



## TAYLOR ENVIRONMENTAL cc



### **Ecological Sensitivity Analysis and Aquatic Assessment for the proposed poultry abattoir at Funda Mlimi Farms, Mpumalanga.**

Prepared by:

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***Declaration of Independence***

I, Dr LR Taylor, hereby declare that,

(1) I, and Ms SJ Taylor, act as independent investigators and do not have an interest in the development for which this work has been undertaken, other than for financial compensation for work completed on the project in the capacity as investigators.

(2) We do not object to or endorse the development, and will present facts and recommendations based on sound scientific data and professional experience.

***Limitations of this Investigation***

The report is based on an investigation within the areas encompassed by Options 1, 2 and 3, for the abattoir, and does not include any long-term consideration of the biophysical attributes. Should additional information come to light subsequent to this report, such information may not be reflected in this report and hence Taylor Environmental reserves the right to amend the report, recommendations or conclusions at any stage of the project should such information become available.

***Acknowledgements***

Ms SJ Taylor is thanked for assisting in the avian survey, as well as other aspects of the project.

***Report prepared for***

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## **Executive Summary**

*The client, represented in terms of the EIA by Aurecon SA (Pty) Ltd, wishes to construct a poultry abattoir at Funda Mlimi Farms (25°25.749'S and 28°51.952'E), Mpumalanga, with a capacity in the first phase of 80 000 broilers.week<sup>-1</sup> to 160 000 broilers.week<sup>-1</sup> in the second phase. The three potential options for the poultry abattoir are situated in the north-eastern area of the property. This report includes an Ecological Sensitivity Analysis for Options 1 to 3, respectively, as well as an Aquatic Assessment for the stream (Station FM01) that flows through and adjacent to the south-western portion of the property. The field work was conducted from 13 to 15 October 2012.*

*The method employed in this investigation is adapted from that suggested by the Mpumalanga Tourism and Parks Agency (MTPA), entitled "Minimum requirements for EMPRs when applying for authorization for an activity that may have a detrimental effect on the environment". The ecological sensitivity of the area is based on available data and the results obtained in the field. The sensitivity is determined on a descriptive scale from Very Low to High, where Very Low reflects a highly transformed natural environment with little or no ecological sensitivity, typically represented where there is existing infrastructure, to High, which may be described as Natural and Unmodified. Impact Assessment methodology is used to assess the significance of the potential environments impacts. For each impact, the extent (spatial scale), magnitude and duration (time scale) are described. Mitigation measures are proposed.*

*The Central Sandy Bushveld, in which the site lies, includes approximately 51 species of trees, shrubs, woody climbers, graminoids, herbs, geophytic herbs and succulent herbs. There are potentially 51 species of trees, tall shrubs and woody climbers at the site. Most of the indigenous plant species are listed as Least Concern by SANBI (2013). The Grey-leaved Brides-bush, *Pavetta zeyheri*, is listed as endangered for the subspecies *microlancea* (found in Sekhukuneland), rare for *middelburgensis* (found between Middelburg and Witbank and therefore possibly at the site) and Least Concern for *zeyheri*. A number of the species found at the sites of the three options are often associated with disturbed lands. The vegetation found on site at Options 1 to 3 includes 39 species of indigenous plants and 11 species of alien plants. Although the plants are listed specifically for the three options, there is little or no difference between the options with respect to plant species composition. The Option 1 area, however, does include a significant area of wetlands. Twenty-one species of indigenous plants and 11 species of alien plants were recorded in the area which includes Option 1. Eleven species of indigenous plants and one species of alien plant were collected in the area of Option 2. Seven species of indigenous plants and one species of alien plant were collected in the area of Option 3.*

*In terms of the wetland vegetation at Station FM01, the change in marginal zone condition was found to be 27% and the change in non-marginal condition 32%. The VEGRAI Ecological Condition (EC) for Station FM01 was found to be 69%, or Category C, defined as Moderately Modified with a loss and change in habitats and biota, with basic ecosystems unchanged, however. A total of 13 macro-invertebrate taxa were collected at Station FM01 and although the SASS5 EC for the site was determined to be Category C/D, defined as Moderately to Largely Modified, the results are not a true reflection of the condition of the stream as there was no SIC and SOOC biotopes to sample from, as is reflected in the biotope suitability score of 37%. The stream can be more correctly classified as being Moderately Modified. In addition, the IHAS was also found to be low (51%). The water quality parameters were acceptable with an NH<sub>4</sub>-N value of 0.19mg/l<sup>1</sup>, COD of 54.0mg/l<sup>1</sup>, Conductivity of 8.0mSm-1 and pH of 6.97. Two species of fish were collected at Station FM01, namely 14 *Barbus paludinosus* (Straightfin Barb) and 5 *Tilapia sparrmanii* (Banded Tilapia). Two of the Straightfin Barb fish were found to be diseased and one of the Banded Tilapia. Both species of fish collected are listed as Least Concern in the classification for*

conservation important taxa (IUCN Red List, 2012). The number of fish species potentially expected at the site, based on information on distribution available and the fish species recorded for FROC site B3MOSE-GROEN was 24 species. The FAIL for Station FM01 was calculated to be Ecological Category C, described as Moderately Modified, with lower than expected species richness, presence of most intolerant species and some impairment of health of the ecosystems (at the lower limit). Although the results obtained are very conservative given the approach taken, it is not envisaged that the status for Station FM01 would be classified at a higher category were more data available.

Eighty-seven species of birds are potentially expected to occur at the Funda Mlimi property. During the survey, for Options 1, 2 and 3 and Station FM01, 43 species were observed. None of the bird species observed possessed a conservation status greater than Least Concern (IUCN Red List, 2012).

The Central Sandy Bushveld is considered vulnerable, with a conservation target of 19%. The veld type has been transformed (24%) by cultivated areas and urban development. The terrestrial environment in the area of the site is classified as Important and Necessary. The aquatic environment is classified as Highly Significant. The ecological sensitivity determined for the options varies from Low for Options 2 and 3 to Medium-Low for Option 1. Option 1 encompasses a stream channel and associated wetland. The ecological sensitivity for Station FM01 is Medium. Any further agricultural development, or associated forms, for example the poultry abattoir, on the property must not be allowed to compromise the associated water resources further. On the contrary, measures, including mitigation measures, must be established to improve the ecological status of the local water resources.

The impact that the abattoir will potentially have on the natural environment at Option 1 may be considered to be local in extent, medium in magnitude and long term in duration, with a significance rating of medium. The impact on the natural environment at Options 2 and 3, respectively, may be considered to be site-specific in extent, low in magnitude, long term in duration, with a significance rating of low.

The most important action for Option 1 is to (1) strongly consider a formal classification and delineation of the wetland to determine the extent of the available footprint for development purposes, (2) to avoid any development activity inside the potential wetland and adjacent buffer area, (3) to remove the alien vegetation within the wetland area and rehabilitate the area by introducing appropriate indigenous trees and shrubs and (4) to clear the stream and wetland immediately downstream of the property of domestic waste. Clearly, any solid or liquid materials foreign to the environment and/or construction waste materials must be prevented from entering the stream. Such action is also valid for any loose soils and sediments that may be generated as a result of the development. It is recommended that a suite of water quality parameters be decided upon and that the water of the stream be analyzed at least once during the construction phase and annually during the operational phase. In the case of Options 2 and 3 the development footprint must be such that runoff from precipitation and the concomitant potential for the carry of loose soil and silt and/or construction waste materials towards the stream is obviated. The potential for this to occur is likely along the north-eastern border and along the western verge of the gravel road, for both options. Although the station is on the south-western border of the property, the wetlands in the south-western sector of the property are such that it may be possible that treated effluent disposed of on pastures or silage crops reaches infiltrated runoff and is deposited into the wetland, riparian and in-stream environments on that side. It is recommended that water quality analyses be conducted for the stream on an annual basis for an appropriate and pre-determined station downstream of Station FM01.

