ECOLOGICAL IMPACT ASSESSMENT (TERRESTRIAL AND AQUATIC)

GRASSROOTS GROUP DAM ON FARM HARTEBEESKRAAL 88 PORTION 8, TULBAGH DISTRICT

Prepared for: Grassroots Group (Pty) Ltd
P.O. Box 16
Gouda
6821
Mr Rikus Muller

Report Authors: Mr Nicolaas Willem Hanekom

Pri Sci Nat (Ecology) 400274/11
Eco Impact Legal Consulting (Pty) Ltd
P.O. Box 45070
Claremont
South Africa
7735
Tel: 021 671 1660
Email: admin@ecoimpact.co.za

Peer Reviewed by: Avhafarei Phamphe
Nemai Consulting
147 Bram Fischer Drive
Ferndale
Randburg
info@nemai.co.za

DATE: 25 February 2019

TABLE OF CONTENTS

COMPLIANCE WITH THE APPENDIX 6 OF THE AMENDED 2014 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS

REQUIREMENTS OF APPENDIX 6 – GN 326	**ADDRESSED IN SPECIALIST REPORT**
1. (1) A specialist report prepared in terms of these Regulations must contain - a) details of: i) the specialist who prepared the report; and ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Chapter 1 and Appendix A
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Original attached to formal application to DEA&DP. Included in beginning of report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Chapter 1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Chapter 3.12
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Chapter 3.
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Chapter 5
g) an identification of any areas to be avoided, including buffers;	Chapter 6
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figures 2 and 3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Chapter 3.12
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Chapter 7
k) any mitigation measures for inclusion in the EMPr;	Chapter 7
l) any conditions for inclusion in the environmental authorisation;	Chapter 7
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Chapter 7
n) a reasoned opinion - i) as to whether the proposed activity or portions thereof should be authorised; and ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Chapter 7
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	BAR Comments and Response Report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	BAR Comments and Response Report
q) any other information requested by the competent authority.	N/A

1. INTRODUCTION AND BACKGROUND

Eco Impact Legal Consulting (Pty) Ltd was appointed by Grassroots Group (Pty) Ltd to undertake a Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) analysis of the freshwater and riparian resources as part of the Water Use Authorization application.

The proposal is for expansion and to upgrade the old dam with a dam wall of 4.9m high, crest length of 143m, water storage capacity of 55 000m^3 and a catchment surface area of 2.4ha. The dam is located on portion 8 of farm Hartebeeskraal 88, Tulbagh district (Figure 1).

Figure 1: The water uses falling within the regulated zones that require authorization in terms of the National Water Act.

2. LEGISLATIVE REQUIREMENTS

Some of the pertinent environmental legislation that has possible bearing on the proposed development are as follows:

National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act (NWA) guides the management of water in South Africa. The Act aims to regulate the use of water and activities that may impact on water resources through the categorisation of "listed water uses" encompassing water extraction and flow attenuation within catchments as well as the potential contamination of water resources, where the Department of Water and Sanitation (DWS) is the administering body in this regard. In terms of the proposed development and its nature, a specialist assessment is needed to provide DWS with the necessary information related to the proposed project's water uses and the potential impacts on the water resources of the area. It is the client's intention to register and license all water uses related to this project.

The National Environmental Management Act, 1998 (Act 107 Of 1998)

The activities in accordance with the requirements of the National Environmental Management Act, 1998 (Act 107 of 1998) for which Environmental Authorization is required applicable to this Ecological Impact assessment is:

- Activity 48 of Listing Notice 1 (GN 327) of the National Environmental Management Act (NEMA) EIA regulations, 2014 (as amended) states that: **The development of- (The expansion of- (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more; where such expansion occurs- (a) within a watercourse;**
- Activity 19 of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states: **The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse;**

The expansion of the dam triggers the above listed activities for which Environmental Authorization is required.

3. METHOD OF ASSESSMENT, ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Input into the overall project was driven by the following Terms of Reference (ToR), which required the specialist to:

- Identify and describe freshwater ecosystems in the study area based on existing data and an onsite survey;
- Place freshwater ecosystems in a regional context and describe freshwater ecosystem-dependent fauna and flora species present;
- Classify, describe and map freshwater ecosystems in terms of their ecological sensitivity and functional value;
- Comment on and map freshwater ecosystem sensitivity in terms of ecologically important habitats, ecological corridors and linkages with other ecological systems;
- Identify potential impacts of the proposed project on freshwater ecosystems;
- Conduct a specialist assessment in line with NEMA (Act no. 107 of 1998) minimum specialist report requirements, which are presented within Appendix 6 of the NEMA: EIA Regulations (2014, as amended);
- Assess the direct, indirect and cumulative impacts (pre and post-mitigation) of the final location of infrastructure (and alternatives, if applicable) on freshwater ecosystems in the study area using the prescribed impact assessment methodology;
- Recommend practicable mitigation measures to avoid and/or minimise/reduce impacts and enhance benefits;

- Investigate an area of 500m from the proposed development area to determine if any wetlands occur within this area which would potentially trigger GN509 as promulgated in 2016;

All watercourses and wetlands directly impacted upon by the project will need to be delineated and assessed (i.e. functionally and health assessment). Whilst distinction shall be made between wetlands that occur as a result of natural land topography and features separate from those that occur because of artificial causes such as leaking water lines and raised culvert inverts relative to the surrounding natural ground; artificially created wetlands will require the same level of assessment as natural wetlands and EAP shall address them in the study and Environmental Management Programme (EMPr) to be submitted for approval. Specific reference shall be made to the distinction and no onus is to be placed on the contractor in the EMPr to preserve those identified as being futile to perpetuate.

3.1. Freshwater Ecological Assessment sites and site selection

The sites were visually assessed. Several methods (refer to below) was used to assess the risks to the freshwater ecology at the project area.

The objective is to demarcate and delineate river reaches[1] following a hierarchical approach according to the following considerations:

- **Broad natural physical reaches** that constitute the river from its source downstream. These reaches are the result of the various drivers of the system under reference conditions, viz. Hydrology, Geomorphology and Physico-chemical attributes. It follows that the biota responded and adapted to these reference conditions (i.e., the broad natural habitat template) in a dynamic way depending on natural climatic variation. The boundaries between different broad natural reaches are not necessarily crisp and clear. However, where marked and rapid changes occur due to geology (e.g. geomorphology and physico-chemical changes) and hydrology (e.g. large tributaries or a change in climate) these boundaries may be easy to identify.
- **Smaller natural reaches** may be distinguished within these large reaches. Depending on the characteristics of the biological group and taxa considered, the distribution of biota will broadly coincide with the demarcation of the natural reaches. However, depending on the attributes (e.g. preferences and intolerances) of the biota they may be limited to smaller natural reaches within the broad natural physical reaches. These will result in so-called biological habitat segments (e.g. fish habitat segments, Kleynhans 1999).
- Superimposed on these natural reaches are the changes brought about by anthropogenic activities. These activities may result in a homogenous impact throughout the length of a broad natural reach or their impact may be heterogeneous and result in smaller distinguishable sub-reaches. Physical driver changes as well as biological change agents (e.g. alien biota) may be involved.

Reference conditions (in terms of natural reaches, drivers and biota) need to be considered as these provide the natural evolutionary setting that indicates the resilience of the system to various forms of modification and stress. However, pragmatic considerations that come into the picture include anthropogenic changes to the system that are within the medium and long term not likely to change. These may include modifications to the system such as impoundments, agricultural, urbanization and forestry. Such modifications brings about changes in the natural reach characteristics in terms of the system drivers and biota and indicates changed reaches that needs particular consideration in order to manage them accordingly inter alia, ecological importance and sensitivity, Present Ecological State (PES), the recommended category and sustainability. This rationale also therefore enables the setting

[1] For the purpose of this document, "reach" is broadly defined as "a specified segment of a stream's path" (www.wwnorton.com/college/geo/earth2/glossary/r.htm).

of resource quality objectives, ecological specifications and monitoring objectives and specifications.

The freshwater delineations as presented in this report are regarded as the best based on the site conditions present at the time of the assessment.

