WATER USE LICENCE APPLICATION SUMMARY

NAME OF APPLICANT: Swartvlei Equestrian Estate

Compiled by: Allan Atkinson

Signature:
Date : 13 December 2021

1. Applicant details

Name of applicant: Swartvlei Equestrian Esttate (Pty) Ltd
Postal address: PO Box 100, Hoekwill
Cell phone number:083305996
Office number:
E-mail address: mark@lancewoodfarm.co.za

2. Person submitting application

Allan Atkinson is not currently part of any professional body. He is involved in various water related requirements for farms from dam design, Irrigation and other infrastructure. He has over 37Years of experience in this field.

3. Background and purpose

S21a b d water uses in QP_1-182.pdf

4. Location of water uses

All other information is in the above PDf

This project in respect of which this water use licence application is submitted is located in the western Cape Province, Within the George Magistrial District Near Sedgefield.The water use will take place on the farm 182 Portion 1 Hoogekraal .This farm form part of the K40D Quaternary Catchment part of the BGCMA Area. The Geographic position of this water use is 33 58 39,54S and 22 43 28,80E

Table 1: Property details

Property description	Title Deed number	Owner
Portion 1 of Farm 182 Hoogekraal	T49253/2012	Swartvlei Estate Equestrian

5. Administrative documents and technical reports submitted by applicants

5.1 Administrative documents

5.1.1 All Documents included in the E Wula

5.2 Reports and other technical documents

5.2.1 All part of the E Wula

6. Project Description

To build a dam of 102 000m3 on the property to secure the clients water demand for the development of Avo and Macadamia orchards

7. Methods statement (only for c and i activity) and mining method/ industrial process

The method statement is part of the E wula this dam is an out of stream.

8. Stormwater Management Plan

The storm water is channelled to the nearest stream that ends up in the Swartvlei Lake.

9. Rehabilitation Plan

The rehabilitation for the damaged dams that will no longer been used will be filled with the excess material excavated out of the new dam site

10. Water Uses applied for

The application includes the following water uses.

Table 2: Water Use Applied for

Water use(s) activities	Purpose	Capacity/ Volume (m^3, tonnes and/or m^3/annum)/ dimension	Property Description	Co-ordinates
Section 21(a)				
Section 21(b)				
New Dam	Storage	102 000m3	1/182	
Section 21 c & i				

Water use(s) activities	Purpose	Capacity/ Volume (m^3, tonnes and/or m^3/annum)/ dimension	Property Description	Co-ordinates
Section 21(g)				
Section 21(f)				
Section 21(h)				
Section 21(j)				

11. Impacts and mitigation measures

The potential impacts and mitigation measures that are expected from the proposed activities are presented in Table 3**.**

Table 3: Summary of impacts and mitigation measures

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures

12. 9. Water demand and water supply

Water demand

Water demand for 102Ha of Avo and Macadamia orchards will be 394 613m3/year.

Water supply

The water will be extracted at the weir in the Wolwe river no change in the extraction point is to be made. This water will be stored in the new dam and use to irrigate the orchards. The water balance is handled in a separate report.

13. Public participation

The public participation process must be done in terms of Section 41 (4) of the National Water Act, Act no 36 of 1998. The outcome of the process is summarised in Table 4.

Table 4: Outcome of the public participation

Person who commented	Comments (support or object)	Reasons for objection	Applicant's response to the objection
Ms Dixon	Enquired about volumes and storage	To get Clarity on validity of application	We explained the process and said that the farm is busy with a V&V as done By Jackie Dubrowski

10. Other authorisations applicable to the activity

10.1
10.2

11. Section 27 (1)

The requirements contained in Section 27(1) of the National Water Act, 1998 (Act 36 of 1998) have been considered and are discussed further in the Section 27 Report in the E wula.

12. We Hereby declare that all information given is correct to our knowledge.

Signed:
Allan Atkinson-Prtoxy
Date: 13 December 2021

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

National Register of Water Use Registration Record 22118414

Water Use Registration Record 22118414 is issued in terms of the regulations requiring that a Water Use be registered, promulgated under Section 26(1)(c) of the National Water Act(Act 36 of 1998) to:

Applicant

Applicant Type:	COMPANY
Name:	SWARTVLEI EQUSTRIAN ESTATE PTY LTD (PTY) LTD
Enterprise Type	PRIVATE COMPANY
Business Registration Number:	2012/033068/07
Postal Address:	PO BOX 678 GEORGE INDUSTRIAL GEORGE 6536
VAT Registration Number:	

Water Management Area

Name:	GOURITZ

Register Status

Status:	ACTIVE

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

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Water Use Registration Record 22118414 is issued in terms of the regulations requiring that a Water Use be registered, promulgated under Section 26(1)(c) of the National Water Act(Act 36 of 1998) to:

Continued from Page 1...

Water Uses

See attached Annexure(s)

Water Use No.	Water Use	Current Authorisation Type	Volume	Volume Start Date	Volume End Date
1	21(a)	LAWFULNESS STILL TO BE DETERMINED	245 978 CUBIC METRES PER YEAR	2012/08/01	
2	21(b)	N/A		2012/08/01	
3	21(b)	LAWFULNESS STILL TO BE DETERMINED		2012/08/01	
4	21(d)	LAWFULNESS STILL TO BE DETERMINED	158 083 CUBIC METRES PER YEAR	2012/08/01	
5	21(a)	LAWFULNESS STILL TO BE DETERMINED	151 546 CUBIC METRES PER YEAR	2012/08/01	

Office: Western Cape Office
Regional Office: Western Cape Region

DEPT. VAN WATERWESE
PRIVATE BAG X 16, SANLAMHOF, 7532
24 DEC 2014
CHIEF DIRECTOR
52 VOORTREKKER ROAD, BELLVILLE 7532
DEPT. WATER AFFAIRS

Date stamp of issuing office

DISCLAIMER :
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2.3 a general authorisation as published in the Gazette; or
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Berhada River

National Register of Water Use Registration Record 22118414

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22118414
Water Use Number:	1
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

Lawfulness Authentication

Finding:	LAWFULNESS STILL TO BE DETERMINED
Finding Date:	2013/08/22
Finding Reason:	
Finding Confirmed:	YES

Succession/Transfer Details

Succession/Transfer Type:	SUCCESSION IN TITLE
Source Part2 Details:	**Register No.** 22087117 **WUN** 1

Water Use Details

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION
Source Type:	RIVER/STREAM
Water Resource Name:	WOLWE RIVER
Point of Abstraction:	**Latitude** 33° 58' 37" south **Longitude** 22° 43' 9" east
Datum Type:	CAPE (MODIFIED CLARKE 1880)
Quaternary Drainage Region:	K40D

Registered Volumes

Start Date	End Date	Registered Volume (m^3)	Time Interval
2012/08/01		245978	PER YEAR

Property Where Water Use Occurs

Property Name:	HOOGEKRAAL
Property Number:	182
Portion of Property:	1
SG Cadastral Code:	C02700000000018200001
Deeds Office:	CAPE TOWN
Registration Division:	GEORGE
Registration Division Province:	WESTERN CAPE

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2012/08/01	

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Borehole

National Register of Water Use Registration Record 22118414

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22118414
Water Use Number:	5
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

