WETLAND OFFSET AND REHABILITATION PLAN FOR A PROPOSED DAM LOCATED ON PORTION 0 OF THE FARM LOT FP 173 NO. 8581, WITHIN THE DR NKOSAZANA DLAMINI-ZUMA LOCAL MUNICIPALITY, KWAZULU-NATAL

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Attention To:

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Date:

January-2024

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HUNTS GREEN

Wetland offset and rehabilitation plan for a proposed dam located on Portion 0 of the Farm Lot FP 173 No. 8581, within the Dr Nkosazana Dlamini-Zuma Local Municipality, Kwazulu-Natal

January-2024

Required Client Review and Approval

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Quality	No			
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STRICTLY CONFIDENTIAL

EXECUTIVE SUMMARY

Hunts Green Consulting (Pty) Ltd was appointed by Emanzini WULA Consultants to conduct a wetland offset and rehabilitation plan for a Water Use License Application (WULA) for a proposed dam that will be utilised for irrigation. The dam is located on Portion 0 of the Farm Lot FP 173 No. 8581, within the Underberg area, Kwazulu-Natal. It is the intention of the applicant to construct a storage dam with a capacity of 1 500 000 m^3 to be used for the irrigation of existing cultivation fields including perennial grass pastures and vegetables.

A wetland impact assessment was conducted in 2023/2024 and identified three seep systems where the dam is proposed to be located. The three seep systems were assessed and classified as moderately modified (PES C) (HGM 1), and largely modified (PES D) (HGM 2 and HGM 3). Impacts to the wetlands stem from various historic and current agricultural activities within the area. These impacts include cultivation practices, the presence of dams, tree (*Eucalyptus* and *Acacia* sp - Wattle) plantations and the construction of dirt roads to access cultivated fields.

The ecosystem services assessment of the seeps furthermore identified moderately functioning systems with highest scores received relating to flood attenuation, streamflow regulation, sediment trapping, filtration, and erosion control. All wetland systems provide ecosystem services for the maintenance of biodiversity within the agricultural landscape. The Ecological Importance and Sensitivity scores for the three seep systems was Moderate for HGM 1 and Low for HGM 2 and HGM 3. This is due to the more impacted nature of HGM 2 and HGM 3 compared to HGM 1. However, all systems provide habitat for floral and faunal, avifaunal and semi-aquatic species for feeding, breeding and foraging.

The proposed dam wall will be constructed in the Ekamanzi River as well as a portion of HGM 2. At full capacity the proposed dam will lead to the direct loss of a 26.94 ha of a portion of HGM 1, HGM 2 and HGM 3 (Figure 5-3) as per the following:

- 0.39 ha of HGM 1 will be lost,
- 11.37 ha of HGM 2 will be lost and
- 15.18 ha of HGM 3 will be lost.

To mitigate this loss of wetland area, a wetland offset plan was created and is deemed appropriate for this proposed project. This wetland offset plan aims to achieve the offset through the use of the Rehabilitation Offset Category for the remaining portions of the wetlands (HGM 1, HGM 2 and HGM 3), that are not impacted by the dam and that are available for rehabilitation. Given the modified state of the remaining extent of the wetland systems, the rehabilitation of these areas is deemed to be a net gain for this catchment area.

To implement this wetland offset plan, the Wetland Offsets: A Best Practice Guideline for South Africa was used. This guideline has been developed to quantify the required offset for the loss of a portion of HGM 1, HGM 2 and HGM 3 due to the proposed dam. The guideline incorporates a calculator which uses the ‘healthy hectare equivalents’ principle to determine

the functional and healthy portion of the wetland systems that will be lost. The healthy hectare equivalents considers the moderately modified (PES Category C) and largely modified (PES Category D) nature of the wetlands, the wetland vegetation group and its threat status. For the three seep systems this is set at the Sub-Escarpment Grassland Group 5 which has a conservation threat status of Least Concern. Based on the results received, the offset ratio of 0.8 is applied to the area that will be lost by the proposed dam. When taking the original area of 26.94 ha and utilising this 0.8 ratio, this equates to an offset area of 21.55 ha.

The remaining extent of HGM 1, HGM 2, and HGM 3 equates to 24.28 ha and thus it is deemed more than sufficient to rehabilitate the remaining areas as the offset plan for the proposed dam. It is therefore recommended that the offset plan rehabilitate the remaining portions of the seeps, in particular HGM 2 and HGM 3 to more functional wetland habitat that will enhance the ecosystem services already provided by these wetlands.

The initial step of the rehabilitation process is centered on the identification of existing impacts and possible impacts arising from the rehabilitation exercise (Armstrong, 2009). The identification of possible drivers of the causes of wetland degradation is vital in order to mitigate these root causes. These impacts can be differentiated in to direct and indirect impacts. Within the three seep systems these are as follows:

<u>Direct impacts</u>

- Historic and current cultivation of the seep systems.
- Hydric soil mixing and disturbance.
- Soil erosion.

<u>Indirect impacts</u>

- Increase in alien invasive vegetation (resulting from anthropogenic disturbances)
- Deposition of sediment on top of the original soil profile associated with the seeps. This causes sedimentation of these systems changing the flow dynamics of the seeps, leading to their eventual desiccation.

In order to address these impacts, the implementation of a wetland rehabilitation plan that not only reinstates favourable hydrological conditions in the seeps but also allows for the regeneration of the functional integrity of the seeps is required. The main aim of this rehabilitation plan is to maximise the ecological functioning of the wetland systems.

The rehabilitation process will therefore encompass the following strategies:

- Closure and rehabilitation of the erosion gullies.
- Removal of invasive alien and problem plant species.

- The removal of existing vegetation must be conducted in a phasic approach to ensure that the revegetated areas become established.

The key to the success of the rehabilitation is the frequent monitoring of the rehabilitated wetland systems. Ongoing monitoring of the rehabilitated wetlands must be undertaken by a wetland ecologist. Vegetation is an excellent indicator of either disturbance to a wetland/terrestrial area or rehabilitation interventions. Monitoring of changes within the vegetation community can help establish if any negative effects are further degrading the vegetation composition.

Monitoring aspects of the rehabilitation plan must be undertaken at the following intervals to ensure effective monitoring:

- 1 month,
- 2 months,
- 3 months,
- 6 months and
- 1 year

Apart from the set intervals detailed above, it is imperative to monitor each aspect outlined in this report to assess the success of the rehabilitation and determine any areas that need extra attention or altered methods. Following on from the monitoring of the vegetation, the wetlands must be monitored independently through assessing the Present Ecological Score (PES) using the WET-Health methods. This score must be evaluated on a bi-yearly basis for the first year to determine the success of the rehabilitation objectives within the wetland. The PES score for the wetlands is currently a PES C category (moderately modified) for HGM 1 and PES D category (largely modified) for HGM 2 and HGM 3. The wetland health for all three HGM units must be improved to at least a PES C category (moderately modified).

It is furthermore recommended that monitoring of the rehabilitated wetland system be undertaken by a suitably qualified wetland ecologist bi-annually for a period of one year after the completion and the implementation of the rehabilitation process. A wetland audit report is recommended to be produced for these site visits, providing an indication of the success of the wetland rehabilitation plan and recommendations to improve the management of the rehabilitated systems.

Provided these recommendations for the rehabilitation of the assessment area are undertaken, the author is of the opinion that these measures should compensate for the loss of a portion of HGM 1, HGM 2 and HGM 3 from the proposed dam.

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1. Introduction

Hunts Green Consulting (Pty) Ltd was appointed by Emanzini WULA Consultants to conduct a wetland offset and rehabilitation plan for a Water Use License Application (WULA) for a proposed dam that will be utilised for irrigation. The dam is located on Portion 0 of the Farm Lot FP 173 No. 8581, within the Underberg area, Dr Nkosazana Dlamini-Zuma Local Municipality, Kwazulu-Natal (Figure 1-1 and Figure 1-2). It is the intention of the applicant to construct a storage dam with a capacity of 1 500 000 m^3 to be used for the irrigation of existing cultivation fields including perennial grass pastures and vegetables.

A wetland impact assessment was conducted in 2024 and this report is to be read in conjunction with the wetland impact assessment report (Hunts Green 2024).

This report is undertaken in compliance with the National Environmental Management Act (Act 107 of 1998), as well as the Water Use Licence Application (WULA) in terms of the National Water Act (Act 36 of 1998). The primary aim of the study is to provide an offset plan for the loss of wetland systems delineated and assessed within the study site, as a result of the proposed dam. Appropriate rehabilitation of the remaining portions of the wetland systems forms the basis of the wetland offset plan with the aim of improving the status quo of these wetlands through remediation interventions.