3.2. Visual Assessment of Aquatic Assessment Points

Each site was selected in order to identify current conditions, with specific reference to impacts from surrounding activities where applicable. The following activities were conducted arriving at the site:

- Note whether site assessment is relative to natural state or previous site survey.
- Note land-use at the site that may impact on water quality, e.g. industrial site, urban, peri-urban, informal housing, subsistence and commercial farming.
- Note flow e.g. slow, medium or fast.
- Take fixed-point photographs of areas of concern, for comparison during later surveys.
- Complete the rating table in the field form for the following water quality indicators for metrics and individual rating tables:
    - Anthropogenic activities at the site that result in impaired in-stream water quality.
    - Odours that may suggest poor water quality.
    - Water column colour, e.g. green may indicate eutrophication.
    - Water clarity as an indicator of suspended sediment loads. This measure may be used as a surrogate for turbidity measurements, e.g. using a Secchi disk or turbidity tube.
    - Water surface, riparian bank and vegetation indicators of potential water quality impacts, e.g. visible scum or purple sheen on the surface, or salt deposits on the bank or riparian vegetation.
    - Extent of algal growth on rocks, i.e. periphyton (note there is a link to the habitat assessment method developed for the biological monitoring programme).
    - Visible biotic responses, e.g. fish kills.

3.3. Riparian Vegetation Response Assessment Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: “riparian habitat" includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al*, 2007). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category) (Table 1).

Table 1: Descriptions of the A-F ecological categories

Ecological Category	**Description**	**Score (% of total)**
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79

Ecological Category	Description	Score (% of total)
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with almost complete loss of natural habitat and biota. In worst instances basic ecosystem functions have been destroyed and changes are irreversible.	0-19

The level of aquatic assessment undertaken was considered to be adequate for this study.

3.4. Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) of riparian areas is an expression of the importance of the aquatic resource for the maintenance of biological diversity and ecological functioning on a local scale to a more broader scale; whilst Ecological Sensitivity (or fragility) refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Kleynhans & Louw, 2007). The list of the EIS categories and rating scheme used in the assessment tool are shown in Table 2 and Table 3 respectively.

Table 2: List of the EIS categories used in the assessment tool (Kleynhans & Louw, 2007)

EISC	General description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/marginal	Quaternaries/delineations which are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 3: Rating scheme used for the assessment of riparian EIS (Kleynhans & Louw, 2007)

Score	Channel Type	Conservation context			Vegetation and Habitat Integrity	Connectivity	Threat status of Vegetation Type
0	Ephemeral Stream	Non-FEPA river	No status	None/ Excluded	No natural remaining	None	No Status
1	Stream non-perennial		Upstream management area	Available	Very poor	Very poor	Least threatened

2	Stream-perennial flow		Rehab FEPA		Poor	Low	Vulnerable
3	Minor river- non-perennial flow		Fish corridor	Earmarked for conservation	Moderately modified	Moderate	Near Threatened
4	Minor river-perennial flow		Fish support area		Largely natural	High	Endangered
5	Major river-perennial flow	FEPA river	River FEPA	Protected	Unmodified / natural habitat	Very high	Critically Endangered

3.4. National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The National Freshwater Ecosystem Priority Areas (NFEPA) project was a partnership and collaborative process led by the CSIR with the South African National Biodiversity Institute (SANBI), Department of Water Affairs (DWA), the Water Research Commission (WRC), WWF South Africa, as well as expertise from South African National Parks (SANParks), the South African Institute for Aquatic Biodiversity (SAIAB) and Department of Environmental Affairs and Tourism (DEAT). The project was originally conceived in 2006 and the project proposal was submitted to the WRC in July 2007. An inception meeting took place in August 2008 to introduce the aims of the project to relevant stakeholders from the freshwater science, governance and management sectors. The NFEPA project aimed to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation.

NFEPA takes forward the implementation of the Cross-Sector Policy Objectives for Inland Water Conservation. It also builds on the river component of the National Spatial Biodiversity Assessment (NSBA) 2004, and will feed directly into the NBA (National Biodiversity Assessment) 2010.

The NFEPA database was searched in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of the proposed development.

3.5. Department of Water and Sanitation (DWS) Resource Quality Information Services (RQIS), Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)

The information obtained from these assessments/databases was used as first level desktop assessments for purposes of ecological reserve determination and for Ecological Water Resource Monitoring (EWRM).

3.6. Rapid Habitat Assessment

The Rapid Habitat Assessment Method (RHAM) is a simplified approach to measure and estimate habitat conditions according to cross sections through broadly defined morphological units (Kleynhans & Louw, 2009). The RHAM methodology consists of a series of steps. The methodology allows for a set cross sections of various Geomorphic Habitat Unit (GHU) to be monitored temporally, and for the biotic results to be interpreted more specifically with regards to habitat potential and availability in the GHUs of the reach.

DATA INTERPRETATION AND THRESHOLDS OF PROBABLE CONCERN (TPC)

For each of the water quality indicators (other than visible biotic response), the following rating system is used:

- 0 = natural / no impact
- 1 = small impact
- 2 = moderate impact
- 3 = large impact
- 4 = serious impact
- 5 = extreme impact

TPCs are set according to the Ecological Importance and Sensitivity (EIS) of the site. If a TPC is exceeded, a management intervention is required. The management action to be undertaken is determined by the indicator exceeded and its significance to the water quality impact on the ecological state of the site.

Low or Moderate EIS: Should any indicator be 2 and lower, i.e. a no impact, small or moderate impact, no management intervention should be initiated.

High EIS: Should any indicator exceed 2, i.e. a large to extreme impact, a management intervention should be initiated, e.g. move up to the next level of monitoring, more frequent biomonitoring, more frequent assessments of that site, or identification of the cause.

3.8. Assumptions and Limitations

The ground-truthing and delineation of the freshwater resource assessment thereof are confined to a single site visit undertaken in November 2018 which considered the freshwater resources associated with the development, as identified within the EIA application. All freshwater resources identified within the investigation area were delineated in fulfilment of Regulation GN509 of the National Water Act, 1998 (Act 36 of 1998) using desktop methods described above, including the use of topographic maps, historical and current digital satellite imagery and aerial photographs and were ground-truthed.

All areas surrounding the development have undergone significant changes (such as infilling, constructed stormwater dams, agricultural activities, road crossings and channelization at places) which have altered the geomorphic characteristics, hydrological regime and vegetation composition. The freshwater resource delineations as presented in this report are regarded as the best based on the site conditions present, as observed during the site assessment. The results obtained are, however, considered sufficiently accurate to allow planning and decision making to take place.

Freshwater resources and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater resource boundaries may occur. However, if the best practice and latest methods are followed, all assessors should get largely similar results. With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, the delineations as provided in this report are deemed appropriately accurate to guide any future development plans.

4. RESULTS OF THE LITERATURE REVIEW

The site is located in the Berg River catchment (DWS Primary Drainage Region G)[2]. The proposed water uses would pass through sections of the G10F quaternary catchment which is drained primarily by the Berg, Diep and Steenbras rivers. The tributary in which the proposed water uses is planned flow into the Berg river. The natural vegetation on site used to be Swartland Shale renosterveld (Critically Endangered conservation status), (Refer to figure 2 below). The impacted and surrounding area is however mostly transformed and disturbed as a result of previous agricultural activities.

