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FINAL BASIC ASSESSMENT REPORT FOR:

BASIC ASSESSMENT FOR THE EXISTING PERSBERG DAM WALL ON PERSBERG FARM (PORTION LINDE NO 4733) SITUATED IN THE HELPMEKAAR AREA, LOCATED WITHIN THE MSINGA LOCAL MUNICIPALITY AND THE UMZINYATHI DISTRICT MUNICIPALITY, KWAZULU-NATAL

EA Reference Number: DC24/0002/2019: KZN/EIA/0001069/2019

Submitted in terms of the 2014 Environmental Impact Assessment Regulations promulgated in accordance with the National Environmental Management Act 107 of 1998 (Act No. 107 of 1998), as amended in 2017

Name of Applicant:	**Mr Eric Muller (on behalf of the Montrose Farming Trust)**
Prepared By:	**Afzelia Environmental Consultants (Pty) Ltd**

******PLEASE NOTE – ALL TEXT HIGHLIGHTED IN YELLOW REPRESENTS NEW INFORMATION ADDED TO THE BAR SUBMISSION AS PER REQUIREMENTS AND COMMENTS DURING THE PUBLIC PARTICIPATION PROCESS (APRIL 2018)**

DOCUMENT INFORMATION

Title	Basic Assessment for the Existing Persberg Dam Wall located on Persberg Farm (Portion LINDE No 4733) within the Helpmekaar Area, located within the Msinga Local Municipality and the Umzinyathi District Municipality, KwaZulu-Natal.
Author	Miss Deshni Naicker
Reviewer	Ms Lisa Guastella
Client	Mr Eric Muller (on behalf of the Montrose Farming Trust)
EA Reference Number	DC24/0002/2019: KZN/EIA/0001069/2019
Draft BAR 1st Issue Date	8th February 2018 (without EA Reference Number)
Draft BAR 2nd Issue Date	28th February 2019 (with EA Reference Number)
Final BAR Issue Date	**13th May 2019**

REVIEW OF THE DRAFT BASIC ASSESSMENT REPORT

The First Draft Basic Assessment Report (without the EA Reference Number) was available for commenting for a period of **30 days** (excluding public holidays) from 8th February 2018 – 8th March 2018. The Second Draft Basic Assessment Report (with the EA Reference Number) was available for commenting for a period of 30 days (excluding public holidays) from 28th February 2019 – 28th March 2019. **The Final Basic Assessment Report is available from the 13 May 2019.**

A copy of the Basic Assessment Report was available (during both the initial commenting periods) at the **Sibongile Public Library (Mbatha Street, Sibongile, Dundee) and Dundee Public Library (Boundary Road, Dundee)** and upon request from Afzelia Environmental Consultants (Pty) Ltd. Comments can be sent to.

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EXECUTIVE SUMMARY

PROJECT BACKGROUND AND LOCATION

The Applicant Mr Erich Muller commenced with listed activities within a watercourse on Persberg Farm (Portions Linde No 4733) in August 2015. The extent of the property is 129.5 hectares and falls within the Msinga Local Municipality and is located within the Umzinyathi District Municipality of the KwaZulu-Natal Province.

As a result of a non-compliance with Section 25 of NEMA, a rectification process is required for activities which have already taken place. A Section 24G Application was therefore submitted to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs – Northern Region by the Applicant in February 2016 to commence this rectification process.

The KwaZulu- Natal Department of Economic Development, Tourism and Environmental Affairs issued an administration fine which was paid by the Applicant. In terms of the directive, a rectification process i.e. a Basic Assessment Process is required to be undertaken. Afzelia Environmental Consultants have been appointed by the Applicant to undertake the rectification process in terms of the EIA Regulations, 2014 (as amended on 7 April 2017).

The original dam was built by the Road Department (NPA) in 1960. The NPA had excavated a quarry to build the tar road and in exchange the NPA built a dam for the farmer. The original dam covered an area of 1.2 hectares with a dam wall height of 3.5 m. The capacity of the original dam was measured to be between 25 000 to 32 500 cubic metres of water.

The water from the original dam was emptied by the Applicant and a core trench was dug to a depth of 5 meters by machinery, the core was dug down to the bottom soil which formed the natural soil structure in the centre area of the old existing dam. This reconstruction of filling the 'core' of the dam was done by moving suitable clay type soil in the vicinity of the dam wall, and as every layer of clay soil was moved by dam scoops and soil was compacted for constructing the base core of the dam. The top soil that was saved was later moved over the top of the dam wall and compacted and kikuyu and grass was planted as an erosion control measure.

The dam has been raised to a height of 8.5 m and covers an area of 8.4 hectares and is estimated to hold a capacity of 152 000 m³ (cubic meters) of water when full. The dam was designed by an Engineering Technician from the Department of Agriculture Mr Terrance Collyer.

PROJECT LOCATION

The dam is located on Persberg Farm (Portion Linde No 4733) and falls within the Msinga Local Municipality, located within the Umzinyathi District Municipality of the KwaZulu-Natal Province.
The GPS co-ordinates of the site are:

South	28^0	26’	02.56”
East	30^0	24’	35.84”

The proposed project is located within the Quarter Degree Grid Square (QDGS) 2830AD and falls within quaternary catchment V33B which is part of the Pongola - Ntamvuna Water Management Area. The Buffels river system is the main river system within this sub-quaternary catchment.

Access to the site is via the R33. The Persberg Dam is situated within the Helpmekaar area and the nearest town, Pomeroy, is approximately 16 km south of the project site.

NEED AND DESIRABILITY

The dam was raised to increase the water holding capacity of the existing dam for planned irrigation purposes. The raised dam will allow the farmer and adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

The construction activities undertaken by the applicant triggered listed activities within the 2014 EIA Regulations (as amended on 7 April 2017) and therefore required an environmental authorisation to be obtained. The applicant was not aware that an environmental authorisation was required before the commencement of such construction activities within a water course. As a result of non-compliance, the rectification process is required to be undertaken.

LEGISLATIVE AND REGULATORY REQUIREMENTS

As a result of non-compliance with Section 24 of NEMA, a rectification process is required for the activities which have already taken place. A Section 24G application was therefore submitted to KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs by the Applicant on 2 February 2016 to commence this rectification process. The Application was submitted in terms of the EIA Regulation of 2014.

The Directive issued on the 26 April 2016, requested that a Basic Assessment (BA) process should be undertaken in terms of General Notice R 327 of the EIA Regulations of April 2017.

The following activities, under Listing Notice 1 of GN R 327 of April 2017, have been identified and are listed in the **Table** below:

Table 1: Listed Activities as per Listing Notice 1 of GN R 327 of April 2017

Number and Date of relevant notice	Activity Number	Description each listed activity as per the project description
No. R 983 of December 2014 as amended by No. R 327 of April 2017 (Listing Notice 1)	19	+-25 cubic metres of material were removed from the dam and was used for the raising of the dam wall.
	48	The original dam covered an area of 1.2 hectares with a dam wall height of 3.5m. The dam has now been raised to a height of 8.5m, the maximum depth is 4m which will cover and area of 8.4 hectares and it will hold approximately 152 000 cubic metres of water.

In terms of Section 24(1) of NEMA, the impact on the environment associated with the activity must be considered, investigated, assessed and reported on to the competent authority that has been placed in charge by NEMA with the responsibility of granting environmental authorisation. As the application is located within the KwaZulu-Natal Province, the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs is identified as the competent authority for the application for authorisation. This project has been registered with the KZN DEDTEA through the submission of an S24G Application for Rectification.

The nature and extent of the affected area, and the environmental impacts associated with the construction activities within the watercourse are explored in more detail in this Draft Basic Assessment Report. This report has been compiled in accordance with the requirements of the 2014 EIA Regulations,) as amended on the 7 April 2017) and includes details of the activity description; the site area and property description; the public participation process; the impact assessment; as well as the recommendations that are proposed by the Environmental Assessment Practitioner (EAP).

Further to the Basic Assessment process, a Water Use License Application (WULA) has been submitted to the Department of Water and Sanitation (DWS0 according to the requirements of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998).

MOTIVATION

The DEA (2017), Guideline on Need and Desirability, has been used to inform and provide structure for the Need and Desirability Report for this project.

The IDP and SDF for the Msinga Local Municipality highlights that agriculture in Msinga is largely practised for subsistence and is subject to limited capacity due to poor soil quality, climatic conditions and overstocking. Despite the large irrigation potential from rivers, the area is subject to water shortages during dry seasons, high soil erosion and low land carrying capacity for grazing.

There is a high potential to increase both crop and stock farming production through improved farmed management and agricultural practices and support systems.

According to the IDP the agricultural sector in Msinga has declined substantially. This has led to a decline in employment and increased dependence on agricultural commodities produced outside the region. A lot of focus is currently placed on the development/rejuvenation of the agricultural sector. Developing this sector can have far

reaching implications for attracting investment (i.e. Agric-processing), as well as the securing of food resources for residents (as a form of poverty alleviation). The practical implementation of agricultural-related projects, however, can increase the competitiveness of the Msinga Local Municipality that it is often lacking.

The SDF states that the agricultural potential of the Msinga Local Municipality revolves around intensive farming, irrigation, dry land farming and stock farming. According to the SDF, potential intensive farming and irrigation projects must be given first priority when allocating land for agricultural use. However, without a programme to construct or increase the size of dams, there is practically no additional irrigation potential in the Msinga Local Municipality

The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

Socio-economic benefits associated with the raising of the existing dam wall include:

- New skilled employment opportunities that were created during the construction phase of the project;
- New skilled employment opportunities created during the operational phase of the project;
- New un-skilled employment opportunities that were created during the construction phase of the project;
- New un-skilled employment opportunities created during the operational phase of the project.

Environmental benefits associated with the raising of the existing dam wall include:

- The dam will have a positive impact on at least the drought low flow environmental water requirement as water is only flowing into the dam at irregular intervals;
- Normal stream water will be released through the 300 mm PVC pipe instead of flowing over the spillways, there preventing erosion of the spillways;
- A normal flow depth of 0.6m was calculated, which indicates that the water would flow in the river channel and not cause any significant damage should the Persberg Farm Dam break.

SITE ALTERNATIVES

No site alternatives have been considered other than the current site Persberg Farm (Portion Linde No 4733), as the applicant has already undertaken construction activities within a watercourse which is located on his property.

DESIGN, LAYOUT OR TECHNOLOGY ALTERNTIVES

There are no design, layout or technology alternatives for the project as the applicant has already undertaken the construction activities within a watercourse which is located on his property.

NO-GO ALTERNATIVES (STATUS QUO)

The “no-go” alternative means that the status quo is maintained as the dam wall has already been constructed and raised.

SPECIALIST STUDIES

Section B of this report highlights the findings of the specialist reports undertaken for the Constructed Montrose Farming Trust Dam on Persberg Farm near Helpmekaar in KwaZulu-Natal and are included in **Appendix C** of the Final Basic Assessment Report:

- Wetland Functionality Assessment and Rehabilitation Plans;
- Hydrology and Dam Safety Report; and
- Reserve Determination for Water Use License Application.

SUMMARY OF SPECIALIST REPORTS

Wetland Functionality Assessment and Rehabilitation Plan

The wetland survey was conducted on the 19th of July 2016 by Mr Wayne Jackson (Earth, Water and Environmental Science Company).

Two (2) FEPA wetlands (not WetFEPA) were identified within the 500m buffer of the Persberg Dam

FEPA wetlands were classified by the Wetland Specialist (Mr Wayne Jackson) as bench (flat) wetland and a Hillslope Seep wetland. The Wetland condition and rankings for both these FEPA wetlands were A/B (>75% Natural vegetation) and rank four (4) (wetlands with an A/B condition and associated with at least three other wetlands). These sites were classified as predominantly natural. The NFEPA wetland information is a coarse data set and must be ground-thruthed.

From the field assessment that was undertaken and the Google Earth historical imagery it is concluded that the wetlands were not Bench Flats and Hillslope Seeps, but rather Unchannelled Valley Bottom wetland system (HGM1). There was an existing dam in 2012 as well as evidence of cattle paths which is indicative of grazing activities within the wetland. These activities will alter the PES or wetland condition to a lower level to what can only be assumed as a Category C (Moderately Modified) state. This can only be assumed, as the wetland assessment was only conducted post-construction of the dam wall.

The PES rating after construction was classified as a Category E (Seriously Modified).

The HGM1 was assessed to have a high benefit for flood attenuation. The wetland also has a moderately high ability to improve water quality by assimilating phosphates, nitrates and toxicants as well as to control erosion.

The ecological importance and sensitivity of the HGM1 was assessed to be High (B) with regards to the Ecological Importance and Sensitivity as well as the Hydrological Functional Importance. These rates were high due to the location of the wetland within FEPA wetland layers, as well as the sensitivity of Unchannelled Valley Bottom wetlands to alteration of low flows (which will occur if the Environmental Water Requirements (EWR) is not implemented). The direct human benefit was rated to be moderately important (C).

The dam has already been constructed and the risks/impacts could not be assessed accurately, as the dam has not undergone its first filling. The operation phase was assessed, and mitigation measures have been recommended to monitor and improve wetland functionality where possible.

Three aspects were addressed in the risk assessment:

- The initial filling of the dam and its impacts on the alteration of flow volumes and patterns, as well as the loss of wetland from the extended inundation area;
- The infestation of alien vegetation post construction and how that would impact on the flow patterns and volumes of the wetlands; and
- The downstream releases and its impacts on the downstream wetland function and ecology.

The risk matrix shows that the initial flooding will have a high impact on the wetlands at the point of inundation, with the remaining aspects having a moderate impact.

The Water Use License Application (WULA) was submitted to the Department of Water and Sanitation on 13th September 2018 and a copy of the Acknowledgement of Receipt Form is attached in **Appendix K** of this Report.

Persberg Farm Dam – Hydrology and Dam Safety Report

The Hydrology Assessment and Safety Analysis for the dam was conducted by Mr Flip Krugel from GFK Consulting Engineers. The engineers had only become involved when the dam was already completed, with the tyres as 'rip-rap' already in place, etc.

The existing dam wall is 8.5 m high, the maximum depth is 4 m and it holds approximately 152 000 m³ of water.

The wall of the present dam is constructed on top of a dam wall that was constructed in the 1960's to provide water that was needed for road construction. A new cut-off trench was constructed and apparently all unsuitable material was removed from the existing wall and from the new footprint of the present dam wall. According to the client, the dam was approximately 4 m high prior to the extension and apparently held water until just before construction, when water was released from the dam for construction purposes. The previous spillway was only a fraction of the present one and very little erosion took place downstream of the old spillway. This was still evident just after partial completion of the dam.

The present spillway capacity is just short of adequate for a Category I dam. The eventual dam size will depend on the safety categorization that will be done by Department of Water and Sanitation (DWS). As an interim measure, it is proposed that the spillway be cut wider, each one at least 15 m wide (or combined 30 m, as it is 27.4 m presently).

Soil compact tests that were conducted by GFK Consulting Engineers indicates that the compact on top is less than what is generally prescribed for earth dams. However, Dynamic Core Penetrometer (DCP) tests have indicated an increase of compaction with depth and it is estimated that the general required compaction has been achieved from approximately 2 m deep from the crest and deeper, where it is most important.

A slope stability analysis indicates that both the upstream and downstream slopes are safe, as the safety factors are above the required minimum safety requirements.

Analysis indicates that the irrigation water yield of the dam for the proposed 90 ha maize and 40 ha oats will not be sufficient to meet the full irrigation demand. Therefore, it is proposed that the client plants a smaller area of both maize and oats in order to reduce the risk of the dam running dry.

A dam break analysis was conducted and indicates that "sunny day'' dam break with a full breach developing in 12 minutes will result in flood water overtopping the downstream road by approximately 630 mm. Should the full supply level be dropped to just less than 50 000 m³ a "sunny day" dam break will cause the resultant flood to flow over the road with a depth of approximately 340 mm. The engineers are of the opinion that reducing the capacity of the dam will not result in a significantly decreased safety risk. Lowering the full supply level is therefore not recommended as it will also result in a significant loss for the client.

A 300 mm PVC pipe was installed at the bottom of the dam wall to allow for any possible environmental release, or constant surplus water to be released instead of flowing over the spillway constantly.

However, it must be noted that the dam level after two years rainfall is about 30% full due to the small catchment area of 340 hectares. The resultant dam break flood for the Persberg Dam is unlikely, as water will be released through the pipe laid in the dam wall to release water and used for the planned irrigation of the lands in area of the dam.

Persberg Farm Dam near Helpmekaar - Reserve Determination for Water Use License Application

GFK Consulting Engineers were appointed by Mr Erich Müller to undertake a Desktop Reserve Determination for the recently raised dam on the farm Persberg, for water use licencing purposes. GFK only become involved when the dam was already completed/raised.