Lawfulness Authentication

Finding:	LAWFULNESS STILL TO BE DETERMINED
Finding Date:	2013/08/22
Finding Reason:	
Finding Confirmed:	YES

Succession/Transfer Details

Succession/Transfer Type:	SUCCESSION IN TITLE	
Source Part2 Details:	**Register No.**	**WUN**
	22087117	5

Water Use Details

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION	
Source Type:	BOREHOLE	
Water Resource Name:	GROUNDWATER (BOREHOLE)	
Point of Abstraction:	**Latitude**	**Longitude**
	33° 59' 25" south	22° 43' 49" east
Datum Type:	CAPE (MODIFIED CLARKE 1880)	
Quaternary Drainage Region:	K40D	

Registered Volumes

Start Date	End Date	Registered Volume (m^3)	Time Interval
2012/08/01		151546	PER YEAR

Property Where Water Use Occurs

Property Name:	HOOGEKRAAL
Property Number:	182
Portion of Property:	1
SG Cadastral Code:	C02700000000018200001
Deeds Office:	CAPE TOWN
Registration Division:	GEORGE
Registration Division Province:	WESTERN CAPE

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2012/08/01	

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Dam. Stove.

National Register of Water Use Registration Record 22118414

Storing water in terms of Section 21(b) of the National Water Act

Water Use Identification

Register Number:	22118414
Water Use Number:	2
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

Succession/Transfer Details

Succession/Transfer Type:	SUCCESSION IN TITLE	
Source Part2 Details:	**Register No.**	**WUN**
	22087117	2

Storage of Raw Water

Total Number of Dams:	5
Water Course(s):	WOLWE RIVER

Dam Details

Name of Dam	Estimated/ Calculated	Measure For Movement of Aquatic Species	Volume Stored (m^3)
RIVER	ESTIMATED	NO	72080.00

Property Where Water Use Occurs

Property Name:	HOOGEKRAAL
Property Number:	182
Portion of Property:	1
SG Cadastral Code:	C02700000000018200001
Deeds Office:	CAPE TOWN
Registration Division:	GEORGE
Registration Division Province:	WESTERN CAPE

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2012/08/01	

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Stove Dam

National Register of Water Use Registration Record 22118414

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22118414
Water Use Number:	3
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

Lawfulness Authentication

Finding:	LAWFULNESS STILL TO BE DETERMINED
Finding Date:	2013/08/22
Finding Reason:	
Finding Confirmed:	YES

Succession/Transfer Details

Succession/Transfer Type:	SUCCESSION IN TITLE	
Source Part2 Details:	**Register No.**	**WUN**
	22087117	3

Water Use Details for Raw Water Dam

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION
Quaternary Drainage Region:	K40D

Dam Details

Dam Name:	182GE/1 D1	
Name of Watercourse:	WOLWE RIVER	
Centre of Dam Wall:	**Latitude**	**Longitude**
	33° 57' 25" south	22° 42' 49" east
Datum Type:	CAPE (MODIFIED CLARKE 1880)	

Centre of River at the point where river crosses the Dam wall:

	Latitude	**Longitude**
Datum Type:	CAPE (MODIFIED CLARKE 1880)	
Capacity:	62 THOUSAND CUBIC METRES	
Billable Dam:	NO	
Safety Risk Dam:	YES	
Completed	YES	
Date of Completion	1998/10/01	

Water Use Sector(s)(i.e. Purpose(s) for Storing of Water): AGRICULTURE: IRRIGATION

National Register of Water Use Registration Record 22118414

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22118414
Water Use Number:	3
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

Property Where Water Use Occurs

Property Name:	HOOGEKRAAL
Property Number:	182
Portion of Property:	1
SG Cadastral Code:	C02700000000018200001
Deeds Office:	CAPE TOWN
Registration Division:	GEORGE
Registration Division Province:	WESTERN CAPE

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2012/08/01	

National Register of Water Use Registration Record 22118414

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22118414
Water Use Number:	3
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

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Extraction

National Register of Water Use Registration Record 22118414

Engaging in a stream flow reduction activity contemplated in section 36 of the National Water Act

Water Use Identification

Register Number:	22118414
Water Use Number:	4
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

Lawfulness Authentication

Finding:	LAWFULNESS STILL TO BE DETERMINED
Finding Date:	2013/08/22
Finding Reason:	
Finding Confirmed:	YES

Succession/Transfer Details

Succession/Transfer Type:	SUCCESSION IN TITLE
Source Part2 Details:	Register No. 22087117 WUN 4

Water Use Details

Water Use Sector(s)(i.e. Purpose(s) of Water Resource:	COMMERCIAL GOERGE MUNICIPAL DISTRICT
Geographic location of the centre of the area where the SFRA is taking place:	Latitude: 33° 57' 25" south Longitude: 22° 43' 50" east
Datum Type:	CAPE (MODIFIED CLARKE 1880)
Quaternary Drainage Region:	K40D

Area Afforested by Species

Species	Area (hectares)	Start Date
EUCALYPTUS	15	1971/01/01
PINE	432	1971/01/01

Reduction Volumes

Start Date	Registered Volume (m^3)	Time Interval
2012/08/01	158083	PER YEAR

Property Where Water Use Occurs

Property Name:	HOOGEKRAAL
Property Number:	182
Portion of Property:	1
SG Cadastral Code:	C02700000000018200001
Deeds Office:	CAPE TOWN
Registration Division:	GEORGE
Registration Division Province:	WESTERN CAPE

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2012/08/01	

National Register of Water Use Registration Record 22118414

Engaging in a stream flow reduction activity contemplated in section 36 of the National Water Act

Water Use Identification

Register Number:	22118414
Water Use Number:	4
Water Use Start Date:	2012/08/01
Water Use Status Date:	2014/12/09
Water Use Status:	REGISTERED