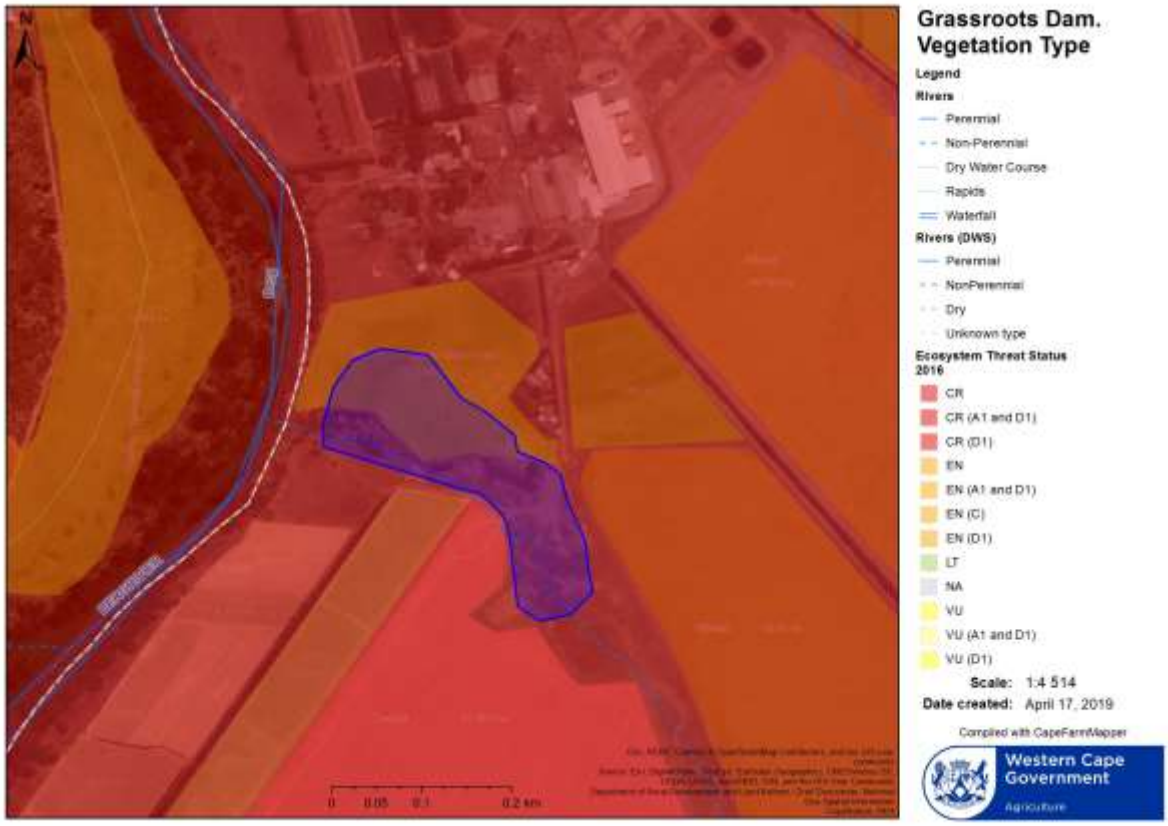

Figure 2: Map of vegetation type and conservation status.

Two biodiversity conservation mapping initiatives are of relevance to the freshwater ecosystems within the study area; namely the Western Cape Biodiversity Spatial Plan mapping initiatives that were undertaken on a regional basis and the NFEPA mapping initiative. The Berg River adjacent to the proposed dam and an artificial wetland (Valley floor unchanneled valley bottom wetland) that formed as a result of a constructed dam is the only identified NFEPA features within the regulated zone (Refer to Figure 1).

The non-perennial river in which the proposed dam expansion is planned was identified as Ecological Support Areas (ESAs) in the latest Western Cape Biodiversity Spatial Plan (2017) (Figure 2). ESA's are supporting zones required to prevent the degradation of Critical Biodiversity Areas (CBAs) and Protected Areas. The Berg River adjacent and downs stream to the dam expansion site was identified as an Aquatic CBA and its buffer areas as an ESA. The proposed dam expansions are however outside the CBA and ESA areas identified. The dam wall and catchment of the dam will be outside the Berg River flood plain and buffer areas.

[2] Department of Water and Sanitation, South Africa. January 2017. Determination of Water Resources Classes and Resource Quality Objectives in the Berg Catchment: Evaluation of Scenarios Report. Report No: RDM/WMA9/00/CON/CLA/0417.

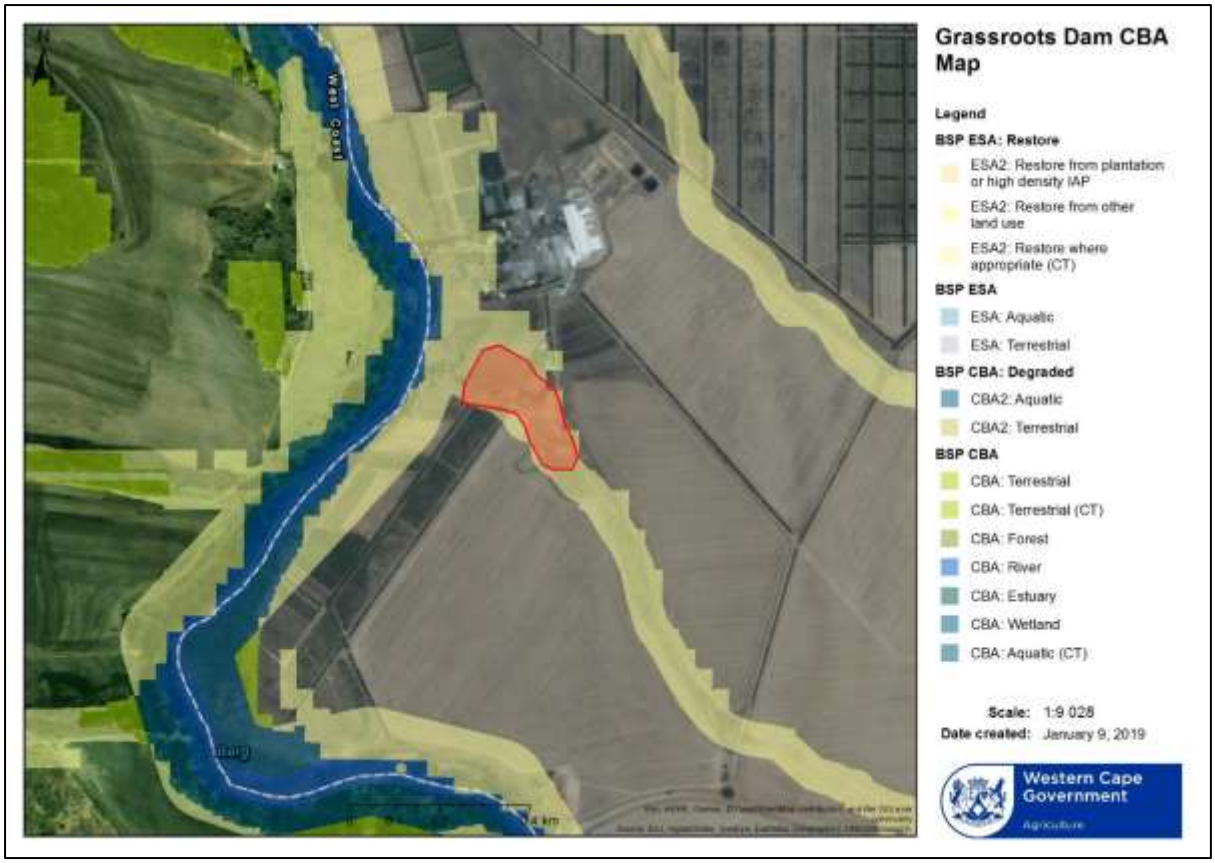

Figure 3: Western Cape Biodiversity Spatial Plan mapping initiative.

The information from PES/EIS database, as developed by the DWS RQIS department, is based on information at a sub-quaternary catchment reach (SQR) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS. No data was available for the non-perennial river in which the proposed dam expansion is planned. The Berg River next to the proposed dam site according to the database has the following:

- Present Ecological State (PES) -Class D,
- mean Ecological Integrity (EI) – moderate,
- mean Ecological Sensitivity – high and
- default Ecological Category (EC) (based on median PES and highest of EI or ES - Class B.

The State of Rivers Report: Rivers of the Berg River System[3] reported that the Berg River had a fair to poor Index of habitat integrity, fair geomorphology index, fair riparian vegetation index, fair SASS index and poor fish index.

5. FRESHWATER ECOLOGICAL ASSESSMENT RESULTS

A photographic record of the impacted area was taken in order to provide a visual record of the condition of the assessment site as observed during the field assessment. The photographs taken are presented (Photos 1-11), followed by a table (Table 4) summarising the observations for the various criteria made during the visual assessment undertaken at each point.