The dam will have a positive impact on at least the drought low flow environmental water requirement as water is only flowing into the dam at irregular intervals. With the dam in place, there will be a constant stream from normal leak water intercepted by a toe drain for embankment safety, regardless of inflow into the dam, unless the dam is obviously pumped dry frequently, which is unlikely as the outlet pipe is not installed at the lowest point of the dam. In other words, there will be unusable storage capacity in the dam, which will at least provide leak water, basically at all times. Additional to the normal leak water, controlled environmental releases through the outlet valve, will improve the situation even more during dry periods. At the worst, the dam will not negatively impact on the downstream water requirement, providing the required water is released, either through leak water or a combination of leak water and releases through the outlet valve. As the required amount to be released is insignificant related to what will be required for planned future irrigation, depending on receipt of a Water Use Licence, it will be more than viable to release the required downstream demand.

A 300 mm PVC pipe is installed at the bottom of the embankment. This existing outlet pipe and valve is more than adequately sized to release the required volume for downstream maintenance as per the Environmental Water Requirement, as well as for downstream domestic and livestock requirements for the affected area.

The mean monthly spills from the dam through the spillway will automatically release more than the required high flow Environmental Water Requirements, with no additional releases required by opening the outlet valve, else than for maintenance flow as required.

It is recommended that a measuring weir is constructed downstream of the dam to measure the required maintenance flow to be released. This weir will also measure the leak water. The total maintenance flow required is the total flow from leak water and water released by opening of the outlet valve, combined. Thus, the release

amount required from the dam is the additional amount required, if any, over and above the leak water, to satisfy the total maintenance release required. The high flow requirement will automatically be met by spills over the spillways, as the dam volume only comprise a small fraction of the total catchment run-off.

Regardless whether there is very seldom visible normal flow in the natural drain into the dam, it is still recommended to construct an upstream measuring weir to measure the flow during such seldom normal flow conditions. Only a maximum of the incoming flow needs to be released to satisfy the downstream requirement.
The owner of this Persberg farm dam is solely responsible for the release from this dam. It was not determined how much water is actually being released from the downstream dam by its owner, but it can be argued that the same requirements will be applicable for the Persberg Dam.

EAPS KEYS CONCERNS

Key concerns with regards to the biophysical environment that have been identified for the proposed raising of the dam wall and which will require careful management are:

- Direct impacts to the unchannelled valley bottom wetlands;
- Direct impacts to the aquatic habitat;
- Direct impacts to the riparian vegetation;
- Hydrological impacts (flow related modifications); and
- Erosion and sedimentation risk including bank stabilisation.

PUBLIC PARTICIPATION

Copies of the Background Information Document with a response form were circulated to the relevant authorities and key stakeholders. All comments received will be recorded in the comments and response report. A list of Key Stakeholders and Interested and Affected Parties (I&APs) contacted as part of this public participation process will continue to be maintained and updated throughout the duration of the Basic Assessment Process.

In compliance with the EIA Regulations as amended (7th April 2017), English and isiZulu notices will be erected at strategic points along the route of the Persberg Farm near Helpmekaar, to inform the community of the project. Flyers will be distributed and handed out to the local community in the vicinity of the development for notification and participation purposes.

ENVIRONMENTAL IMPACT STATEMENT

As a result of a non-compliance with Section 25 of NEMA, a rectification process is required for activities which have already taken place. A Section 24G Application was therefore submitted to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs – Northern Region by the Applicant in February 2016 to commence this rectification process. In terms of the directive, a rectification process i.e. a Basic Assessment Process is required to be undertaken.

The original dam was built by the Road Department (NPA) in 1960. The NPA had excavated a quarry to build the tar road and in exchange the NPA built a dam for the farmer. The original dam covered an area of 1.2 hectares with a dam wall height of 3.5 m. The capacity of the original dam was measured to be between 25 000 to 32 500 cubic metres of water.

The dam was raised to increase the water holding capacity of the existing dam for planned irrigation purposes. The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

The water from the original dam was emptied by the Applicant and a core trench was dug to a depth of 5 meters by machinery, the core was dug down to the bottom soil which formed the natural soil structure in the centre area of the old existing dam. This reconstruction of filling the 'core' of the dam was done by moving suitable clay type soil in the vicinity of the dam wall, and as every layer of clay soil was moved by dam scoops and soil was compacted for constructing the base core of the dam. The top soil that was saved was later moved over the top of the dam wall and compacted and kikuyu and grass was planted as an erosion control measure.

The dam has been raised to a height of 8.5 m and covers an area of 8.4 hectares and is estimated to hold a capacity of 152 000 m³ (cubic meters) of water when full.

The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

The following environmental specialist studies were conducted for the proposed project:

- Wetland Functionality Assessment and Rehabilitation Plans;
- Hydrology and Dam Safety Report; and
- Reserve Determination for Water Use License Application.

The wetland assessment had identified an unchannelled valley bottom wetland system with a Category C (Moderately Modified) state. This can only be assumed, as the wetland assessment was only conducted post-construction of the dam wall. The PES rating after construction was classified as a Category E (Seriously Modified).

The HGM1 was assessed to have a high benefit for flood attenuation. The wetland also has a moderately high ability to improve water quality by assimilating phosphates, nitrates and toxicants as well as to control erosion.

The ecological importance and sensitivity of the HGM1 was assessed to be High (B) with regards to the Ecological Importance and Sensitivity as well as the Hydrological Functional Importance. These rates were high due to the location of the wetland within FEPA wetland layers, as well as the sensitivity of Unchannelled Valley Bottom wetlands to alteration of low flows (which will occur if the Environmental Water Requirements (EWR) is not implemented). The direct human benefit was rated to be moderately important (C).

Three aspects were addressed in the risk assessment:

- The initial filling of the dam and its impacts on the alteration of flow volumes and patterns, as well as the loss of wetland from the extended inundation area;
- The infestation of alien vegetation post construction and how that would impact on the flow patterns and volumes of the wetlands; and
- The downstream releases and its impacts on the downstream wetland function and ecology.

The risk matrix shows that the initial flooding will have a high impact on the wetlands at the point of inundation, with the remaining aspects having a moderate impact.

The Hydrology Assessment and Safety Analysis indicates that the present spillway capacity is just short of adequate for a Category I dam. The eventual dam size will depend on the safety categorization that will be done by Department of Water and Sanitation (DWS). As an interim measure, it is proposed that the spillway be cut wider, each one at least 15 m wide (or combined 3 0m, as it is 27.4 m presently).

Soil compact tests indicated that the compact on top is less than what is generally prescribed for earth dams. However, Dynamic Core Penetrometer (DCP) tests have indicated an increase of compaction with depth and it is estimated that the general required compaction has been achieved from approximately 2m deep from the crest and deeper, where it is most important.

A slope stability analysis indicated that both the upstream and downstream slopes are safe, as the safety factors are above the required minimum safety requirements.

A dam break analysis was conducted and indicates that "Sunny day'' dam break with a full breach developing in 12 minutes will result in flood water overtopping the downstream road by approximately 630mm. Should the full supply level be dropped to just less than 50 000m³ a "sunny day" dam break will cause the resultant flood to flow over the road with a depth of approximately 340 mm. The engineers are of the opinion that reducing the capacity of the dam will not result in a significantly decreased safety risk. Lowering the full supply level is therefore not recommended as it will also result in a significant loss for the client.

According to the Desktop Reserve Determination Report, the dam will have a positive impact on at least the drought low flow environmental water requirement as water is only flowing into the dam at irregular intervals. With the dam in place, there will be a constant stream from normal leak water intercepted by a toe drain for embankment safety, regardless of inflow into the dam, unless the dam is obviously pumped dry frequently, which is unlikely as the outlet pipe is not installed at the lowest point of the dam. In other words, there will be unusable storage capacity in the dam, which will at least provide leak water, basically at all times. Additional to the normal leak water, controlled environmental releases through the outlet valve, will improve the situation even more during dry periods. At the worst, the dam will not negatively impact on the downstream water requirement, providing the required water is released, either through leak water or a combination of leak water and releases through the outlet valve. As the required amount to be released is insignificant related to what will be required for planned future irrigation, depending on receipt of a Water Use Licence, it will be more than viable to release the required downstream demand. A 300 mm PVC pipe that is installed at the bottom of the embankment, is more than adequately sized to release the require downstream maintenance Environmental Water Requirement, as well as downstream domestic and livestock requirement, for the affected area.

The mean monthly spills from the dam through the spillway will automatically release more than the required high flow Environmental Water Requirements, with no additional releases required by opening the outlet valve, else than for maintenance flow as required.

However, it is recommended that a measuring weir is constructed downstream of the dam, to measure the required maintenance flow to be released which will also measure the leak water. The total maintenance flow required is the total flow from leak water and water released by opening of the outlet valve, combined. Thus, the release amount required from the dam is the additional amount required, if any, over and above the leak water, to satisfy the total maintenance release required. The high flow requirement will automatically be met by spills over the spillways, as the dam volume only comprises a small fraction of the total catchment run-off. Regardless

whether there is very seldom visible normal flow in the natural drain into the dam, it is still recommended to construct an upstream measuring weir to measure the flow during such seldom normal flow conditions. Only a maximum of the incoming flow needs to be released to satisfy the downstream requirement.

RECOMMENDATIONS

Based on the information that is contained in this report and also taking into account the outcome of the impact assessment, the opinions and recommendations included in the specialist studies as well as all supporting documentation, it is the recommendations of the practitioner that the Environmental Authorisation be granted by the Department of Environmental Affairs for the Raised Persberg Dam Wall on Persberg Farm (Portion Linde No 47733) situated in the Helpmekaar area.

The following key recommendations, which may also influence the conditions of the EA (where relevant), accompany the BA for the proposed BAR for the Raised Persberg Dam Wall on Persberg Farm (Portion Linde No 47733) situated in the Helpmekaar area:

- Frequent monitoring of the dam wall must be carried out to prevent its subsequent washing out of dam material;
- Frequent monitoring of the raised dam must be carried out as per an operational environmental management programme to ensure that any minor problems with erosion can be timeously fixed.
- Agricultural activities around the dam structure should be restricted to ensure that deposition of fertiliser into the dam does not take place; as such, a buffer of at least 30 metres should be implemented;
- Regular compensatory flows should be provided downstream so as to meet minimum demand required by aquatic biota located downstream;
- A flow meter should be installed within the flow release mechanism to monitor the flow release from the dam;
- Removal of aquatic weeds along the footprint of the dam should be carried out to prevent the proliferation of stream flow reducing vegetation;
- Measures such as sediment traps must be implemented to slow run-off and capture material;
- Ensure no erosion occurs at the dam inlet and outlet points;
- Establish and maintain a buffer of natural vegetation around wetlands. Buffer zones slow run-off and also act as filters to protect the wetland from sediments and other contaminants;
- Reduce the proposed irrigation usage to allow the wetland to sustain some function upstream and downstream;
- Fence off the wetland to prevent cattle from grazing within the wetland.
- Disturbed areas must be rehabilitated by using indigenous hydrophytic plant species. To carry out the above, a site investigation must be conducted by the Wetland Specialist during the wetter months.
- Stone rip-rap must be improved on the wing walls. Further, a concrete sill should be constructed to be level with the present ground level in the spillways to ensure that local flow points do not develop and result in erosion. This sill has to be 100% level and cut sufficiently into the embankments to prevent water from bypassing it.
- Rehabilitation activities must take place within the existing dam servitude and property boundaries to improve the operational status of the dam and its linkage to biodiversity in the area;

- An operations and maintenance plan is recommended, as this will outline the operating procedures necessary to keep the dam compliant and to identify any warning signs, such as cracking, wall movement and leakage that may indicate problems. To ensure this, a comprehensive dam safety inspection must be undertaken by a qualified engineer every five (5) years.
- During the operational phase vehicles must remain on designated roads and must not drive in the wetland areas or the edge of the dam as new wetland zones / footprints would have established there.

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ACRONYMS AND ABBREVIATIONS

EDTEA	Department of Economic Development, Tourism and Environmental Affairs (KZN)
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
ESO	Environmental Site Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ERC	Ecological Reserve Category
HGM	Hydrogeomorphic Unit
I&AP	Interested and Affected Parties
IDP	Integrated Development Plan
WULA	Water Use License Application
KZN	KwaZulu-Natal
NEMA	National Environmental Management Act (107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act (No 36 of 1998)
PES	Present Ecological State
PPP	Public Participation Process
SABS	South African Bureau of Standards
SANS	South African National Standards
SDF	Spatial Development t framework
SMP	Stormwater Management Plan
SUDS	Sustainable Urban Drainage Systems
WRSM	Water Resource Stimulation Model

DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONER, SPECIALIST AND PROPONENT

NAME AND CONTACT DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAPS) ORGANISATION

Table 2: Contact Details of EAP's Organisation

Contact details of the EAP's organisation	
Business name	Afzelia Environmental Consultants (Pty) Ltd
Physical address	Office 101A Windermere Centre, 163-177 Lilian Ngoyi Road, 4001
Postal address	PO Box 37069, Overport, Durban, 4067
Telephone	031 303 2835
Fax	086 692 2547
E-mail	Deshni@afzelia.co.za

Table 3: Names and details of expertise of the EAP involved in the preparation of the report

Names of the EAP	Education qualifications	Roles / Responsibility on the Project	Professional affiliations	Experience at environmental assessments (years)
Miss Deshni Naicker	MA (Geography) Environmental and Development Management	Lead EAP	IAIAsa	9.5
Mrs Lisa Guastella	MSc Oceanography	External Reviewer	Pr.Sci.Nat. 400676/15 IAIAsa	21

NAMES AND EXPERTISE OF SEPCIALISTS

Table 4: Names and details of expertise of each specialist that has contributed to this report

Name of Specialist	Qualifications	Field of Expertise	Title of specialist report/s as attached in Appendix E
Mr Wayne Jackson	BSc Soil Science and Hydrology. WRYM-IMS (Water Resources Yield Model) DWAF. BASOS (Fertilizer Advisory Course)	Soils, Wetlands and Surface Water Specialist	Wetland Functionality Assessment and Rehabilitation Plan for the Constructed Montrose Farming Trust Dam on Persberg Farm Near Helpmekaar in KwaZulu-Natal.
Mr Flip Kruger	Bachelor of Engineering	Integrated Plant Management, Bulk Water Supply, Repairs and Upgrading of Dams and Weirs, Design and Construction of Roads, Bridges and Air Strips, Project Management, Mechanical Engineering, Stormwater Management, Hydrology and Water Use Licencing, Open Channel Hydraulics and Soil Conservation Structures	Persberg Farm Dam – Application for Licence to Store Water and Application for Classification of Proposed Dam.
Mr Flip Kruger	Bachelor of Engineering	Integrated Plant Management, Bulk Water Supply, Repairs and Upgrading of Dams and Weirs, Design and Construction of Roads, Bridges and Air Strips, Project Management, Mechanical Engineering, Stormwater Management, Hydrology and Water Use Licencing, Open Channel Hydraulics and Soil Conservation Structures	Reserve Determination for Water Use License Application.

Table 5: CONTACT DETAILS OF PROPONENT

Proponent	**Montrose Farming Trust**
Contact person	Mr. Erich Müller
Physical address	13 Cabel Road, Dundee, 3000
Postal address	PO Box 748, Dundee, 3000
Email	erich@dundeekzn.co.za
Tel	082 443 8049

PURPOSE OF THE BASIC ASSESSMENT

The purpose of this report is to:

- Determine the policy and legislative context within which the activity is located and how the activity complies with and responds to the said policy;
- Provide a description of the receiving environment that would be affected by the proposed activity;
- State the need and desirability of the proposed activity;
- Provide a summary of specialist studies that have been conducted as part of the BA process;
- Identify, assess and rank the significant impacts and risks that the activity will impose on the preferred site;
- Identify suitable measures to avoid, reverse, mitigate or manage identified impacts;
- Outline the Public Participation Process that was undertaken;
- Provide recommendations for the competent authority to make an informed decision.

1. INTRODUCTION AND PROJECT DESCRIPTION

1.1. PROJECT BACKGROUND

The Applicant Mr Erich Muller commenced with listed activities within a watercourse on Persberg Farm (Portions Linde No 4733) in August 2015. The extent of the property is 129.5 hectares and falls within the Msinga Local Municipality and is located within the Umzinyathi District Municipality of the KwaZulu-Natal Province.

As a result of non-compliance with Section 25 of NEMA, a rectification process is required for activities which have already taken place. A Section 24G Application was therefore submitted to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs – Northern Region by the Applicant in February 2016 to commence this rectification process.

The KwaZulu- Natal Department of Economic Development, Tourism and Environmental Affairs issued an administration fine which was paid by the Applicant.

In terms of the directive, a rectification process i.e. A Basic Assessment Process is required to be undertaken.