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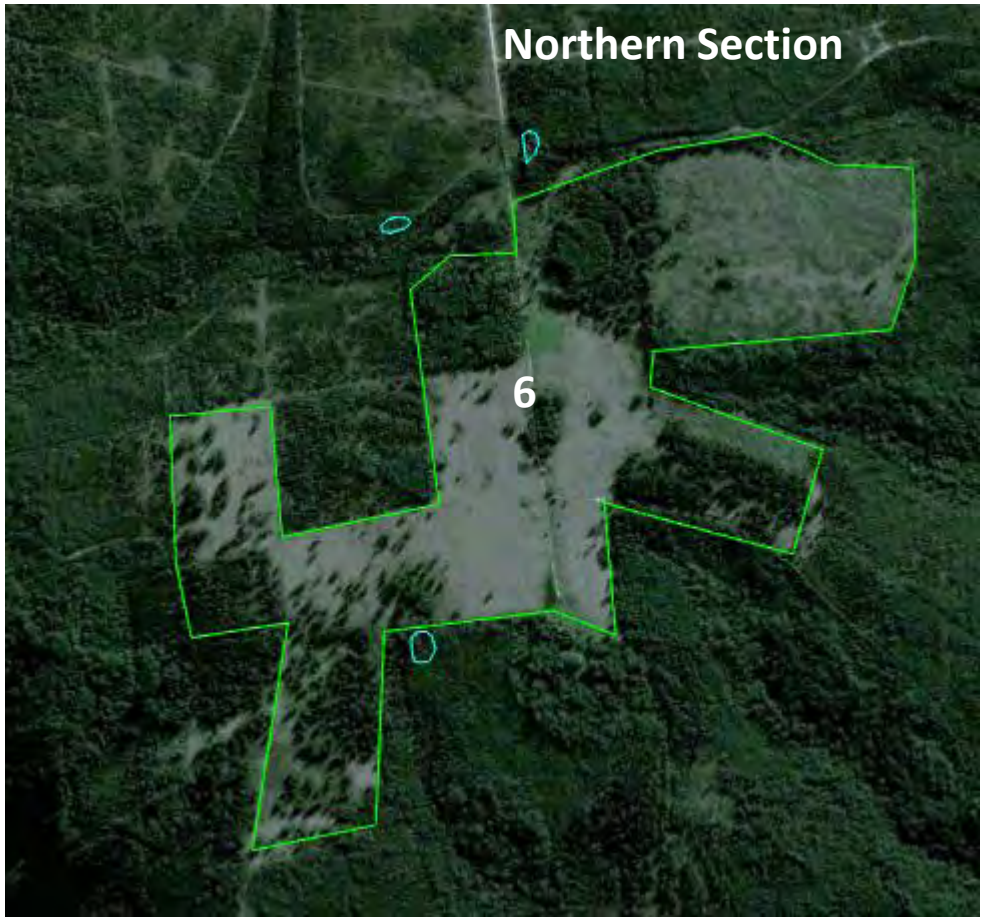
Section 21a (taking water)



Historical map of Swartvlei Lake showing agricultural lands in white in the vicinity of the historic fields (1983)