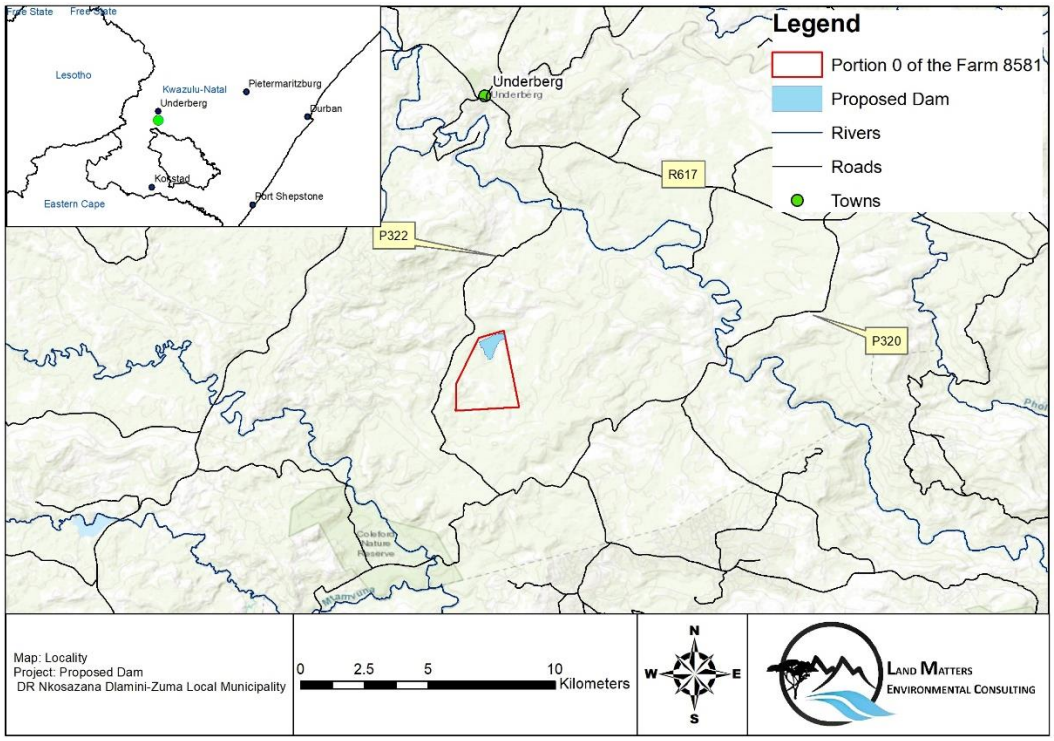

Figure 1-1: Local setting of the project area

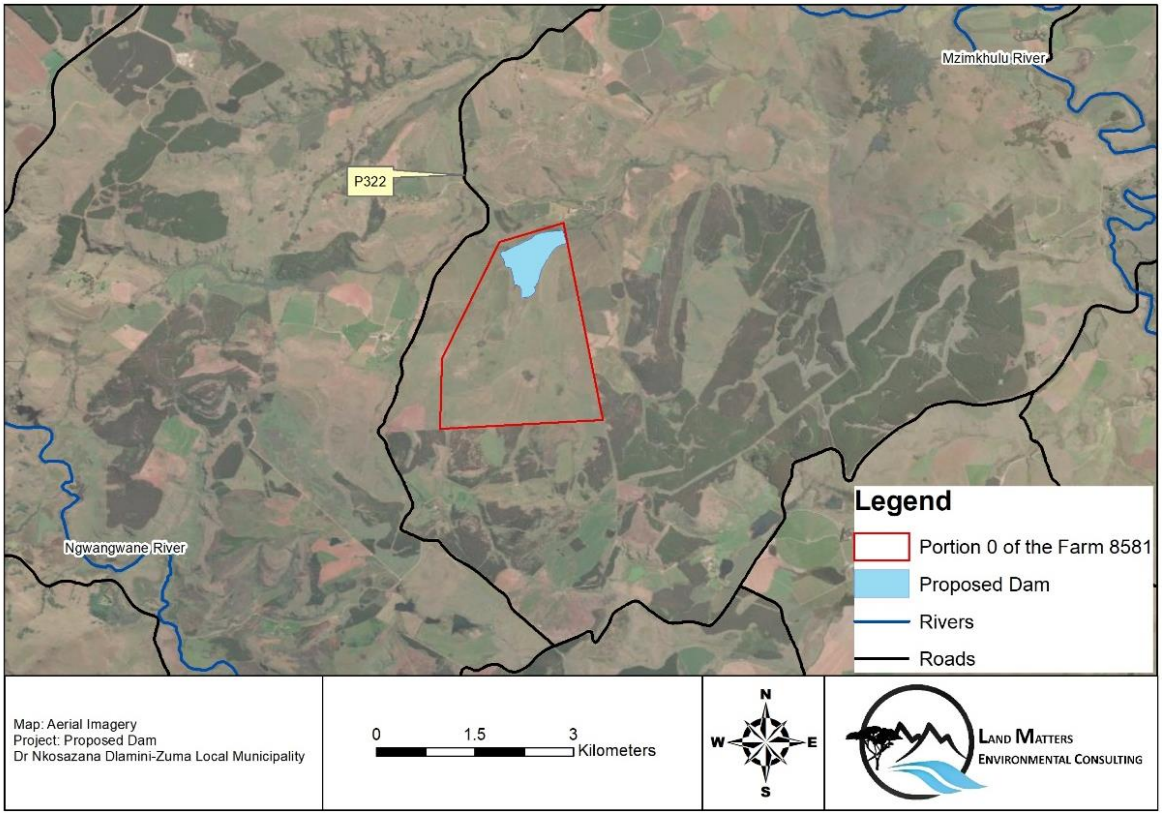

Figure 1-2: Description of the project site

2. Scope of Work

The scope of work required for the study includes the following:

1. To calculate the wetland offset required to compensate for the loss of wetland habitat as a result of the proposed dam.
2. Identify areas that are suitable for the offset to take place.
3. Provide a rehabilitation plan for the remaining extent of the wetlands not affected by the proposed dam as part of the offset strategy.
4. Recommend long-term mitigation measures and monitoring to ensure the success of rehabilitation efforts as part of the offset strategy.
5. Reporting – this report was compiled to present findings of the study as well as conclusions and recommendations considering the proposed dam and irrigation activities.

3. Legal and Administrative Framework

This specialist assessment was compiled in support of the Water Use License Application and is be utilised in environmental authorisations legislated under the;

- The Constitution Act (Act 108 of 1996) , Section 24 on environmental rights.
- National Environmental Management Act (Act 107 of 1998), (NEMA) as amended.
- Environmental Impact Assessment Regulations of 2010.
- National Water Act (Act 36 of 1998) (NWA).

4. Project Background

A wetland impact assessment was conducted as part of the WULA for the proposed dam. The dam is to be used a storage dam for the irrigation of existing cultivation fields including perennial grass pastures and vegetables. It is proposed to be 1 500 000 m^3 and is situated along the Ekamanzi River. Where the dam is proposed to be situated, three seep systems (Figure 4-1) were identified, delineated, and assessed as per the Wet-Health methodology (Level 2)[1] (MacFarlane et al. 2020), the Wet-Ecoservices methodology (Level 2) (Kotze et al. 2021) and the Ecological Importance and Sensitivity (EIS) methodology.

[1] The current size of the delineated wetlands was recorded. It must be noted that this is not the entire size of the wetland but rather the portion of the system delineated within the assessment area.