## 1. Introduction

### 1.1. Project description and site locality

The client wishes to:

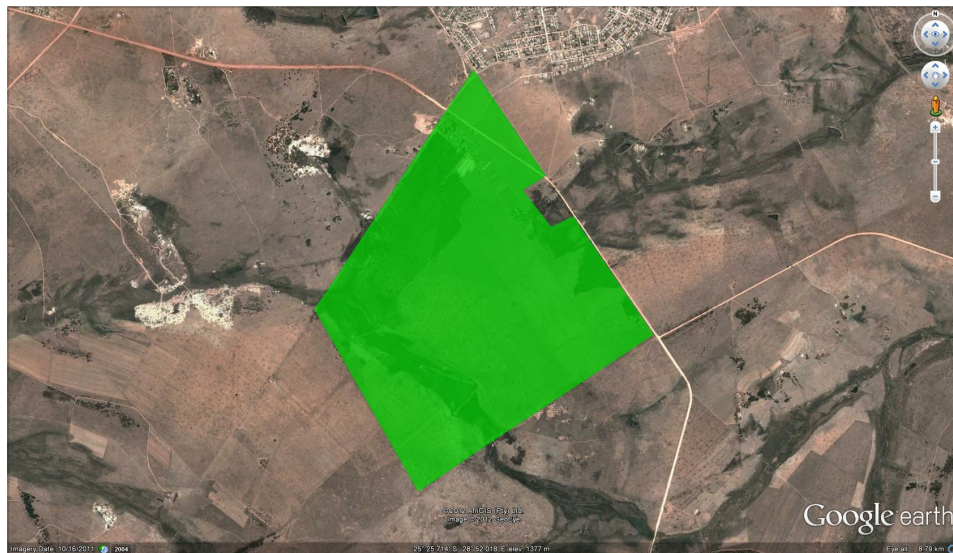
(1) Construct a poultry abattoir at Funda Mlimi Farms (25°25.749'S and 28°51.952'E), Mpumalanga, with a capacity in the first phase of 80 000 broilers.week<sup>-1</sup> to 160 000 broilers.week<sup>-1</sup> in the second phase.

(2) It is assumed that 21.0 litres.broiler<sup>-1</sup> of water will be used, with 92% thereof entering the effluent stream. Water flow to the abattoir in the second phase will be 672m<sup>3</sup>.d<sup>-1</sup> and effluent from the abattoir 544m<sup>3</sup>.d<sup>-1</sup>.

(3) It is assumed that the effluent treatment plant will include an anaerobic-aerobic hybrid pond system, with an anaerobic reactor area of 1 170m<sup>2</sup>, aerobic pond area of 13 750m<sup>2</sup>, maturation pond area of 8333m<sup>2</sup> and drying bed area of 1145m<sup>2</sup>. Although the footprint for the broiler units is not assumed, the total reactor, pond and bed area equates to approximately 2.5ha. The total area encompassed by the property is approximately 560ha. Three areas, designated Options 1 to 3, respectively, were chosen as potential sites for the abattoir.

(4) It is assumed that the treated effluent will be subjected to UV treatment and then drawn from a storage dam to irrigate pastures or silage crops.

The three potential options for the poultry abattoir (Figures 1 and 2), are situated in the north-eastern area of the property. Option 1 borders the entrance to the property and present infrastructure, Option 2 lies further away to the north-east and Option 3 in between.



**Figure 1. The area in which the Funda Mlimi property lies**  
(After Google Earth, 2013).

### 1.2. Terms of Reference for the present study

Given the TOR as stated in an Email communication by Aurecon (Pty) LTD, this report includes an Ecological Sensitivity Analysis for Options 1 to 3, respectively, as well as an

Aquatic Assessment for the stream that flows through and adjacent to the south-western portion of the property.





Figure 2. Options 1 to 3 in the north-eastern area of the Funda Mlimi property.



## **2. Methodology**

### **2.1. Background information**

The approach for this investigation is to assess the sensitivities of the proposed area for the development footprint by means of an ecosystem approach. Given the historically significant transformation of the region in which the development footprint falls, and that the brief for the study does not include an exhaustive investigation over a significant period of time, including all four climatic seasons, the results for this study are limited to the local scale within the proposed development footprint and immediate surrounds for the period October 2012.

The following documents were made available for the preparation of this report:

- (1) A drawing (N2388/1/1-004) entitled, "Abattoir Development Options", by ENDECON UBUNTU (2012),
- (2) Conservation Sensitivity Map (AURECON, *undated*),
- (3) Scan map example (for conservation sensitivity areas) (AURECON, *undated*), and
- (4) Notes for the EIA Consultant (AURECON, *undated*).

### **2.2. Method**

The method employed in this investigation is adapted from that suggested by the Mpumalanga Tourism and Parks Agency (MTPA), entitled "*Minimum requirements for EMPRs when applying for authorization for an activity that may have a detrimental effect on the environment*". The necessity for adaptation of the approach is based on the fact that the development site is already significantly transformed historically as a result of agriculture. Note that the information made available on the proposed development and concomitant footprint is restricted to that stated in Section 1.1 and 2.1 above.

The method that will be employed includes the following:

#### **2.2.1. Vegetation.**

(2.2.1.1) Information and/or maps indicating the total area of disturbance and transformation on the property, including the proposed development, the vegetation communities and sensitive areas and all surrounding land-use on adjacent properties, will be produced.

(2.2.1.2) A list of threatened plant species (Red Data listed) that may potentially occur in the area should be produced. A floristic survey will also be undertaken.

(2.2.1.3) A list of alien plant species will be provided as well as the invasion of category 1 and 2 plants (CARA, Act 43 of 1983, regulation 15) investigated. Any existing or planned eradication programs for alien vegetation should be indicated.

#### **2.2.2. Birds**

(2.2.2.1) A list of potential species will be submitted, with the Red Data and Protection status indicated, where appropriate. An opinion of the likelihood of that species occurring on the site and the reason should be provided.

(2.2.2.2) A survey to determine species richness should be carried out and should also include adjacent areas to the development site. The list of species recorded during the survey should be forwarded to the MTPA.

(2.2.2.3) An indication in the report whether the development site is within an Important Birding Area.

(2.2.2.4) The production of information and/or maps indicating the areas of sensitivity, areas of disturbance and transformation on the property, including the proposed development, all surrounding land-use on adjacent properties and the location of important species as well as roosting and hibernation sites, where appropriate.

(2.2.2.5) Recommendations on buffer zones should be made once comprehensive species lists have been received and reviewed, where appropriate.

### **2.2.3. Wetlands**

(2.2.3.1) A detailed map of delineated wetlands on the property should be provided, including the size of the wetlands, the permanent, seasonal and/or temporary wetland areas and scarce wetland habitat types. The terrain unit/s should be indicated and the landform settings that best describe the wetland.

(2.2.3.2) Problem areas in the wetland should be indicated, including eroded areas, drains, roads, powerlines and alien invasive plants.

(2.2.3.3) The biodiversity of the wetland should be described by vegetation surveys, invertebrate surveys and fish, amphibian, bird and mammal surveys.

(2.2.3.4) The availability of alternative sites with less important habitat should be indicated.

### **2.2.4. Riverine and riparian vegetation**

The riverine and riparian vegetation was assessed at Station FM01. The technique is composed of a number of metrics (cover, abundance and species composition) and metric groups (marginal and non-marginal zone), which are rated in the field. The status of indigenous riparian vegetation (woody and non-woody) in the reference and current states is described for each metric. Differences between the two states are then compared as a measure of vegetation response to an impact zone. Exotic vegetation is also assessed separately.

The metrics are rated and weighted and an Ecological Category (EC) for the riparian vegetation state determined, between A and F (Table 1). The rating system comprises a six-point scoring system, where 0 represents no discernable change from reference conditions to 6 representing extreme modifications from reference. The vegetation component (woody and non-woody) in each vegetation zone is considered in terms of its importance in maintaining the condition of the vegetation zone under reference conditions. The vegetation component considered the most important in influencing the EC of the vegetation zone if it changed is ranked 1 and awarded a weight of 100%, and the next most important component is ranked 2 and awarded a rating proportionately less than 100%, and so on. The weighting of metric groups (vegetation zones) follows a similar approach.

A field form was completed for VEGRAI determination at the Station FM01 (Appendix A) and photographs were taken to provide additional information.

**Table 1. Ecological Categories for EcoStatus determination of riverine and riparian vegetation**

<b>Ecological Category</b>	<b>Description</b>	<b>Score (% of total)</b>
A	<b>Unmodified, Natural</b>	90 – 100
B	<b>Largely Natural with few modifications.</b> A small change in habitats and biota has taken place, with ecosystem function essentially unchanged.	80 – 89
C	<b>Moderately Modified.</b> Loss and change in habitats and biota has occurred, with basic ecosystem functions predominantly unchanged.	60 – 79
D	<b>Largely Modified.</b> A large loss of habitats, biota and basic ecosystem function has occurred.	40 – 59
E	<b>Seriously Modified.</b> There is extensive loss of habitats, biota and ecosystem function.	20 – 39
F	<b>Critically Modified.</b> Almost complete loss of habitat and biota. In the worst case scenario, basic ecosystems function has been destroyed and the changes are irreversible.	0 - 19

(After Kleynhans et al, 2007, modified from Kleynhans, 1996 and Kleynhans, 1999).