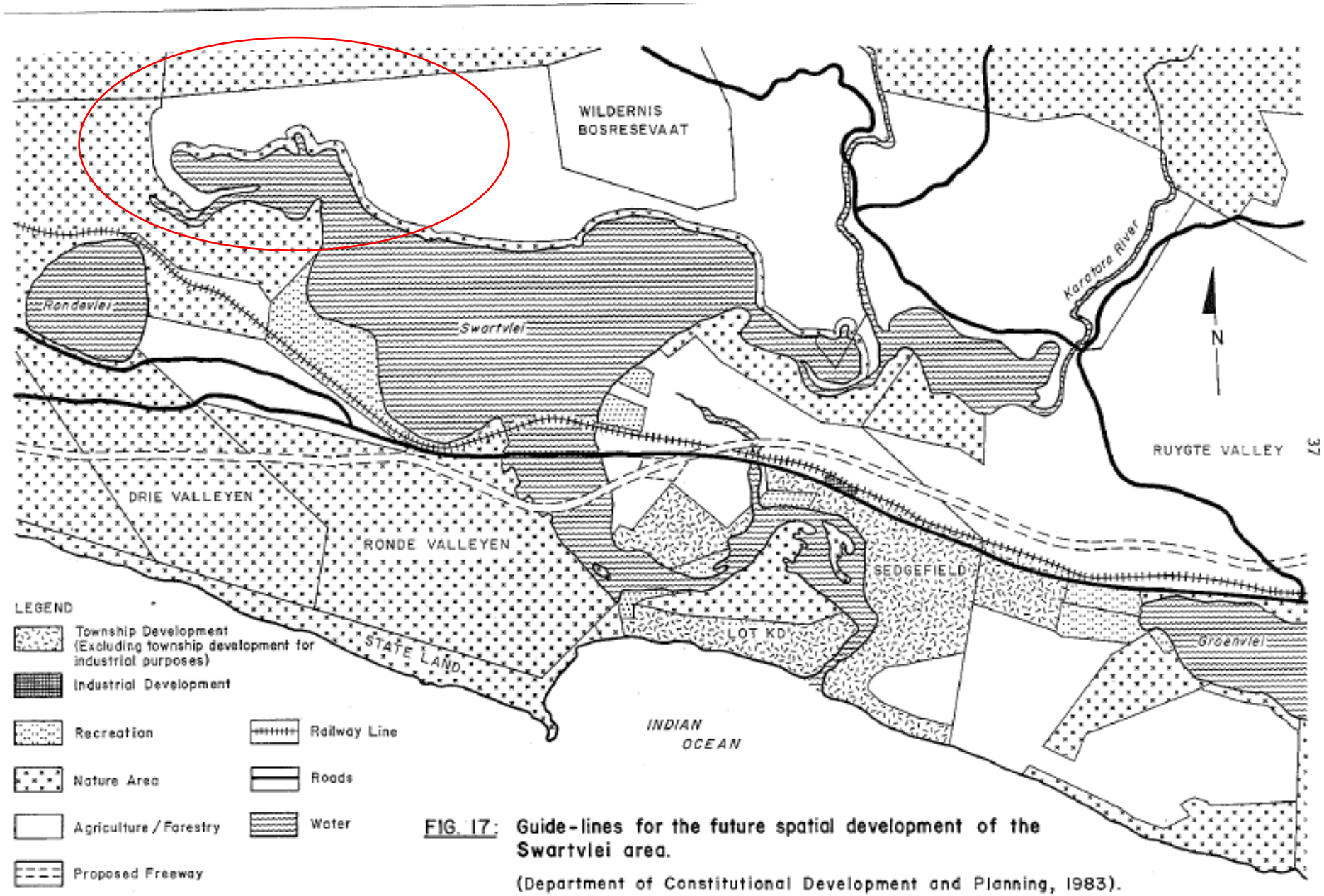


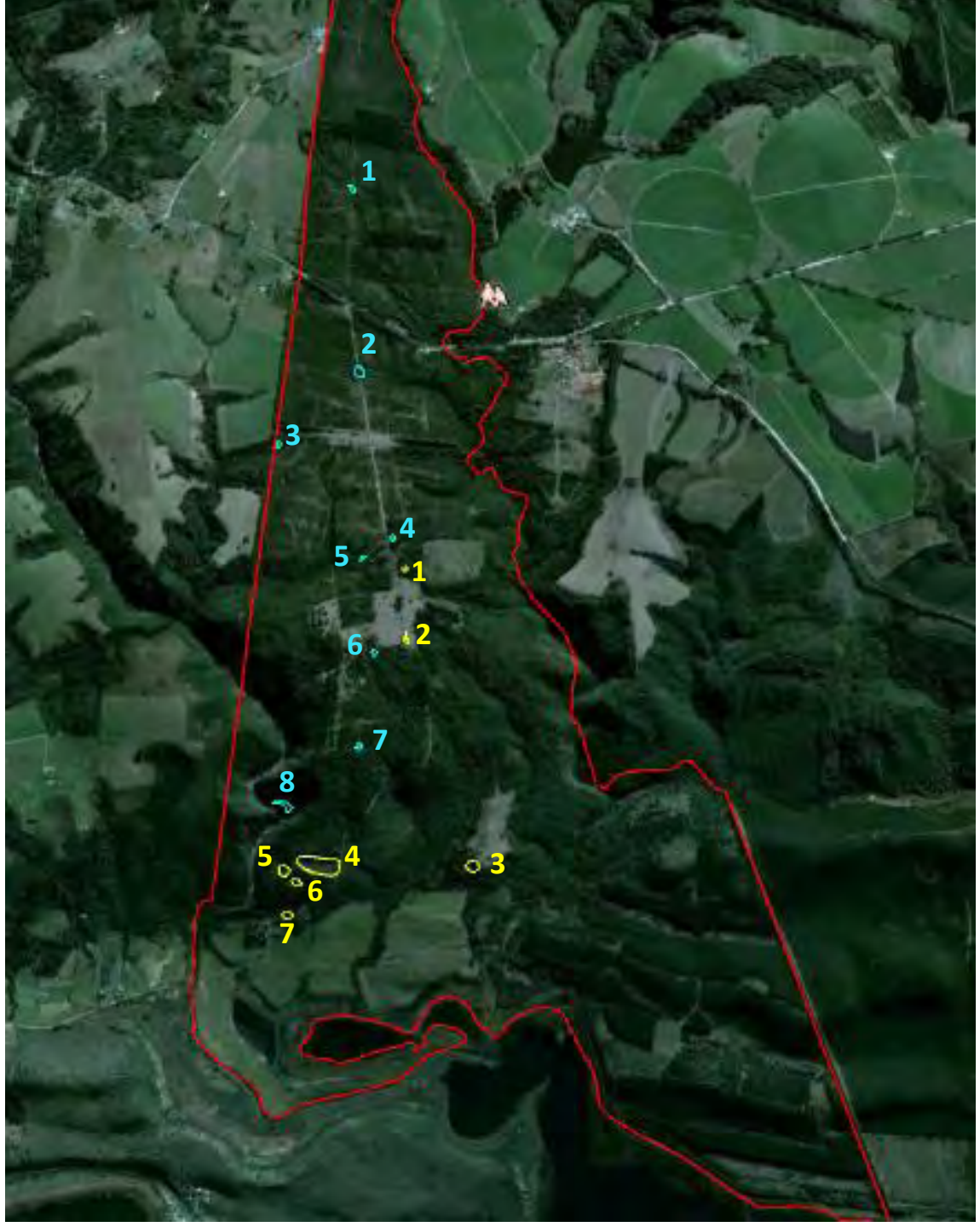
FIG. 17: Guide-lines for the future spatial development of the Swartvlei area.

(Department of Constitutional Development and Planning, 1983).

Field No.	Area (ha)	Crop?	Irrigation method (if applicable)	Notes	SAPWAT Irrigation Volume (m3/annum)
1	6.66	Annual Pastures	Quick Coupler Irrigation		
2	24.3	Hops Perennial Pastures	Micro Irrigation Draglines Irrigation		
3	12.4	Hops Perennial Pastures	Micro Irrigation Irrigation moving cannons		
4	8.79	Perennial Pastures Perennial Pastures	Irrigation moving cannons Quick Coupler Irrigation		
5	2.92	Perennial Pastures	Irrigation moving cannons		
6	33.6	Annual Pastures	Quick Coupler Irrigation		
7	13.6	Perennial Pastures	Quick Coupler Irrigation		
Total	**102.27**				**388 245m3 / annum**

Catchment = K40D

Section 21b (storing water)



Estimated instream dam storage = blue on map

INSTREAM DAM No.	Irrigation / livestock / firefighting	Approx. volume	Notes
1		1405m2 x 1 x 0.45 = **633 m3**	
2		1955 m2 x 1 x 0.45 **= 880 m3**	
3	In a kloof with high wall (6m)	693m2 x 6 x 0.45 = **1 871 m3**	
4		573m2 x 1 x 0.45 **= 258 m3**	
5		629m2 x 1 x 0.45 = **283 m3**	
6	Alien trees pushed into it	Can't calculate	
7		480m2 x 1.8 x 0.45 = **389 m3**	
8	Klein Wolwe River instream dam	1549m2 x 2 x 0.45 = **1394 m3**	
TOTAL INSTREAM STORAGE		**5708 m3**	

Offstream dam storage = yellow on map

OFFSTREAM DAM No.	Irrigation / livestock / firefighting	Approx. volume	Notes
1		470m2 x 1m x 0.45 = **212 m3**	
2		362m2 x 1m x 0.45 = **163 m3**	
3		**4000m3**	Area 0.185Ha
4	Only dam remaining Irrigation	**63200m3**	Area 1.45Ha
5		**22000m3**	Area 0.5275Ha
6		**9500m3**	Area 0.2450Ha
7		**20650m3**	Area 0.4050Ha
TOTAL OFFSTREAM STORAGE		**119725 m3**	

Dams in red are to be closed and consolidated into one big offstream 100 000 m3 dam.
Dams 3 – 7 were surveyed by a dam surveyor.

Section 21d (afforestation)

Forestry Area	Area (ha)
1	23.7
2	106
3	52.8
4	46.3
5	79.6
6	20.1
7	193
TOTAL	**521.5**

ASD

Atkinson Survey and Designs

11 Protea Hill, Blanco, George, 6529. Tel 081 831 2469

Section 27

For

Swartvlei Equestrian Estate (Pty)Ltd

Compiled by

Allan Atkinson

Licence Applicant: Swartvlei Equestrian Estate (Pty) Ltd

Swartvlei Equestrian Estate is applying for a new storage dam licence on the farm Wolwe revier 182 Portion 1, in Sedgefield Western Cape. The dam volume will be approximately 106 000m3. This Farm is run as Swartvlei Equestrian Estate farming with Avocado and Macadamia nuts.

Section27 (a) Existing Lawful uses

WARMS REG: 22118414

The farm Wolwe Revier 182 Portion 1 has a current registration for both storing of water and usage of water for irrigation purposes extracted from the Wolwe river. The idea is to consolidate 4 existing dams and build one new storage dam to ensure water security during dry months. Availability of water is becoming a great concern for us due to increased farming activity and developments upstream.

There is no effect on neighbouring farms by replacing 4 dams with one dam for storage. There are no areas of ecological and national importance (e.g. heritage sites or wetlands) that will be affected directly downstream.

Section 27 (b) Redress of past racial and gender discrimination

The farm will employ 85 Female seasonal workers, 5 Permanent female workers and 15 Male workers. With the expansion of the farm when the packhouse is built a additional 20 Permanent female positions will be filled. The farm also embarked on a training schedule to transfer skills. There is a constant training in plant production that is facilitated by the farm. They make use of external trainers to do the training. The area of Touwsranten there is a great amount of unemployed people and with the new dam the farm will be able to supply work all year round. We are also in line with the basic Equity employment act and closely monitor fair and equal opportunities and development across the scope of our business.

Section 27 (c) Efficient and beneficial use of water in the public interest.

The farm is developed with the most efficient drip and Fertigation systems available. They make ever drop of water count. The trees are planted on ridges with mulching to prevent evaporation. They make use of soil moisture probes to continuous monitoring to prevent over irrigation. All the pump stations and River extractions are metered. All irrigation is automated.

Section27(d) The sosio-economic impact

(i) The water use if authorised

The impact is huge if authorised as this will directly benefit everyone employed at Swartvlei Equestrian Estate and their extended family. This will

give us security to farm sustainably even in times of low or no rainfall. Swartvlei Equestrian Estate employs around 120 people of which 35 permanent and 85 seasonal workers. The direct benefit to the area of Towsranten is that this employment will effect at least 480 to 500 people directly.