Afzelia Environmental Consultants has been appointed by the Applicant to undertake the rectification process in terms of the EIA Regulations, 2014 (as amended on 7 April 2017).

The original dam was built by the Road Department (NPA) in 1960. The NPA had excavated a quarry to build the tar road and in exchange the NPA built a dam for the farmer. The original dam covered an area of 1.2 hectares with a dam wall height of 3.5 m. The capacity of the original dam was measured to be between 25 000 to 32 500 cubic metres of water.

The water from the original dam was emptied by the Applicant and a core trench was dug to a depth of 5 meters by machinery, the core was dug down to the bottom soil which formed the natural soil structure in the centre area of the old existing dam. This reconstruction of filling the 'core' of the dam was done by moving suitable clay type soil in the vicinity of the dam wall, and as every layer of clay soil was moved by dam scoops and soil was compacted for constructing the base core of the dam. The top soil that was saved was later moved over the top of the dam wall and compacted and kikuyu and grass was planted as an erosion control measure.

The dam has been raised to a height of 8.5m with a maximum depth of 4m.and will cover an area of 8.4 hectares and is estimated to hold a capacity 152 000 m³ (cubic meters) of water when full. The dam was designed by an Engineering Technician from the Department of Agriculture Mr Terrance Collyer.

1.2. LOCATION OF THE PROPOSED ACTIVITY

The dam is located on the Persberg Farm (Portion Linde No 4733) and falls within the Msinga Local Municipality, located within the Umzinyathi District Municipality of the KwaZulu-Natal Province.

The GPS co-ordinates of the proposed project are:

South	28^0	26’	01.81”
East	30^0	24’	36.00”

The proposed project is located within the Quarter Degree Grid Square (QDGS) 2830AD and falls within quaternary catchment V33B which is part of the Pongola - Ntamvuna Water Management Area. The Buffels river system is the main river system within this sub-quaternary catchment.

Access to the site is via the R33. The Persberg Dam is situated within the Helpmekaar area and the nearest town of Pomeroy is approximately 16 km south of the project site. Refer to **Figure 1 for the Locality Map and**

Figure 2 for the Aerial view of the present dam.

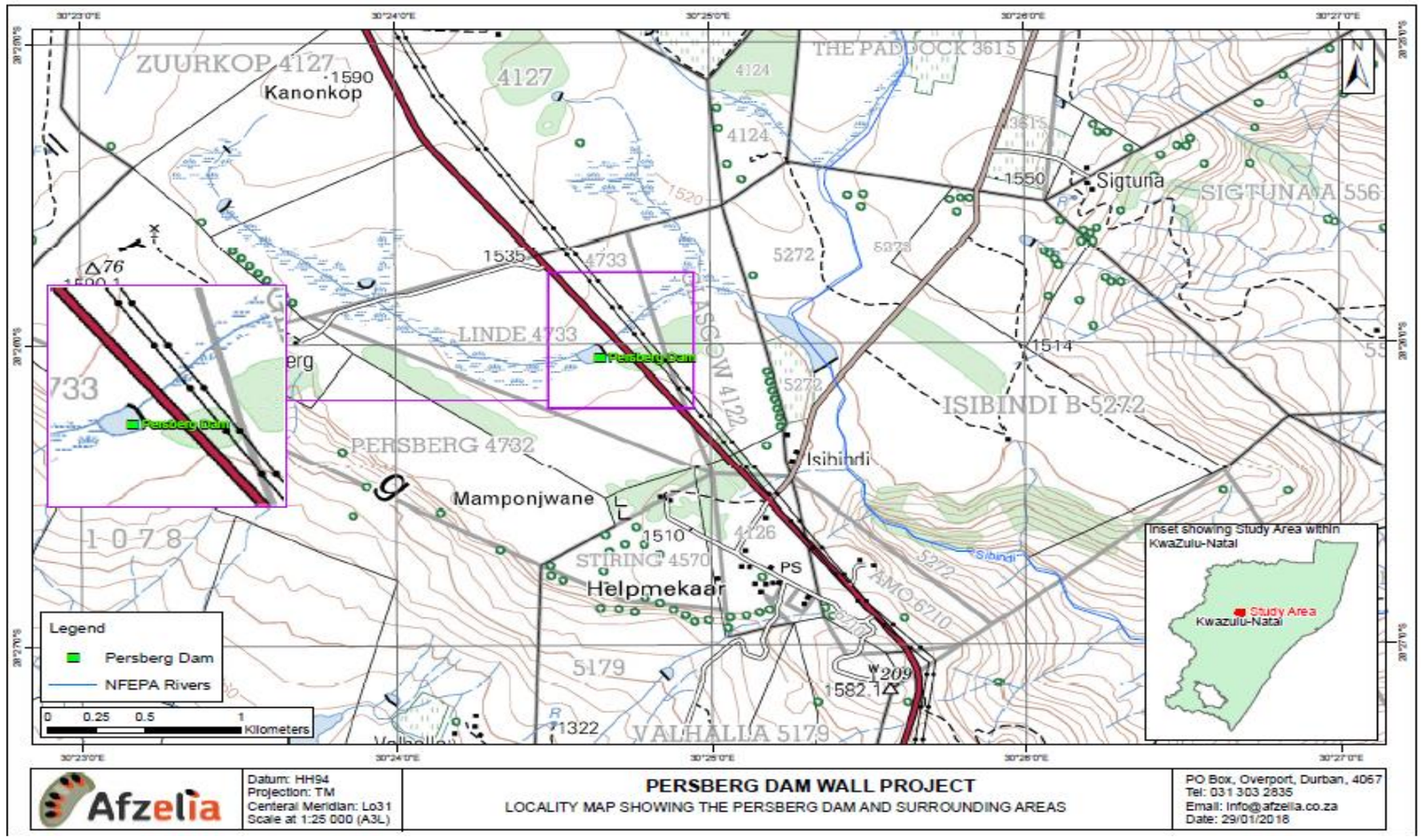


Figure 1: Locality Map showing Persberg Dam and Surrounding Areas.

Figure 2: Aerial view of the Persberg dam site (courtesy Google Earth).

1.3. ALTERNATIVES

SITE ALTERNATIVES

No site alternatives have been considered as the applicant has already undertaken construction activities and raised the dam wall which is located on his property Persberg Farm (Portion Linde No 4733).

DESIGN, LAYOUT OR TECHNOLOGY ALTERNTIVES

There are no design, layout or technology alternatives for this project as the applicant has already constructed and raised the dam wall.

No-Go Alternatives (status quo)

The "no-go" alternative means that the status quo is maintained as the dam wall has already been constructed and raised.

2. DESCRIPTION OF THE RECEIVING ENVIRONMENT

2.1. Climate of the Area

The area is characterised by a summer rainfall pattern, with peak rainfall from December to January. Frequent mist adds to the overall precipitation. Mean Annual Precipitation (MAP) is almost 920 mm and mean annual evaporation reaches 1 770 mm. A Mean Annual Temperature (MAT) of 14.3 °C and almost 30 days of frost indicate that the unit is found close to the lower limit of warm temperate climate (Mucina, et al., 2006).

2.2. Geology and Soils

The geology of the area is mainly Ecca and Beaufort Groups (Karoo Supergroup) mudstone or shale.

According to the land type database (Land Type Survey Staff, 1972 – 2006) the Persberg Dam falls within the Bb72 land type and it is expected that the dominant soils in the crest positions will be Shallow Mispah and Glenrosa soils. The midslope positions should have Hutton, Avalon, and Westleigh soil forms. The soils that dominated the foot slopes and the valley bottoms are Katspruits.

2.3. Vegetation

The project area falls within the Sub-Escarpment Grassland vegetation group, but more specifically the GS 3 (Low Escarpment Mist Grassland vegetation type) (Mucina, et al., 2006). Features of this vegetation group are: Complex mountain topography. Steep, generally east and south facing slopes, with a large altitudinal range. Supporting tall, closed grassland with *Hyparrhenia hirta* and *Themeda triandra* dominant. *Protea caffra* communities and patches of *Leucosidea* scrub feature at higher altitudes.

Ecosystem types are categorised as **Critically Endangered, Endangered, Vulnerable or Least Threatened**, based on the proportion of ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. According to the Threatened Ecosystems Map, the Persberg dam project falls within the least threatened ecosystems. **(Refer to Figure 3)**.

The Vegetation Map for the Persberg Dam and surrounding areas **(Refer to Figure 4)** indicates that the project area falls within the **Mooi River Highland Grassland** and the **Highveld Alluvial Vegetation**.

The Mooi River Highland Grassland is found in the KwaZulu-Natal Province the centre of occurrence is in the Mooi River Basin, with several scattered large patches near Underberg and Greytown and on the Helpmekaar Plateau southeast of Dundee (Mucina and Rutherford, 2006). Mooi River Highland Grassland is classified as **Vulnerable** with a national conservation target of 23%.

Highveld Alluvial Vegetation occurs in alluvial drainage lines and floodplains along rivers that are embedded within the Grassland Biome. The vegetation is characterised by a flat topography that supports riparian thickets, seasonally flooded grasslands and disturbed herb lands often dominated by alien plants (Mucina and Rutherford, 2006). According to Mucina and Rutherford (2006), this vegetation type is classified as **Least Threatened** with approximately 10% conserved in statutory reserves. More than a quarter has been transformed by cultivation and dam building. Intensive grazing and alien invasive vegetation are major threat to this vegetation type.

2.4. National Freshwater Ecosystem Priority Area (NFEPA) Status

The National Freshwater Ecosystem Priority Areas (NFEPA) is a tool developed to assist in the conservation and sustainable use of South Africa's freshwater ecosystems, including rivers, wetlands and estuaries. Nel et al. (2011) classified the freshwater ecosystems according to their Present Ecological State 'AB', 'C', and 'DEF' or 'Z.

Table 6: Description of NFEPA wetland condition categories (Net et al. 2011, p.37)

PES equivalent	NFEPA condition	Description	% of total national wetland area*
Natural or Good	AB	Percentage natural land cover ≥ 75%	47
Moderately modified	C	Percentage natural land cover 25-75%	18
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river	2
	Z1	Wetland overlaps with a 1:50 000 'artificial' inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007)	7
	Z2	Majority of the wetland unit is classified as 'artificial' in the wetland locality GIS layer	4
	Z3	Percentage natural land cover ≤ 25%	20

*this percentage excludes unmapped wetlands, including those that have been irreversibly lost

Two (2) FEPA wetlands were identified within the 500m radius of the dam. The FEPA wetlands in the vicinity of the dam are shown in **Figure 5**.

The FEPA wetlands were classified by the Wetland Specialist (Mr Wayne Jackson) as a bench (flat) wetland and a hillslope seep wetland. However, from the field assessment undertaken by the specialist and the Google Earth historical imagery, it was concluded that the wetlands were not bench flats and hillslope seeps, but rather are unchannelled valley bottom wetland systems. There was an existing dam in 2012, as well as evidence of cattle paths, which indicate grazing activities within the wetland. These activities have altered the Present Ecological State (PES) or wetland condition to a lower level of what can only be assumed as a **PES C (Moderately Modified)** state. This can only be assumed as the wetland assessment was only conducted post construction of the new dam wall.

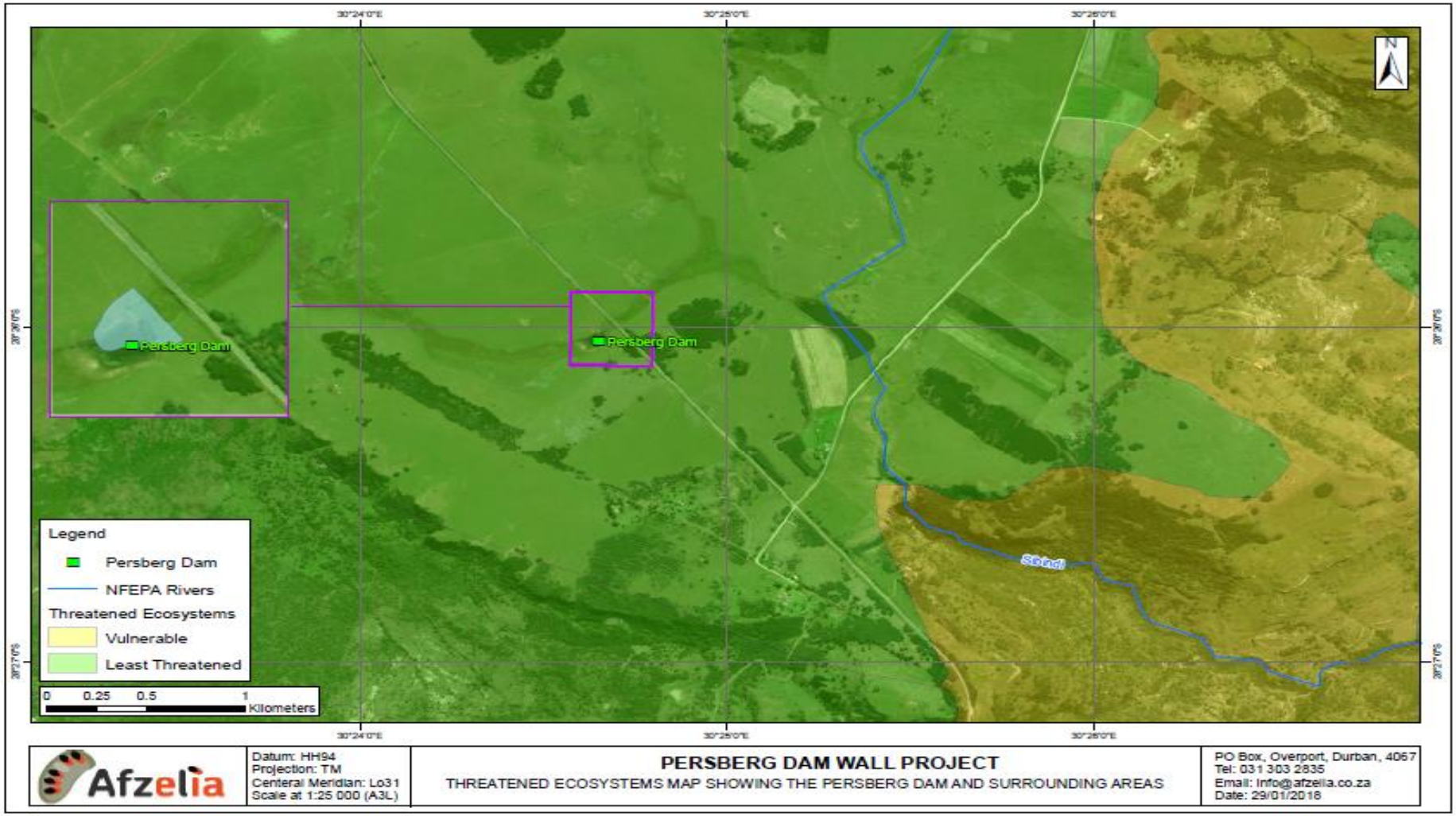


Figure 3: Threatened Ecosystems Map showing the Persberg Dam and Surrounding Area

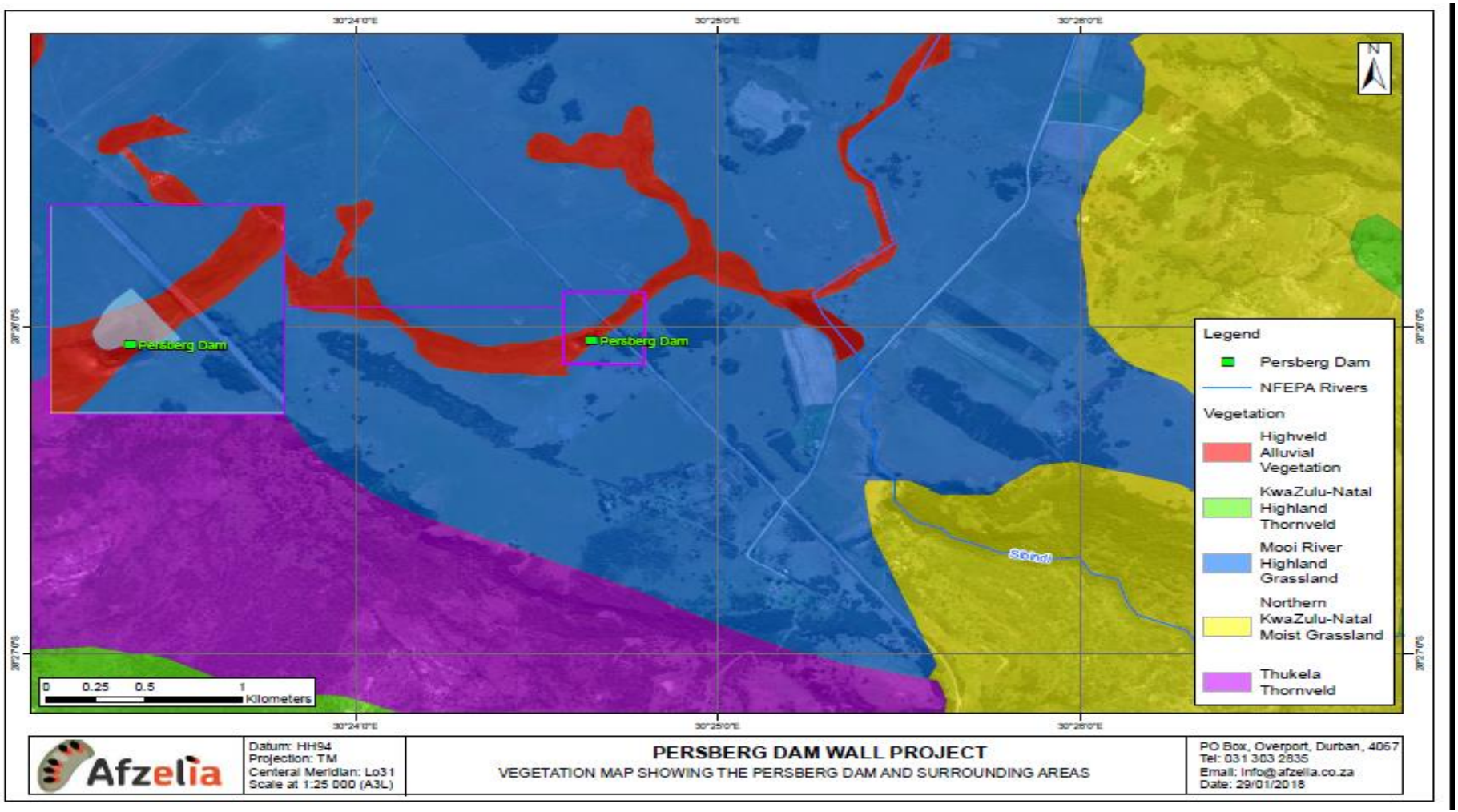


Figure 4: Vegetation Map showing the Persberg Dam and Surrounding Areas.