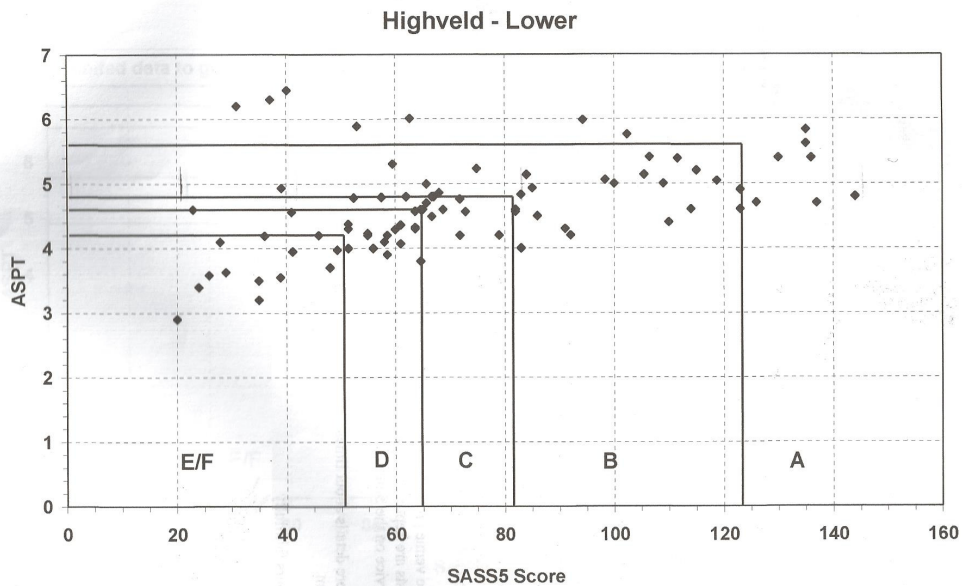
### **2.2.5. The aquatic macroinvertebrates**

The macro-invertebrate fauna was sampled using standard procedures, and additions or modifications to, where appropriate, including SASS5 (Chutter, 1998; Dickens & Graham, 2002, Dallas, 2007) and IHAS (McMillan, 1998). The physico-chemical parameters determined for the river water at Station FM01 included temperature (°C), pH, conductivity (mS/m), flow rate, clarity, turbidity and colour. Biotic parameters measured included macro-invertebrate biodiversity in stones in current (SIC), stones out of current (SOOC), bedrock, aquatic vegetation, marginal vegetation in current, marginal vegetation out of current (Veg) and gravel, sand and mud (GSM) habitats. Total SASS5 and ASPT scores were determined, the IHAS and overall biotope suitability (SASS5) was estimated and an Ecological Category (EC) assigned to each station. The determination of ECs was according to Dallas (2007), across six bands, where Band A reflects unmodified natural conditions, through to F, the latter reflecting a critically or extremely modified status (Table 2, Figure 3). A standard form was used to record the data at the station (Appendix B).

**Table 2. The Biological Bands and Ecological Categories for the interpretation of SASS5 data.**

Biological Band / Category	Ecological Category Name	Description	Colour
A	Natural	Unmodified, natural.	Blue
B	Good	Largely natural with few modifications.	Green
C	Fair	Moderately modified.	Yellow
D	Poor	Largely modified.	Red
E	Seriously Modified	Seriously modified.	Purple
F	Critically Modified	Critically modified.	Black

(After Dallas, 2007).



(After Dallas, 2007)

**Figure 3. The Biological Bands for the Highveld, Lower Zone.**

### 2.2.6. The fish fauna

The Fish Assemblage Integrity Index (FAII) technique (Kleynhans, 1999), was used to assess the fish fauna. This included the fish species collected on 15 October 2012 within the biological segments (fish habitats) of the tributary of the Gemsbokspruit at Station FM01, as well as information for the Reference Frequency of Occurrence (FROC) Site B3MOSE-GROEN (25°09.54'S, 29°19.68'E) (Kleynhans et al, 2008) in the Moses River. Fish were

collected using a SAMUS 725 electro-fishing apparatus. The fish were categorized according to an intolerance index which takes into account trophic preferences and specialization, flowing water requirements during different life stages and association with habitats with unmodified water quality. The intolerance index (IT), the expected frequency of occurrence (F) and expected health (H) of the fish species at the localities was used to formulate an index for the situation expected under minimally impaired conditions and compared with the observed conditions following sampling. An IT value was determined at the stations for each expected species of fish, using habitat preference and present general aquatic conditions at the respective station as guidelines, and an average IT value was calculated for the species across all three stations. The average IT value was used in FAIL determination. The values obtained were compared against values used by Kayde (2008) for fish species in the Nyagui River, Zimbabwe. The expected F value for each species at the stations was determined taking habitat preference and regional distribution (Skelton, 1993) into consideration. In the case of the reference site, Station B3MOSE-GROEN, a value of 3 was used for species, except in cases where the species is known to be hardy and encountered in a variety of habitats. The observed situation is expressed as a fraction of the expected situation, deriving a FAIL value, described in the form of an EC (Kleynhans, 1999) (Table 3).

The expected H for all species of fish expected to be found was fixed at a value of 5, the latter representing the fact that the frequency of fish for a species affected by externally evident disease or other anomalies is <2% (Kleynhans, 1999). Observed values for the fish collected were determined after examination of each individual fish.

**Table 3. The FAIL Integrity Classes, their description and relative score.**

<b>Integrity Class rating</b>	<b>Description of conditions expected for the associated Integrity Class</b>	<b>Relative FAIL score (% of the expected)</b>
A	<b>Unmodified, Natural</b> conditions approximated.	90 to 100
B	<b>Largely Natural</b> , few modifications. Change in community characteristic may be present, species richness and presence of intolerant species indicate little modification.	80 to 89
C	<b>Moderately Modified</b> . Lower than expected species richness, presence of most intolerant species. Some impairment of health of the ecosystems, at lower limit.	60 to 79
D	<b>Largely Modified</b> . Lower than expected species richness, absence or lowered presence of intolerant species. Impairment of health more evident at lower limit.	40 to 59
E	<b>Seriously Modified</b> . Strikingly lower than expected species richness and absence of intolerant species. Impairment of health very evident.	20 to 39



F	<b>Critically Modified.</b> Extremely lowered species richness and absence of intolerant species. Complete loss of species in the lower limit. Impairment of health very evident.	0 to 19

(After Kleynhans, 1999).

### 2.2.7. Biophysical sensitivity analysis

The ecological sensitivity of the area is based on available data and the results obtained in the field during the site visits on 13 to 15 October 2012. The sensitivity is determined on a descriptive scale from **Very Low to High** (Table 4), where **Very Low** reflects a **highly transformed** natural environment with little or no ecological sensitivity, typically represented where there is existing infrastructure, to **High**, which may be described as **Natural and Unmodified**.

**Table 4. The classification system used to describe the ecological sensitivity of the site.**

Description of sensitivity	Comment
Very Low	No ecological significance. Highly transformed, dominated by infrastructure development. Ecological functions may be considered nearly irreversibly impaired.
Low	Low ecological significance. Highly transformed, dominated by agriculture development. Ecological functions seriously modified.
Medium-Low	Low to medium ecological significance. Ecological functions largely modified.
Medium	Medium ecological significance. Ecological functions moderately modified.
Medium-High	Medium to high ecological significance. Ecological functions with few modifications.
High	High ecological significance. Ecological functions unmodified.

Note: Classification partly based on that represented for EcoClassification determination as stated in Kleynhans and Louw (2008).

### 2.2.8. Impact Assessment and Mitigation

#### 2.2.8.1. Assessment Methodology

This section outlines the methodology used to assess the significance of the potential environments impacts. For each impact, the extent (spatial scale), magnitude and duration (time scale) are described (Table 5). These criteria are used to ascertain the significance of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described represents the full range of plausible and pragmatic measures and does not imply that they would or should be implemented. The tables below show the scale used to assess these variables, and define each of the rating categories.

**Table 5: Assessment criteria for the evaluation of impacts**

CRITERIA	CATEGORY	DESCRIPTION
<b>Extent or spatial influence of impact</b>	<b>Regional</b>	Beyond 5 km of the proposed activity.
	<b>Local</b>	Within 5 km of the proposed activity.
	<b>Site specific</b>	On site or within 100 m of the site boundary.
<b>Magnitude of impact (at the indicated spatial scale)</b>	<b>High</b>	Natural and/ or social functions and/ or processes are <i>severely</i> altered.
	<b>Medium</b>	Natural and/ or social functions and/ or processes are <i>notably</i> altered.
	<b>Low</b>	Natural and/ or social functions and/ or processes are <i>slightly</i> altered.
	<b>Very Low</b>	Natural and/ or social functions and/ or processes are <i>negligibly</i> altered.
	<b>Zero</b>	Natural and/ or social functions and/ or processes remain <i>unaltered</i> .
<b>Duration of impact</b>	<b>Construction</b>	Up to 2 years.
	<b>Short Term</b>	0-5 years (after construction).
	<b>Medium Term</b>	5-15 years (after construction).
	<b>Long Term</b>	More than 15 years (after construction).