We also uplift our local Touwsranten community by offering employment almost 12 months of the year. High rates of unemployment exist currently within this community. Production bonusses and incentive bonusses will be considered.

(ii) The water use not authorised

This will have a severe negative impact on our business as we will have to shut down operations for several months of the year to supply fruit to many local and international clients. This will cause great job losses and opportunities will be lost for our local communities

Section27(e)Catchment management strategy

Responsibility of Breede-Gouritz water management

Section 27(f) Likely effect of the water use to be authorised on the water resource and on other water users

The dam will be out of stream and is there to store water to be used for irrigation of the Avo and Macadamia farming. We are not applying for additional water rights only storing off water mainly in the winter time. We need to store this water and use it in the summer months when rainfall is low. There is no impact on other users.

Section 27(g) The class and the resource quality objectives of the water resource

There is no impact on the resource.

Section 27(h) Investments already made by the water user in respect of the water use in question.

Currently investment in the property was R30 Million For the land, Infrastructure 10 Million and further expansion will be an additional R25Million of which includes the New dam with its infrastructure. The money spend on the irrigation systems and infrastructure is to ensure absolute affective irrigation methods and water saving systems like drip irrigation and usage of mulch to preserve moisture and decrease water usage.

Section 27(i) The strategic importance of water use to the authorised

This successful application will secure current operations and improve possibilities of future expansion and development of packhouse and other value added operations. This is all done with the vision of uplifting our local community further by creating more jobs and developing skills of workers that would otherwise not have had any opportunity to do so. We are also in line with the basic Equity employment act and closely monitor fair and equal opportunities and development across the scope of our business.

Section 27(j) The quality of water in the water resource which may be required for the reserve and for meeting International obligations.

This farming operation use the Globalgap verification process as they are a supplier to export markets and standards of water quality is monitored regularly.

Section 27(k) The probable duration of any undertaking for which a water use is to be authorised

The duration of the project does not have an end date it will continue in the future as long as there is a demand for food.

Summary

Swartvlei Equestrian Estate is a dynamic farming enterprises with its focus on developing workers and improving living conditions to all its staff. We are set in an area that has high unemployment levels and we aim to address this issue even further by farming better and creating more jobs for locals. It is crucial that we get authorisation for this application to secure the sustainability of our business and see it grow with the help of our people.


Wolwerivier
Broken Dam
Damaged Dam
House dam
Swartvlei
Equestrian estate
New Dam

FRESHWATER SPECIALIST REPORT FOR PROPOSED CONSTRUCTION OF AN OFF-STREAM DAM

Portion 1 of Farm 182, Hoogekraal

Photo of the approximate site of a proposed off-stream dam. ***Photo courtesy M. Mackay***

Prepared by Dr. Jackie Dabrowski of Confluent Environmental (Pty) Ltd

For

Swartvlei Equestrian Estate

December 2021

confluent

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DECLARATION OF CONSULTANTS INDEPENDANCE

I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

• At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;

• Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;

• I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;

• I do not have any influence over decisions made by the governing authorities;

• I undertake to disclose all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;

• I have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;

• This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.

• All the particulars furnished by me in this document are true and correct.

Jackie Dabrowski (Ph.D., Pr.Sci.Nat. *Aquatic Science*)
SACNASP Registration Number 115166
Co-director: Confluent Environmental (Pty) Ltd

Qualifications: BSc, BSc Honours (Entomology), MSc & PhD (Veterinary Science)

Expertise: > 10 years' experience working on aquatic ecosystems across South Africa, with a focus on the Southern Cape in the last 3 years. Includes research and consulting expertise, having published > 10 water-related research articles and compiled > 80 aquatic specialist reports. Research and consulting have been in a range of sectors including agriculture, urban developments, linear structures, renewable energy, conservation, and mining.

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1. INTRODUCTION

Confluent Environmental was appointed by Swartvlei Equestrian Estate to conduct an Aquatic Specialist Report for a proposed off-stream dam development on Portion 1 of Farm 182, Hoogekraal, George in the Western Cape. The dam proposed would have a storage capacity of 106 000 m^3 which would comprise of storage transferred from four existing off-stream dams on the property, as well as additional storage to make up the difference (Figure 1).

Figure 1. Satellite image of the site showing the proposed off-stream dam site (red) and the 4 existing off-stream dams (yellow) to be closed and consolidated for storage of water in the new dam.

The depth would be approximately 7.4 m, with the northern section excavated below ground level, and the western, southern and eastern sections slightly built up with an embankment (Figure 2). Soil at the site is very sandy with high infiltration rates, so soil from the site will be mixed with clay, and the final embankments and basin will be sealed with a clay layer. Approximately 20 000 m^3 of soil needs to be excavated, and it is proposed that excavated material be used to fill the redundant dams elsewhere on the property. The water will be utilised for irrigation of Macadamia nut and Avocado orchards which were converted from historical commercial forestry and pasture in the last 12 – 24 months.

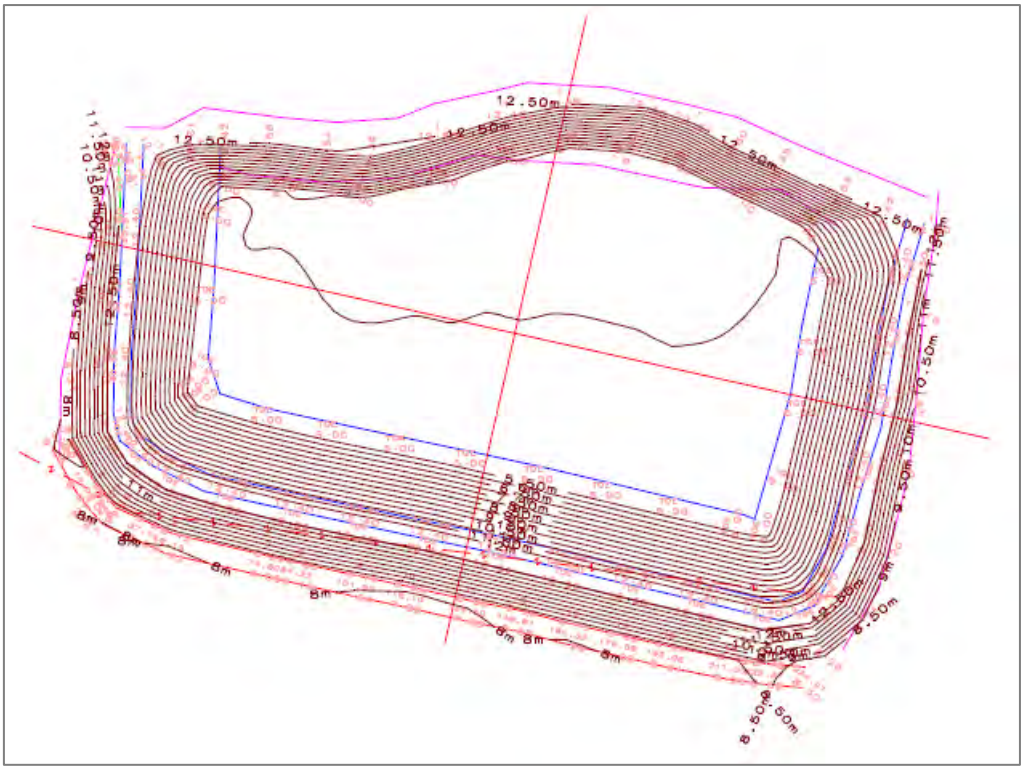

Figure 2. Diagrammatic layout of the proposed off-stream storage dam on 1/182 Hoogekraal (supplied by A. Atkinson).