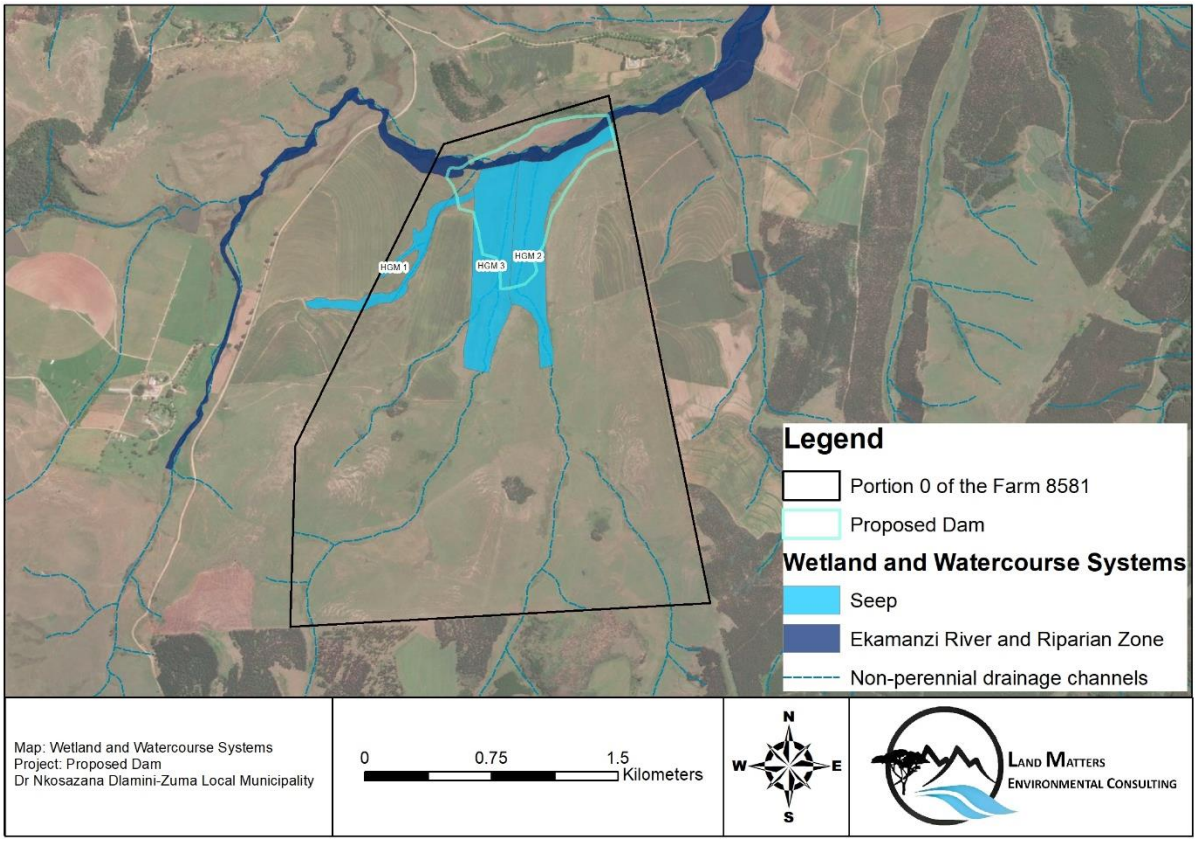

Figure 4-1: The three seep systems delineated at the proposed dam site

The three seep systems were classified as Moderately Modified (PES C) (HGM 1), and Largely Modified (PES D) (HGM 2 and HGM 3) (Figure 4-1). Impacts to the wetlands stem from various historic and current agricultural activities within the area. These impacts include cultivation practices, the presence of dams, tree (*Eucalyptus* and *Acacia* sp - Wattle) plantations and the construction of dirt roads to access cultivated fields. HGM 2 and HGM 3 in particular have been impacted by sediment deposition, as parts of these wetland systems were historically cultivated, as well as the dense infestation of alien invasive species (particularly *Rubus* sp). HGM 1 has not been as extensively impacted with the majority of this seep (outside of the proposed dam site) in very good condition.

Table 4-1: Summary of PES scores

HGM Unit	Extent Delineated (Ha)	Hydrology	Geomorphology	Water Quality	Vegetation	PES Score (Category)
HGM 1	7.08	3.9	2.7	5.1	2.6	C (3.6)
HGM 2	21.27	4.1	3.0	4.8	5.1	D (4.2)
HGM 3	23.28	4.7	3.7	5.2	5.4	D (4.7)

The ecosystem services assessment of the seeps furthermore identified moderately functioning systems (Figure 4-2) with highest scores received relating to flood attenuation, streamflow regulation, sediment trapping, filtration, and erosion control. All wetland systems provide ecosystem services for the maintenance of biodiversity within the agricultural landscape.The EIS scores for the three seep systems was Moderate for HGM 1 and Low for HGM 2 and HGM 3 (Table 4-2). This is due to the more impacted nature of HGM 2 and HGM 3 compared to HGM 1. However, all systems provide habitat for floral and faunal, avifaunal and semi-aquatic species for feeding, breeding and foraging.

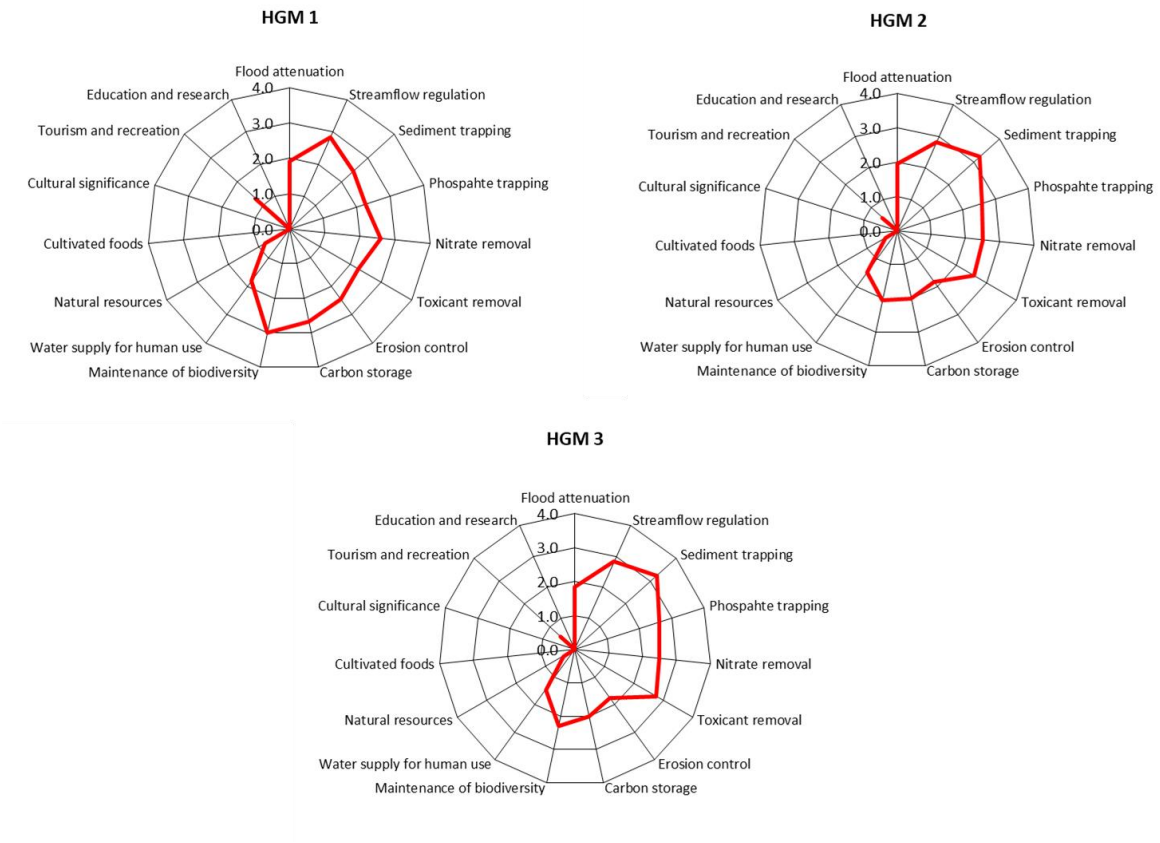

Figure 4-2: General WET-EcoServices results for HGM units 1-3

Table 4-2: Summary of the Ecological Importance and Sensitivity

HGM UNIT	EIS	SCORE (0-4)	CONFIDENCE (0-5)	CATEGORY
HGM 1	Ecological Importance and Sensitivity	2.36	4.00	**Moderate**
	Hydrological Functional Importance	2.43	4.50	**Moderate**
	Direct Human Benefits	1.00	4.00	**Low**
HGM 2	Ecological Importance and Sensitivity	1.81	4.00	**Low**
	Hydrological Functional Importance	2.44	4.50	**Moderate**

HGM Unit	EIS	Score (0-4)	Confidence (0-5)	Category
	Direct Human Benefits	1.00	4.00	**Low**
HGM 3	Ecological Importance and Sensitivity	1.78	4.00	**Low**
	Hydrological Functional Importance	2.43	4.50	**Moderate**
	Direct Human Benefits	1.00	4.00	**Low**

4.1. Proposed dam in relation to the seep systems

The proposed dam wall will be constructed in the Ekamanzi River as well as a a portion of HGM 2. At full capacity the proposed dam will lead to the direct loss of a 26.94 ha of a portion of HGM 1, HGM 2 and HGM 3 (Figure 4-3) as per the following:

- 0.39 ha of HGM 1 will be lost,
- 11.37 ha of HGM 2 will be lost and
- 15.18 ha of HGM 3 will be lost.