The non-perennial river in which the dam expansion is proposed is a tributary of the Berg

[3] River Health Programme (2004). State-of-Rivers Report: Berg River System. Department of Water Affairs and Forestry Pretoria ISBN No: 0-620-32075-3

River. The source of the non-perennial river is approximately 3km east of the proposed dam expansion site and flows into the Berg River west of the proposed dam site. The first approximately 2km river was channelized into a earthern channel into which agricultural engineered constructed contours runoff water feed into.

Photo 1: Upstream channelled non-perennial river.

The non-perennial river is crossed by a gravel access road and bridge before it flows into a dam.

Photo 2: Dam downstream of the road crossing in the Non-perennial river

The next 500m flow through an area consisting of natural vegetation in a poor to moderate ecological condition.

Photo 3: Non-perennial river downstream of dam

Photo 4: Non-perennial river upstream of proposed dam expansion site and catchment basin.

The last 350m of the non- perennial river (proposed dam expansion area) consists of area impacted by the existing dam and agricutural activities that resulted in the degradation of the non-perennial rivers PES. The PES for this section of the river and where the dam is proposed was assessed to have a poor PES status. The riparian system falls into the category E. This indicates that the loss of natural habitat, biota and basic ecosystem functions is extensive.

Photo 5: Upper catchment of the proposed dam expansion basin area (high water mark of dam when full).

Photo 6: Existing dam in the non-perennial river.

Photo 7: Ecological State of the non-perennial downstream of the existing dam that will be covered by water once the dam is constructed/completed.

Photo 8: Ecological State of the non-perennial downstream of the existing dam and terrestrial ecology that will be covered by water once the dam is constructed.

Photo 9: Ecological State of the non-perennial downstream of the existing dam and terrestrial ecology that will be covered by water once the dam is constructed.

Proposed Dam Impacting on the Non-Perennial River

Photo 10: Propose dam basin

Photo 11: Upstream of the proposed dam ecological condition of the non-perennial river.

Table 4: Descriptions of the location of dam in relation to mapped non-perennial river

Characteristics	Dam site	Upstream area	Downstream area
Significance of the point	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.
Surrounding anthropogenic activities	The site is situated at the area where the dam will impact on the non-perennial river.	The site is situated upstream where the dam will impact the non-perennial river.	The site is situated downstream where the dam will impact the non-perennial river.
Riparian zone characteristics	Limited riparian at this point and it is characterised by *Typha capensis* in the existing constructed dam basin and alien grasses (*Avena sativa*) as a result of the current and past agricultural activities in the area. Patches of *Eucalyptus camaldulensis* were recorded in the dam basin area. A small area of approximately 3% (floodplain of the	Limited riparian at this point as a result of the onsite agricultural activities and upstream impacts on the non-perennial river such as the dam, channelization and road crossing. The vegetation is commonly dominated by alien grasses (*Avena sativa*) as a result of the current and past agricultural activities in the area. It is typically dominated by the *Juncus lomatophyllus* in the instream zone. Other species associated with the non-perennial river and its floodplain is	Limited riparian at this point. The Berg River in the area are typically dominated by the common reed *Phragmites australis* in the instream zone and invasive alien trees such as River gums (*Eucalyptus camaldulensis*) and Port Jackson willows (*Acacia saligna*) dominating the riparian zones.

	non-perennial river) of the dam basin area where *Wurmbea stricta* is dominant, was recorded. This area was the only area recorded that have natural wetter soils in winter as it is in the floodplain of the non-perennial river. The artificial dam area is the other area were plant species that is an indication of wet soils were recorded. *Wurmbea stricta* is common in the bigger area and was also recorded in areas where water logging occurs during winter next to constructed agricultural engineered contours and water discharged points at these outlets.	*Pauridia aquatica* and *Zantedeschia aethiopica*.	

5.1. Riparian Vegetation Response Assessment Index (VEGRAI)

The results of the VEGRAI are indicated in Table 5 below.

Table 5: The overall VEGRAI score of the impacted area

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	20.0	7.5	2.7	2,0	60,0
NON MARGINAL	43.8	27.3	2.7	1,0	100,0
2.0					160,0
LEVEL 3 VEGRAI (%)				34.8	
VEGRAI EC				**E**	
AVERAGE CONFIDENCE				2.7	

The score attained for the VEGRAI indicated that the riparian system falls into the category E and this indicates that the loss of natural habitat, biota and basic ecosystem functions is extensive.

5.2. Ecological Importance and Sensitivity (EIS)

The results of the EIS are indicated in Table 6 below.

Table 6: Results of the EIS assessment for the affected watercourse

Component	Score	Confidence	Comments/description
Channel type	1	4	Channelled non-perennial river.
Conservation context	0	4	No Status
Vegetation and habitat Integrity	1	4	Largely modified
Connectivity	1	4	Not connected. Downstream connection is lost.
Threat Status of Vegetation Type	1	4	Critically Endangered Vegetation at the dam impact site has a low botanical conservation value
EIS Category	**0.8**		**Low to marginal**

EIS considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale. The median of the resultant score is calculated to derive the EIS category.

The non-perennial river is considered to be of low/marginal ecological importance. The non-perennial river and proposed dam areas were also not identified as a Critical Biodiversity Area or important area from a terrestrial ecology and botanical perspective.

The non-perennial river was classified according to the Classification System[4] as an Inland System, located within the Southern Coastal Belt Ecoregion.

5.3. Rapid Habitat Assessment

Description of the site

Geomorphic zone
The South Western Coastal Belt is typified by renosterveld-covered plains

Geomorphic Habitat Unit (GHU) characterisation
Alluvial run

Valley shape
U Shape

Channel shape
Broad valley

Longitudinal connectivity at low flows (time of survey)
Moderately restricted passage

[4] Kleynhans, CJ, Thirion, C and Moolman, J (2005). A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Types of bars present
Side/point bars vegetated

Bank shape
Concave

Bank slope
Low slope

Bed compaction
Tightly packed, armoured.

Sediment matrix
Bedrock

Local Disturbances at the site

The information relates to the Index of Habitat Integrity (IHI) information that is collated to derive the IHI ratings (Kleynhans *et al.* 2008). However, the IHI evaluations of impacts are applicable to the Management Resource Unit (MRU) and not to the site per se. This information required here is applicable to the site and only serves as a record to identify any additional local disturbances or changes. The IHI for the MRU is a requirement as part of the baseline for Ecological Water Resources Monitoring (EWRM) and therefore does not have to be addressed here.

Table 7 identify the disturbance, to provide a comment regarding the disturbance, and to provide a rating (1 – 5). The rating is an evaluation of the extent and severity of the disturbance with 5 relating to a severe disturbance applicable to most of the site. The focus area is the channel condition and the riparian zone as well as any disturbances immediately outside of the riparian zone which impacts on the site.

MODIFICATION	COMMENT	RATING
Abstraction (run of river)	Dam upstream and at point where dam expansion is planned.	4
Animal farming	Area use for grazing of livestock. Dam basin area severely impacted by farming activities. Upstream section between road bridge crossing, dam and proposed dam is in better ecological state.	4
Artificial covering	None	NA
Bed: material disturbance/removal	Existing dam and historical agricultural disturbances.	4
Bed: stabilization (e.g. concrete)	None	NA
Buildings	None	NA
Channel Straightening	Applicable in the upstream section of the non-perennial river (upstream of road bridge crossing and dam)	3
Construction activities	None	NA
Crossings low water (immediately upstream or downstream)	Bridge crossing upstream	4
Dams (immediately upstream or downstream)	Upstream dam and existing dam in proposed expansion of dam basin.	4
Dry land farming	Ploughed and planted wheat fields	4

MODIFICATION	COMMENT	RATING
Erosion	Minimal	1
Forestry	None	NA
Invasive alien vegetation	*Avena sativa* as a result of the current and past agricultural activities in the area. Patches of *Eucalyptus camaldulensis*	3
Irrigation	None	NA
Mining	None	NA
Off-channel dams	None	NA
Recreation	None	NA
Riparian vegetation removal	Upstream section and in dam basin area as a result of historical farming activities.	4
Roads	Two road crossings (One at access road with bridge and one informal road through the river immediately upstream of the dam catchment basin.	3
Rubbish dumping	None	NA
Runoff/effluent	None	NA
Trampling	None	NA
Weirs (immediately upstream or downstream)	None	NA

Geomorphic Habitat Unit (GHU)
Run (RN): Water moving with a relatively smooth, unbroken surface. Low turbulence. (FAST SHALLOW AND OR FAST DEEP). Similar to a glide

Depth
Approximately 1m

Velocity
The velocity is judged to be moderate considering the characteristics of the bed and banks.