1.1 Terms of Reference

This assessment was requested by the Breede-Gouritz Catchment Management Agency (BGCMA) to inform the application for a Water Use License (WUL) required for the off-stream dam. The objectives of this assessment included the following:

- To undertake a desktop analysis and site inspection to verify the presence and condition of watercourses within the regulated area of the proposed off-stream dam.
- Determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of watercourses.
- Classify watercourses within the regulated area of the proposed construction.
- Identify sensitive areas and recommend riparian buffer zones of protection where necessary.
- Compile an impact assessment of the proposed dam construction including mitigation measures to reduce the risk of degrading aquatic ecosystems.

1.2 Assumptions and Exclusions

- Delineating wetlands where recent disturbance of soil has taken place for orchard establishment is challenging. However, allowance was made for the fact that a more-or-less constant (20-30 cm) amount of soil had been scraped into ridges for Macadamia Nut trees. This was accounted for when augering to the stipulated 50 cm depth for delineation purposes.

2. ASSESSMENT AREA

2.1 Catchment Context

The property is in quaternary catchment K40D (Table 1; Figure 3). Several watercourses flow through the property that drain into the western arm of Swartvlei Lake through the Diep (a.k.a. Wolwe) River and other smaller tributaries. The Diep River forms part of the western boundary of the property, and water stored in the proposed dam would be pumped from an existing instream dam on the Diep River. The total Swartvlei catchment area is 340 km^2 with the Diep River system covering 125 km^2. A large proportion of this catchment was under forestry (*Eucalyptus* sp. and Pine) until the current landowner commenced with clearing and conversion to other forms of agriculture. Namely dryland pastures for dairy farming to the north, and Macadamia Nuts and Avocados in the vicinity of the proposed off-stream dam.

The mapped extent of Swartvlei Lake shown in Figure 3 corresponds with the 5 m. a.m.s.l. contour which defines the Estuarine Functional Zone (EFZ). The proposed dam site has a fairly uniform gentle slope which averages 4%.

Table 1. Summary of relevant catchment features for 1/182 at the location of the proposed dam.

Feature	Description
Water Management Area	Gouritz
Quaternary catchment	K40D
Mean Annual Runoff	254 mm
Mean Annual Precipitation	757 mm
Ecoregion Level II	22.02
NFEPA area	9027, Upstream Management Area
Vegetation Type	Garden Route Shale Fynbos

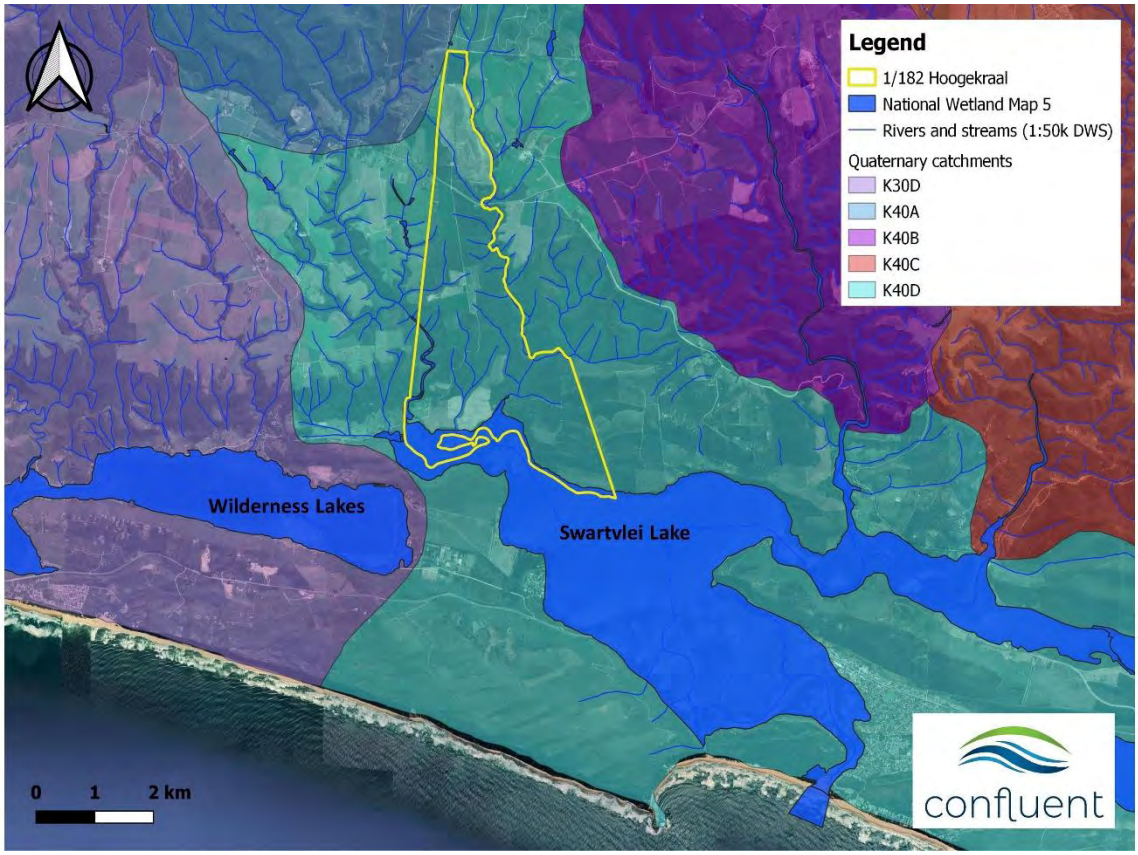

Figure 3. Location of Portion 1/182 Hoogekraal Farm in quaternary catchment K40D.

Although multiple watercourses are present on and adjacent to the property, there are no mapped aquatic features within the footprint of the proposed dam (Figure 4).

However, according to the National Water Act (Act No. 36 of 198) Government Notice 509 of 2016, the regulated area of a watercourse includes a 500 m radius from the delineated boundary (extent) of a wetland. As indicated in Figure 4, mapped watercourses do occur within the regulated area which formed the subject of this assessment. This includes areas defined as the Estuarine Functional Zone in Swartvlei Lake.