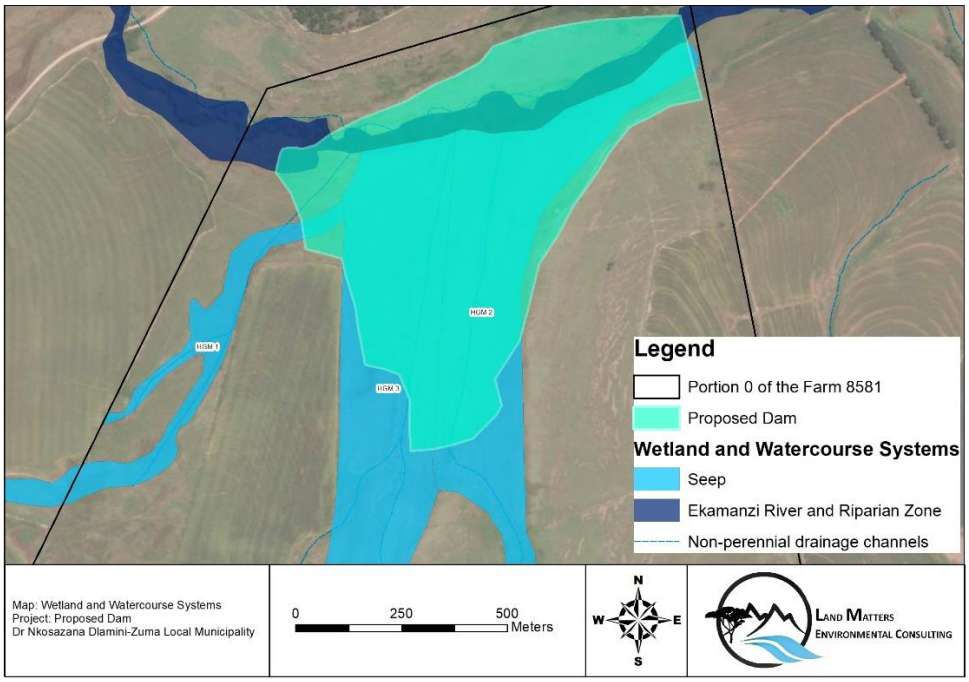

Figure 4-3: The proposed dam in relation to the seep systems

To mitigate this loss of wetland area, a wetland offset plan will need to be created and is deemed appropriate for this proposed project.

5. Wetland Offset Rational

Wetland offsets are measurable conservation outcomes resulting from actions designed to compensate for the loss in wetland area as a result of development. They are only considered after appropriate avoidance, minimisation and rehabilitation measures have been taken into account. The goal of wetland offsets is to achieve a 'No Net Loss' and preferably a 'Net Gain' with respect to the full spectrum of functions and values provided by wetlands. The Wetland Offsets: A Best Practice Guideline for South Africa (Macfarlane et al. 2016) is utilised.

The key objectives of a wetland offset plan, according to MacFarlane et al. (2016) include:

- Providing appropriate and adequate compensation for residual impacts on key water ecosystem services and contribute to achieving water resource objectives by:
    - Ensuring no net loss in the overall wetland functional area by providing gains in wetland area and/or condition equal to or greater than the losses due residual impacts.
    - Directing offset activities that will improve key regulating and supporting services towards those wetlands where these specific services can best be enhanced.
    - Providing 'in kind' services through offset activities, or substitute services acceptable to affected communities.
- Securing formal protection of wetland systems in a good condition so as to contribute to meeting national biodiversity and protection targets for the representation and persistence of different wetland types; and
- Adequately compensating for residual impacts on threatened or otherwise important species through appropriate offset activities that support and improve the survival and persistence of these species.

There are five different ways of achieving an offset plan for the proposed dam. These include:

- **Protection**: This refers to the implementation of legal mechanisms (e.g. declaration of a Protected Environment or Nature Reserve under the National Environmental Management: Protected Areas Act, a legally binding conservation servitude, or a long term Biodiversity Agreement under National Environmental Management Act) and putting in place appropriate management structures and actions (this may include

setting appropriate water reserve determinations and specifying protection measures within DWA planning instruments, as well as inclusion of offset sites into appropriate land use zones and land use plans including provincial and local conservation plans) to ensure that conservation outcomes are secured and maintained in the long-term.

- **Averted loss**: This refers to physical activities which prevent the loss or degradation of an existing wetland system, its ecosystem services, and its biodiversity, where there is a clearly demonstrated threat of decline in the system's condition, ability to provide ecosystem services or support overall Water Resource Objectives (both quality and quantity).
- **Rehabilitation**: Rehabilitation results in an improvement in wetland condition, function, and associated biodiversity. Rehabilitation involves the manipulation of the physical, chemical, or biological characteristics of a degraded wetland system in order to repair or improve wetland integrity and associated ecosystem services.
- **Establishment**: This involves the development (i.e. creation) of a new wetland system where none existed before by manipulating the physical, chemical, or biological characteristics of a specific site.
- **Direct compensation**: Direct compensation involves directly compensating affected parties for the ecosystem services lost as a result of development activities. This is ideally done by providing an equivalent substitute form of asset or in some cases may take the form of monetary compensation.

This wetland offset plan aims to achieve the offset through the use of the Rehabilitation Offset Category for the remaining portions of the wetlands (HGM 1, HGM 2 and HGM 3), that are not impacted by the dam and that are available for rehabilitation. A precautionary approach must however be implemented. This must realistically assess the level of potential success of rehabilitation and other mitigation measures that would be required for the offset plan to work for this project. Importantly, the ability to restore, rehabilitate or recreate a full complement of biodiversity in a wetland (including all aspects of species composition, ecosystem structure and function) should not be overestimated (Macfarlane et al. 2016).

Given the modified state of the remaining extent of the wetland systems, the rehabilitation of these areas is deemed to be a net gain for this catchment area.

6. Wetland Offset Plan

To implement this wetland offset plan, the Wetland Offsets: A Best Practice Guideline for South Africa (Macfarlane et al. 2016) was used. This guideline has been developed to quantify the required offset for the loss of a portion of HGM 1, HGM 2 and HGM 3 due to the proposed dam.

The guideline incorporates a calculator which uses the 'healthy hectare equivalents' principle to determine the functional and healthy portion of the wetland systems that will be lost. The healthy hectare equivalent is a common unit or currency that allows for the residual losses and gains to be measured and compared. The wetland hectare equivalent concept uses a refined currency that incorporates a measure of ecological function, quality and/or integrity. The basic hectare equivalents of intact wetlands include a combination of the extent of the wetland impacted, as well as the change in condition or functionality. They are furthermore used as a substitute for measuring lasting loss and are the primary currency for evaluating impacts of the proposed dam on the wetland ecosystems.

Wetland hectare equivalents are determined using three wetland calculators as represented in Figure 6-1. The hectare equivalents for the wetland functionality and ecosystem conservation targets were calculated for this study. Since no Red Data species were recorded during the field investigation, the species conservation targets calculated was not deemed as necessary.