The significance of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table 6.

**Table 6: Definition of significance ratings**

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
<b>High</b>	<ul style="list-style-type: none"> <li>• High magnitude with a regional extent and long term duration.</li> <li>• High magnitude with either a regional extent and medium term duration or a local extent and long term duration.</li> <li>• Medium magnitude with a regional extent and long term duration.</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>• High magnitude with a local extent and medium term duration.</li> <li>• High magnitude with a regional extent and short term duration or a site specific extent and long term duration.</li> <li>• High magnitude with either a local extent and short term duration or a site specific extent and medium term duration.</li> <li>• Medium magnitude with any combination of extent and duration except site specific and short term or regional and long term.</li> <li>• Low magnitude with a regional extent and long term duration.</li> </ul>
<b>Low</b>	<ul style="list-style-type: none"> <li>• High magnitude with a site specific extent and short term duration.</li> <li>• Medium magnitude with a site specific extent and short term duration.</li> <li>• Low magnitude with any combination of extent and duration except site specific and short term.</li> <li>• Very low magnitude with a regional extent and long term duration.</li> </ul>
<b>Very low</b>	<ul style="list-style-type: none"> <li>• Low magnitude with a site specific extent and short term duration.</li> <li>• Very low magnitude with any combination of extent and duration except regional and long term.</li> </ul>
<b>Neutral</b>	<ul style="list-style-type: none"> <li>• Zero magnitude with any combination of extent and duration.</li> </ul>

Once the significance of an impact has been determined, the probability of this impact occurring as well as the confidence in the assessment of the impact, are estimated using the rating systems outlined in Tables 7 and 8, respectively. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring. Lastly the reversibility is estimated using the rating system outlined in Table 9.

**Table 7: Definition of probability ratings**

<b>PROBABILITY RATINGS</b>	<b>CRITERIA</b>
<b>Definite</b>	Estimated greater than 95 % chance of the impact occurring.
<b>Highly probable</b>	Estimated 80 to 95 % chance of the impact occurring.
<b>Probable</b>	Estimated 20 to 80 % chance of the impact occurring.
<b>Possible</b>	Estimated 5 to 20 % chance of the impact occurring.
<b>Unlikely</b>	Estimated less than 5 % chance of the impact occurring.

**Table 8: Definition of confidence ratings**

<b>CONFIDENCE RATINGS</b>	<b>CRITERIA</b>
<b>Certain</b>	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
<b>Sure</b>	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
<b>Unsure</b>	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

**Table 9: Definition of reversibility ratings**

<b>REVERSIBILITY RATINGS</b>	<b>CRITERIA</b>
<b>Irreversible</b>	The activity will lead to an impact that is permanent.
<b>Long Term</b>	The impact is reversible within 2 to 10 years after construction.
<b>Short Term</b>	The impact is reversible within the 2 years of construction.

### **2.2.8.2. Subjectivity in Assigning Significance**

To facilitate informed decision-making, EIA's must endeavour to come to terms with the significance of the potential environmental impacts associated with particular development activities. Despite their attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, EIA processes can never completely escape the subjectivity inherent in attempting to define significance. Recognising this, there is an attempt here to address potential subjectivity in the current process as follows:

(1) Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above.

(2) Developing an explicit methodology for assigning significance to impacts and outlining this methodology. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing toward determination of significance, thereby avoiding arbitrary assignment, but also provides the reader with a clear summary of how the assessor derived the assigned significance.

(3) Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

### **2.2.8.3. Consideration of Cumulative Impacts**

Section 24(4) of the National Environmental Management Act requires the consideration of cumulative impacts as part of any environmental assessment process. EIA's have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:

(1) Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and

(2) EIA's are typically carried out on specific developments, whereas cumulative impacts may result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

## **3. Results and Discussion**

### **3.1. Vegetation analysis**

#### **3.1.1. Introduction**

The Central Sandy Bushveld, in which the site lies, includes approximately 51 species of trees, shrubs, woody climbers, graminoids, herbs, geophytic herbs and succulent herbs (Mucina and Rutherford, 2006). Based on the distribution maps in Schmidt et al (2002), there are potentially 51 species of trees, tall shrubs and woody climbers at the site. Most of the indigenous plant species that occur in the region in which the site is found are listed as Least Concern by SANBI (2013). The Grey-leaved Brides-bush, *Pavetta zeyheri*, is listed as endangered for the subspecies *microlancea* (found in Sekhukuneland), rare for *middelburgensis* (found between Middelburg and Witbank and therefore possibly at the site) and Least Concern for *zeyheri*. A number of the species found at the sites of the three options are often associated with disturbed lands.

The vegetation found on site at Options 1 to 3 includes 39 species of indigenous plants and 11 species of alien plants (Table 10). Although the plants are listed specifically for the three options, there is little or no difference between the options with respect to plant species composition. The Option 1 area, however, does include a significant area of wetlands.

##### **3.1.1.1. Option 1**

Twenty-one species of indigenous plants and 11 species of alien plants were recorded in the area which includes Option 1 (Figure 4). There is a disused storage reservoir in Option 1, a wide drainage trench which runs from the south-west to the north-east past the reservoir and a seepage zone below the wall (Figure 5a) of the reservoir. A first-order stream (Figure 5b) runs through Option 1 in a north-easterly direction, includes a pond and passes under the adjacent gravel road on the edge of the property (Figure 5c). The present impact on the first-order stream is significant, as may be measured by the presence of a dump site of diapers (Figure 5d) outside of the borders of the property immediately downstream of the gravel road.





**Figure 4. The north-eastern part of Option 1 with the drainage canal in the foreground.**

**Table 10. The indigenous and alien plant species found in the area of Options 1 to 3, Funda Mlimi.**

Species name	Common name	Option / wetland	Comments / Conservation status
<i>Pergularia daemia</i>	Trellis-vine	1	Woodland, riverine forest fringes. LC
<i>Widdringtonia nodiflora</i>	Mountain Cypress	1	Terrestrial. LC
<i>Eucalyptus grandis</i>	Saligna Gum	1	Alien; 2 <sup>1</sup> ;1b,2 <sup>2</sup>
<i>Pinus patula</i>	Patula pine	1	Alien; 2;2
<i>Solanum mauritianum</i>	Bugweed	1	Alien; 1;1b
<i>Aloe greatheadii daviana</i>	Grasaalwyn	1	Terrestrial grasslands, disturbed areas. LC
<i>Chamaecrista</i> sp		1	Terrestrial. LC
<i>Melinus repens</i>	Red Top grass	1	Terrestrial. Disturbed lands. LC
<i>Felicia clavipilosa</i>		1	Terrestrial. LC.
<i>Melinis nerviglumis</i>	Bristle-leaved Red Top	1	Terrestrial. Undisturbed veld, shallow gravelly soil. LC
<i>Lopholaena coriifolia</i>	Pluisiebos	1	Terrestrial. LC
<i>Gomphocarpus fruticosus</i>	Milkweed	1	Terrestrial grassland, dry, disturbed areas. LC
<i>Verbena bonariensis</i>	Purple Top	1	Alien; -;1b
<i>Sesamum triphyllum</i>	Wild sesame	1	Terrestrial. LC
<i>Pellaea calomelanos</i>	Hard fern	1	Terrestrial. LC
<i>Cryptolepis oblongifolia</i>	Melkbos	1, wetland	Terrestrial. LC
<i>Helichrysum coriaceum</i>		1	Terrestrial.
<i>Pseudognaphalium oligandrum</i>		1	Terrestrial. LC
<i>Hyparrhenia hirta</i>	Thatch Grass	1	Terrestrial. LC
<i>Lantana camara</i>	Lantana	1	Alien: 1; 1b
<i>Asteraceae</i> sp		3	
<i>Senecio erubescens</i>	Ragwort	3	Terrestrial. LC