Substrate
Bedrock

Cover
Emergent instream vegetation. Plants with a significant portion of their biomass above the water (Simonson *et al.* 1993). Plants that are rooted in mud beneath water, but grow tall enough to stick out above water or have leaves that float on the water under normal conditions.

Anthropogenic activities
Anthropogenic activities have impacts on in-stream water quality and obvious sources of activities that can result in impaired in-stream water quality (Table 8).

Table 8: Non-perennial river anthropogenic activities recorded for the river reach affected

ANTHROPOGENIC ACTIVITIES	RATING					
	0	1	2	3	4	5
Ploughing along banks					x	
Sand-mining	x					
Cattle watering or crossing point					x	
Abstraction point					x	
Discharge point	x					
Chemical spill, e.g. abandoned pesticide containers, spillage from pumps, vehicle accidents	x					

Car washing	x					
Laundry washing	x					
In-stream building activities	x					
Litter	x					
Dump site	x					
Other (List, e.g. weir immediately upstream). Dam upstream and inside expansion basin.					x	

Odour

The type of odour that is present at the site, if any (Table 9). NOTE WHETHER ODOURS ARE ASSOCIATED WITH THE SEDIMENT IN THE RIPARIAN ZONE. The following odours have been identified: a. Sewage, b. Cattle, e.g. cattle-watering point, c. Chemical, e.g. chlorine or pesticides, d. Anaerobic, e.g. hydrogen sulphide (or "rotten egg" smell normally associated with sediments) and e. Other: describe if possible

Table 9: Non-perennial river water quality indicator recorded for the river reach affected

WATER QUALITY INDICATOR	RATING						
	NA	0	1	2	3	4	5
Odour type 1 – sewage	x						
Odour type 2 – cattle	x						
Odour type 3 – chemical	x						
Odour type 4 – anaerobic	x						
Odour type 5 – other	x						

Colour

The colour of the water column at the site, if discoloured (Table 10). The following colours can be identified: a. Brown-black, indicating humics or low pH. DO NOT SCORE IF NATURAL, E.G. WESTERN CAPE STREAMS, b. Milky, indicating possible chemical pollution, c. Green, indicating algal growth in the water column and probable eutrophication, d. Orange, indicating presence of iron-oxidizing bacteria or acid mine drainage. NOTE THAT THIS IS NOT TURBIDITY and e. Other: describe if possible

Table 10: Non-perennial river water quality indicator (colour) recorded for the river reach affected

WATER QUALITY INDICATOR	RATING						
	NA	0	1	2	3	4	5
Colour type 1 – brown-black	x						
Colour type 2 – milky	x						
Colour type 3 – green	x						
Colour type 4 – orange	x						
Colour type 5 – other	x						

Clarity

Turbidity can be described as the following levels of clarity (Table 11) if a turbidity meter, turbidity tube or Secchi disk is not available to conduct a quantitative measurement.

Table 11: Non-perennial river water quality indicator (clarity) recorded for the river reach affected

WATER QUALITY INDICATOR	RATING					
	0	1	2	3	4	5
Clarity		x				

0: no turbidity in the water column, 1: slightly turbid, 2: moderately turbid,3: largely turbid,4: seriously turbid and 5: extremely turbid or opaque throughout the site

Water surface and riparian bank and vegetation clues

The presence of deposits on the surface of the water and riparian banks or vegetation may be indicative of potential water quality impairment (Table 12).

Table 12: Non-perennial river surface water quality indicator recorded for the river reach affected

SURFACE WATER QUALITY INDICATOR	RATING						
	NA	0	1	2	3	4	5
Scum (e.g. from elevated organics)	x						
Foam (e.g. detergent use)	x						
Purple / oily sheen (e.g. diesel + oils)	x						
Visible salt deposits on banks and vegetation				x			
Other							

Extent of algal growth on rocks

The presence of algal growth on rocks, i.e. periphyton, may indicate eutrophication or elevated nutrients in the water column (Table 13). It is important to compare these indicators to the natural state as some rivers may have naturally high nutrient levels due to geological and other factors.

Table 13: Extent of algal growth on rocks recorded for the river reach affected

WATER QUALITY INDICATOR	RATING					
	0	1	2	3	4	5
Extent of algal growth on rocks	x					

0: no periphyton growth on rocks, 1: slight periphyton growth, 2: moderate growth, 3: large periphyton growth, 4: serious periphyton growth and 5: extreme coverage of rocks.

Visible biotic response

Any visible biotic responses displayed by megafauna, e.g. fish kills, should be noted and will require an immediate management action (Table 14). A more detailed water quality assessment will need to be conducted immediately, including toxicity testing of in-stream water.

Table 14: Visible biotic response recorded for the river reach affected

VISIBLE BIOTIC RESPONSE	RATING						
	NA	0	1	2	3	4	5
Visible fish kill	x						
Visible other species (note species)	x						

The overall Ecological and Importance of the non-perennial river where the proposed dam expansion is planned is assessed to be Low to moderate.

This confirm the assessment results of the NFEPA study and State of the River report findings.

6. HYDROLOGY AND ENVIRONMENTAL WATER REQUIREMENTS

The catchment area of the proposed dam expansion is approximately 107ha catchment area. In line with this, the proposed dam has an estimated mean annual runoff of about 33 170m^3.[5] No Reserve or environmental water requirement determination was undertaken due to the fact that the water utilized to fill the proposed dam would be from already allocated water from the Berg River. Although the proposed dam would be placed within a minor tributary, the runoff from the streams is small. The abstraction from Berg River should be reduced by the amount impeded from the stream by the dam.

There is only likely to be surface water runoff from the catchment of the minor tributaries between the months of April/May and October. The Environmental Water Requirement of the watercourses within the study area for the recommended ecological category for these streams of a C category (moderately modified) would be approximately 20% of the Mean Annual Runoff (MAR) of the watercourses. This would equate to an environmental flow requirement of approximately 6 600 m^3. There is however only a very short stretch of the watercourse (about 45m) downstream of the proposed dam that would benefit from any environmental flow release. This section of the river is flooded from time to time during winter when the Berg River flow is high.

7. TERRESTRIAL ECOLOGICAL ASSESSMENT RESULTS

The study area according to Mucina and Rutherford (2006) lies within the Fynbos Biome and would have consisted largely of Swartland Shale Renosterveld (Critically endangered). Much of this natural vegetation has been replaced by cultivated crops with remnants only remaining within the non-perennial river and its floodplain areas. The Berg River in the area are typically dominated by the Common reed *Phragmites australis* in the instream zone and invasive alien trees such as River gums *Eucalyptus camaldulensis* dominating the riparian zones. The natural Fynbos Riparian Vegetation associated with the Berg River is virtually non-existent in the current project area as a result of its destruction through farming activities and the clearing of the consequent invasion by exotic (alien) invader species such as *Eucalyptus camaldulendsis*, *Salix babylonica* and European annual grasses, such as *Avena sativa*.