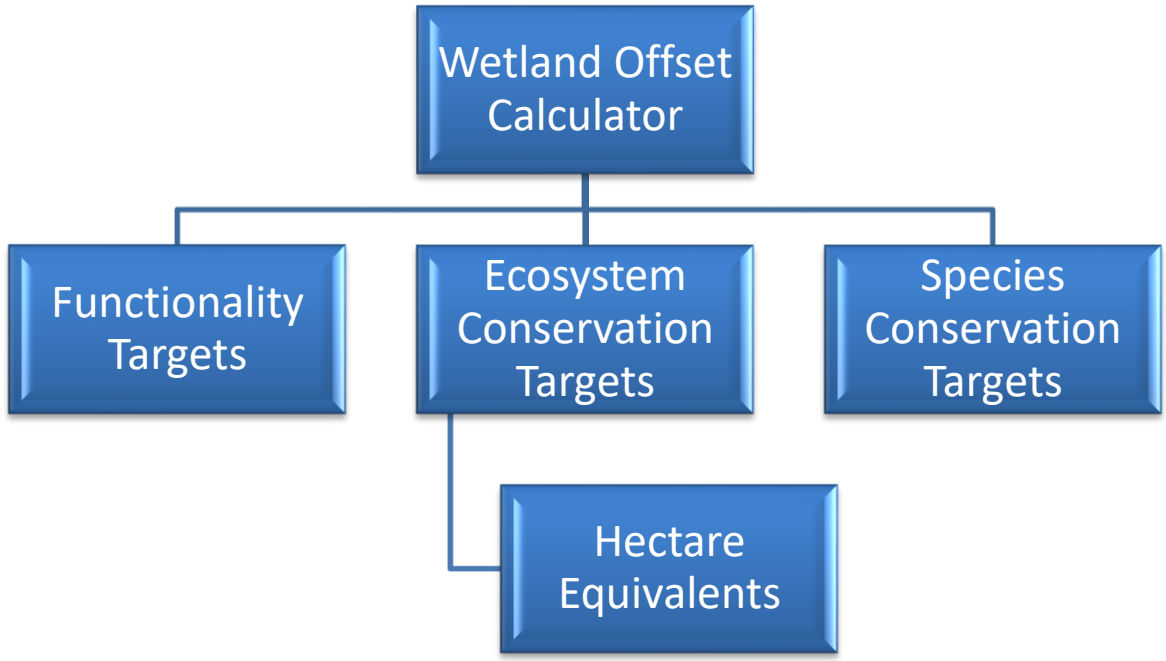

Figure 6-1: Healthy Hectare Calculation

The healthy hectare equivalents considers the Moderately Modified (PES Category C) and Largely Modified (PES Category D) nature of the wetlands, the wetland vegetation group and

its threat status. For the three seep systems this is set at the Sub-Escarpment Grassland Group 5 which has a conservation threat status of Least Concern. The results of the inputs and outputs for the offset ratio are displayed in Table 6-1 and Table 6-2.

Table 6-1: Results of the Offset Calculator – Wetland Functionality Target

Wetland Functionality Targets			
Impact Assessment	Prior to development	Wetland size (ha)	26.94
		Functional value (%)	70
	Post development	Functional value (%)	60
		Change in functional value (%)	10
	Key Regulating and Supporting Services Identified		Flood attenuation, Streamflow regultion, Sediment trapping, Erosion Control
	Development Impact (Functional hectare equivalents)		2.7
Offset calculation	Offest Ratios	Triggers for potential adjustment in exceptional circumstances	None
		Functional Importance Ratio	1.0
	Functional Offset Target (Functional hectare equivalents)		2.7

Table 6-2: Results of the Offset Calculator – Ecosystem Conservation Targets

Ecosystem Conservation Targets				
Impact Assessment	Prior to development	Wetland size (ha)	26.94	
		Habitat intactness (%)	70	
	Post development	Habitat intactness (%)	60	
		Change in habitat intactness (%)	10	
	Development Impact (Habitat hectare equivalents)		2.694	
Determining offset	Ecosystem Status	Wetland Vegetation Group (or type based on local clasification)	Sub-Escarpment Grassland Group 5 - Seep	
		Threat status of wetland	Threat status	LT
			Threat status Score	1

	Regional and National Conservation context	Protection level of wetland	Protection level	Moderately Protected
			Protection level Score	0.75
			Ecosystem Status Muliplier	**0.75**
		Priority of wetland as defined in Regional and National Conservation Plans	Not specifically identiifed as important	0.5
			Regional & National Context Multiplier	**0.5**
	Local site attributes	Uniqueness and importance of biota present in the wetland	Moderate biodiversity value	0.75
		Buffer zone integrity (within 500m of wetland)	Buffer compatability score	0.7
		Local connectivity	Good connectivity	1
			Local Context Multiplier	**0.8**
			Ecosystem Conservation Ratio	**0.29**
Offset Calculation	**Development Impact (Habitat hectare equivalents)**		**2.7**	
	Ecosystem Conservation Ratio		**0.3**	
	Ecosystem Conservation Target (Habitat hectare equivalents)		**0.8**	

Based on the results received, the offset ratio of 0.8 is applied to the area that will be lost by the proposed dam. When taking the original area of 26.94 ha and utilising this 0.8 ratio, this equates to an offset area of 21.55 ha.

The remaining extent of HGM 1, HGM 2, and HGM 3 equates to 24.28 ha and thus it is deemed more than sufficient to rehabilitate the remaining areas as the offset plan for the proposed dam. It is therefore recommended that the offset plan rehabilitate the remaining portions of the seeps, in particular HGM 2 and HGM 3 to more functional wetland habitat that will enhance the ecosystem services already provided by these wetlands.

A rehabilitation plan that takes into account the recommendations of the Department of Water and Sanitation (DWS) as well as that incorporates the use of indigenous species within the rehabilitated parts of the wetland is recommended to form part of the plan.

7. WETLAND REHABILITATION PLAN

Wetlands are dynamic ecosystems that provide numerous essential ecosystem services. It is imperative that careful consideration is given when selecting rehabilitation techniques as poorly planned rehabilitation can and will have a negative impact on the receiving environment. Therefore, all aspects of the rehabilitation plan must be scrutinised, and all negative impacts assessed (Armstrong, 2009). In order to ensure the continued persistence and protection of wetland systems, monitoring and reporting on the state of the wetland system is also critical.

The initial step of the rehabilitation process is centered on the identification of existing impacts and possible impacts arising from the rehabilitation exercise (Armstrong, 2009). The identification of possible drivers of the causes of wetland degradation is vital in order to mitigate these root causes. These impacts can be differentiated in to direct and indirect impacts. Within the three seep systems these are as follows:

Direct impacts

- Historic and current cultivation of the seep systems.
- Hydric soil mixing and disturbance.
- Soil erosion.

Indirect impacts

- Increase in alien invasive vegetation (resulting from anthropogenic disturbances)
- Deposition of sediment on top of the original soil profile associated with the seeps. This causes sedimentation of these systems changing the flow dynamics of the seeps, leading to their eventual desiccation.

In order to address these impacts, the implementation of a wetland rehabilitation plan that not only reinstates favourable hydrological conditions in the seeps but also allows for the regeneration of the functional integrity of the seeps is required. The main aim of this rehabilitation plan is to maximise the ecological functioning of the wetland systems.

The rehabilitation process will therefore encompass the following strategies:

- Closure and rehabilitation of the erosion gullies.
- Removal of invasive alien and problem plant species.
- The removal of existing vegetation must be conducted in a phasic approach to ensure that the revegetated areas become established.

- All rehabilitated areas must be fenced off to allow the rehabilitation process to occur successfully (such as allowing vegetation to re-establish).

7.1. Closure and rehabilitation of any erosion gullies

Soil erosion refers to the displacement of soil usually associated with wind, water flow and in some instances due to heavy machinery. Erosion gullies were noted within the seep systems, particularly in the steeper areas of HGM 2 and HGM 3. These gullies are evident adjacent to the non-perennial drainage channels that flow into and through the seep systems and are likely caused by both historic and current disturbances to the site. Of importance though is the expansion of the erosion gullies. If not remediated these gullies are likely to become more pronounced (potentially resulting in scouring and deeper gully erosion). Deeper gullies are more costly and take longer to be remediated, so it is important to implement the rehabilitation of these areas as soon as possible.

Both shallow and deeper erosion gullies exist. The shallower gullies can be re-profiled and then filled in with sediment. To reprofile the gullies, topsoil from an area immediately adjoining the erosion gully channel can be removed and stockpiled (Figure 7-1). The underlying subsoil can then be excavated at a slope equivalent 1:3 (vertical to horizontal) and deposited in the gully. This soil must be carefully compacted whilst in a moist state. Topsoil must then be brought in and placed onto the sloped area and spread as evenly as possible over it. Vegetation suitable to the site must be planted. The advantage of this is that as the gully cross section is made shallower and wider and revegetated, the new shape will facilitate a reduction in flow velocity leading to the rehabilitation of the gully. It is however critical that the stockpiling of topsoil and its replacement is emphasized. Failure to do this is tantamount to a waste of money and time as the planted vegetation will need topsoil to become successfully established.