<i>Vernonia sp</i>		3	
<i>Pechuel-Loeschea leubnitziae</i>	Sweat bush	3	Terrestrial. LC
<i>Nidorella sp</i>		3	
<i>Pergularia daemia</i>	Trellis-vine	3	Woodland, riverine forest fringes. LC
<i>Cotula sp</i>		3	
<i>Acacia mearnsii</i>	Black Wattle	3	Alien; 2;2
<i>Hyparrhenia hirta</i>	Thatch Grass	2	Disturbed places, old cultivated lands. Terrestrial. LC
<i>Solanum lichtensteinii</i>		2	Terrestrial. LC
<i>Lopholaena coriifolia</i>	<i>Pluisiebos</i>	2	Terrestrial. LC
<i>Rubus cuneifolius</i>	American Bramble	2	Alien; 1;1b
<i>Senecio sp</i>		2	
<i>Eragrostis plana</i>	Fan Love Grass	2	Terrestrial. Disturbed places, old cultivated lands. LC
<i>Ocimum obovatum</i>	Cat's Whiskers	2	Terrestrial. LC
<i>Hypoxis colchicifolia</i>	Broad-leaved Hypoxis	2	Terrestrial. LC
<i>Ocimum obovatum</i>	Cat's Whiskers	2	Terrestrial. LC
<i>Sporobolus africanus</i>	Ratstail Dropseed	2	Disturbed lands, trampled veld. Terrestrial. LC
<i>Aristida sp</i>		2	
<i>Parinari capensis</i>	Bosapple	2	Terrestrial. LC
<i>Kyllinga erecta</i>	White sedge	1, Wetland	Terrestrial. LC
<i>Fuirena pubescens</i>		1, Wetland	Terrestrial. LC
<i>Lobelia sp?</i>		1, Wetland	
<i>Mynopsis sp?</i>			
<i>Helichrysum sp</i>		1, Wetland	
<i>Oenothera stricta</i>	Evening primrose	1, Wetland	Alien; X3
<i>Verbena bonariensis</i>	Purple Top	1, Wetland	Alien; -;1b
<i>Indigofera sp</i>		1, Wetland	
<i>Eucalyptus grandis</i>	Saligna gum	1, Wetland	Alien, 2;1b/2
<i>Rosa sp</i>	Domestic rose	1, Wetland	Alien
<i>Bambusa balcooa</i>	Common bamboo	1, Wetland	Alien
<i>Agave sisalana</i>	Sisal	1, Wetland	Alien; 2;2

<i>Typha capensis</i>	Common bulrush	1, Wetland	Freshwater. LC
<i>Aloe greatheadii daviana</i>	<i>Grasaalwyn</i>	1, Wetland	Terrestrial grasslands, disturbed areas. LC
<i>Cheilanthes viridis</i>		1, Wetland	Terrestrial. LC

Note: \*1: WESSA-KZN (2008). \*2: Bromilow (2010)



a) Seepage zone below reservoir wall.



b) First-order stream.



c) Stream flow under the gravel road.

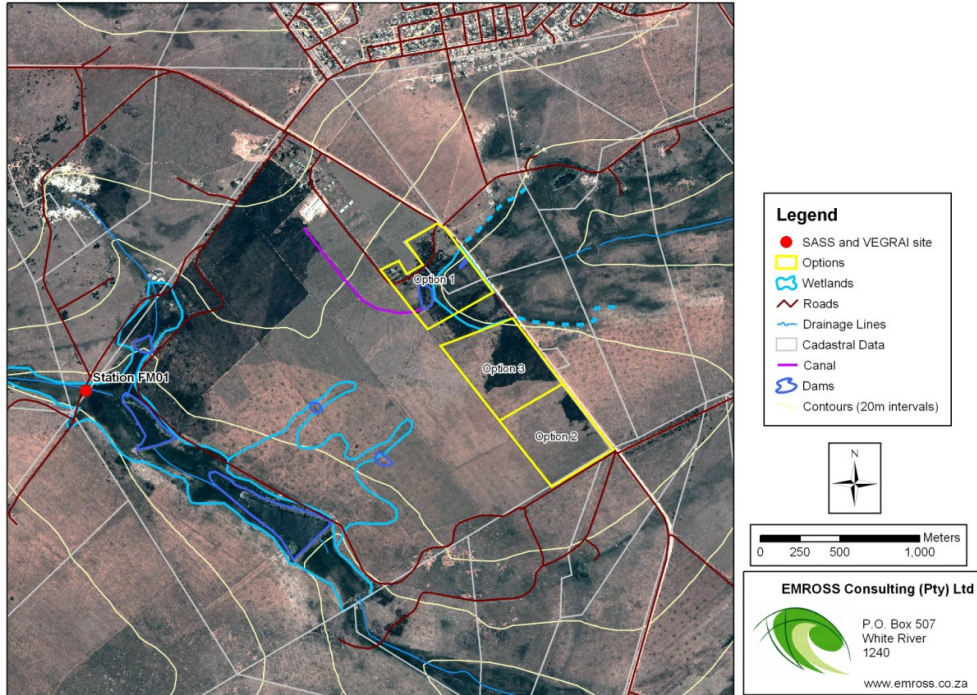


d) Diapers dumped as waste in the stream.

**Figure 5. First-order stream and wetland areas in the area of Option 1.**

Although a detailed wetland delineation, including the identification of temporary, seasonal and permanent wetland areas, was not intended as part of the brief and TOR of this study and report, the broad area of the wetland in Option 1 was determined (Figure 6) by observing hygrophilic plants in the area.





**Figure 6. The wetland areas determined for the property.**

The wetland area in the south-western portion of the property was determined by careful consideration of available satellite imagery. Clearly, a significant portion of the north-eastern part of Option 1 is a wetland area (Figure 6).

### 3.1.1.2. Option 2

Eleven species of indigenous plants and one species of alien plant were collected in the area of Option 2 (Table 10, Figure 7). Option 2 is characterized by disused agricultural land with stands of *Hyparrhenia hirta* and exposed ground with short grass cover.



**Figure 7. The area for Option 2, facing in a north-easterly direction.**



### 3.1.1.3. Option 3

Seven species of indigenous plants and one species of alien plant were collected in the area of Option 3 (Table 10, Figure 8). Option 3 is also characterized by disused agricultural land and stands of *Hyparrhenia hirta* and exposed ground with short grass cover.



**Figure 8. The area for Option 3, facing in a north-easterly direction.**

## 3.2. Aquatic assessment

### 3.2.1. Introduction

The inclusion of an aquatic assessment for the water resources bordering the south-western part of the property was necessary in order to better inform the ecological sensitivity analysis. It is assumed that treated effluent from the abattoir development will be used to irrigate pastures or silage crops. This implies that the effluent will enter the water resources associated with the property at some time or point, either directly or indirectly. Given the very low discharge and highly transformed nature of the stream in Option 1, it was not appropriate to undertake the Aquatic Assessment at the site of the option.

### 3.2.2. Riverine and riparian vegetation

Station FM01 (Figure 6) is bordered along the Left Bank (LB) and Right Bank (RB) by a moderately-sloped area, predominated by heavily grazed and recently burnt grasslands (Appendix A). An extensively eroded and exposed area exists 380m upstream of the site. Two smaller tributaries of 980m and 1.54km in length join together about 1.2km upstream of the site. There are homesteads, severely eroded areas and *Pinus patula* plantations in the upper reaches of the tributary, upstream of the site. The site is immediately upstream of two water storage reservoirs positioned in the in-stream channel. The active channel of the tributary is a shallow, single one, flowing over alluvial substrates. The marginal zone is dominated by sedges within the in-stream channel. The marginal zone is impacted by overgrazing and was recently burnt. A fence crosses the marginal zone approximately 276m

upstream of the site and the tributary lies immediately to the north of heavily eroded upstream areas. Two water storage reservoirs, as well as a third one with a breached wall, lie immediately downstream of the site. The first reservoir is 490m long with a 250m wall and the second 830m long with a 340m wall. Both reservoirs have well-developed marginal vegetation. There is a drainage line, eroded area and ponds to the north of the site. Water flows into a pond with an earthen wall, on the property, and subsequently into the tributary. The non-marginal zone at the site is dominated by overgrazed and burnt grasslands. Occasional annual flowering plants are present and the zone is devoid of trees.