An area with poor to moderate Swartland Shale Renosterveld vegetation occurs upstream of the proposed dam and its catchment basin. The vegetation is commonly dominated by alien grasses (*Avena sativa*) as a result of the current and past agricultural activities in the area. It is typically dominated by the *Juncus lomatophyllus* in the instream zone. Other species associated with the non-perennial river and its floodplain are *Pauridia aquatica* and *Zantedeschia aethiopica*. The following plant species were recorded in this area: *Amarylis belladona, Androcymbium capense, Asparagus capensis, Babiana odorata, Cyanella hyacinthoides, Dimorphotheca pluvialis, Empodium gloriosum, Eriocephalus africanus, Geishoriza aspera, Gladiolus alatus, Hermannia trifurca, Hermannia althaeifolia, Heamanthus coccineus, Indigofera incana, Ixia lutea, Lachenalia contaminata, Lachenalia unifolia, Lachenalia unicolour, Limeum africanum, Moreae polystachya, Moraea aspera, Moraea gawleri, Moraea fugacissima, Moraea fugax, Microloma sagittatum, Ornithogalum thyrsoides, Onixotis stricta, Oxalis hirta, Oxalis pes-caprea, Pelargonium triste, Romulea flava, Romulea tabularis, Spiloxene capensis, Spiloxene aquatica, Tetragonia herbacea, Wurmbea stricta* and *Zantedeschia aethiopica.* This area will not be impacted by the dam.

[5] Sarel Bester Engineers. 06June 2018. Feasibility study for the proposed new dam on farm Hartebeeskraal 88 portion 8, Tulbagh District, Grassroots Group.

Limited riparian vegetation was recorded on the area that will be impacted by the dam wall and catchment basin as a result of the onsite agricultural activities and upstream impacts on the non-perennial river such as the dam, channelization and road crossing. Riparian vegetation is characterised by *Typha capensis* in the existing constructed dam basin and alien grasses (*Avena sativa*) as a result of the current and past agricultural activities in the area. Patches of *Eucalyptus camaldulensis* were recorded in the dam basin area. A small area of approximately 3% (floodplain of the non-perennial river) of the dam basin area where *Wurmbea stricta* is dominant, was recorded. This area was the only area recorded that have natural wetter soils in winter as it is in the floodplain of the non-perennial river. The artificial dam area is the other area were plant species that is an indication of wet soils were recorded. *Wurmbea stricta* is common in the bigger area and was also recorded in areas where water logging occurs during winter next to constructed agricultural engineered contours and water discharged points at these outlets.

The area that will be impacted by the dam was classified having a poor ecological status.

8. IMPACT ASSESSMENT OF THE ACTIVITIES

You need to explain what extent, duration, magnitude, probability, significance mean etc

Nature of impact: Loss of freshwater ecology habitat
Discussion: Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, thereby reducing biodiversity. Modification of habitats for agriculture as well as surface mining and urban development are the main causes of habitat destruction in this case. Additional causes of habitat destruction include water pollution, introduction of alien species and overgrazing. The non-perennial riverine systems have very low flows as part of their annual hydrological cycles and are particularly susceptible to changes in habitat condition. The proposed development project has the potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. It is however important to note that the freshwater ecology, and especially aquatic habitats of most of the systems has been impaired or impacted already as a result of existing dams, road crossings, channelization upstream and historical agricultural impacts and as such the risk to the receiving environment as a result of the proposed project is reduced to some degree.
Cumulative impacts: ***Riparian zone*** Earthworks in the vicinity of drainage systems leading to increased runoff and erosion and altered runoff patterns. Construction of the dam wall. Alien invasive vegetation encroachment. ***Instream zone*** Loss of aquatic refugia. Altered substrate conditions due to the deposition of silt. Altered depth and flow regimes in the non-perennial river.

Mitigation:

Essential mitigation measures:

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.
- Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the non-perennial river, its riparian zones and 32m buffer areas is regarded as no-go and no impact areas.
- On-going aquatic ecological monitoring must take place as per the water use authorization by a suitably qualified assessor.
- Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the watercourses.
- Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation.
- Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream.

Recommended mitigation measures

- Permit only essential construction personnel within 32m of all riparian systems;
- Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development and aim for completion in early spring at which time revegetation should take place allowing for a full summer growing season to become established.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	No-Go Alternative With Mitigation
Extent	2	1	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	5	5		
Magnitude	2	2		
Probability	4	2		
Significance	36-Medium	16-Low		
Status	Medium significance if not mitigated	Low significance if mitigated		
Reversibility	0%			
Irreplaceable loss of resources	2- Partly Replaceable			
Can impacts be mitigated?	2-Partly, but impact on sub-surface geological layers during excavations is inevitable.			

Nature of impact:

Degradation / loss of naturally occurring / indigenous flora and habitats.

Discussion:

A localised loss of riparian habitat and modification of the stream bed or banks of the watercourse at the dam site and immediately downstream is likely to occur as a result of the dam construction as well as the pipeline construction. This impact is however likely to be small due to the fact that the habitat within the watercourse for the preferred dam site as well as the watercourse and dam basin catchment that will be impacted by the dam are already moderately to largely modified.

Special precaution is to be taken during the construction of the infrastructure that falls within the regulated area as determined in the NWA. Construction activities must be controlled to ensure that the river and its buffer areas are not negatively impacted.

Cumulative impacts:
None as a result of the degraded habitat at the proposed dam impact area.

Mitigation:

- Undertake construction activities only in identified and specifically demarcated areas.
- Invasive vegetation to be removed during construction to be disposed of at landfill site if not use for fire wood, in such a manner that seeds must not be able to spread from the disposal site or during transportation.
- At no point may construction equipment stand unauthorised within or near the river.
- All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.
- Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	No-Go Alternative With Mitigation
Extent	3	2	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	2	1		
Magnitude	4	2		
Probability	4	2		
Significance	36 - Medium Significance	10 - Low Significance		
Status	Medium significance if not mitigated	Low significance if mitigated		
Reversibility	30%	70%		
Irreplaceable loss of resources	2 - Resource may be partly destroyed			
Can impacts be mitigated?	2 - Partly mitigable			

Nature of impact:
Flow modification

Discussion:
The proposal is to store 55 000 cubic meters of allocated water from the Berg River in a newly constructed dam that would be constructed within a minor tributary of the Berg. Flow within the minor tributary would only occur for a short period of time in winter.

Cumulative impacts:
There is only likely to be surface water runoff from the catchment of the minor tributaries between the months of April/May and October. The Environmental Water Requirement of the watercourses within the study area for the recommended ecological category for these streams of a C category (moderately modified) would be approximately 20% of the Mean Annual Runoff (MAR) of the watercourses. This would equate to an environmental flow requirement of approximately 6 600 m^3. There is however only a very short stretch of the watercourse (about 45m) downstream of the proposed dam that would benefit from any environmental flow release.

Mitigation:
The tributary in which the dam is proposed as well as that associated with the pump station and pipeline still contains some indigenous vegetation within the watercourse but also contains invasive alien plants. It is important that the disturbed area is rehabilitated and that ongoing monitoring and management of invasive alien plants with the watercourses are undertaken. The erosion within the watercourse in which the dam is proposed should be addressed and where possible re-vegetated with suitable vegetation. Follow up work should be carried out after rehabilitation to ensure that no invasive alien plants establish themselves within the watercourse adjacent to the dam as well as downstream of the dam. All of the above recommendations should be included in a River Management Maintenance Plan (MMP) for the project that would form part of the Environmental Management Plan.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	No-Go Alternative With Mitigation
Extent	1	2	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	5	1		
Magnitude	2	2		
Probability	2	2		
Significance	16	10		
Status	Low Significance	Low Significance		
Reversibility	0%			
Irreplaceable loss of resources	2- Partly Replaceable			
Can impacts be mitigated?	2-Partly, but impact on subsurface geological layers during excavations is inevitable.			

Nature of impact:
Water quality impairment

Discussion:
There is a potential for some sedimentation and contaminated run-off to impact on the aquatic features during the construction phase activities.

Cumulative impacts:
Contamination and degrading of the water quality downstream of the proposed dam in the non-perennial river and Berg River.

Mitigation:
The water quality impacts during the construction phase in particular should be addressed through the Construction Environmental Management Plan (CEMP) for the project and implemented by an on-site Environmental Officer (EO). Contaminated runoff from the construction site should be prevented from directly entering the water features. Construction should also preferably take place during the drier months when flow in the streams and run off from the surrounding land is low.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	No-Go Alternative With Mitigation
Extent	1	2	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	5	1		
Magnitude	2	2		
Probability	2	2		
Significance	16	10		
Status	Low Significance	Low Significance		
Reversibility	0%			

Irreplaceable loss of resources	2- Partly Replaceable	
Can impacts be mitigated?	2-Partly, but impact on subsurface geological layers during excavations is inevitable.	