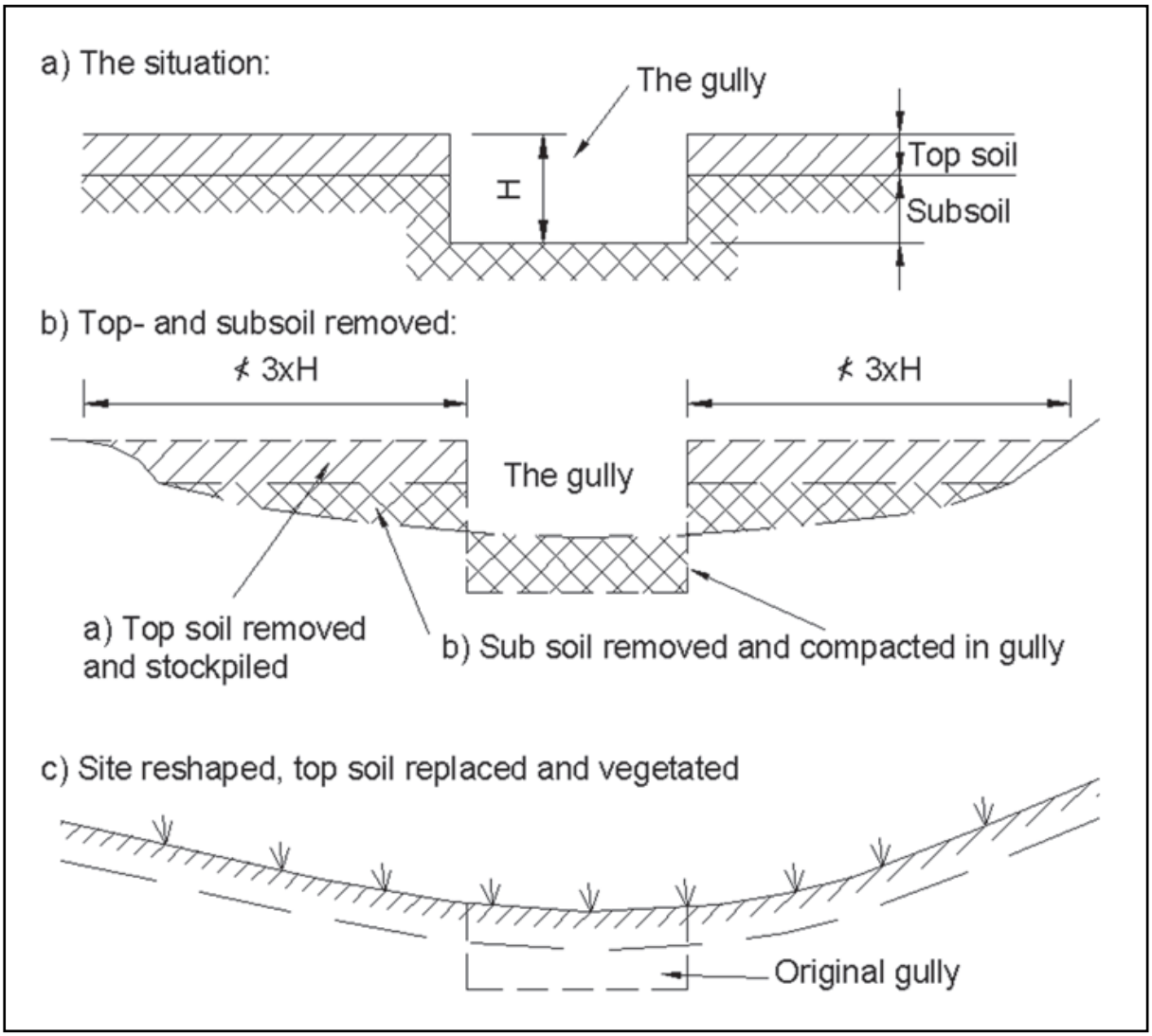

Figure 7-1: Examples of soil plugs and rock packs which are keyed into the side of the drainage trench

For deeper gullies it is recommended that these are first stabilised. This is achieved through diverting and modifying the flow of water moving into and through the gully so that scouring is reduced, sediment accumulates, and revegetation can proceed. Stabilising the gully head is important to prevent damaging water flow and headward erosion. Filling should only be attempted after the water flow that caused the gully has been controlled or diverted above the gully head. Otherwise fill placed in the gully is likely to be undermined and washed away. The use of natural soil retention systems including but not limited to brush mattresses, fibre mattresses, plant plugs, and hay bales are recommended for filling these gullies (Figure 7-2). These methods were extracted from WET-Rehab Methods' (Russell 2009) and are detailed below.

- **Brush mattresses:** Live cuttings or branches that are layered on sloping ground, with or without a layer of soil over them. Depending on the steepness of the slope, wire or wire-netting can be used to keep the layers of vegetation in place.
- **Brush fences:** Low fences created by using a wire fence with vegetation laced through the spaces in the fence or by weaving brush bundles between wooden stakes that have been driven into the ground.
- **Fibre mats:** Relatively thin mats made from biodegradable fibres, often with plastic netting to keep the fibre in place. They are typically used in applications where the underlying soil needs to be protected from erosion processes by the overlying mat. The mat also absorbs moisture and provides a good environment for seed germination and plant growth.
- **Fibre rolls:** Rolls of natural fibre (e.g. coir) that have been rolled into units of various thicknesses and lengths, with a thin sleeve of plastic netting generally used to keep the fibre in position.
- **Vegetative bundles:** Cigar-shaped bundles of live cuttings (approximately 2m long) that are tied together and placed in trenches, staked, and partially covered with soil.

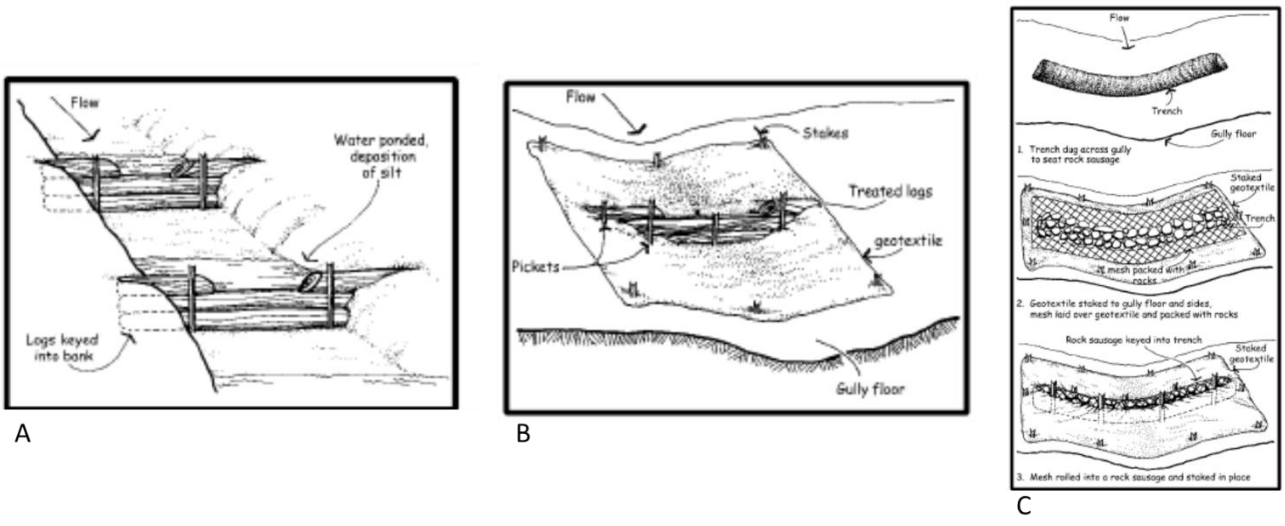

Figure 7-2: Some examples of natural soil retention systems including (A and B) brush mattresses and fences and (C) fibre rolls vegetation bundles and rock packs (www.lrm.nt.gov.au)

These rehabilitated areas must be isolated from grazing livestock. This will facilitate the establishment of introduced vegetation. The use of fences is recommended but the lower portion of these fences (30-40cm) must be permeable and have gaps. This will allow for the movement of small faunal species (mammals, reptiles and/or amphibians) into the rehabilitated area and the continuation of a functioning ecosystem.

Of importance is not to fill the erosion gullies with solid objects such as old drums, plastic pollution, rocks, old fencing, or concrete. This only creates further erosion by directing water around such objects and removing more soil.