The overall rating for land use, in both the marginal and non-marginal zones, for indigenous plant removal and water quantity and quality, varies between 1 and 3 for both intensity and extent of impact (Appendix A). The change in marginal zone condition was found to be 27% and the change in non-marginal condition 32%. **The VEGRAI Ecological Condition (EC) for Station FM01 was found to be 69%, or Category C, defined as Moderately Modified with a loss and change in habitats and biota, with basic ecosystems unchanged, however.**

### 3.2.3. Aquatic macro-invertebrates

A total of 13 macro-invertebrate taxa were collected at Station FM01 (Figure 9; Appendix B). Although the SASS5 EC for the site was determined to be Category C/D, defined as Moderately to Largely Modified, the results are not a true reflection of the condition of the stream at Station FM01 as there was no SIC and SOOC biotopes to sample from, as is reflected in the biotope suitability score of 37%. The in-stream channel, turbid and partially flooded due to recent rains, was dominated by short grasses and sedges (Veg biotope, Appendix B) and sand and gravel with occasional small boulders (GSM biotope). **The stream can be more correctly classified as being Moderately Modified.** In addition, the IHAS was also found to be low (51%). The water quality parameters were acceptable with an  $\text{NH}_4\text{-N}$  value of  $0.19\text{mg l}^{-1}$ , COD of  $54.0\text{mg l}^{-1}$ , Conductivity of  $8.0\text{mS m}^{-1}$  and pH of 6.97.



a) The stream channel facing upstream.      b) Downstream view towards the dam.

**Figure 9. The in-stream channel at Station FM01.**

### 3.2.4. Fish fauna

Two species of fish were collected at Station FM01 in the turbid water, namely 14 *Barbus paludinosus* (Straightfin Barb) and 5 *Tilapia sparrmanii* (Banded Tilapia). Two of the Straightfin Barb fish were found to be diseased and one of the Banded Tilapia. Both species of fish collected are listed as Least Concern in the classification for conservation important taxa (IUCN Red List, 2013). The number of fish species potentially expected at the site, based on information on distribution available in Skelton (1993) and the fish species recorded for FROC site B3MOSE-GROEN (Kleynhans, 2008) was 24 species (Appendix C).

None of the fish species expected at the site possessed a conservation status greater than LC (IUCN Red List, 2013), except for the Marico Barb (*Barbus motebensis*), classified as Vulnerable [B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)]. Using this information and undertaking the approach as stated in Section 2.2.6, **the FAIL for Station FM01 was calculated to be Ecological Category C, described as Moderately Modified, with lower than expected species richness, presence of most intolerant species and some impairment of health of the ecosystems (at the lower limit)**. Although the results obtained are very conservative given the approach taken, it is not envisaged that the status for Station FM01 would be classified at a higher category were more data available.

### **3.2.5. Birds**

Using Sinclair et al (2002), 87 species of birds are potentially expected to occur at the Funda Mlimi property. During the survey conducted at the property, for Options 1, 2 and 3 and Station FM01, 43 species were observed (Table 11). None of the bird species observed possessed a conservation status greater than LC (IUCN Red List, 2013). The property does not lie in an IBA. The closest IBA is at Loskop Dam to the east of the property.

**Table 11. The bird species observed at the Funda Mlimi project, 13 to 15 October 2012.**

Species Name	Common Name	Comment, conservation status
<i>Cisticola juncidis</i>	Zitting Cisticola	Thick grass, damp conditions. LC
<i>C. textrix</i>	Desert Cisticola	Arid grassland, old fields. LC
<i>C. lais</i>	Wailing Cisticola	Grassland, bracken. LC
<i>Lanius collaris</i>	Common Fiscal Shrike	Broad habitats. LC
<i>Acridotheres tristis</i>	Common Myna	LC
<i>Quelea quelea</i>	Red-billed Quelea	Croplands. LC
<i>Plocepasser mahali</i>	White-browed Sparrow-weaver	Dry river courses. LC
<i>Ploceus velatus</i>	Southern Masked-weaver	Grassland, nests near water. LC
<i>Euplectes progne</i>	Long-tailed Widowbird	Grassland, damp areas. LC
<i>Eupodotis afrioides</i>	White-quilled Bustard	LC.
<i>Elanus caeruleus</i>	Black-winged Kite	Agricultural areas. LC
<i>Streptopelia capicola</i>	Cape Turtle-dove	Broad habitats. LC
<i>Centropus burchelli</i>	Burchells Coucal	Long grass, riverine scrub, reedbeds. Not assessed.
<i>Hirundo cucullata</i>	Greater-striped Swallow	Grassland, vleis. LC
<i>H. abyssinica</i>	Lesser-striped Swallow	Near water. LC
<i>H. rustica</i>	Barn Swallow	Cosmopolitan. LC
<i>Trachyphonus vaillantii</i>	Crested Barbet	Woodland, riverine forest. LC
<i>Mirafra africana</i>	Rufous-naped Lark	Open grassland, cultivated areas. LC
<i>Calendulauda sabota</i>	Sabota Lark	Thornveld. Not listed.
<i>Pinarocorys nigricans?</i>	Dusky Lark	Grassland, Woodland, burnt areas. LC
<i>Macronyx capensis</i>	Cape Longclaw	Upland grasslands. LC
<i>Corvus albus</i>	Pied Crow	Cosmopolitan. LC
<i>Pycnonotus tricolor</i>	Dark-capped Bulbul	Broad habitats. Not assessed.
<i>Emberiza flaviventris</i>	Golden-breasted Bunting	Exotic plantations. LC
<i>Vidua paradisaea</i>	Long-tailed Paradise Whydah	Mixed woodland. LC
<i>Chlidonias leucopterus</i>	White-winged Term	Open water bodies, marshes. LC
<i>Ardeola ralloides</i>	Squacco Heron	Freshwater lakes, slow rivers. LC
	Intermediate Egret	
<i>Mycteria ibis</i>	Yellow-billed Stork	Lakes, rivers. LC
<i>Platalea alba</i>	African Spoonbill	Lakes, floodplains. LC
<i>Threskiornis aethiopicus</i>	African Sacred ibis	Grasslands, vleis. LC
<i>Bostrychia hagedash</i>	Hadedda Ibis	Diverse, open grassland. LC
<i>Vanellus armatus</i>	Blacksmith Lapwing	Damp areas, wetland margins, grasslands, fields. LC
<i>V. coronatus</i>	Crowned Lapwing	Short grassland, grazed or burnt. LC
<i>V. senegallus</i>	African Wattled Lapwing	Damp grassland, wetland fringes. LC
<i>Dendrocygna viduata</i>	White-faced Duck	Water bodies. LC
<i>Alopochen aegyptiaca</i>	Egyptian Goose	Freshwater bodies. LC
<i>Anas undulata</i>	Yellow-billed Duck	Freshwater bodies. LC
<i>Fulica cristata</i>	Red-knobbed Coot	Dams, pans, lakes. LC
<i>Amaurornis flavirostris</i>	Black Crake	Marshes, reeds. Not listed
<i>Gallinago nigripennis</i>	African Snipe	Marshes, wetlands. Not listed
<i>Actophilornis africanus</i>	African Jacana	Wetlands. LC
<i>Burhinus capensis</i>	Spotted Thick-knee	Grassland

### 3.2.6. Other taxa

Other taxa observed in Options 1 to 3 during the surveys conducted from 13 to 15 October 2012 included the Elegant Grasshopper, *Zonocerus elegans*, the Two-spotted Ground Beetle, *Thermophilum homoplatum* and the Guttural Toad, *Amietophrynus gutturalis*. Active termitaria as well as flying termite reproductives were observed.

### 3.3. Biophysical sensitivity analysis

In terms of conservation status, the Central Sandy Bushveld is considered vulnerable, with a conservation target of 19% (Mucina and Rutherford, 2006). The veld type has been transformed (24%) by cultivated areas and urban development. Lotter and Ferrar (2006) classify the terrestrial environment in the area of the site as Important and Necessary. The aquatic environment is classified as Highly Significant.

The ecological sensitivity determined for the options varies from **Low** for Options 2 and 3 to **Medium-Low** for Option 1. It is important to take cognizance of the fact that Option 1 encompasses a stream channel and associated wetland (Table 12). The ecological sensitivity for Station FM01 is **Medium**. Any further agricultural development, or associated forms, for example the poultry abattoir, on the property must not be allowed to compromise the associated water resources further. On the contrary, measures, including mitigation measures, must be established to improve the ecological status of the local water resources.

**Table 12. The ecological sensitivity analysis for the site.**

Part of development site	Ecological sensitivity	Description	Comment
Option1	Medium-Low	Highly transformed, dominated by agricultural development. Ecological functions seriously modified.	The option is characterized by disused agricultural fields, a disused storage reservoir and an alien plant plantation. <b>The option, however, does also include a stream and a wetland.</b> The transformed nature of the stream and wetland places the area into the medium-low category.
Option 2	Low	Highly transformed, dominated by agricultural development. Ecological functions seriously modified.	The option is characterized by disused, partly eroded and dessicated agricultural fields, with the presence of alien vegetation.
Option 3	Low	Highly transformed, dominated by agricultural development. Ecological functions seriously modified.	The option is characterized by disused, partly eroded and dessicated agricultural fields, with the presence of alien vegetation.
Station FM01	Medium	Ecological functions moderately modified.	The results for the VEGRAI, SASS5 and FAIL all place the Station and immediate surrounds into the Ecological Category, Moderately Modified.