Figure 5: NFEPA wetlands located within the 500m of the dam.

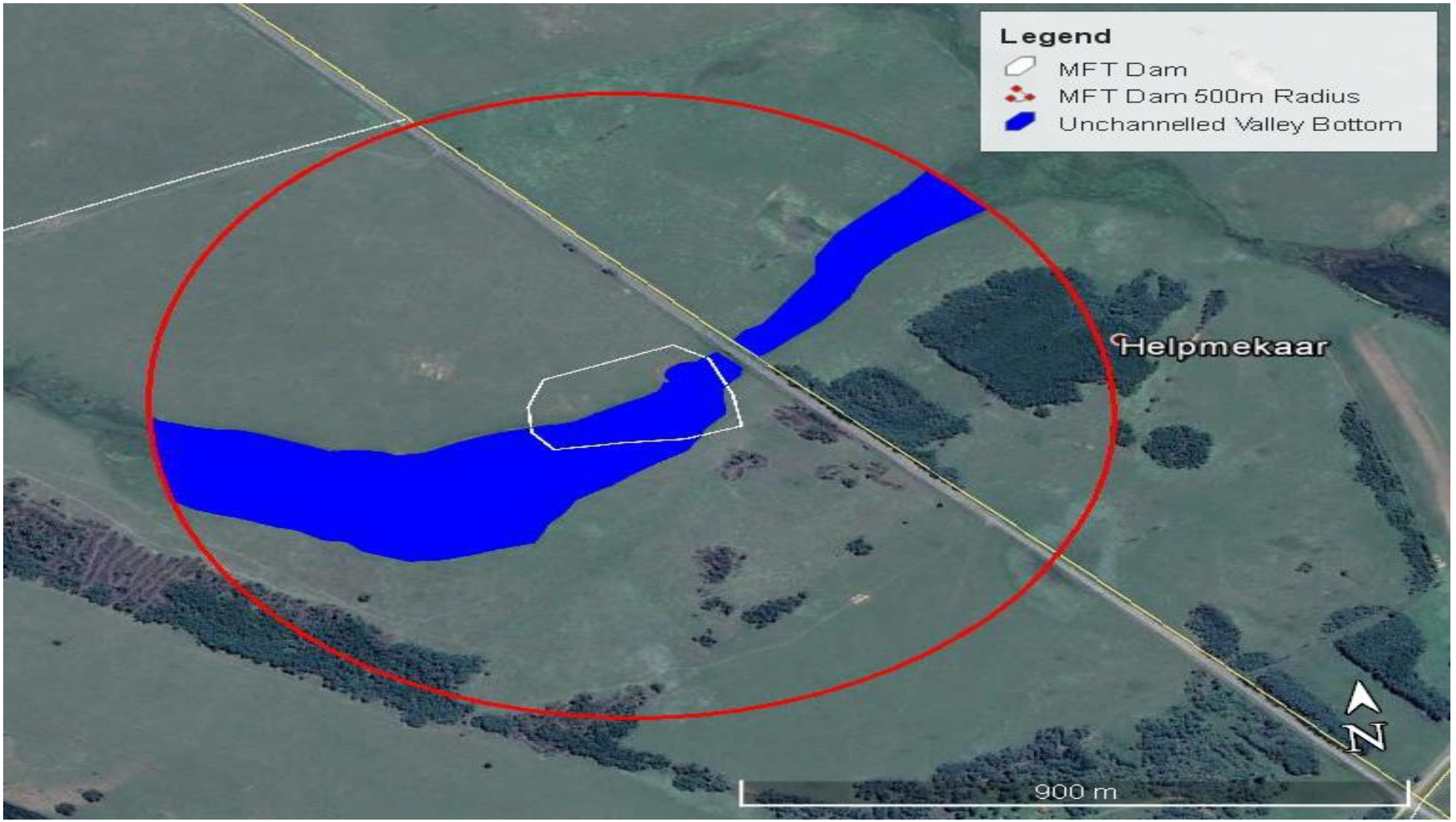


Figure 6: Wetland Delineation within the 500m assessment buffer

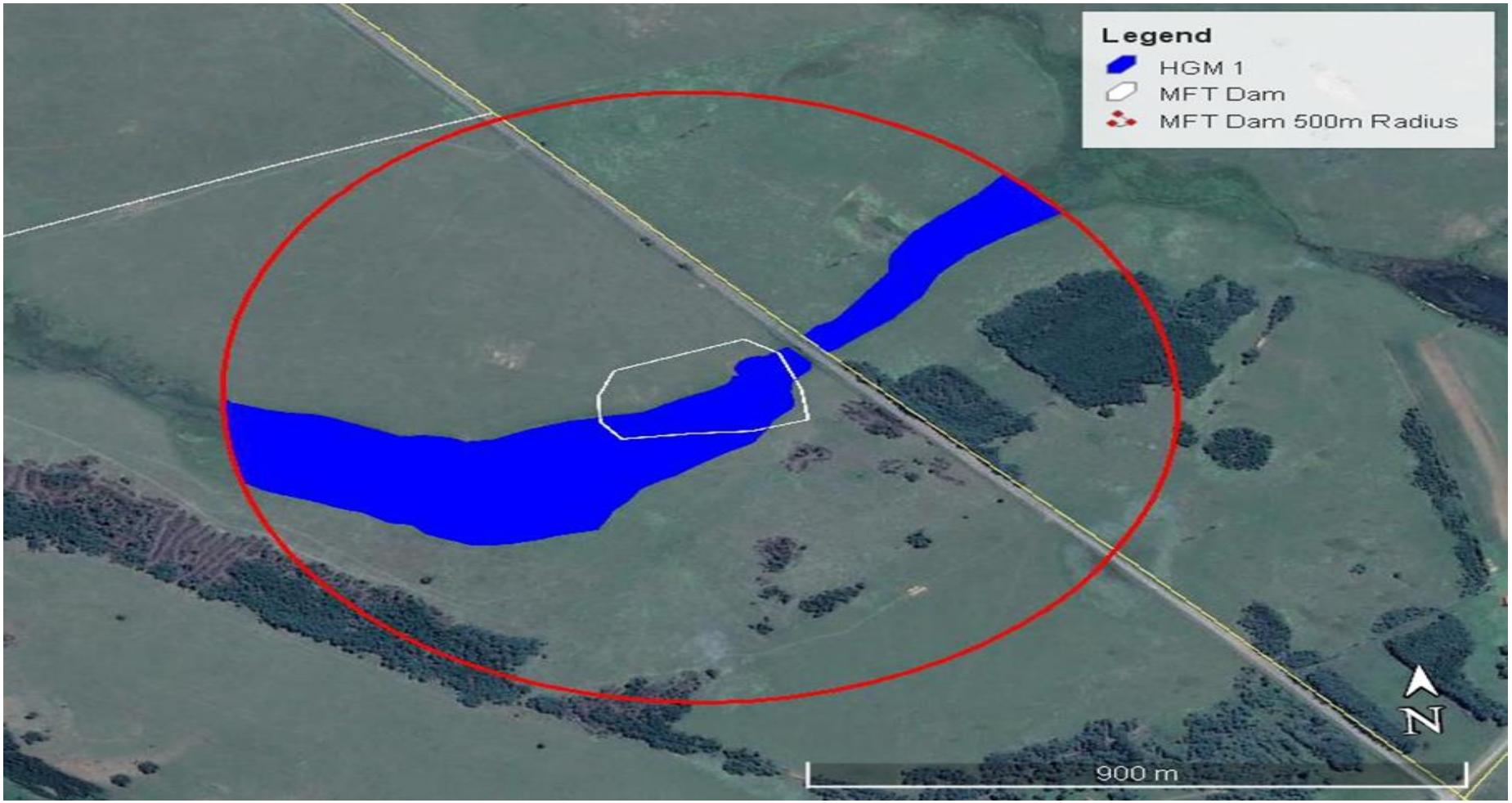


Figure 7: Dam HGM Unit

3. ENVIRONMENTAL LEGAL REQUIREMENTS FOR THE PROPOSED PROJECT

3.1. NEMA EIA Regulations 2014

In accordance with the Environmental Impact Assessment (EIA) Regulations and its Government Notice No. 327 of Listing Notice 1, promulgated in April 2017, the table shows all the activities that trigger a Basic Assessment Process.

Table 7: Listed Activities in terms of the 2014 EIA Regulations, as amended:

Government Notice Number	Activity Number	Description each listed activity as per the project description
No. R. 327 of April 2017. (Listing Notice 1)	19	+-25 cubic metres of material was removed from the dam and was used for the raising of the dam wall.
No. R 327 of April 2017. (Listing Notice 1)	48	The original dam covered an area of 1.2 hectares with a dam wall height of 3.5m. The dam has now been raised to a height of 8.5m, the maximum depth is 4m which will cover and area of 8.4 hectares and it will hold approximately 152 000 cubic metres of water.

3.2. National Water Act (Act 36 of 1998)

The proposed project requires a water use authorisation in in terms of Section 21 (c) and (i) in accordance with the National Water Act (NWA) 1998 (Act No. 36 of 1998), as amended.

A Water Use License Application (WULA) has been submitted to the Department of Water and Sanitation Affairs (DWS).

The following table provides a summary of water uses that apply to this project:

Table 8: Listed activities in term of the National Water Act 1998 (Act No. 36 of 1998)

Activity Number	Water Use	Explanation / definitions
Section 21 (b) of NWA, 1998	Storing of water	• Storage of water in a dam, which will be enlarged by increasing the gross storage capacity.
Section 21 (c) of NWA, 1998	Impeding or diverting the flow of water in a watercourse.	• Impeding flow means the temporary or permanent obstruction or hindrance to the flow of water into watercourse by structures built either fully, or partially, in or across a watercourse. • Diverting flow means a temporary or permanent structure causing the flow of water to be rerouted in a watercourse for any purpose.
Section 21 (i) of NWA, 1998	Altering the bed and banks of a watercourse or characteristics of a watercourse.	• Altering the bed and banks means any change affecting the resource quality of the watercourse (the area within the riparian habitat or 1:100-year floodline, whichever is the greatest).

3.3. Applicable Legislation, Policies and Guidelines

The legislation that has possible bearing on the Existing Persberg Dam wall is captured in the table below:

Table 9: Applicable Legislations, Policies and / or Guidelines

Title of legislation, policy or guideline	Administering authority	Date	RELEVANCE
South Africa's Constitution (Act 108 of 1996), specifically the Bill of Rights (Chapter 2, Section 24)	The State	1996	Applicant is obliged to comply with all existing environmental laws. The Applicant must also ensure that any of their activities which are not controlled by law do not negatively impact on human health and well-being.
National Water Act (Act 36 of 1998) Chapter12	Department of Water and Sanitation	1998	Chapter 12 of the National Water Act deals with the safety of dams. This Chapter contains measures aimed at improving the safety of new and existing dams with safety risks so as to reduce the potential for harm to the public, as well as damage to property, or to resource quality.
National Environmental Management Act (Act No. 107 of 1998)	National Department Environmental Affairs (DEA) Department of Economic Development, Tourism and Environmental Affairs (EDTEA (Provincial CA)	1998	The following section's of the NEMA Act (Act 107 of 1998) have relevance to the proposed project: • Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). • Section 28 – Duty of care and remediation of environmental damage. • Environmental management principles. • Authorities – Department of Environmental Affairs (DEA) (national) and KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) (provincial).
Environmental Impact Assessment Regulations Government Notice No. R 326, 325 and 327 (as amended on April 2017)	Provincial EDTEA	2017	The Directive issued on the 26 April 2016, requested that a Basic Assessment (BA) process should be undertaken in terms of General Notice R 327 of the EIA Regulations of April 2017. The following activities, under Listing Notice 1 of GN R 327 of April 2017, have been identified:

Number and Date of relevant notice	Activity Number	Description each listed activity as per the project description
No. R 983 of December 2014	19	+-25 cubic metres of material were removed from the dam and

			as amended by No. R 327 of April 2017 (Listing Notice 1)		was used for the raising of the dam wall.
				48	The original dam covered an area of 1.2 hectares with a dam wall height of 3.5m. The dam has now been raised to a height of 8.5m, the maximum depth is 4m which will cover and area of 8.4 hectares and it will hold approximately 152 000 cubic metres of water.
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	DEA & Ezemvelo KZN Wildl (Provincial)	2004	Management and conservation of the country's biodiversity. • Protection of species and ecosystems.		
Alien and Invasive Species Regulations (2014) in terms of section 97(1) of NEMBA	DEA & Ezemvelo KZN Wildlife (Provincial)	2014	Invasive and other noxious plants must be managed as per the requirements of the appointed vegetation specialist. Refer to Appendix A of the OEMPs provides details necessary for an effective alien vegetation control programme		
National Environmental Management: Waste Management Act (59 of 2008)	National Department Environmental Affairs (DEA)	2008	It must be noted that no waste generating activities will occur and that no waste permits are being applied for and therefore has not bearing to the proposed project.		
The National Heritage Resources Act (Act No 25 of 1999 as amended)	Amafa aKwaZulu-Natali	1999	Provincial heritage conservation agency for KZN. Protection and preservation of cultural and heritage resources through approvals for development permits.		
KwaZulu-Natal Nature Conservation Ordinance 15	Ezemvelo KZN Wildlife (Provincial)	1974	Institutional bodies for nature conservation in KZN and to establish control and monitoring bodies and mechanisms.		
Integrated Environmental Management (IEM) Guidelines	Department of Economic Development, Tourism and Environmental Affairs	2017	IEM provides an holistic framework that can be embraced by all sectors of society for the assessment and management of environmental impacts and aspects associated with each stage of the activity life cycle, taking into consideration a broad definition of environment and with the overall aim of promoting sustainable development. IEM was taken into consideration for the raised dam to allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative as the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.		
Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)	Department of Agriculture, Forestry, and Fisheries	1983	Conservation of natural agricultural resources. The following measures to ensure monitoring have been implemented in the EMPr for the Proposed Project/ • Control measures for erosion. • Control measures for alien and invasive plant species.		