7.2. Invasive alien species management plan

A number of alien invasive species were noted within the seep systems, in particular HGM 2 and HGM 3. These alien species will quickly establish into any disturbed areas, including those where rehabilitation is taking place. These species include species such as *Rubus cuneifolius* (American bramble), *Cirsium vulgare* (Spear thistle), *Ageratum conyzoides, Tagetes minuta* (Khakibos), and *Bidens Pilosa* (Blackjack) (Table 7-1).

The removal of alien invasive vegetation must therefore also occur prior to the re-vegetation of the rehabilitated wetland areas. The primary benefits of alien invasive control plans include:

- Limit the spread of alien plant species into non-affected areas.
- Improvement of water quality and quantity.
- Legal compliance. A list of the legislation and policy frameworks governing alien invasive plant control is provided in Appendix A.
- Improvement of biodiversity in and around the wetlands.
- Reduction in soil erosion. Certain species of alien invader plants reduce soil cover, leading to increased erosion.

<u>Important factors influencing the effectiveness of a control programme</u>

- Timeous implementation of control operations is important as alien plants are more susceptible to herbicides when they are young and lower herbicide rates can be used.
- Appropriate herbicides must be chosen. Care must be taken when applying herbicides and label prescriptions must be strictly adhered to.
- Operations must be directed towards eradicating alien vegetation.

- A reputable company or a suitably qualified person must be hired to undertake herbicide application and train staff on-site.

Requirements for an effective alien vegetation control programme

- Identify the problem: extent, location, and species of problem plants.
- Identify the original ecosystem applicable to the area. The method of control will be influenced by the type of vegetation to which the area must revert.
- Identify an appropriate control method: mechanical or chemical, type of herbicide, application etc. (Mechanical methods are preferred, compared to chemical methods). The preferred method will be influenced by a variety of factors including applications, sensitivity of the site, species to be controlled and age of the plant. Further to this, the financial implications of the selected method of treatment must be considered to ensure the effective clearing of the site.
- Consideration must be given to both the topography of the site and the connectivity of water resources. Due to the ability of water resources to transport pollutants into downstream habitats, only the use of herbicides approved for use in wetland systems are to be considered.
- Make provision for a number of follow up operations. The initial clearing operation is only part of the total programme. Failure to follow up will result in a failure of the entire programme.
- Recommended methods of control associated with the age and size of target plants are detailed below:

Seedlings and saplings

- Hand pulling or hoeing: Hand pulling, and hoeing are most suited under conditions where seedlings are easily removed from the soil. Seedlings should be severed below the soil surface or removed from the soil. Soil disturbance must be minimised to reduce re-germination.
- Foliar applications: spraying of herbicides can be carried out in dense stands or open stands. The use of mist spraying however, is discouraged as this usually results in “drift” occurring and the dying off of non-targeted species. It is best to fit narrow angle solid cone nozzles and a coarse droplet spray must be used on leaves and small cut stems. Ensure there is sufficient foliage to carry the applied herbicide to the root system. This method uses a sprayer to spray IAPs knee high or below. Leaves are sprayed to the point of run-off

- Basal stem treatments. Application of suitable herbicides in diesel can be carried out to the bottom 250 mm of the stem. Again, applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle.

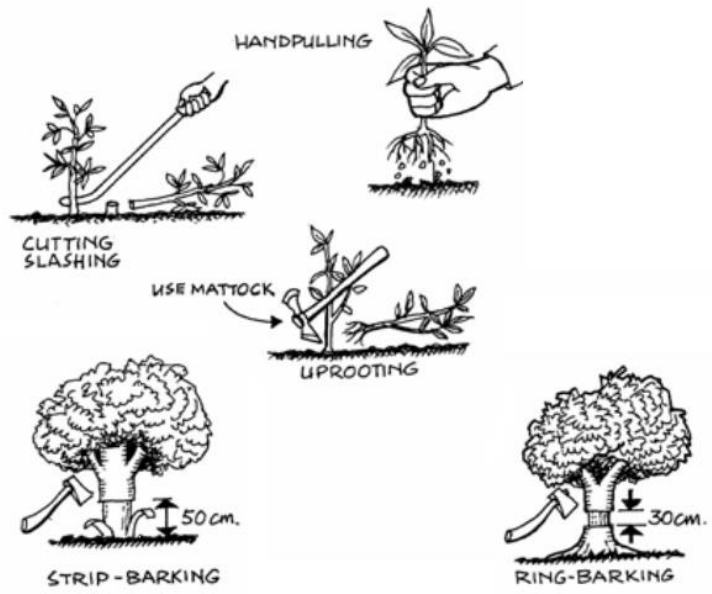

Figure 7-3: Controls to be used for the specific alien invasive species identified in the seeps

Table 7-1: Controls to be used for common alien invasive plants

SPECIES NAME	COMMON NAME	MECHANICAL METHOD	CHEMICAL METHOD	HERBICIDE
Ageratum conyzoides	Invading Ageratum 	Hand Pull in small areas or use foliar spray	Droplet Spray	Plenum (as tri-isopropanolamine salt)

SPECIES NAME	COMMON NAME	MECHANICAL METHOD	CHEMICAL METHOD	HERBICIDE
Tagetes minuta	Khaki Weed 	Hand Pull	Droplet Spray	Plenum (as tri-isopropanolamine salt)
Bidens Pilosa	Black Jack 	Hand Pull	Droplet Spray	Plenum (as tri-isopropanolamine salt)
Rubus cuneifolius	American bramble 	Slashing / Chopping / Cutting with herbicides applied to actively growing plants after flowering and regrowth	Droplet / paint cut stump	Plenum (as tri-isopropanolamine salt) Kaput Gel (pyridine carboxylic acid-as potassium salt)
Cirsium vulgare	Spear thistle 	Slashing / Chopping / Cutting with herbicides applied to actively growing plants after flowering and regrowth	Droplet / paint cut stump	Plenum (as tri-isopropanolamine salt) Kaput Gel (pyridine carboxylic acid-as potassium salt)

The seed bed for many invasive alien species is about 15 years so it is important to continue monitoring the vegetation communities present within the property and manage the regrowth of weeds. This monitoring must be conducted by the landowner on an on-going basis.

The removal of alien species must occur three times a year for the first year and then twice a year for the next three years or until the seed bank has become depleted and indigenous vegetation has become dominant. This elimination effort must be adjusted as required.

7.3. Revegetation of the seeps

Should large areas be cleared of alien invasive species, and/or eroded areas rehabilitated these will need to be revegetated/.

A seed mix can be used to establish a vegetative layer within the prepared areas of the seeps. The seed mix can be applied to the areas via sowing within rows or plugs of hydrophytic species can be hand planted in the more saturated areas of the seeps. If working with whole plants, this must be done just prior to or within the growing season.

Species that are recommended for the revegetation include but are not limited to *Juncus effuses*, Cyperus and Kyllinga species including *Cyperus rupestris, Cyperus sphaerocephalus, Kyllinga pulchella,* Harpochloa falx, *Sporobolus* sp., *Imperata cylindrica*.

It must be noted that it might be important to maintain the planted vegetation through irrigation to ensure their successful growth and cover of the rehabilitated areas.

8. Rehabilitation Monitoring Plan

The key to the success of the rehabilitation is the frequent monitoring of the rehabilitated wetland systems. Monitoring is the systematic collection of data that will provide information on changes that can indicate problems and/or progress towards target criteria or performance standards which, when met, indicate that established ecological goals have been reached. Ongoing monitoring of the rehabilitated wetlands/and terrestrial areas must be undertaken by a suitably qualified ecologist.

Monitoring aspects of the rehabilitation plan must be undertaken at the following intervals to ensure effective monitoring:

- 1 month
- 2 months

- 3 months
- 6 months
- 1 year

Apart from the set intervals detailed above, it is imperative to monitor each aspect outlined in this report to assess the success of the rehabilitation and determine any areas that need extra attention or altered methods.

8.1. Vegetation

Vegetation is an excellent indicator of either disturbance to a wetland/terrestrial area or rehabilitation interventions. Monitoring of changes within the vegetation community can help establish if any negative effects are further degrading the vegetation composition (i.e., through sediment deposition which can smother emergent vegetation, or through the continued encroachment of alien vegetation species), or whether the planted vegetation is growing as expected and covering the rehabilitated areas.

Visual observation of the rehabilitated areas as well as the taking of photographic evidence at observation points will aid in monitoring the vegetation aspect.