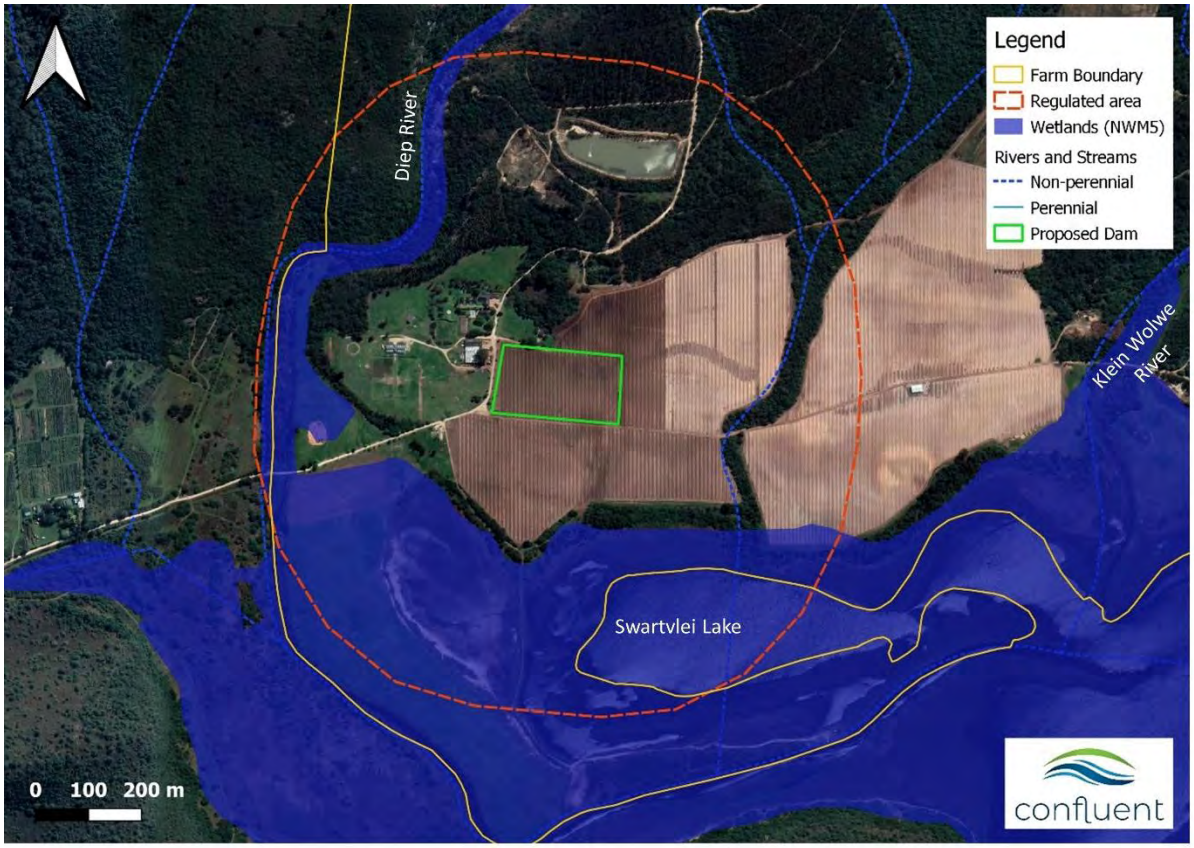

Figure 4. Map of the southern portion of 1/182 showing the proposed location of the off-stream dam in relation to mapped wetlands, rivers, and streams within 500 m of the dam (regulated area).

2.2 Conservation status and management guidelines

Swartvlei estuary is ranked 7th out of 273 estuaries in South Africa from a biodiversity conservation perspective, which is considered highly important (Turpie *et al*., 2002).

2.2.1 Resource Quality Objectives

Resource Quality Objectives (RQOs) are defined as clear goals (numerical or descriptive statements) relating to the quality of a water resource and are set in accordance to the management class for the resource to ensure the water resource is protected. The purpose of RQOs is to set clear objectives for the resource against which water use licenses and the related impacts can be evaluated and managed to achieve a balance between the need to protect and utilise the resource. The Breede-Gouritz Catchment Management Agency (BGCMA) concluded an assessment of water resources in the Water Management Area (DWS, 2018).

The recently determined Resource Quality Objectives (RQOs) for Swartvlei Estuary (quaternary catchment K40D) acknowledge that demands for freshwater supply will increase, but that these should be carefully managed to ensure that the estuary remains in a 'B' ecological category (DWS, 2018; Appendix 1). The abstraction of any water from the Diep (Wolwe) River to sustain the irrigated areas over and above the historical use of water, must be assessed to ensure that water abstracted does not compromise the quantity and quality of water in terms of the Ecological Reserve for both the river itself, and the Swartvlei Estuary.

2.2.2 National Freshwater Ecosystem Priority Atlas

The property is in area 9027 according to the National Freshwater Ecosystem Priority Atlas (Nel *et al.,* 2011) which is classified as an Upstream Management Area with the following management objectives: "*These are sub-quaternary catchments in which human activities need to be managed to prevent the degradation of downstream Protected Areas and Fish Support Areas."*

2.2.3 Western Cape Biodiversity Spatial Plan

According to the Western Cape Biodiversity Spatial Plan (WCBSP, 2017) there are no Critical Biodiversity Areas or Ecological Support Areas located within the footprint of the proposed dam (Figure 5). However, within the Regulated Area of the proposed dam site are sections of watercourses mapped as **Protected Areas**, **Critical Biodiversity Area 1 (CBA1)** and **Ecological Support Area 2 (ESA2)**. The definition and management objectives for these classified areas are as follows:

Protected Area:
Swartvlei Lake is located in the Garden Route National Park and managed by SANParks. This is the highest level of conservation protection as protected areas are proclaimed under national legislation (National Environmental Management: Protected Areas Act, Act 57 of 2003).
Protected Area Objective:
Keep in a natural state, with a management plan focussed on maintaining or improving biodiversity. A benchmark for biodiversity conservation.

CBA1 Definition:
Areas in a natural condition that are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure.
CBA1 Objectives:
Maintain in a natural or near-natural state, with no further loss of natural habitat. Only low-impact, biodiversity-sensitive land uses are appropriate.

ESA2 Definition:
Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas or Critical Biodiversity Areas and are often vital for delivering ecosystem services.
ESA2 Objectives:
Restore and / or manage to minimise impact on ecological processes and ecological infrastructure functioning, especially soil and water-related services, and to allow for faunal movement.