Hazardous Substances Act (Act No. 15 of 1973)	Department of Health	1973	The Hazardous Substances Act, 1973 provides measures for the control of substances and certain electronic products which may be toxic, corrosive, irritant, strongly sensitizing or flammable in nature which may cause injury or ill-health to or death of humans. This Act divides the substances or products into groups in relation to the degree of danger and makes provision for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products.
Occupational Health and safety Act (Act No. 85 of 1993)	Department of Labour	1993	The Applicant is to ensure that the Occupational Health and Safety Act is taking into consideration during operation and monitoring of the dam wall.
Local Economic Development Strategy	Msinga Local Municipality	2012	Due to the Proposed Project falling within the Msinga Local Municipality, the LED Strategy highlights the keys issues which need attention and need to be addressed in Msinga and is highlighted in Table 10 of Page 40 of the Report.
Final Integrated Development Plan	Msinga Local Municipality	2016 / 2017	The IDP for the Msinga Local Municipality highlights that agriculture in Msinga is largely practised for subsistence and is subject to limited capacity due to poor soil quality, climatic conditions and overstocking. Despite the large irrigation potential from rivers, the area is subject to water shortages during dry seasons, high soil erosion and low land carrying capacity for grazing. The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.
Spatial Development Framework	Msinga Local Municipality	2016 / 2017	The SDF for the Msinga Local Municipality highlights that agriculture in Msinga is largely practised for subsistence and is subject to limited capacity due to poor soil quality, climatic conditions and overstocking. Despite the large irrigation potential from rivers, the area is subject to water shortages during dry seasons, high soil erosion and low land carrying capacity for grazing. The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.
Regulations regarding the Safety of Dams in terms of Section 123(1) of the National Water Act, 1998.	Department of Water Affairs	2012	The Regulation regarding the Safety of dams has relevance and is to ensure the following: • Improve the safety of existing dams with a safety risk so as to reduce the potential for harm to the public, damage to property or to resource quality; • To reduce the risk of a dam failure, control measures require an owner to comply with

			certain directives and regulations, such as to submit a report on the safety of a dam, to repair or alter a dam, or to appoint an approved professional person to undertake these tasks; and • Lastly, these measures are in addition to the owners' common law responsibility to ensure the safety of their dams.
Summary of Legal Requirements for Prospective and Existing Dam Owners in South Africa	Department of Water and Sanitation	2013	Only dams with a safety risk (i.e. dams with a maximum wall height exceeding 5,0 m and with a storage capacity exceeding 50 000 m³ or any other dam declared by the Minister as a dam with a safety risk) are subject to these Regulations. The original dam covered an area of 1.2 hectares with a dam wall height of 3.5m. The dam has now been raised to a height of 8.5m, the maximum depth is 4m which will cover and area of 8.4 hectares and it will hold approximately 152 000 cubic metres of water.
Design Guidelines for a Category 1 Earth fill Dam Wall	Department of Water and Sanitation	1995	The Helpmekaar Dam is a Licenced Category 1 – Earth Fill Dam Wall.
Dam Safety Regulations (Government Notice R.139 of 24 February 2012)	Department of Water and Sanitation	2012	The Helpmekaar is an existing dam and is Classified as a Category 1 Dam.
Dam Safety Regulations (Government Notice R. 138 of 24 February 2012)	Department of Water and Sanitation	2012	The Helpmekaar is an existing dam and is Classified as a Category 1 Dam.

4. ACTIVITY LIFE DESCRIPTION

The total construction period was approximately 3 months, and it is unlikely that the dam will be decommissioned.

5. ASSUMPTIONS AND LIMITATIONS

Assumptions and limitations as addressed in this Draft Basic Assessment Report for the Existing Persberg dam wall are:

- All information provided by the Project Manager, GFK Consulting Engineers to the EAP was correct and valid at the time it was provided;
- The EAP does not accept any responsibility in the event that additional information comes to light at a later stage of the process from the Project Manager;
- The scope of the work is limited to assessing the potential environmental impacts associated with the raising of the dam wall and the area that will be flooded as shown on the engineering diagrams submitted by GFK Consulting Engineers.
- However, it must be noted that as the dam level after two years rainfall is about 30% full due to small catchment area of 340 hectares. Due to the rainfall being lower over the past few two years, other dams with bigger catchment areas in the Helmekaar area are 'full' and have filled due to rain filling the dams from bigger catchment of out to 1000 hectares to 1500 hectares filling the dams. The resultant dam break flood is unlikely as water will be released through the pipe laid in the dam wall to release water and used for the planned irrigation of the lands in area of the dam.

In addition to the above, assumptions and limitations were noted by the specialist team, who have clearly stated that:

- The wetland survey was conducted in July 2016 during the drier winter months and it is recommended that a survey is also conducted during the wet season;
- The dam has already been constructed and the risks/impacts cannot be assessed accurately as the dam has not undergone its first filling and this has been included in the impact register / risk assessment; and
- Site visits should ideally be conducted over differing seasons in order to better understand the hydrological and geomorphological processes governing wetland systems as well as the use of the wetlands by both the surrounding community as well as faunal species.

6. ACTIVITY MOTIVATION

6.1. The Need and Desirability for the proposed activities

The DEA (2017) Guideline on Need and Desirability has been used to inform and provide structure for the Need and Desirability Report for this project

The concept of "need and desirability" relates to, amongst others, the nature, scale and location of the development being proposed, as well as the sustainable use of land. Need and desirability are inter-related and the two have been considered in an integrated and holistic manner.

The following policies, statues and documents were interrogated:

1. The Integrated Development Plans (IDP) for the Msinga Local Municipality;
2. The Spatial Development Framework (SDF) for the Msinga District Municipality;
3. Msinga Local Municipality LED Strategy.

This project is in line with the IDP and SDF for Msinga Local Municipality:

Although the Provincial Spatial Economic Development Strategy of KZN identified only the southern part of the Msinga Municipality as having agricultural potential, it also identified an important regional Agricultural Corridor traversing the Municipality along the R33 in a North South Direction.

The IDP and SDF for the Msinga Local Municipality highlights that agriculture in Msinga is largely practised for subsistence and is subject to limited capacity due to poor soil quality, climatic conditions and overstocking. Despite the large irrigation potential from rivers, the area is subject to water shortages during dry seasons, high soil erosion and low land carrying capacity for grazing.

There is a high potential to increase both crop and stock farming production through improved farmed management and agricultural practices and support systems.

According to the IDP the agricultural sector in Msinga has declined substantially. This has led to a decline in employment and increased dependence on agricultural commodities produced outside the region. A lot of focus is currently placed on the development/rejuvenation of the agricultural sector. Developing this sector can have far reaching implications for attracting investment (i.e. Agric-processing), as well as the securing of food resources for residents (as a form of poverty alleviation). The practical implementation of agricultural-related projects, however, can increase the competitiveness of the Msinga Local Municipality that it is often lacking.

The SDF states that the agricultural potential of the Msinga Local Municipality revolves around intensive farming, irrigation, dry land farming and stock farming. According to the SDF, potential intensive farming and irrigation projects must be given first priority when allocating land for agricultural use. However, without a programme to construct or increase the size of dams, there is practically no additional irrigation potential in the Msinga Local Municipality

The Msinga Municipality LED Strategy highlights the keys issues which need attention and need to be addressed in Msinga. The table below highlights the Goal, Strategy and Programmes of the LED Strategy associated with the proposed project.

Table 10: Key Goal, Strategy and Programmes of the LED Strategy associated with the project

Goals	***Strategy***	***Programmes***
Goal 1: Enhance the key sectors identified to broaden the economic base of Msinga.	*Strategy 1.1: Ensure sustainable agricultural practices and enhance the agricultural sector.*	*Programme 1.1.1: Improve and enhance the irrigation schemes;* *Programme 1.1.2: Enhancing Agricultural Practice throughout Msinga;* *Programme 1.1.3: Develop the Agriprocessing Sector.*

The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

7. SPECIALIST STUDIES

This section of the report highlights the findings of specialist reports undertaken for the proposed project, namely, the Wetland Functionality Assessment and Rehabilitation Plans, Hydrology and Dam Safety Report and Reserve Determination for Water Use License Application.

7.1. Wetland Field Delineation

The wetland survey was conducted by Mr Wayne Jackson from the Earth, Water and Environmental Science Company on the 19th of July 2016 during the drier winter months and a follow up investigation is recommended in the wetter months. The survey included all the wetland indicators as well as assessing the PES, the ecoservices provided by the wetlands, and the EIS of the wetlands **(Refer to Appendix C1).**

The wetland delineation is shown in Figure 6 and the hydrogeomorphic (HGM) units in Figure 7, with the wetland classification as per SANBI guidelines (Ollis, et al., 2013).

7.1.1. Unchannelled Valley Bottom (HGM 1)

The wetland is fed by a 340-ha catchment on the top of a mountain. It drains from the north-west into the assessment buffer and then drains north-east into the dam location. The wetland then drains into a culvert under the R33 road and continues draining north-east. The unchannelled valley bottom then links up with another unchannelled valley bottom system and drains south-west down the mountain, feeding the larger catchment.

The soils are shallow Mispah soils on the northern banks, with slopes in excess of 10%. The southern bank is flatter in slope and the soils are deeper with Clovelly and Hutton soils dominating the midslope positions in the landscape. The valley bottom shows a transition from Clovelly soils (midslope), to Westleigh soils (foot slope), to Katspruit soils (valley bottom).

Photograph 1: Depicting soils present from left to right (Clovelly, Westleigh and Katspruit)

Photograph 2: Depicting the unchannelled valley bottom.

7.1.2. Present Ecological State (PES)

7.1.2.1. Unchannelled Valley Bottom (HGM 1)

The overall PES score for the Unchannelled Valley Bottom wetland was a **Category E (Seriously Modified)** as shown in **Table 6**. The following was assessed and described below:

Hydrology

The hydrological component of the HGM unit was categorised as a **Category F (Critically Modified)** as a result of the increased dam size with regards to the relatively small catchment of 340ha and the high level of abstraction that has been proposed in the hydrological assessment (Krugel, 2016). The hydrological assessment has not discussed any Environmental Water Releases, which will impact the downstream portions of these wetlands significantly. The wetland portions are also located at the top of the mountain and are the source of wetlands down the catchment.

Geomorphology

The geomorphology of the wetland was categorised as a **Category C (Moderately Modified)** as a result of the dam's construction, which has affected the actual size of the wetland.

Vegetation

The vegetation component of the wetland was categorised as a **Category D (Largely Modified)** as a result of the new dam volume increasing the surface area that will be inundated by water. This has resulted in the drowning of previously established wetland plant communities. The dam wall has also reduced the wetland vegetation area purely through its construction footprint. The area is being used for cattle grazing which has resulted in the reduction of the natural vegetation community.

Recommendations

The PES rating before dam construction was assumed to be a **Category C (Moderately Modified)**; this however cannot be verified as a wetland assessment was not conducted prior to construction. The PES rating after construction is a **Category E (Seriously Modified)**.

An EWR assessment is crucial to determine the feasibility of the dam wall and whether it will have a significant impact on the wetlands downstream.

Table 11: The PES results for the dam

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 1	17.4	F: Critically Modified	10.0	C: Moderately Modified	3.0	D: Largely Modified	5.9
Overall PES Score		6.8		Overall PES Class		E: Seriously Modified	

7.1.3. Ecosystem Services Assessment

The Ecosystem services provided for the HGM unit present at the site were assessed and rated as per **Table 7** using the WET-Eco Services method (Kotze, et al., 2009). The results for HGM 1 have been summarised in **Table 8** and have been illustrated with the spider diagram **(Refer to Figure 8)**.

The wetland that was identified provides an intermediate level of services to the environment and people.

HGM 1 was assessed to have a high benefit for flood attenuation. The wetland also has a moderately high ability to improve water quality by assimilating phosphates, nitrates and toxicants, as well as to control erosion.

Table 12: Eco Services rating using the WET Eco Service Method

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

Table 13: The Eco Service being provided by the HGM 1

Wetland Unit					HGM 1
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		1.6
			Streamflow regulation		2.7
			Water Quality enhancement benefits	Sediment trapping	1.9
				Phosphate assimilation	2.2
				Nitrate assimilation	2.8
				Toxicant assimilation	2.1
				Erosion control	2.1
			Carbon storage		2.0
	Direct Benefits	Biodiversity maintenance			1.8
		Provisioning benefits	Provisioning of water for human use		2.1
			Provisioning of harvestable resources		1.6
			Provisioning of cultivated foods		1.2
		Cultural benefits	Cultural heritage		0.0
			Tourism and recreation		1.1
			Education and research		1.3
Overall					26.4
Average					1.8

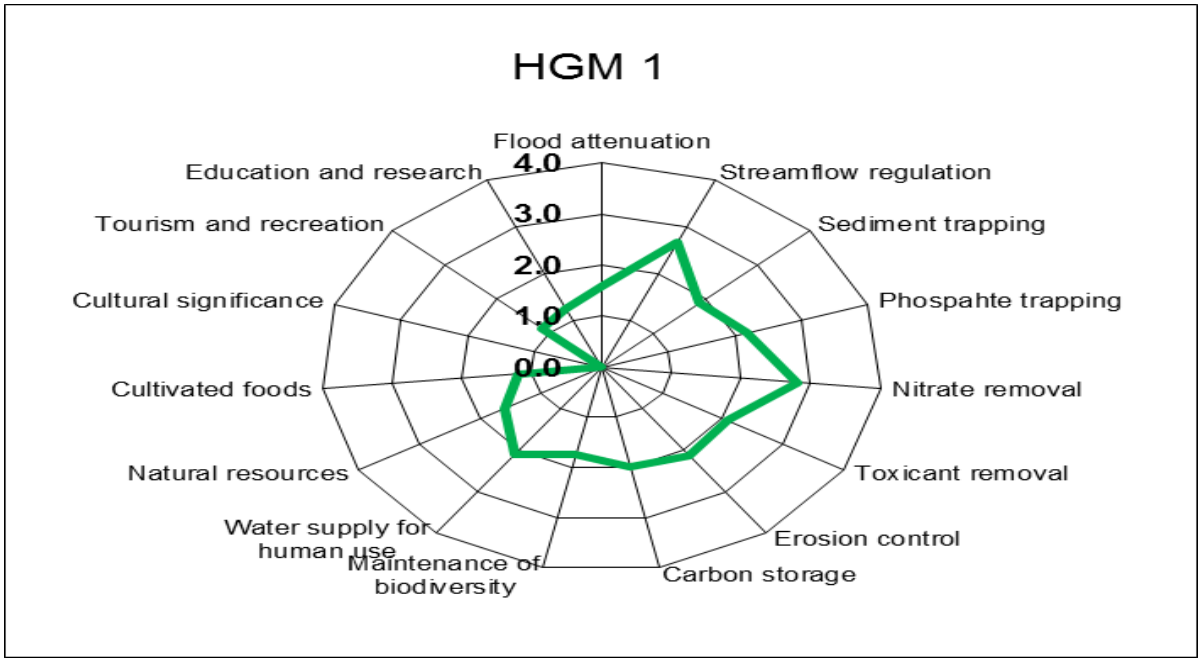


Figure 8: The spider diagram illustrating Ecosystem Services provided by the HGM 1

7.1.4. Ecological Importance and Sensitivity (EIS)

The EIS assessment was applied to the HGM units to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in **Table 9** below.

The ecological importance and sensitivity of HGM 1 was assessed to be **high** with regards to the Ecological Importance and Sensitivity as well as the Hydrological Functional Importance. These were rated high due to the location of the wetland being within FEPA wetland layers as well as the sensitivity of the Unchannelled Valley Bottom wetlands to the alteration of low flows (which will occur if the EWR is not implemented). The direct human benefit was rated to be moderately important.

Table 14: Ecological Importance and Sensitivity (EIS) results of the dam

WETLAND IMPORTANCE AND SENSITIVITY	
HGM 1	
	Importance
ECOLOGICAL IMPORTANCE & SENSITIVITY	**2.3**
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	**2.2**
DIRECT HUMAN BENEFITS	**1.2**

7.2. Risk Assessment

7.2.1. Methodology

The risk assessment was conducted in accordance with the Department of Water and Sanitation (DWS) risk-based water use authorisation approach and delegation guidelines. The matrix assesses impacts in terms of consequence and likelihood.

7.2.2. Findings of the Risk Assessment

It is important to note that the dam has already been constructed and the risks/impacts cannot be assessed accurately as the dam has not undergone its first filling - this will be included in the assessment by estimating the impacts of deep flooding of the unchannelled valley bottom wetland. The operational phase was estimated, and mitigation measures have been recommended to monitor and improve wetland functionality were possible.

Three aspects were addressed in the risk assessment:

- The initial infilling of the dam and its impacts on the alteration of the flow volumes and patterns as well as the loss of wetland from the extended inundation area;
- The infestation of alien vegetation post construction and how that would impact on the flow patterns and volumes of the wetlands; and
- The downstream releases and its impacts in the downstream wetland function and ecology.

The risk matrix shows that the initial flooding will have a high impact on the wetlands, with the remaining aspects having moderate impact. The mitigation measures are described in **Section 14** of this Report and address how the risks can be reduced, as well as measures to improve the PES rating of the wetlands affected.