The watercourses within the study area have already been subjected to modification as a result of the surrounding agricultural activities. These impacts relate largely to the loss of the indigenous vegetation within the riparian zones and the associated growth of invasive alien plants. The proposed dam will result largely in a localized loss or modification of some habitat within the basin of the proposed dam. Most of the impacts would be during the construction phase. With effective implementation of the recommended mitigation measures, including the environmental water requirements and implementation of an approved River MMP, the condition of the streams could be maintained at the desired level of ecosystem functioning.

9. CONCLUSION

Eco Impact Legal Consulting (Pty) Ltd was appointed to undertake a Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) analysis of the freshwater and riparian resources as part of the Water Use Authorization application.

The main water features within the study area comprise of the Berg River and its minor tributary.

There are no significant wetland habitats within the study area. Those that do occur are closely associated with the watercourses in which they occur. The following comments are made with regards to the wetland habitats in the area:

- The only wetland habitat associated with the dam site is the artificial one as a result of the existing dam; and
- The Berg River approximately 50m downstream of the site consists largely of valley bottom wetland habitat. This wetland habitat is closely associated with the Berg River and the proposed dam will not have any impact on it.

From the assessment of freshwater features within the study area, it can be concluded that there are no significant freshwater features that would potentially be impacted by the proposed dam. The valley bottom wetland downstream of dam site associated with the Beg River will not be impacted. No water will be required to be released from the dam to maintain the downstream channel. The Berg River, when flowing in winter, will push water upstream into the non-perennial river towards the dam wall to maintain the downstream river ecological functioning.

The Department of Water and Sanitation, Western Cape Regional Office should be approached for approval of the water use aspects of the proposed activities. A risk assessment for the proposed activities that are associated with this project will be included in the final freshwater impact assessment report and Water Use Application after site visit and meeting with DWS officials on site.

Riparian Vegetation Response Assessment Index (VEGRAI)

The score attained for the VEGRAI indicated that the riparian system impacted by the proposed dam falls into the category E and this indicates that the loss of natural habitat, biota and basic ecosystem functions is extensive.

Ecological Importance and Sensitivity (EIS)

EIS considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale. The median of the resultant score is calculated to derive the EIS category.

The non-perennial river is considered to be of low/marginal ecological importance. The non-perennial river and proposed dam areas was also not identified as a Critical Biodiversity area or important area from a terrestrial ecology and botanical perspective.

The overall Ecological and Importance of the non-perennial river where the proposed dam expansion is planned is assessed to be Low to marginal.

This confirms the assessment results of the NFEPA study and State of the River report findings.

Mitigation measures for inclusion in the EMPr

Essential mitigation measures:

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.
- Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the water courses and wetlands, its riparian zones and 32m buffer areas is regarded as no go and no impact areas.
- Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the water courses and wetlands.
- Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation
- Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream
- Allow only essential construction personnel within 32m of all riparian systems;
- Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development.
- Invasive vegetation to be removed during construction (the material that cannot be used for fire wood) to be disposed of at landfill site in such a manner that seeds must not be able to spread from the disposal site or during transportation.
- At no point may construction equipment stand unauthorised within or near the river.
- All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.
- Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.

Operational Phase

- The amount abstracted from the Berg River should be reduced by the amount impeded from the catchment.
- Monitoring of the volume abstracted from the Berg River and that stored within the dam should be undertaken.

Conditions for inclusion in the environmental authorisation

- Appointment of Environmental Control Officer during construction phase.

Monitoring requirements for inclusion in the EMPr or Environmental Authorisation

- On-going aquatic ecological monitoring must take place by a suitably qualified assessor as per the conditions of the Water Use Authorization.

10. REFERENCES

CapeNature. 2017 WCBSP Stellenbosch [Vector] 2017. Available from the Biodiversity GIS website.

Driver, Nel, Snaddon, Murray, Roux, Hill (2011). Implementation Manual for Freshwater Ecosystem Priority Areas. Draft Report for the Water Research Commission.

DWAF, 2009. Rapid Habitat Assessment Model Manual. Report no RDM/ Nat/00/CON/0707. Authors: D Louw & CJ Kleynhans Submitted by Water for Africa.

KEMPER, N. 1999: Intermediate habitat integrity assessment for use in the rapid and intermediate assessments. IWR Environmental.

Kleynhans C.J., Thirion C. and Moolman J. 2005. *A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria

Kleynhans CJ, Louw MD. 2007. Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No.

Kleynhans CJ, Mackenzie J, Louw MD. 2007. Module F: Riparian Vegetation Response Assessment Index in River Eco Classification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and DWA and Forestry report.

Mucina L and Rutherford M. C (eds.) (2004) Vegetation map of South Africa, Lesotho and Swaziland. Strelitzia 18. South African National Biodiversity Institute, Pretoria.

SANBI Biodiversity GIS 2016. http://bgis.sanbi.org/WCBF14/additional.asp

APPENDIX A: ABBREVIATED CURRICULUM VITAE AND DECLARATION OF INDEPENDENCE OF FRESHWATER SPECIALIST

Name:	Nicolaas Willem Hanekom (Pri.Sci.Nat)
Profession:	Ecological Scientist
Nationality:	South African
Years experience	26 Years
Academic Qualifications	• National Diploma, Nature Conservation (Cape Technikon) • B. Tech Degree in Nature Conservation (Cape Technikon) • M.Tech in Nature Conservation (Cape Peninsula University of Technology) • Completed various Environmental Management Courses • Qualified Environmental Management System ISO 14001: 2004 Audit: Internal Auditor Course Based on ISO 19011:2002 (Centre for Environmental Management North West University)
Areas of specialisation:	• Ecosystem (terrestrial and aquatic) monitoring and assessments • Design of monitoring programmes for ecosystems (terrestrial and aquatic) • Environmental Impact Assessments • River classification and environmental water requirements • Wetlands Delineation • River and Wetlands management • Water Use Authorization Applications • Water quality management • River Health Assessments
Countries of Work Experience:	South Africa (Northern Cape, Western Cape, Free State, Mpumalanga, Gauteng)
Employment Record	• Student at Bontebok National Park (1992) • Assistant Reserve Manager at Gariep Dam Nature Reserve, Free State (1993 - 1998) • Reserve Manager, Conservation Services Manager for Western Cape Nature Conservation Board (1998 - 2006) • External Lecturer at Cape Peninsula University of Technology (2003 - 2005) • Director: Environmental Management at Cape Lowlands Environmental Services (2006 – 2010) • Director, Environmental Management and lead Environmental Impact Assessment Practitioner at Eco Impact (Pty) Ltd (2010 – to date)
Professional membership, accreditations and courses	• South African Council for Natural Scientists Professions Pri.Sci.Nat (Ecological Science) • Riparian vegetation identification and health assessment. Internal Western Cape Nature Conservation short course presented by Dr C Boucher (Stellenbosch University) in 2000. • SASS5 Aquatic Biomonitoring Training Course. 2 to 5 September 2013. Ground Truth Water and Environmental Engineering consultancy in partnership with the Department of Water Affairs. • Workshop on “Section 21(c) and (i) Water Use Training: Understanding Watercourses and Managing Impacts to their Characteristics”. 10 May 2017. Presented by Dr Wietsche Roets of the Department of Water and Sanitation (Sub-Directorate: Instream Water Use).