## 4. Impact Assessment and Mitigation Measures

### 4.1. Impact Assessment

#### 4.1.1. Option 1

The impact that the abattoir will potentially have on the natural environment at Option 1 may be considered to be **local** in extent, **medium** in magnitude and **long term** in duration, with a significance rating of **medium** (Table 13). Although the area is characterized by disused agricultural fields, a disused storage reservoir and an alien plant plantation, the option, however, does also include a stream and a wetland. The transformed nature of the stream and wetland places the area into the medium-low category for ecological sensitivity.

**Table 13. The extent, magnitude, duration and significance of the impact of the potential development of the Funda Mlimi poultry abattoir on the area within Option 1.**

Criterion	Extent	Magnitude	Duration	Significance	Probability	Confidence	Reversibility
Impact of the abattoir on the area in which Option 1 is placed	Local	Medium	Long Term	Medium	Highly probable	Sure	Long Teerm

#### 4.1.2. Option 2 and Option 3

The impact that the abattoir will potentially have on the natural environment at Options 2 and 3, respectively, may be considered to be **site-specific** in extent, **low** in magnitude, **long term** in duration, with a significance rating of **low** (Table 14). The areas are characterized by disused agricultural fields and alien plants. The transformed nature of the areas places them into the low category for ecological sensitivity.

**Table 14. The extent, magnitude, duration and significance of the impact of the potential development of the Funda Mlimi poultry abattoir on the area within Options 1 and 2.**

Criterion	Extent	Magnitude	Duration	Significance	Probability	Confidence	Reversibility
Impact of the abattoir on the area in which Options 2 and 3 are placed	Site-specific	Low	Long Term	Low	Highly probable	Sure	Long Term

#### 4.1.3. Station FM01

The impact that the abattoir will have on the natural environment at Station FM01 may be considered to be **local** in extent, **very low** in magnitude and **long term** in duration, with a significance rating of **very low** (Table 15). It may be possible that treated effluent disposed of on pastures or silage crops reaches infiltrated runoff and is deposited into the wetland, riparian and in-stream environments immediately downstream of Station FM01.

**Table 15. The extent, magnitude, duration and significance of the impact of the potential development of the Funda Mlimi poultry abattoir on Station FM01.**

Criterion	Extent	Magnitude	Duration	Significance	Probability	Confidence	Reversibility
Impact of the abattoir on Station FM01	Local	Very Low	Long Term	Very Low	Highly probable	Sure	Long Term

## **4.2. Mitigation measures and/or recommendations**

### **4.2.1. Option 1**

The most important action for Option 1 is to (1) strongly consider a formal classification and delineation of the wetland to determine the extent of the available footprint for development purposes, (2) to avoid any development activity inside the potential wetland and adjacent buffer area, (3) to remove the alien vegetation within the wetland area and rehabilitate the area by introducing appropriate indigenous trees and shrubs and (4) to clear the stream and wetland immediately downstream of the property of domestic waste.

Clearly, any solid or liquid materials foreign to the environment and/or construction waste materials must be prevented from entering the stream. Such action is also valid for any loose soils and sediments that may be generated as a result of the development.

It is recommended that a suite of water quality parameters be decided upon and that the water of the stream be analyzed at least once during the construction phase and annually during the operational phase.

### **4.2.2. Options 2 and 3**

In the case of these options the development footprint must be such that runoff from precipitation and the concomitant potential for the carry of loose soil and silt and/or construction waste materials towards the stream is obviated. The potential for this to occur is likely along the north-eastern border and along the western verge of the gravel road, for both options.

### **4.2.3. Station FM01**

Although the station is on the south-western border of the property, the wetlands in the south-western sector of the property are such that it may be possible that treated effluent disposed of on pastures or silage crops reaches infiltrated runoff and is deposited into the wetland, riparian and in-stream environments on that side. It is recommended that water quality analyses be conducted for the stream on an annual basis for an appropriate and pre-determined station downstream of Station FM01.

## **5. Conclusion**

The vegetation found on site at Options 1 to 3 includes 39 species of indigenous plants and 11 species of alien plants. Although the plants are listed specifically for the three options, there is little or no difference between the options with respect to plant species composition. The Option 1 area, however, does include a significant area of wetlands. The ecological

sensitivity determined for the options varies from Low for Options 2 and 3 to Medium-Low for Option 1. The impact that the abattoir will potentially have on the natural environment at Option 1 may be considered to be local in extent, medium in magnitude and long term in duration, with a significance rating of medium. The impact that the abattoir will potentially have on the natural environment at Options 2 and 3, respectively, may be considered to be site-specific in extent, low in magnitude, long term in duration, with a significance rating of low. The Ecological Category for the riparian vegetation, macro-invertebrate fauna and fish in the stream on the south-western side (Station FM01) of the property is Moderately Modified. Mitigation measures and recommendations are proposed for Options 1 to 3 and Station FM01.

## 6. Bibliography

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## Appendix A

### VEGRAI ASSESSMENT FUNDA MLIMI FARMS POULTRY ABATTOIR

**Assessor:** Dr LR Taylor, Ms S Taylor  
**River:** Moses River (tributary of the Elands River)  
**Latitude (E):** 28°50.152'  
**Longitude (S):** 25°25.778'  
**Quaternary Catchment:** B32G  
**Date:** 13/10/2012

#### Longitudinal boundary of site

**Description:**

The site (Station FM01) is bordered along the Left Bank (LB) and Right Bank (RB) by a moderately-sloped area, predominated by heavily grazed and recently burnt grasslands. An extensively eroded and exposed area exists 380m upstream of the site. Two smaller tributaries of 980m and 1.54km in length join together about 1.2km upstream of the site. There are homesteads, severely eroded areas and *Pinus patula* plantations in the upper reaches of the tributary, upstream of the site.

The site is immediately upstream of two water storage reservoirs positioned in the in-stream channel. The Funda Mlimi agricultural property lies to the north-east and south-west of the reservoirs (LB).

#### RIPARIAN VEGETATION ZONES: MARGINAL

**Description:**

The active channel of the tributary is a shallow, single one, flowing over alluvial substrates. The marginal zone is dominated sedges within the in-stream channel. The marginal zone is impacted by overgrazing and was recently burnt. A fence crosses the marginal zone approximately 276m upstream of the site and the tributary lies immediately to the north of heavily eroded upstream areas. Two water storage reservoirs, as well as a third one with a breached wall, lie immediately downstream of the site. The first reservoir is 490m long with a 250m wall and the second 830m long with a 340m wall. Both reservoirs have well-developed marginal vegetation.

There is a drainage line, eroded area and ponds to the north of the site. Water flows into a pond with an earthen wall, on the property, and subsequently into the tributary.

#### RIPARIAN VEGETATION ZONES: NON MARGINAL (split into **lower** and **upper** for level 4)

**Description:**

The non-marginal zone at the site is dominated by overgrazed and burnt grasslands. Occasional annual flowering plants are present and the zone is devoid of trees.

**PHOTOGRAPHS OF THE MARGINAL AND NON-MARGINAL ZONES**



a) Station FM01 and the upstream erosion.



b) Upstream marginal zone.



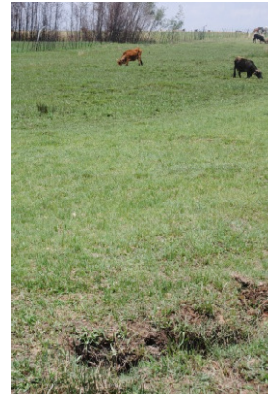
c) Downstream marginal zone.



d) Storage reservoir below the site.



e) Non-marginal zone along the Left Bank



f) Right Bank non-marginal zone.



g) Drainage line and ponds to the north of the site.

h) Pond in the drainage line on the property.

### SPECIES LIST

L = Lower, U = Upper, W = woody, NW = Non-woody

SPECIES	MARGINAL		NON MARGINAL			
	W	NW	L: W	L: NW	U: W	U: NW
					NM	NM
<i>Cyperaceae</i>		X		X		
<i>Poaceae</i>		X		X		

Comments: The marginal and non-marginal zones are dominated by sedges and hygrophilous grasses, most of which has been overgrazed and recently burnt.