Phase	Activity	Aspect	Impact	Flow Regime	Physical & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota		Severity	Spatial scale	Duration		Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection		Likelihood	Significance	Risk Rating
Construction	Construction of the Dam	Initial Flooding of Dam	Alteration of patterns of flows (increased /decreased flood peaks)	5	4	5	5		4.75	4	5		13.75	1	5	5	2		13	178.75	H
			Alteration of existing wetland area	5	5	5	5		5	4	5		14	1	5	5	2		13	182	H
Operational	Operation of completed dam	Infestation of alien vegetation post construction	Alteration to flow volumes	4	4	4	4		4	4	5		13	1	4	5	2		12	156	M
		Downstream Releases	Increase erosion potential and changes in downstream ecology	4	4	4	4		4	4	5		13	1	4	5	2		12	156	M

Figure 9: Risk Assessments as per DWS guidelines

7.3. Hydrology Assessment and Dam Safety Analysis

The Hydrology Assessment and Dam Safety Analysis was conducted by GFK Consulting Engineers for the dam on the farm Persberg for development appraisal and dam/water use licensing purposes. **(Refer to Appendix C2).**

GFK only became involved after the dam was compacted with tyres as "rip-rap".

The wall of the present dam is constructed on top of a dam wall that was constructed in the 1960's to provide water needed for road construction. A new cut-off trench was constructed and apparently all unsuitable material was removed from the existing wall and new footprint, for the present dam wall. This dam wall was approximately 4m high and apparently held water until just before construction when water was released from the dam for construction purposes. The previous spillway size was only a fraction of the present one and very little erosion took place downstream of the old spillway. This was still evident just after partial completion of the dam.

7.3.1. Dam Yield Analysis and Irrigation Area Optimization

The volume of the dam was calculated using data from a built survey that was done on the dam while the dam was still empty. The current full supply level of the dam is 1513.3m; hence the dam has a volume of 152 000m³.

There is no irrigation demand from the significantly smaller downstream dam and the catchment directly contributing to flow to the smaller downstream dam is significantly larger than for the upper dam. The runoff of this catchment would be more than adequate to provide the downstream dam with sufficient water to be always full, given the fact that there is no irrigation from the lower dam. In the future, should irrigation be done from the lower dam, the size of the dam will be a restricting factor and the fact that some of the run-off from the two catchments combined will be held back in the upper dam.

It is the opinion of the Engineer that the planting of 30-40 ha maize and 10 ha oats is an acceptable risk at the current volume.

The dam's full supply level (FSL) could be lowered to a level of approximately 1511.6 m in order to reduce the volume to maximum 50 000m³. The dam will then fall outside the requirement for categorization but a licence to use and store water will still be required. Should the dam be reduced to a volume of just less than 50 000m³ the maximum area to be irrigated would be in the order of 20 ha maize and 10 ha.

7.3.2. Flood Determination

The Persberg Dam catchment covers a total area of 3.5 km². The majority of the catchment is covered in grasslands and the proposed land to be cultivated as well as the light bush in the area was taken into account for the flood analysis.

7.3.4. Spillway Design, Present Capacity and Design Floods

The dam may be regarded as a small Category I dam (5 m to 12 m high walls). However, due to the downstream road it may be given a "significant'' hazard rating; hence the Category II floods were also determined. According to DWS the Recommended Design Flood (RDF) for a Category I dam shall be the 1:50 year flood with an additional dry freeboard and the Safety Evaluation Flood (SEF) shall be the 1:100-year flood with no dry free board. The RDF for a Category II dam shall be the 1:100-year flood and the SEF the 1:200-year flood.
The spillway design for the RDF should allow for a dry freeboard over and above the flood height through the spillway. A total dry freeboard of 0.5 m is required to accommodate the wave action.

Tyres are used as riprap on the upstream side of the wall **(Refer to Photo 3 and Photo 4)**. Bricks are further placed from the FSL to the crest, on top and into tyres.

Photograph 3: Tyres used as rip rap along the upstream side of the wall during construction

Photograph 4: Tyres used as rip rap along the upstream side of the dam wall after construction

The maximum present capacity was calculated using the current spillway dimensions with the total minimum freeboard available and being 1.5 m above the FSL. The maximum capacities of the present spillways are represented in **Table 15** below are as follows:

Table 15: Maximum capacity of present spillways

Spillway	Depth (m)	Length (m)	SEF (m^3/s)	RDF (m^3/s)
North	1.5	13.9	47	24
South	1.5	13.5	43	24
Total		27.4	90	48

It is clear that the present spillways meet the SEF requirements for both Category I and II dams.

The spillways have been levelled since the attached survey was done and grass has been planted to minimise erosion on the wing walls and the spillways. Proper stone rip rap should be improved on the wing walls. A concrete sill could further be constructed to level with the present ground level in the spillways to ensure local low points do not develop that could cause erosion. This sill has to be 100% level and cut sufficiently in to the embankments to prevent water bypassing the sill.

7.3.5. Dam Building Material Test Results

Troxler (nuclear density instrument) and DCP (Dynamic Cone Penetrometer) compaction tests were conducted at five locations on the completed dam wall. The results obtained concluded that the compaction over the first meter does not meet the general required compact of 95% of Maximum Proctor density. An average compaction of 86% was achieved with only one location exceeding the requirement at 98.3%. However, the compaction increases with an increase in the depth of the dam wall and is higher at the bottom. By extrapolating the DCP results with increased depths to the compaction achieved at the top, it can be estimated that the required compaction is met at approximately 2 m from the dam crest and exceeded towards the bottom where it counts the most.

The permeability was tested at a compacted density of 95% of Maximum Proctor density. The results indicated that the actual in-situ compaction measured is lower than 95% at the top of the dam wall, but most likely higher at the bottom where it counts most. Higher compacted materials may have a lower permeability due to excess voids removed. The permeability of the embankment may be higher at the top due to insufficient compaction. The foundation permeability is lower than that of the embankment making the foundation material suitable for construction of an earth wall on top.

7.3.6. Seepage Line and Slope Stability

The phreatic surface was determined using a permeability of 9.306 x 10-8 cm/sec for the natural ground and 1.083 x 10-5 cm/sec for the embankment. The analysis was done before a vertical filter was installed and indicated that the phreatic surface will appear on the downstream face at a height of approximately 2 m from the ground level, in the absence of a vertical filter or toe drain. It was noted that a filter consisting of granular material sandwiched between geotextile layers has since been cut into the downstream toe of the wall at a location on the

wall where the vertical height is 2 m from ground level. A 110mm drainage pipe was placed at the bottom of the filter to allow the water to drain.

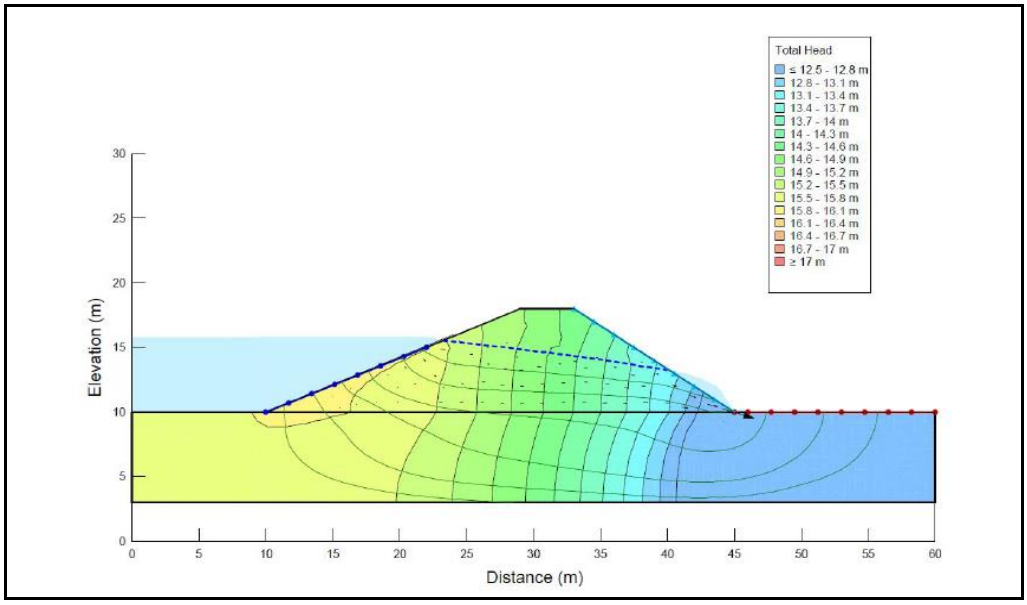


Figure 10: Phreatic surface and seepage through dam wall.

Using the above phreatic surface and slope stability of the dam was analysed to determine if it would be stable during operation

The slope stability was analysed at full supply level and the minimum factors of safety (FOS) were determined using the Slope Stability software.

The following average slopes measured were used:

- Upstream slope: 1:1.7
- Downstream slope: 1:2.4

Minimum Factors of Safety (FOS) were obtained and are reflected in **Table 16**:

Table 16: Minimum Factors of Safety

Place	With phreatic line	Ru value of 0.6	Rapid drawdown
Upstream	1.83	1.51	1.73
Downstream	2.15	1.82	2.15

Rapid drawdown simulation was done by maintaining the phreatic line but removing the water from the basin. A Ru value of 0.6 is conservative and is most likely the reason why the FOS result is lower than for rapid drawdown.

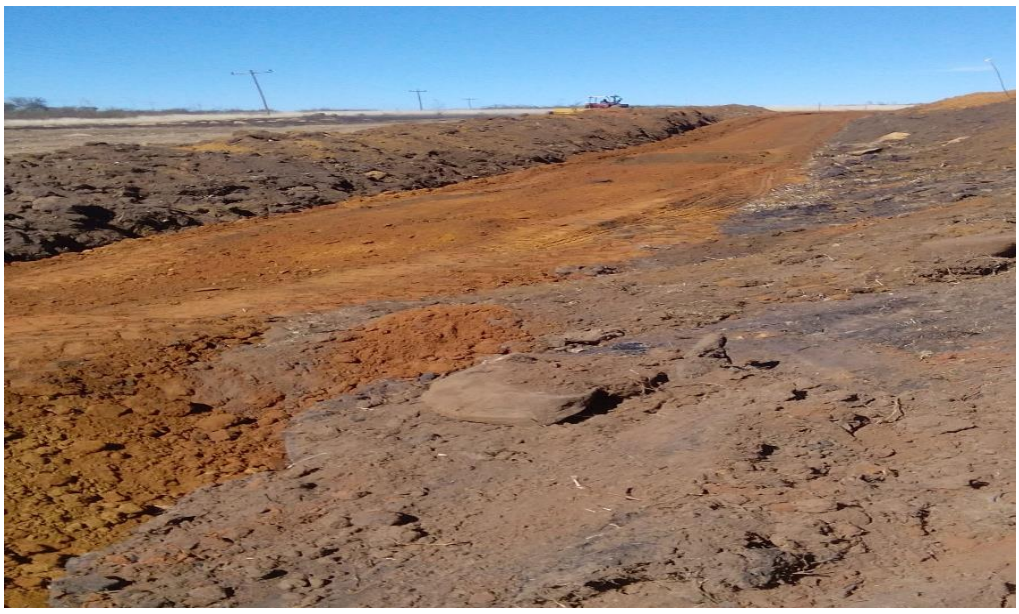
The downstream factor of safety should not be lower than 1.5. The lowest factor of safety calculated is 1.82 which is sufficient. Similarly, the minimum recommended upstream slope safety factor is 1.5. The lowest upstream calculated factor of safety is 1.51 which is sufficient.

7.3.7. Construction Background

A 1.5 m deep by 3 m wide cut-off trench was constructed and clay material was compacted in layers in the centre of the dam wall, just downstream of the remains of the old existing dam wall **(Refer to Photo 5 and Photo 6)**.

A 300 mm PVC pipe was also installed at the bottom of the dam during construction. This allows "normal stream" water to be released through the pipe instead of flowing over the spillways, thereby preventing erosion of the spillways **(Refer to Photo 7 and Photo 8)**.

Photograph 5: 1.5m deep and 3m wide cut of trench during construction of the dam wall.



Photograph 6: Dam cut of key.

Photograph 7: Outlet pipe during construction of the dam wall.

Photograph 8: Outlet pipe after construction of the dam wall.

Photograph 9: View downstream of the dam wall during construction.

Photograph 10: View downstream of the dam wall after construction

7.3.8. Dam Break Analysis

A dam break analysis was simulated to determine the effect that a possible dam break will have on the downstream road. Refer to **Table 17** for the Dam Break Results summary.

Table 17: Dam Break Results Summary.

Event	Flood	Effect on the downstream road
Dam break at Present FSL over 12 minutes.	Without flood (Sunny day dam break).	Flood water will flood the road by approximately 630mm deep.
Dam break at Present FSL over 18 minutes.	Without flood (Sunny day dam break).	Flood water will flood the road by approximately 540mm deep.
Dam break at FSL for 49 300m³ dam over 12 minutes.	Without flood (Sunny day dam break).	Flood water will flood the road by approximately 340mm deep.
Flood without dam break.	1:20.	The culvert size is sufficient to accommodate a 1:20 flood.
Flood without dam break.	1:50	Flood will cause the water to flow over the road with a depth of approximately 50mm.

The engineers are of the opinion that the break width, slopes and development time is conservative, however, these values were obtained from case studies by Froelich (1995).

The effect of the dam break as far as 7.8 km downstream was analysed. A large cliff is found approximately 6 km downstream of the dam. The flow conditions downstream of this cliff were analysed separately as there are no obstructions. A flow rate was determined just upstream of the cliff, which was then used to calculate the flow depth of the water in the river channel. A normal flow depth of 0.6 m was calculated, which indicates that the water would flow in the river channel and not cause any significant damage should the Persberg Farm Dam break.

7.4. PERSBERG FARM DAM NEAR HELPMEKAAR - RESERVE DETERMINATION FOR WATER USE LICENSE APPLICATION

GFK Consulting Engineers were appointed by Mr Erich Müller to undertake a Desktop Reserve Determination for the recently raised dam on the farm Persberg, for water use licencing purposes. GFK only become involved when the dam was already completed/raised **(Refer to Appendix C3).**

7.4.1. Environmental Water Requirements

The Desktop Environmental Status (ERC) for catchment V33B in which the dam is situated is “B”. An existing 300 mm diameter PVC outlet pipe is constructed in the dam wall. This outlet pipe has a capacity of approximately 85 litre/sec. This is more than enough capacity for the releases required, refer to Table 5: Average monthly environmental release requirements (l/h).

The storage capacity of the dam of 152 000m³ is only 0.62% of the total quaternary catchment run-off, thus there will be significant spills to satisfy the high flow requirement. The average monthly projected spills from the dam

are indicated in Table 18 below. It can be seen that the maximum average annual spill is as high as 13 l/h. This is higher that the required total IFR release of 5.4.1 l/s. It is therefore clear that no additional high flow water requirements need to be released from the dam other than what will automatically spill over the spillways (15 m wide on each side, thus 30 m wide in total).

A downstream measuring weir is required to check if the release requirements are met.

Table 18: Average monthly outflows from dam over spillway from WRSM 2000 (l/h)

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Average monthly spills (l/h)	9322	17197	32144	44198	48859	41466	16393	4179	1286	1286	2572	9161	19005

Table 19: Average monthly environmental release requirements (l/h)

Month		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Low flows (l/h)	Maintenance	3099	3914	5676	7013	7568	7176	5382	3556	2479	2153	2153	2642	4401
	Drought	783	946	718	1664	1794	1696	1305	913	652	587	587	685	1028
High flows (l/h)	Maintenance	2740	4338	4045	18854	8057	5448	1272	0	0	0	0	0	3730

According to the Mean Monthly Hydrograph (in the Engineering Report): **The average monthly spills over the spillway is significantly more than the required high flow environmental demand**.

7.4.2. Stock and Domestic Water Requirements

It is assumed that a conservative maximum of 15% of the quaternary catchment V33B will be affected downstream of the dam. This means that the downstream catchment area applicable will be 61 km².

The catchment area can be classified as Highveld Sourveld and Dohne type veld. For this veld type, the stock carrying capacity is estimated to be 5 ha/MSU maximum. Each mature stock unit (MSU) has a demand of 50 l/MSU/day. Taking into consideration the number of livestock and their daily demand, the proportional release requirement for the number of livestock is 146 l/h. This is conservative as there are some areas that are fenced off for dwellings and there are also large areas of thick bush, reducing the grazing area.

For human consumption, 35 households were counted in the applicable area it was assumed that each household has up to 7 people and a daily consumption of 60 l/capita/day was used. This equates to a release requirement of 35 l/h.

There are no known major pumped river water abstraction works up to the Buffalo River and no known other uses, therefore: **The water requirement for livestock + domestic use, other than environmental requirements, is 181l/h (refer Table 20).**

7.4.3. Total Reserve Requirement

The total reserve release requirements are indicated in Table 20 below. The environmental release is based on the total IFR release requirement which is 29.9% of the MAR (920 mm).