Summary of experience	1992: South African National Parks. Student at Bontebok National Park with management and monitoring actions related to the Breede River. 1993 -1998: Free State Nature Conservation. Ecological management and monitoring actions related to the Gariep Dam, Orange and Caledon Rivers. 1998 -2006: CapeNature. Ecological management and monitoring actions related to the Berg River Estuary, Verlorenvlei, Lamberts bay's Jackalsvlei, Wadrift Soutpanne, Oliphant's River mouth, Rocherpan Nature Reserve, etc. Review and assessment of EIA applications, inclusive of Freshwater ecology. Did some site visits with Department of Water Affairs and Forestry (Hester Lyons) to confirm the presence of aquatic ecological features during EIA water use registration applications. 2006 to date: Cape Lowland Environmental Services and Eco Impact Legal Consultant. Ecological (Freshwater and aquatic) Specialist input, assessment, monitoring and reports.
Publications and assessment reports	Just to name a few. Was involved in many Ecological Assessments, monitoring and inputs in EIA applications. • Elandskloof Farm 475 Citrusdal Biodiversity Baseline Survey. August 2010. This Biodiversity Assessment Covering Terrestrial and Aquatic Aspects to Inform Decisions Regarding The Proposed Elandskloof Weir Flood Damage Project On Farm 475, In The Citrusdal Area. • Cape Solar Energy Electricity Generation Facility. Farm 187/3 & 187/13 Kenhardt. Biodiversity And Ecological Baseline Survey. January 2011. (Included Terrestrial and aquatic ecological assessments and water use authorization applications) • Prieska Photvoltaic Power Generation Project. Prieska Commonage Northern Cape. Biodiversity And Ecological Baseline Survey. July 2011. (Included Terrestrial and aquatic ecological assessments and water use authorization applications) • Witteklip Erf 123 Extension, Vredenburg. Biodiversity Baseline Survey. Updated - October 2012 (Included Terrestrial and aquatic ecological assessments and water use authorization applications) • Baseline Biodiversity Survey And Wetland Delineation for ECCA Holdings: Cape Bentonite Mine on Erf 1412 Near Heidelberg. Prepared for: Shangoni Management Services Pry (Ltd). October 2014. • Freshwater Impact Assessment Laingsburg Flood Damage Repairs & Storm Water Infrastructure. 18 February 2016. • Ecological Assessment for Swartland Municipality - Upgrades To Voortrekker/Bokomo Road And Voortrekker/Rozenburg Road Intersections and Upgrade to the Diep River Bridge, Malmesbury on A Portion Of Erf 327, Malmesbury (Road) Erf 1530, Diep River Bridge Crossing, and Erf 1528, Property South of Diep River where Road Widening and Turning Circle Will Be Constructed. March 2016. (Freshwater Ecology Inputs and Water Use Registration) • Freshwater Impact Assessment. McGregor Bridge, Robertson Bridge and Willem Nels River Maintenance Management Plan. 24 June 2016. (Freshwater Ecology assessment and input as well as Water Use Registration)

	• Water Use Authorization Application Risk Matrix. Orange Grove Trust Vegetation Clearing and Agricultural Development on Portion 4 of Farm Glen Heatlie No 316, Worcester. 12 June 2017. (Freshwater ecological inputs in EIA process and Water Use Registration). • Water Use Authorization Application Risk Matrix Prepared For: Witzenberg Municipality Sand Mine Farm 1 Prince Alfred Hamlet. 28 March 2017. (Freshwater ecological inputs in EIA process and Water Use Registration). • Proposed Hartmanshoop Agri Vegetation Clearing Project and Irrigation on Erf 686, Laingsburg. 12 August 2017. (Freshwater ecological inputs in Water Use Registration). • County Fair: Hocraft Abattoir And Rendering Facility Waste Water Treatment Works "CF Hocraft WWTW" Mosselbank River Second Quarter 2018 Biomonitoring Report. June 2018. (Done quarterly biomonitoring for the last three years).

THE SPECIALIST

Note: Duplicate this section where there is more than one specialist.

I N.W. HANEKOM, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the Specialist: N Hanekom

Name of Company: Eco Impact Legal Consulting (Pty) Ltd

Date: 24 April 2019

APPENDIX B: ABBREVIATED CURRICULUM VITAE AND DECLARATION OF INDEPENDENCE OF PEER REVIEW SPECIALIST

1. A CV clearly showing expertise of the peer reviewer

Avhafarei Phamphe is currently employed by Nemai Consulting (PTY) Ltd and focuses on the facilitation of Ecological/Biodiversity Assessments, Environmental Impact Assessment, Environmental Management Programme, Basic Assessment (BA), Rehabilitation Plan, Search, Rescue & Relocation Plan and Biodiversity Action Plan processes. As a Senior Biodiversity Specialist, he is also responsible for peer reviewing external freshwater and wetlands reports as part of the BA and EIA reports . He has attended and completed a wetland course. Avhafarei is a passionate field biologist with more than 16 years' experience in ecological assessments throughout Southern, Eastern, Central and West Africa. Further skills include Alien vegetation clearing and monitoring courses. He has compiled several ecological and biodiversity reports in all provinces of South Africa.

He has been involved in various projects throughout Africa (including South Africa, Rwanda, Ghana and Mozambique) focusing on terrestrial ecological assessments which involve phytosociological community assessments, Red Data Listed faunal and floral species assessments, alien and invasive species control methods and rehabilitation plans. He holds a BSc Botany (Hons) from University of Venda (Univen) and holds a MSc (Botany) from the University of Pretoria (UP). He is also registered with the South African Council for Natural Scientific Professions (SACNASP) in the field of ecological science.

Specialist reports include:

- Biodiversity Specialist for proposed Development for Augmentation of the Western Cape Water Supply System. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed Water Supply System will have on the flora and fauna along the route.
- Specialist external review of the ecological impact assessment (terrestrial and aquatic ecology, fauna and avifauna) for the proposed 300mw Photovoltaic Electricity generation facility on portions 6 and 3 of farm 187 Olyvenkolk, Kenhardt district
- Specialist external review of the ecological impact assessment (terrestrial and aquatic ecology, fauna and avifauna) for the proposed 400mw Photovoltaic Electricity generation facility on portions 7 and 3 of farm 187 Olyvenkolk, Kenhardt district
- Biodiversity Specialist for the proposed New Wastewater Treatment Works development. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed New Wastewater Treatment will have on the flora and fauna on site.
- Biodiversity Specialist for proposed 400kV Powerline. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed powerline will have on the flora and fauna on site.
- Biodiversity Specialist for proposed Development of the Makalu B Transmission Line. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed distribution line will have on the flora and fauna along the route.
- Biodiversity Specialist for proposed Development of the Makalu B Transmission Line. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed transmission line will have on the flora and fauna along the route.
- Biodiversity Specialist for proposed development of the Foxwood Dam. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed Dam will have

on the flora and fauna on site.

- Biodiversity Specialist for proposed development of Ncwabeni Dam. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed Dam will have on the flora and fauna on site.
- Biodiversity Specialist for proposed development of high altitude training centre. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed Centre will have on the flora and fauna on site.
- Ecologist, Monitoring and data capturing of Elephants of the Red Volta: Earthwatch expedition
- Project Manager, Three selected areas around the Gorongosa National park, Sofala province, Mozambique
- Botanical impact assessment: Proposed Zoar Amalienstein Agricultural Development Feasibility Study, Western Cape.
- Biodiversity Specialist for proposed Graaff-Reinet FET college. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed college will have on the flora and fauna on site.
- Biodiversity Specialist for proposed Balfour FET college. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed college will have on the flora and fauna on site.
- Biodiversity Specialist for proposed Academic Hospital. Compile a Terrestrial Ecology Specialist Study, which forms part of the Environmental Impact Assessment process, which assess the impacts that the proposed hospital will have on the flora and fauna on site.

The REVIEW SPECIALIST

I ……Avhafarei Phamphe……., as the appointed Review Specialist hereby declare/affirm:

- that I have reviewed all the work produced by the Specialist(s);
- the correctness of the specialist information provided as part of this Report;
- that I have, throughout this EIA process met all of the general requirements of specialists as set out in Regulation 13;
- I have, throughout this EIA process disclosed to the applicant, the EAP, the review EAP (if applicable), the Specialist(s), the Department and I&APs, all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared as part of the application; and
- I am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of Review Specialist:	
Name of Company:	Nemai Consulting (Pty) Ltd
Date:	24 April 2019