## LANDUSE AND IMPACT EVALUATION

<b>MARGINAL ZONE: SURROUNDING AND UPSTREAM LAND USE</b> (any land use that causes an impact on the VEGRAI site)						
<b>LANDUSE</b>	<b>IMPACTS</b>					
	<b>Rating: 0 (no impact) - 5 (severe impact)</b>					
	<b>REMOVAL</b>		<b>QUANTITY</b>		<b>QUALITY</b>	
	<b>INT</b>	<b>EXT</b>	<b>INT</b>	<b>EXT</b>	<b>INT</b>	<b>EXT</b>
Nature reserve, game farming, natural areas	0	0	0	0	0	0
Picnic site/recreational area	0	0	0	0	0	0
Subsistence (rural) farming (not stock)	3	3	1	1	2	2
Stock farming	2	2	1	1	1	1
Firewood, reed, medicinal plant utilisation	1	1	0	0	1	1
Forestry	1	1	1	1	1	1
Irrigation farming (formal) crops	3	3	1	1	2	2
Residential, urban	0	0	0	0	0	0
Residential, rural	2	2	1	1	2	2
Large dams	0	0	0	0	0	0
Weirs and farm dams	1	1	0	0	1	1
Mining, quarrying (including obsolete)	2	2	1	1	2	2
Sewerage treatment and releases	0	0	0	0	0	0
Infrastructure (formal roads)	0	0	0	0	0	0
Infrastructure (vehicle tracks)	1	1	0	0	1	1
Infrastructure (rails)	0	0	0	0	0	0
Infrastructure (foot- and livestock paths)	1	1	0	0	1	1
Rubbish Dumping	0	0	0	0	0	0
Industrial	0	0	0	0	0	0
Other: Specify						
<b>OVERALL RATING</b> (representative of the maximum rating above)	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>CONFIDENCE</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Comments:** Subsistence and irrigation farming has impacted significantly on vegetation removal and water quality due to the loss of sediments to the tributary from (1) the highly eroded area upstream of the site and (2) agriculture immediately downstream of the site.



<b>NON-MARGINAL OR LOWER ZONE: SURROUNDING AND UPSTREAM LAND USE</b> (any land use that is causes an impact on the VEGRAI site)						
<b>LANDUSE</b>	<b>IMPACTS</b>					
	<b>Rating: 0 (no impact) - 5 (severe impact)</b>					
	<b>REMOVAL</b>		<b>QUANTITY</b>		<b>QUALITY</b>	
	<b>INT</b>	<b>EXT</b>	<b>INT</b>	<b>EXT</b>	<b>INT</b>	<b>EXT</b>
Nature reserve, game farming	0	0	0	0	0	0
Natural areas	0	0	0	0	0	0
Picnic site/recreational area	0	0	0	0	0	0
Subsistence (rural) farming	3	3	1	1	2	2
Stock farming	3	3	1	1	2	2
Forestry	1	1	1	1	1	1
Irrigation farming (formal) crops	3	3	1	1	2	2
Residential, urban	0	0	0	0	0	0
Residential, rural	3	3	1	1	2	2
Large dams	0	0	0	0	0	0
Weirs and farm dams	2	2	1	1	1	1
Mining, quarrying (including obsolete)	3	3	1	1	2	2
Sewerage treatment and releases	0	0	0	0	0	0
Infrastructure (formal roads)	0	0	0	0	0	0
Infrastructure (vehicle tracks)	1	1	0	0	1	1
Infrastructure (rails)	0	0	0	0	0	0
Infrastructure (foot- and livestock paths)	1	1	0	0	1	1
Rubbish Dumping	0	0	0	0	0	0
Industrial	0	0	0	0	0	0
Other: Specify						
<b>OVERALL RATING</b> (representative of the maximum rating above)	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>CONFIDENCE</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Comments:** Subsistence and irrigation farming, rural residential development and mining and quarrying has impacted significantly on vegetation removal and water quality due to the loss of sediments to the tributary from (1) the highly eroded area upstream of the site and (2) agriculture immediately downstream of the site.



User information compiled on exotic vegetation to derive the potential impact on species composition. Provide a rating of 0 – 5 in the Marginal and Non – Marginal columns and provide a motivation in the comments block.

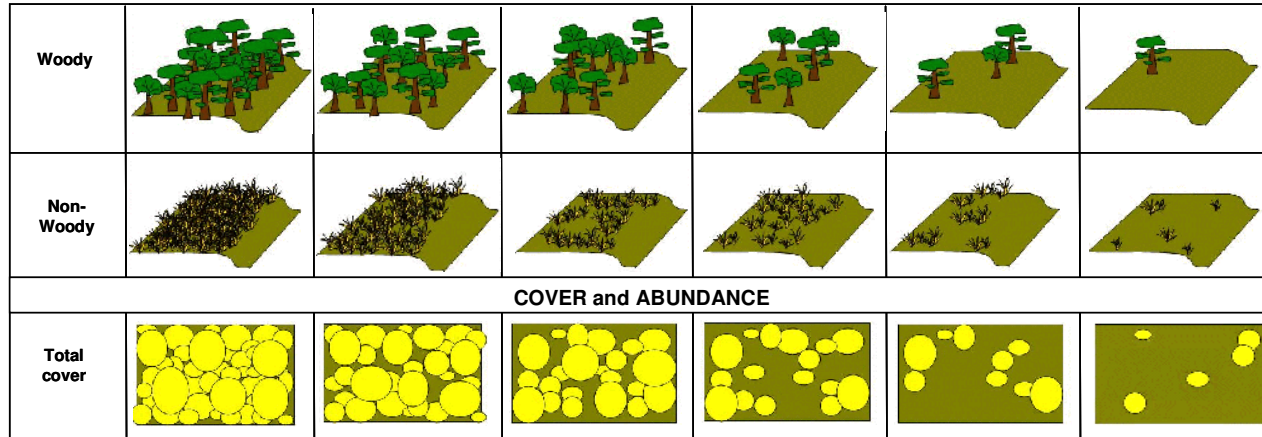
<b>Species Composition</b>			
<b>Vegetation Components</b>	<b>Marginal rating</b>	<b>Non Marginal rating</b>	<b>Comment</b>
<b>Woody</b>	0	1	
<b>Non Woody</b>	1	1	

## REFERENCE CONDITIONS

IMPACTS TO REMOVE	RESPONSE METRIC	DESCRIPTION OF STATE CHANGE
Vegetation removal	Cover Abundance	Although difficult to determine given the level of significant transformation of the site (sampling station and upstream and downstream of the site to a maximum distance of 2.0km) as a result of agricultural and rural residential activity, it is plausible that indigenous woody and non-woody total cover for reference conditions would have been in the region of 80 to 100%. The present state is 60 to 80%. Woody marginal abundance under reference and present conditions is less than 10%. Woody non-marginal abundance has diminished from 10 to 20% to less than 10%. Non-woody marginal abundance under reference and present conditions is 60 to 80%. Non-woody non-marginal abundance under reference conditions would be 80 to 100% and under present conditions 60 to 80%. The state remains shrub and grass dominated.
Exotic invasion	Cover Abundance	The influence of exotic invasion on the marginal and non-marginal zones, in terms of both cover and abundance, from the reference to present states, is in the order of less than 10% for the former and 10 to 20% for the latter. The state remains shrub and grass dominated.
Water quantity	Cover Abundance	The influence on water quantity from reference to present conditions as a result of changes in cover and abundance of indigenous vegetation is not likely to be significant. The presence of two reservoirs immediately below the site has a direct, positive bearing on water availability in the local hydrological setting.
Water quality	Cover Abundance	The influence on water quantity from reference to present conditions as a result of changes in cover and abundance of indigenous vegetation is likely to be associated with changes (low significance) to the physical and chemical characteristics of the surface water. The turbidity is likely to be high, especially under high flow conditions, due to the presence of sediments and silt in the water derived from exposed, eroded non-marginal and terrestrial environments due to agricultural and rural residential activity.

## ABUNDANCE AND COVER:

Use the top two rows (woody and non-woody) to assess abundance and the third row (circles) to assess cover. Tick the appropriate cell for present condition of INDIGENOUS VEGETATION. If possible, indicate the percentage in the range where you think it lies. Then, derive reference conditions using the reference conditions guide at the end of the forms and indicate which percentage range represents reference condition. Using the rating table at the end of the document, determine the appropriate rating to populate the model. ((Figure Supplied by Douglas Macflardane)



### WOODY

		80 – 100%		60 – 80%		40 – 60 %		20 – 40%		10 -20%		<10%	
		Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance
<b>Marginal</b>	Present			X									X
	Reference	X											X
<b>Non-marginal</b>	Present			X									X
	Reference	X								X			

### NON-WOODY

		80 – 100%		60 – 80%		40 – 60 %		20 – 40%		10 -20%		<10%	
		Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance
<b>Marginal</b>	Present			X	X								
	Reference	X			X								
<b>Non-marginal</b>	Present			X	X								
	Reference	X	X										