Table 20: Average monthly outflows from dam over spillway from WRSM 2000 (l/h)

Month	Environmental Maintenance (Litre/h)	Livestock (Litre/h)	Domestic (Litre/h)	Total flows (Litre/h)
Oct	3099	146	35	3280
Nov	3914	146	35	4095
Dec	5676	146	35	5857
Jan	7013	146	35	7194
Feb	7568	146	35	7749
Mar	7176	146	35	7357
Apr	5382	146	35	5563
May	3556	146	35	3737
Jun	2479	146	35	2660
Jul	2153	146	35	2334
Aug	2153	146	35	2334
Sep	2642	146	35	2823
Average	**4401**	**146**	**35**	**4582**

Table 21: Total release requirements with drought environmental low flow (l/h)

Month	Environmental Drought (Litre/h)	Livestock (Litre/h)	Domestic (Litre/h)	Total flows (Litre/h)
Oct	783	146	35	964
Nov	946	146	35	1127
Dec	718	146	35	899
Jan	1664	146	35	1845
Feb	1794	146	35	1975
Mar	1696	146	35	1877
Apr	1305	146	35	1486
May	913	146	35	1094
Jun	652	146	35	833
Jul	587	146	35	768
Aug	587	146	35	768
Sep	685	146	35	866
Average	**1028**	**146**	**35**	**1209**

Note that only a maximum of the total requirement, or the incoming flow, will have to be released to a maximum of the release requirement. In the event that the incoming flow is more than the total release requirement, only the release requirement will have to be released. It is therefore recommended to also install an upstream measuring weir.

8. Public Consultation Process

In accordance with the National Environmental Management Act (NEMA) (Act 107 of 1998) as amended, Public Participation is conducted as part of stakeholder involvement. The main aims of conducting public participation are *inter alia*;

- To give Interested and Affected Parties (I&APs) transparent and concise information regarding the proposed causeway and road re-alignment;
- To give governmental departments critical relevant information that will allow authorities to making informed decisions for a specific project; and
- To allowing for commenting by all I&APs and Stakeholders.

The following is an outline of the public consultation process undertaken to date as part of this Basic Assessment process:

- Background Information Documents were circulated to all stakeholders on the 6th of February 2018 **Refer to Appendix B2;**
- In accordance with the stipulations of the 2014 EIA regulations, and the National Water Act 36 of 1998 (Act 36 of 1998), site notices in English and IsiZulu were erected at various points along the Persberg Dam. This was done on the 7th of February 2018 **(Refer to Appendix B3);**
- Flyers were distributed to local community members within the vicinity of the proposed development on the 7th of February 2018 (**Refer to Appendix B4)**; and
- English and isiZulu newspaper advertisements were published in the Northern Natal Courier Newspaper on the 9th February 2018 **(Refer to Appendix B5);**
- The initial Draft Basic Assessment Report was available for commenting for a period of **30 days** (excluding public holidays) from Thursday, 8th February 2018 until Thursday, 08 March 2018. A second round of public participation began on the 28th February 2019, this allowed for an additional commenting period of 30 days (excluding public holidays) which ended on the 28th March 2019 to the following Key Stakeholders, Government Departments and registered Interested and Affected Parties:
    - Department of Economic Development, Tourism and Environmental Affairs
    - Ezemvelo KZN Wildlife
    - AMAFA KwaZulu-Natal
    - Department of Water and Sanitation
    - Department of Agriculture, Forestry & Fisheries
    - Department of Transport
    - Umzinyathi District Municipality – Municipal Manager.
    - Msinga Local Municipality

Sibongile Public Library and the Dundee Public Library to be accessed by the public and other I&AP's

8.1. Identification of Interested and Affected Parties

Afzelia has developed an initial I&AP's database consisting of key I&AP's and authorities. This database is maintained throughout the public participation process. **Table 13** below lists the I&AP's identified.

Table 22: I&AP database compiled for this project.

Name	Organisation
Mr Gerald Willis-Smith	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs – Dundee Offices.
Mr S.B. Ndabandaba – Municipal Manager	Umzinyathi District Municipality – Municipal Manager.
Mr FB Sithole	Msinga Local Municipality – Municipal Manager
Mr Jeffrey Maivha	Department of Agriculture, Forestry and Fisheries
Ms Bernadet Pawandiwa	AMAFA KwaZulu - Natal
Mr Dominic Weiners	Ezemvelo KZN Wildlife
Ms Zama Hadebe	Department of Water and Sanitation
Mrs Michelle Smidt	Department of Transport
Ms Sithembile Mzobe	Librarian
Mr Mike Gardner	Neighbour

8.2. Issues raised by the interested and affected parties (I&APs)

NO.	COMMENT	NAME	METHOD & DATE	RESPONSE
1	This dam is to the benefit of the area. Ground water levels in the surrounding area have improved. Agricultural potential can be improved on the adjoining lands to the benefit of food provision and food security. This area does not have other surface water; thus, this dam provides valuable water for livestock, thus benefitting livestock production	Org Burger – Neighbouring farmers on farm Giba, Helpmekaar area.	Email received on the 13 February 2018	Thank you for your comment on the DBAR. Afzelia acknowledges your comment
2	The above-mentioned dam was an improvement of an existing dam that was built many years ago by the Roads Department. The new dam was planned and built to specific specifications and is an asset for the district. The water will be used for irrigation of crops (food for humans and livestock). In the process of making new dams invader wattles jungles were cleaned up. More of these jungles will be cleaned and save water, it will stop seeding of wattles downstream. I think that land owners should be encouraged to build well planned and well-constructed dams on	Frans J Joubert – Ou Transvaal Bees Boerdery Helpmekaar District. Simba Breeders	Email received on the 5 March 2018	Thank you for your comment on the DBAR. Afzelia acknowledges your comment

	their property where possible. This will stop excess run off water to be wasted. Water in dams feeds the underground water sources and therefore feeds springs and streams in a wide area. This area is dependent on springs and streams for water that is utilized by humans and animals.			
	People that build well planned dams should be commended; they should actually be financially supported because it benefits the whole surrounding area. The dams and construction should be monitored. In this case, I know the land owner, the designer and the building contractor well and they are well experienced. The technical data e.g. catchment area, overflow, was taken into consideration and should not have a bigger thread than the old, smaller dam that was accepted. To the people involved Mr Muller, Collier and Strydom – well done. This is a small step to solve the water shortage in our country, help with food security and creating jobs.			
3	The original dam was built round about 1960 and was quite small. Over time sludge started to fill it up and Wattle trees were overgrowing the dam so that it could not hold water for livestock, wild animals or human consumption.	HJH Strydom – Boerdery En Kontrakteur	Email received on the 28 February 2018	Thank you for the attached letter. Your comments from the Letter will be noted in the Comments and Response Report for the FBAR.

	Due to this, Persberg farm had no water and could consequently not be used for farming purposes. In 2015, the owner, Mr E.K.H. Muller, contracted me to lift the wall of the dam.			
	I, Mr H.J.H. Strydom, am a contractor who have wide experience in the building of dams, dam walls and the inlet and the overflow of dams. A core was dug which complied with requirements, and it was filled with clay soil, which was then well compacted. The compacting was done with tractors and dam scoops and it is a well-known fact that tractors do the best form of compacting soil dam walls, because they drive on and across the wall as it is built and, in that way, excellent compacting is done. Compacting studies were performed and the test performed with a probe to test the density could not even penetrate the surface of the dam wall. Thereafter the building work was approved.			
	<u>Inlet catchment area</u> The catchment area of the dam is more or less 300 hectares. There is no donga above the dam, which is indicative of the fact that rain water slowly flows into the dam through the dense grass above the dam. If water had streamed into the dam at a fast pace there would have been disturbance in the grass and a donga would have been present.			

	Overflow Two overflows have been built, one on either side of the dam, which will definitely allow for more water to flow out than the volume of water that enters the inlet from a 300 hectares catchment area. Furthermore, a dam wall built with soil does not break in the manner that a concrete dam wall will break. Concrete bursts when it breaks, and water forcefully spurts out at once. If a hole would form in a dam wall made with soil, the water would seep through gradually. After years of experience in the building of dams and dam walls, I can state with assurance that there is no danger of the Persberg Dam breaking and subsequently damaging the nearby national tar road or causing harm to humans or animals.			
	Benefits of the dam The construction of the dam provided many job opportunities. Before the dam was built the wetland areas upstream and downstream were very dry and almost non-existent. Presently there is a wetland area both upstream and downstream and the eco system has been improved and is healthy and lively. Wild animals are attracted, and they, together with cattle drink water at the dam. There is also a big variety of water birds and fish that lives in and on			

	the water. In addition to this the dam water can be used for irrigation of crops, which ensures food security. The increase in the water availability resulted in more farming activities for which more farm workers from the local community are used. It is clear that the dam adds immense value to the environment in many ways.			
	Downstream The seepage water of this dam flows down the Isibindi Valley into the Isibindi Spruit. Before the Persberg Dam was enlarged and the dam wall was made higher, many local people who live next to this spruit did not have water for their cattle or for household purposes, especially during droughts. After the dam has been enlarged there is sustainable water supply for both humans and animals: these households use the seepage water for washing, cooking and drinking water for their cattle and there is not a single person who complains about the dam – in fact, they are very glad to have a consistent supply of water for all their needs.			
	The owner, Mr E.K.H. Muller, is a person that contributes hugely towards the people in our community: he provides jobs to local people in the plantations, with cattle farming and with crops. Mr			

	Muller also organises the plant project for the community at Pomeroy, Tugela Ferry, Nqutu and many more.			
4	Comments are based on the Guideline for the 2017 Environmental Impact Assessment Regulations promulgated in accordance with the National Environmental Management Act of 107 of 1998 (NEMA Act No. 107 of 1998) as amended. The Umzinyathi District Municipality does not object to the project and hence supports the call by the KZN Department of Economic Development, Tourism and Environmental Affairs to charge the Applicant with Section 24G of NEMA for non-compliance with Section 25 of NEMA. The rectification process for the commencement of the listed activities within a watercourse on Persberg Farm (Portion Linde No 4733) in August 2015 is much appreciated. Please note that on page 46 of the Basic Assessment Report, Table 14: I&AP database, the name of the Umzinyathi District Municipality District – Municipal Manager has changed to Mr S.B. Ndabandaba.	Mr S.B. Ndabandaba – Municipal Manager Umzinyathi District Municipality	Email received on the 08 March 2018	Dear Sir/Madam, Thank you for the attached comments. The comments will be added into the comments and response report for the Final Basic Assessment Report.

NO.	COMMENT	NAME	METHOD & DATE	RESPONSE
5	1) Pg 8: Listing Notice 1: Activity 50 This activity must be excluded as it refers to the expansion of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, where the combined capacity will be increased by 50 000 cubic metres or more. 2) Pg 11: Hydrology and Dam Safety Report The report states that the existing dam wall is 8,5m high, the maximum depth is 4m and it holds approximately 152 000m³ of water. On Pg 8 it is stated that the existing dam wall is 6.3m high and it holds approximately 130 000m³ of water. The correct information must be included in the Final BAR. 3) Pg 24: Appendix C2: Wetland Functionality Assessment and Rehabilitation Plan. The report states that it is crucial to conduct and Environmental Water Requirement (EWR)) assessment to determine if the dam is fatally flawed.	Mr Gerald Willis Smith - KZN Department of Economic Development, Tourism and Environmental Affairs	15 March 2018	Hi Gerald, Thank you for the attached comments on the Existing Persberg Dam Wall. The comments will be incorporated and addressed into the FBAR.

	When will the EWR assessment be conducted? 4) Appendix D: Draft Operational Environmental Management Programme (draft OEMPr) The Compliance Monitoring and Enforcement component of this office will forward comments after reviewing the draft OEMPr.			

Comments received during the Draft Basic Assessment Report Phase - 28th February 2019 to 28th March 2019				
No.	**COMMENT**	**NAME**	**METHOD & DATE**	**RESPONSE**
1	With Reference to the document received on the 07/03/2019 and desktop analysis conducted using Google Earth Imagery. The area in question consists of grassland with no indigenous or protected trees in terms of sections 7 and 15 of the National Forests Act No. 84 of 1998 which was affected by the construction of the dam wall. Therefore, the Department does not have any further comments on this project. This letter does not exempt you from considering other environmental legislations. Should any further information be required, please do not hesitate to contact this office.	Ms. N. Zikhali – Department of Agriculture, Forestry and Fisheries	Letter was received via email on the 12 March 2019	Response provided on the 28 March 2019 Good Day, Thank you for your comments on the Persberg Dam Wall.

No.	COMMENT	NAME	METHOD & DATE	RESPONSE
2	I Nonhlanhla Nguse; Waste and Environment Manager at Msinga Local Municipality would like to support the reconstruction of Pernsberg Dam on Pernsberg Farm. However, we request that all relevant environment legislation is fully enforced and ensure compliance during the construction and operation. Mitigation measures must be fully implemented to minimise impact and also ensure water is not polluted either during construction or operation.	Ms Nonhlanhla Nguse – Waste and Environment Manager at Msinga Local Municipality	Letter was received via email on the 27 March 2019	Response provided on the 27 March 2019 Good Morning Thabile, Thank you for your comment on the DBAR for the Persberg Dam Wall. Your comments will be note in the FBAR.
3	Good Day Eric, The 30 day commenting period has come to an end today for the DBAR for the Persberg Dam Wall, please can you assist us and see if any comments have been left by the Public at the Dundee Library.	Mr Eric Muller - Applicant	Email was sent to the Applicant on the 28 March 2019	Response provided on the 28 March 2019 Hi Deshni At Spongile library and dundee Endumeni library, boundary road, no comments were left, at the two libraries

No.	COMMENT	NAME	METHOD & DATE	RESPONSE
4		Ms Samukelisiwe Mchunu - KZN Department of Economic Development, Tourism and Environmental Affairs	Letter was received via emailed on the 28 March 2019	Response provided on the 28 March 2019 Good Day Samukelisiwe, Thank you for the attached comments on the DBAR, the correct height of the dam wall has been highlighted in a different colour in the FBAR that will be submitted to the Department.
4.1	Detailed information on how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks and instruments. [Please refer to 3. (1) (e)(ii) of Appendix 1 (Basic Assessment Process) of the EIA Regulations, 2014].			Please refer to Section 3.3 – Applicable Legislation, Policies and Guidelines of the FBAR that has relevance to the Existing Persberg Dam Wall which has been captured in Table 9.
4.2	The correct surface area of the dam. On page 6 of the application form and pages 4 & 36 of the DBAR it is stated that the dam covers 8.4 hectares, whereas page 10 of the application form states that the dam covers 8.5 hectares. If the information on the application form is incorrect, the applicable page of the application form must be amended and submitted to the Dundee office.			Please see refer to Appendix A 3 – Application form for Environmental Authorisation, (page 10 of 13) with the correct area of hectares that the dam will cover.

4.3	The correct height of the dam wall. On page 6 of the application form and page 4 of the DBAR it is stated that the dam wall is now 8.5 m in height, whereas on page 36 of the DBAR, it is stated that the height of the dam wall is 6.3 m. If the information on the application form is incorrect, the applicable page of the application form must be amended and submitted to the Dundee office.			Please refer to page 36 of the FBAR with the correct height of the dam that has been highlighted.
4.4	The Compliance Monitoring and Enforcement component of this office will forward comments after reviewing the draft OEMPr.			

8.3. Public Meeting

No public meeting has been conducted for the proposed raising of the dam wall and one is not planned unless specifically called for. However, should there be a need, focus group meetings and a meeting with officials will be arranged at the dam site.

8.4. Distribution of Draft Basic Assessment Report

The Draft Basic Assessment Report (dBAR) will be available for public comments for 30 days at the following locations:

Draft Report:	Draft Basic Assessment Report	Venue
1st Draft Report	Draft Basic Assessment Report (dBAR) was available from 8th February 2018 until 8th March 2018	Sibongile Public Library (Located in Mbatha Street, Sibongile, Dundee)
2nd Draft Report	Draft Basic Assessment Report (dBAR) was available from 15th February 2018 until 15th March 2018	Sibongile Public Library (Located in Mbatha Street, Sibongile, Dundee) and Dundee Public Library (Boundary Road, Dundee (next to Indumeni Municipality Building)

Electronic Copy:
www.afzelia.co.za
info@afzelia.co.za (on request)

Any comments received regarding the Draft Basic Assessment Report will be incorporated into the Final Basic Assessment Report.

9. Impact Assessment

Significance scoring assesses and predicts the significance of environmental impacts through the evaluation of the following factors:

- probability of the impact,
- duration of the impacts,
- extent of the impact, and
- the magnitude of the impact.

