relevant necessary safety clothing / equipment must be provided to workers.
			Any relevant specifications forming part of the Occupational Health and Safety Act must be complied with.
			Ponds must be backfilled to prevent the creation of potentially dangerous ponds after rainfall events.
	During emptying or removal of infrastructure, workers may be exposed to pathogens.	5.2.2. Prevent exposure of workers to pathogens.	Removal of equipment / infrastructure must be overseen by an experienced and suitably qualified specialist.
			All workers must wear relevant protective gear such as nose-and-mouth masks and latex gloves.
			Suitable washing facilities must be provided for workers to be able to wash themselves thoroughly, particularly in the event of coming into contact with raw sewage.
5.3. Security	Risk of criminal elements being attracted to the site	5.3.1. Limit criminality and violence.	No fire-arms to be allowed onsite.
			No alcohol to be allowed onsite.
			Only workers employed on the site may be allowed onto the site and particularly into the site camp (if any). No friends or other associates of workers may loiter on the site, enter the camp or spend the night onsite.
6. Site camp			
6.1. **If** a site camp is established, bio-physical and socio-economic impacts may be associated with it	Socio-economic impacts.	6.1.1. Minimize negative socio-economic impacts that may be associated with construction camp.	Workers will not be allowed to remain onsite overnight, apart from those responsible for security.
			No alcohol to be allowed in the camp, whether by day or by night.
			No firearms to be allowed in the camp.
			No loud music will be allowed within the camp outside of working hours, so as not to disturb neighbours.
			Friends or relatives (or any other acquaintances) of workers will not be allowed into the site camp at any time.

ASPECT	ISSUE / IMPACT / RISK	OBJECTIVE	RECOMMENDED MITIGATION MEASURES
			The camp must be clearly fenced off and have a lockable gate in order to enforce entry control.
	Bio-physical impacts.	6.1.2. Minimize negative bio-physical impacts that may be associated with construction camp.	The site is not affected by any drainage line or flood line, therefore there is no risk of the site camp being established within any 1:100 year flood line.
			The camp must be situated in a position with a low fire risk, e.g. not close to any highly flammable substances (e.g. fuel) nor close to large amounts of dry vegetation, as activities will take place in the camp which may pose a fire hazard, e.g. workers spending the night onsite will use this camp to make cooking and/or heating fires, and this will most likely also be the designated smoking area.

5. ENVIRONMENTAL COMPLIANCE MONITORING

5.1. Environmental Control Officer and Monitoring

Environmental compliance during the construction phase is the responsibility of the Mopani District Municipality, though the contractors and sub-contractors (during construction) and onsite staff (during operation) will be responsible for the day-to-day implementation of specific aspects of the EMP. The MDM must ensure that all relevant parties are supplied with copies of the approved EMP as well as copies of the waste management licence issued by the Department of Environmental Affairs (DEA).

An Environmental Control Officer (ECO) must be appointed before commencement of construction / site preparation activities, and must remain on the project for the duration of the construction phase in order to oversee the implementation of and compliance with the EMP and any other environmental requirements, such as that which may be contained in the environmental authorisation. The ECO will be responsible for the following:

- Compiling monthly monitoring / compliance reports during the construction phase for submission to DEA and DWA;
- Formulating, and overseeing the implementation of, remedial and/or management measures in case of negative impacts or environmental damage that may not have been anticipated and provided for in the EMP. Such measures may need to be developed in consultation with relevant authorities, specialists or stakeholders, as the case may be.
- Providing guidance and assistance to all participants in implementing and complying with the EMP.
- Keeping a permanent written and photographic record of activities during the construction phase, in particular (but not limited to) any instances of non-compliance.
- Maintaining a complaints register and an incident register, in which any complaints or incidents during the construction phase are noted along with a description of how the incidents or complaints were mitigated.
- Must be fully conversant with the contents of the Environmental Impact Report and this EMP.
- Must be fully conversant with the environmental authorization for the project and any conditions that may be stipulated therein.

The EMP and waste management licence must be available at the site camp during the whole of the construction phase. During the operational phase, these documents must be kept in the plant manager's office onsite. If the site is to be decommissioned, a copy of the decommissioning EMP must be available at the site office for the duration of this phase.

5.2. Compliance with the Environmental Management Plan

- All persons employed by the applicant or their sub-contractors must abide by the requirements of the EMP and environmental authorisation. Any members of the construction, operation or maintenance workforce found to be in breach of any of the specifications contained within the EMP may be ordered to leave the site and/or to pay a fine, but MDM remains ultimately responsible for activities undertaken on the site and for compliance with the EMP.
- Complaints about irresponsible behaviour or actions that cause or may cause environmental damage or pollution must be reported to the ECO, who in turn will notify DEA.

- The designated ECO is to keep an Environmental Register in which any and all environmental incidents, transgressions of the EMP or authorization and/or comments or complaints received from the public and affected parties will be recorded. Monthly monitoring reports are also to form part of the Register. The Register must available for perusal by representatives of DEA if necessary.
- The Contractor or applicant (to be agreed upon between the aforementioned two parties) shall be responsible for and shall bear the cost of any delays or corrective or remedial actions required as a result of non-compliance with the specifications and clauses of the EMP.
- The developer or their contractors may not direct a person to undertake any activity which would cause them to breach the specifications contained within the EMP.
- Should a contractor be in breach of any of the specifications contained in the EMP, the developer must, in writing, instruct the responsible Contractor regarding corrective and/or remedial action required, specify a timeframe for implementation of these actions, implement a penalty and/or indicate that work shall be suspended should non-compliance continue.

5.3. Environmental Awareness Plan

- At the outset of the construction phase, the ECO must present an environmental awareness plan to the lead contractor and a training workshop must be presented to the construction workers, with specific concentration on those aspects that directly affect the workers or in which workers will be directly involved.
- A copy of the construction-phase environmental awareness plan must be available onsite at all times during construction.
- At the outset of the operational phase (following completion of construction), the ECO must present an operational-phase environmental awareness plan to the plant manager, who in turn will be responsible for briefing all his staff in this regard.
- A copy of the operational-phase environmental awareness plan must be available in the plant manager's office onsite.
- In case of decommissioning, a decommissioning environmental awareness plan must be compiled by the ECO and presented to the lead contractor responsible for overseeing the decommissioning or destruction activities. A training workshop must also be presented to the workers, and a copy of the environmental awareness plan must be available onsite at all times until decommissioning and site rehabilitation have been completed.