8.2. Wetland Health and Integrity

Following on from the monitoring of the vegetation, the wetlands must be monitored independently through assessing the Present Ecological Score (PES) using the WET-Health methods (Kotze et al., 2020). This score must be evaluated on a bi-yearly basis for the first year to determine the success of the rehabilitation objectives within the wetland. The PES score for the wetlands is currently a PES C category (moderately modified) for HGM 1 and PES D category (largely modified) for HGM 2 and HGM 3. The wetland health for all three HGM units must be improved to at least a PES C category (moderately modified).

8.3. Monitoring and audit reports

Ongoing monitoring of the rehabilitated wetland systems must be undertaken by a suitably qualified wetland ecologist bi-annually for a period of one year after the completion and the implementation of the rehabilitation process. A wetland audit report must be produced for these site visits, providing an indication of the success of the wetland rehabilitation plan and recommendations to improve the management of the rehabilitated systems.

8.4. Photographic Record

It is important to monitor the visual appearance of the vegetation prior to and following the rehabilitation activities. A photographic record is an ideal method of documenting these visual

changes. Panoramic photos must be taken at a fixed location to provide good coverage of the area to be rehabilitated at the frequency indicated above. The location of the fixed points must be recorded with a GPS device. The camera must also be located on a tripod at a fixed height.

9. Conclusions

A wetland impact assessment was conducted in 2023/2024 and identified three seep systems where the dam is proposed to be located. The three seep systems were assessed and classified as moderately modified (PES C) (HGM 1), and largely modified (PES D) (HGM 2 and HGM 3).

The proposed dam wall will be constructed in the Ekamanzi River as well as a a portion of HGM 2. At full capacity the proposed dam will lead to the direct loss of a 26.94 ha of a portion of HGM 1, HGM 2 and HGM 3 (Figure 5-3) as per the following:

- 0.39 ha of HGM 1 will be lost,
- 11.37 ha of HGM 2 will be lost and
- 15.18 ha of HGM 3 will be lost.

To mitigate this loss of wetland area, a wetland offset plan has been created and is deemed appropriate for this proposed project. This wetland offset plan aims to achieve the offset through the use of the Rehabilitation Offset Category for the remaining portions of the wetlands (HGM 1, HGM 2 and HGM 3), that are not impacted by the dam and that are available for rehabilitation. Given the modified state of the remaining extent of the wetland systems, the rehabilitation of these areas is deemed to be a net gain for this catchment area.

Based on the results received, the offset ratio of 0.8 is applied to the area that will be lost by the proposed dam. When taking the original area of 26.94 ha and utilising this 0.8 ratio, this equates to an offset area of 21.55 ha.

The remaining extent of HGM 1, HGM 2, and HGM 3 equates to 24.28 ha and thus it is deemed more than sufficient to rehabilitate the remaining areas as the offset plan for the proposed dam. The offset plan therefore proposes the rehabilitation of the remaining portions of the seeps, in particular HGM 2 and HGM 3 to more functional wetland habitat that will enhance the ecosystem services already provided by these wetlands.

The rehabilitation process will encompass the following strategies:

- Closure and rehabilitation of the erosion gullies.
- Removal of invasive alien and problem plant species.

- The removal of existing vegetation must be conducted in a phasic approach to ensure that the revegetated areas become established.

The key to the success of the rehabilitation is the frequent monitoring of the rehabilitated wetland systems. Ongoing monitoring of the rehabilitated wetlands must be undertaken by a wetland ecologist. Vegetation is an excellent indicator of either disturbance to a wetland/terrestrial area or rehabilitation interventions. Monitoring of changes within the vegetation community can help establish if any negative effects are further degrading the vegetation composition.

Following on from the monitoring of the vegetation, the wetlands must be monitored independently through assessing the PES score. This score must be evaluated on a bi-yearly basis for the first year to determine the success of the rehabilitation objectives within the wetland. The PES score for the wetlands is currently a PES C category (moderately modified) for HGM 1 and PES D category (largely modified) for HGM 2 and HGM 3. The wetland health for all three HGM units must be improved to at least a PES C category (moderately modified).

It is furthermore recommended that monitoring of the rehabilitated wetland system be undertaken by a suitably qualified wetland ecologist bi-annually for a period of one year after the completion and the implementation of the rehabilitation process. A wetland audit report is recommended to be produced for these site visits, providing an indication of the success of the wetland rehabilitation plan and recommendations to improve the management of the rehabilitated systems.

Provided these recommendations for the rehabilitation of the assessment area are undertaken, the author is of the opinion that these measures should compensate for the loss of a portion of HGM 1, HGM 2 and HGM 3 from the proposed dam.

10. Details of Specialist

This Specialist Report has been compiled by the following specialists:

Table 10-1: Details of the Specialist(s) who prepared this Report

Responsibility	Report Writing
Full Name of Specialist	Rowena Harrison
Highest Qualification	PhD
Professional Accreditation	Pr. Sci. Nat. Reg. Number 400715/15
Years of experience in specialist field	>10

Declaration of the Specialist

I, **Rowena Harrison**, as the appointed specialists hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
- other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
- am not independent, but another specialist that meets the general requirements set out in Regulation 13 have been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and

affected parties and the public and that participation by interested and affected parties was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;

- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application;
- have ensured/will ensure the inclusion of inputs and recommendations from the specialist reports in respect of the application, where relevant;
- have kept/will keep a register of all interested and affected parties that participate/d in the public participation process; and
- I am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Rowena Harrison Pr. Sci. Nat. No. 400715/15

Signature of the specialist

Rowena Harrison

Full Name and Surname of the specialist

Land Matters on behalf of Hunts Green Consulting

Name of company

January 2024

Date

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12. Appendix A: Legislation and policy framework governing alien invasive plant control

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT NO. 10 OF 2004 (NEMBA)

The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations were published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. All listed Invasive Alien Plants are divided into three categories which are:

- Category 1a: invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. These species need to be extirpated on all land and water resources. Officials from the Department of Environmental Affairs must be allowed access to monitor or assist with control.
- Category 1b: invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. Category 1b species are major invaders and must be contained/controlled. To achieve control of these species they, in all but very specific cases, need to be extirpated.
- Category 2: These are invasive species that can remain in your garden, but only with a permit, which is granted under very few circumstances.
- Category 3: These are invasive species that can remain in your garden. However, you cannot propagate or sell these species and must control them in your garden. Such control includes but is not limited to preventing the spread of Category 3 IAPs. It must be noted that in riparian zones or wetlands all category 3 plants become category 1b plants.

CONSERVATION OF AGRICULTURAL RESOURCES ACT NO. 43 OF 1983 (CARA)

Regulation 15 of CARA regulates and restricts the propagation, harbouring and sale of invasive alien plant and weed species listed in a set of Regulations publish in terms of the Act.

BIODIVERSITY MANAGEMENT

- NEMBA ensures that the utilisation of biodiversity is managed in an ecologically sustainable way by addressing the protection of threatened or protected ecosystems and species by providing, within this legislation, for the protection of ecosystems that are threatened or in need of protection to ensure the maintenance of their ecological integrity; and, the protection of species that are threatened or in need of protection to ensure their

survival in the wild; as well as, stipulating the regulations pertaining to the protection of threatened or protected indigenous species.

This is achieved by addressing various aspects of management:

DUTY OF CARE RELATING TO LISTED INVASIVE SPECIES (SECTION 73 OF NEMBA)

A person who is the owner of land on which a listed invasive species occurs must notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; take all the required steps to prevent or minimise harm to biodiversity, inter alia, control and eradicate the listed invasive species so as to prevent it from spreading.

A competent authority may, in writing, direct any person who has failed to control/eradicate (extirpate) any IAP to take such steps, as may be necessary, to remedy any harm to biodiversity caused by: -

(i) the actions or inactions of that person; or
(ii) the occurrence of the listed invasive species on land of which that person is the owner; and
(iii) as may be specified in the directive.

If that person fails to comply with a directive issued, a competent authority may:-

(a) implement the directive; and
(b) recover all costs reasonably incurred by a competent authority in implementing the directive either from that person; or proportionally from that person and any other person who benefited from implementation of the directive.

The Department of Environmental Affairs issued regulations last year with lists of invasive alien species that fall into different categories, namely 1a, 1b, 2 and 3. Essentially this means that property owners have to remove and control all species on the lists if found on their properties unless such species fall into Category 2 which may stay provided a permit for their existence has been obtained. The regulations also require that property owners identify which species are on their properties and develop a control plan for the next 5-10 years stating what measures will be taken to remove and control these species; implementing the actions that must be taken and reporting back on the effectiveness of said action.