The significance of the environmental impacts is then assessed considering any proposed mitigations. The significance of the impact ''without mitigation'' is the prime determinant of the nature and degree of mitigation required. Each of the above impact factors have been used to assess each potential; impact using ranking scales.

Unknown parameters are given the highest score (5), as significance scoring follows the Precautionary Principle. The Precautionary Principle is based on the following statement: when the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.

This section provides an indication of potential positive and negative environmental impacts associated with the proposed development.

9.1. Methodology used for the Risk Assessment

Table 23: Risk Assessment

Formula for Significance Scoring SS = (Magnitude + Duration + Scale) x Probability			
Duration		**Magnitude**	
Permanent	5	Very High / Don't Know	10
Long Term (Ceases with operation life)	4	High	8
Medium Term (5-15 years)	3	Moderate	6
Short Term (0-5 years)	2	Low	4
Immediate	1	Minor	2
Scale / Extent		**Probability**	
International	5	Definite	5
National	4	Highly Probable	4
Regional	3	Probable	3
Local Area	2	Improbable	2
Site Only	1	Very Improbable	1

Significance Scoring Calculation Significance Scoring (SS) = (Magnitude + Duration + Scale) x Probability

Table 24: Significance Scoring (Negative Impact Results)

Low significance (<30 significance points)	Low environmental significance	Impacts with little effect and which should not have an influence on or require modification of the project design.
Medium significance (31-59 significance points	Moderate environmental significance	An impact which is sufficiently important to require management, and which could have an influence on the decision unless mitigated.
High significance (>60 significance points)	High environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.

Table 25: Significance Scoring (Positive Impact Results)

Low significance (<30 significance points)	Low environmental significance	Impacts with little positive effect and which should not have an influence on or require modification of the project design.
Medium significance (31-59 significance points	Moderate environmental significance	A positive impact or benefit which is sufficiently important, and which could have an influence on the decision taking into consideration set mitigation measures.
High significance (>60 significance points)	High environmental significance	A positive impact which could influence the decision in a positive way about whether to proceed with the project regardless.

Impact scores given "with mitigation" are based on the assumption that the mitigation measures recommended in this assessment are implemented correctly and at all times and that rehabilitation of the site is fully and correctly undertaken. Failure to implement mitigation measures during construction and rehabilitation will keep the impacts at an unacceptably high level.

9.2. Impacts that may arise from the Construction and Operational Phase

9.2.1. Construction Related Impacts

The Construction Related Impacts could not be assessed as the Dam wall is already built.

9.2.2 Operational Related Impacts

A number of operational impacts on the dam and wetland system downstream of the dam are associated with an increase in the flooded area of the dam. This includes changes in the hydrological flow through wetlands, sedimentation and therefore erosion of the downstream channel and into wetland systems downstream of the dam.

9.2.2.1. Sedimentation, erosion and disturbance

Downstream impacts that are associated with sediment influx due to exposure of soil during the raising of the dam wall increases the possibility of its deposition within the dam area. This sedimentation of the dam would have resulted in an increase of the turbidity of the water flowing out of the dam into the wetland system. Sedimentation of wetlands is destructive to many faunal species, affecting their habitat, breeding and feeding cycles. Furthermore, it changes the geomorphological function of the channel and wetland, increasing the risk of erosion in the longer term.

Operational Phase

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
Degradation of Wetland Areas	5	5	2	8	75 High	4	5	1	6	48 Moderate

Mitigation Options

- Frequent monitoring of the dam wall must be carried out to prevent its collapse and subsequent washing out of dam material.
- Frequent monitoring of the raised dam must be carried out as per an operational environmental management programme to ensure that any minor problems with erosion can be timeously fixed.

9.2.2.2. Pollution of water resources and soil

The dam is linked to a downstream wetland system. An increase in pollutants will lead to changes in the water quality of the wetland (and subsequent deterioration of the ecological integrity and functionality that is associated with the wetland) and furthermore, this will affect its ability to act as an ecological corridor in the larger landscape.

Operational Phase

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
Pollution of water resources and soil	5	5	2	8	75 High	4	5	1	6	48 Moderate

Mitigation Options

- Agricultural activities around the dam structure should be restricted to ensure that the deposition of fertiliser into the dam does not take place; as such, a buffer of at least 30 metres should be implemented.

9.2.2.3. Bank destabilisation

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
• Bank destabilisation	5	2	2	10	70 High	3	5	1	4	30

Mitigation Options

- Frequent monitoring of the integrity of the dam wall must be ensured to prevent its collapse. Monitoring should be carried out as often as required.

9.2.2.4. Change in Hydrological Flow

The change in the hydrological flow of the dam size will have a negative impact on the downstream wetland and its functionality. This includes the timing, water quality and chemical composition of the water flowing into the wetland.

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
• Change in Hydrological Flow	5	5	2	10	85 High	3	5	2	10	51 Moderate

Mitigation Options

- Regular compensatory flows should be provided downstream so as to meet minimum demand required by aquatic biota located downstream;
- A flow meter should be installed within the flow release mechanism to monitor the flow release from the dam; and
- Removal of aquatic weeds along the footprint of the dam should be carried out to prevent the proliferation of stream flow reducing vegetation.

9.2.2.5. Sedimentation of wetland areas

An increase in the flooded area of the dam will hold back a greater quantity of sediments that would naturally replenish downstream ecosystems, including the wetlands associated with the dam. When a channel is deprived of its sediment load, it seeks to recapture it by eroding the downstream channel bed and banks. Channel beds downstream of dams are therefore typically eroded and this damage can extend for kilometres outside of the dam area.

Further to this, channel bed deepening (or incising) will also lower the groundwater table along the channel and within the associated wetland. This decreases the accessibility of plant roots, affecting the biodiversity within the wetland area downstream as well as altering habitat for fish or invertebrates which spawn in the channel.

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
• Sedimentation of wetland areas	5	5	2	10	85 High	3	5	2	10	51 Moderate

Mitigation Options

- Measures such as sediment traps must be implemented to slow run-off and capture material;
- Establish and maintain a buffer of natural vegetation around wetlands. Buffer zones slow run-off and also act as filters to protect the wetland from sediments and other contaminants;
- Reduce the proposed irrigation usage to allow the wetland to sustain some function upstream and downstream; and
- Fence off the wetland to prevent cattle from grazing within the wetland.

9.2.2.6. Infestation of alien vegetation post construction

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
• Infestation of alien vegetation post construction	5	5	2	10	85 High	3	5	2	10	51 Moderate

Mitigation Options

- It is critical that an alien vegetation eradication programme is implemented;
- During the operational phase vehicles must remain on designated roads and must not drive in the wetland areas or the edge of the dam as new wetland zones / footprints would have established there.

9.2.2.7. Downstream Releases

Impact	Without mitigation					With mitigation				
	Probability	Duration	Extent	Magnitude	Rating	Probability	Duration	Extent	Magnitude	Rating
• Downstream Releases	5	5	2	10	85 High	3	5	2	10	51 Moderate

Mitigation Options

- During the operational phase vehicles must remain on designated roads and must not drive in the wetland areas or the edge of the dam as new wetland zones / footprints would have been established there;
- Reduce the proposed irrigation usage to allow the wetland to sustain some function upstream;

- Access to the wetland must be closely controlled and monitored; and
- Ensure no erosion occurs at the dam inlet and outlet points.

10. ENVIRONMENTAL IMPACT STATEMENT

As a result of a non-compliance with Section 25 of NEMA, a rectification process is required for activities which have already taken place. A Section 24G Application was therefore submitted to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs – Northern Region by the Applicant in February 2016 to commence this rectification process. In terms of the directive, a rectification process i.e. A Basic Assessment Process is required to be undertaken.

The original dam was built by the Road Department (NPA) in 1960. The NPA had excavated a quarry to build the tar road and in exchange the NPA built a dam for the farmer. The original dam covered an area of 1.2 hectares with a dam wall height of 3.5 m. The capacity of the original dam was measured to be between 25 000 to 32 500 cubic metres of water.

The dam was raised to increase the water holding capacity of the existing dam for planned irrigation purposes. The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

The water from the original dam was emptied by the Applicant and a core trench was dug to a depth of 5 meters by machinery, the core was dug down to the bottom soil which formed the natural soil structure in the centre area of the old existing dam. This reconstruction of filling the 'core' of the dam was done by moving suitable clay type soil in the vicinity of the dam wall, and as every layer of clay soil was moved by dam scoops and soil was compacted for constructing the base core of the dam. The top soil that was saved was later moved over the top of the dam wall and compacted and kikuyu and grass was planted as an erosion control measure.

The dam has been raised to a height of 8.5 m and covers an area of 8.4 hectares and is estimated to hold a capacity of 152 000 m³ (cubic meters) of water when full.

The raised dam will allow the adjacent farmers to access water from the dam for irrigation purposes. It is therefore imperative that the raised dam will increase surety of irrigation water supply and increase the existing irrigation of the area.

The following environmental specialist studies were conducted for the proposed project:

- Wetland Functionality Assessment and Rehabilitation Plans;
- Hydrology and Dam Safety Report; and
- Reserve Determination for Water Use License Application.

The wetland assessment had identified an unchannelled valley bottom wetland system with a Category C (Moderately Modified) state. This can only be assumed, as the wetland assessment was only conducted post-construction of the dam wall. The PES rating after construction was classified as a Category E (Seriously Modified).

The HGM1 was assessed to have a high benefit for flood attenuation. The wetland also has a moderately high ability to improve water quality by assimilating phosphates, nitrates and toxicants as well as to control erosion.

The ecological importance and sensitivity of the HGM1 was assessed to be High (B) with regards to the Ecological Importance and Sensitivity as well as the Hydrological Functional Importance. These rates were high

due to the location of the wetland within FEPA wetland layers, as well as the sensitivity of Unchannelled Valley Bottom wetlands to alteration of low flows (which will occur if the Environmental Water Requirements (EWR) is not implemented). The direct human benefit was rated to be moderately important (C).

Three aspects were addressed in the risk assessment:

- The initial filling of the dam and its impacts on the alteration of flow volumes and patterns, as well as the loss of wetland from the extended inundation area;
- The infestation of alien vegetation post construction and how that would impact on the flow patterns and volumes of the wetlands; and
- The downstream releases and its impacts on the downstream wetland function and ecology.

The risk matrix shows that the initial flooding will have a high impact on the wetlands at the point of inundation, with the remaining aspects having a moderate impact.

The Hydrology Assessment and Safety Analysis indicates that the present spillway capacity is just short of adequate for a Category I dam. The eventual dam size will depend on the safety categorization that will be done by Department of Water and Sanitation (DWS). As an interim measure, it is proposed that the spillway be cut wider, each one at least 15m wide (or combined 30m, as it is 27.4m presently).

Soil compact tests indicated that the compact on top is less than what is generally prescribed for earth dams. However, Dynamic Core Penetrometer (DCP) tests have indicated an increase of compaction with depth and it is estimated that the general required compaction has been achieved from approximately 2m deep from the crest and deeper, where it is most important.

A slope stability analysis indicated that both the upstream and downstream slopes are safe, as the safety factors are above the required minimum safety requirements.

A dam break analysis was conducted and indicates that “Sunny day’’ dam break with a full breach developing in 12 minutes will result in flood water overtopping the downstream road by approximately 630mm. Should the full supply level be dropped to just less than 50 000m³ a “sunny day” dam break will cause the resultant flood to flow over the road with a depth of approximately 340 mm. The engineers are of the opinion that reducing the capacity of the dam will not result in a significantly decreased safety risk. Lowering the full supply level is therefore not recommended as it will also result in a significant loss for the client.

A 300 mm PVC pipe was installed at the bottom of the dam wall to allow for any possible environmental release, or constant surplus water to be released instead of flowing over the spillway constantly.

According to the Desktop Reserve Determination Report, the dam will have a positive impact on at least the drought low flow environmental water requirement as water is only flowing into the dam at irregular intervals. With the dam in place, there will be a constant stream from normal leak water intercepted by a toe drain for embankment safety, regardless of inflow into the dam, unless the dam is obviously pumped dry frequently, which is unlikely as the outlet pipe is not installed at the lowest point of the dam. In other words, there will be unusable storage capacity in the dam, which will at least provide leak water, basically at all times. Additional to the normal leak water, controlled environmental releases through the outlet valve, will improve the situation even more during dry periods. At the worst, the dam will not negatively impact on the downstream water requirement, providing the required water is released, either through leak water or a combination of leak water and releases through the outlet valve. As the required amount to be released is insignificant related to what will be required for

planned future irrigation, depending on receipt of a Water Use Licence, it will be more than viable to release the required downstream demand. A 300 mm PVC pipe that is installed at the bottom of the embankment, is more than adequately sized to release the require downstream maintenance Environmental Water Requirement, as well as downstream domestic and livestock requirement, for the affected area.

The mean monthly spills from the dam through the spillway will automatically release more than the required high flow Environmental Water Requirements, with no additional releases required by opening the outlet valve, else than for maintenance flow as required.

However, it is recommended that a measuring weir is constructed downstream of the dam, to measure the required maintenance flow to be released which will also measure the leak water. The total maintenance flow required is the total flow from leak water and water released by opening of the outlet valve, combined. Thus, the release amount required from the dam is the additional amount required, if any, over and above the leak water, to satisfy the total maintenance release required. The high flow requirement will automatically be met by spills over the spillways, as the dam volume only comprise a small fraction of the total catchment run-off. Regardless whether there is very seldom visible normal flow in the natural drain into the dam, it is still recommended to construct an upstream measuring weir to measure the flow during such seldom normal flow conditions. Only a maximum of the incoming flow needs to be released to satisfy the downstream requirement

11. RECOMMENDATIONS

The EAP is of the opinion that the already built dam be authorised by the Department of Economic Development, Tourism and Environmental Affairs. The EAP further recommends that the following recommendations be taken into consideration:

- Frequent monitoring of the dam wall must be carried out to prevent its subsequent washing out of dam material;
- Frequent monitoring of the raised dam must be carried out as per an operational environmental management programme to ensure that any minor problems with erosion can be timeously fixed;
- Agricultural activities around the dam structure should be restricted to ensure that the deposition of fertiliser into the dam does not take place; as such, a buffer of at least 30 metres should be implemented;
- Regular compensatory flows should be provided downstream so as to meet minimum demand required by aquatic biota located downstream;
- A flow meter should be installed within the flow release mechanism to monitor the flow release from the dam;
- Removal of aquatic weeds along the footprint of the dam should be carried out to prevent the proliferation of stream flow reducing vegetation;
- Measures such as sediment traps must be implemented to slow run-off and capture material,
- Sediment must be removed periodically to ensure that sediment traps remain functional,
- Ensure that erosion control measures or monitoring are in placed so that no erosion occurs at the dam inlet and outlet points;
- Establish and maintain a buffer of natural vegetation around wetlands. Buffer zones slow run-off and also act as filters to protect the wetland from sediments and other contaminants;

- Reduce the proposed irrigation usage to allow the wetland to sustain some function upstream and downstream;
- Fence off the wetland to prevent cattle from grazing within the wetland;
- Disturbed areas must be rehabilitated by using indigenous hydrophytic plant species. To carry out the above, a site investigation must be conducted by the Wetland Specialist during the wetter months
- Stone rip rap must be improved on the wing walls. A concrete sill should further be constructed to be of level with the present ground level in the spillways to ensure that local flow points do not develop and result in erosion. This sill has to be 100% level and cut sufficiently into the embankments to prevent water from bypassing the sill;
- Rehabilitation activities must take place within the existing dam servitude and property boundaries to improve the operational status of the dam and its linkage to biodiversity in the area;
- An operations and maintenance plan is recommended, as this will outline the operating procedures necessary to keep the dam compliant and to identify any warning signs, such as cracking, wall movement and leakage that may indicate problems. To ensure this, a comprehensive dam safety inspection must be undertaken by a qualified engineer every five (5) years;
- During the operational phase vehicles must remain on designated roads and must not drive in the wetland areas or the edge of the dam as new wetland zones / footprints would have established there.

APPENDIX A

Appendix A 1 – EAP's Declaration

Appendix A 2 – EAP's Curriculum Vitae

Appendix A 3 – Application Form for Environmental Authorisation

APPENDIX B

Appendix B 1 – Background Information Document

Appendix B 2 – Proof of Distribution of BIDs to Respective I&Ps

Appendix B 3 – Proof of Placing of Site Notices

Appendix B 4 - Distribution of Flyers

Appendix B 5 – Newspaper Advertisements

Appendix B 6 – I&AP Database

Appendix B 7– Comment from Stakeholders and I&APs

APPENDIX C

Appendix C 1 – Wetland Functionality Assessment and Rehabilitation Plans

Appendix C 2 – Hydrology and Dam Safety Report

Appendix C 3 – Reserve Determination for Water Use License Application

APPENDIX D

Final Environmental Management Programme

APPENDIX E

Other Information