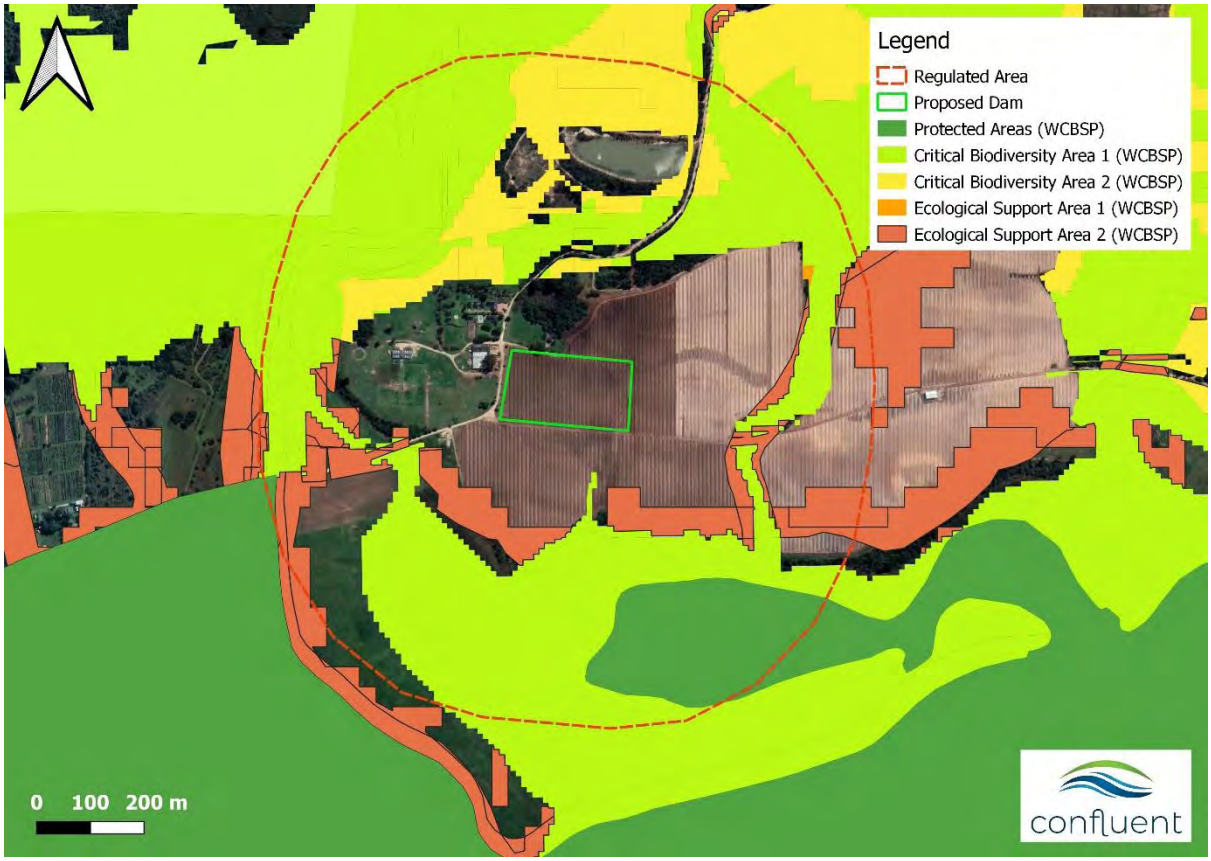

Figure 5. Areas identified for the protection of biodiversity in the Western Cape Biodiversity Spatial Plan (WCBSP).

2.3 Vegetation

Vegetation within the proposed dam footprint is mapped as Garden Route Shale Fynbos, which has a Vulnerable conservation status (SANBI, 2018). The mapped vegetation type has been largely modified from its original state by farming which has taken place at the site for many decades.

Within the Regulated Area the mapped vegetation is fairly complex with multiple elements (Figure 6). Along the shoreline of Swartvlei Lake are two estuarine vegetation units: Estuarine vegetation, reeds and sedges; and Estuarine Vegetation Salt Marsh, neither of which have a conservation classification. Knysna Sand Fynbos is mapped through much of the rest of the area including a large part of the shoreline along Swartvlei Lake, which corresponds to the Critical Biodiversity Area 1 in the WCBSP. This vegetation unit is classified as Critically Endangered. Areas of the Diep River are mapped as Southern Afrotemperate Forest and Garden Route Shale or Granite Fynbos, which are classified as Least Concern, Vulnerable and Critically Endangered respectively. Southern Cape Dune Fynbos occurs within the Estuarine Functional Zone adjacent to the Diep River and is classified as Least Concern.

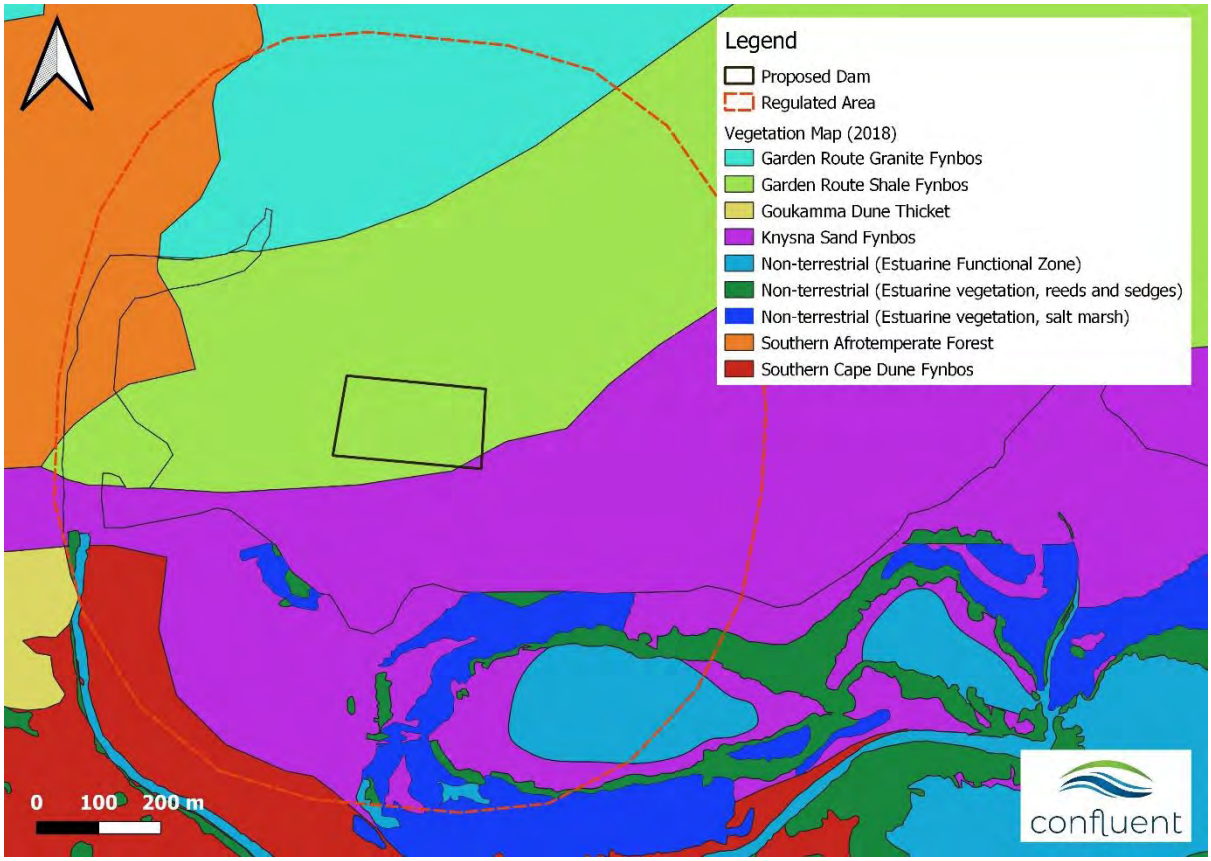

Figure 6. Mapped vegetation units based on SANBI VegMap (2018).

The mapped vegetation type as indicated in Figure 6 represents the reference condition with no consideration for development which may have occurred. A more representative picture of the state of vegetation is presented in Figure 7 which was compiled by SANParks for the Swartvlei Lake and Estuary shoreline c. 1998. This indicates the historical agricultural fields as 'Developed' which is defined as: "Areas that have been completely transformed by human activities and no longer support estuarine functioning. They consist of hard structures such as residential and industry that are unlikely to be removed. It also includes agricultural land."

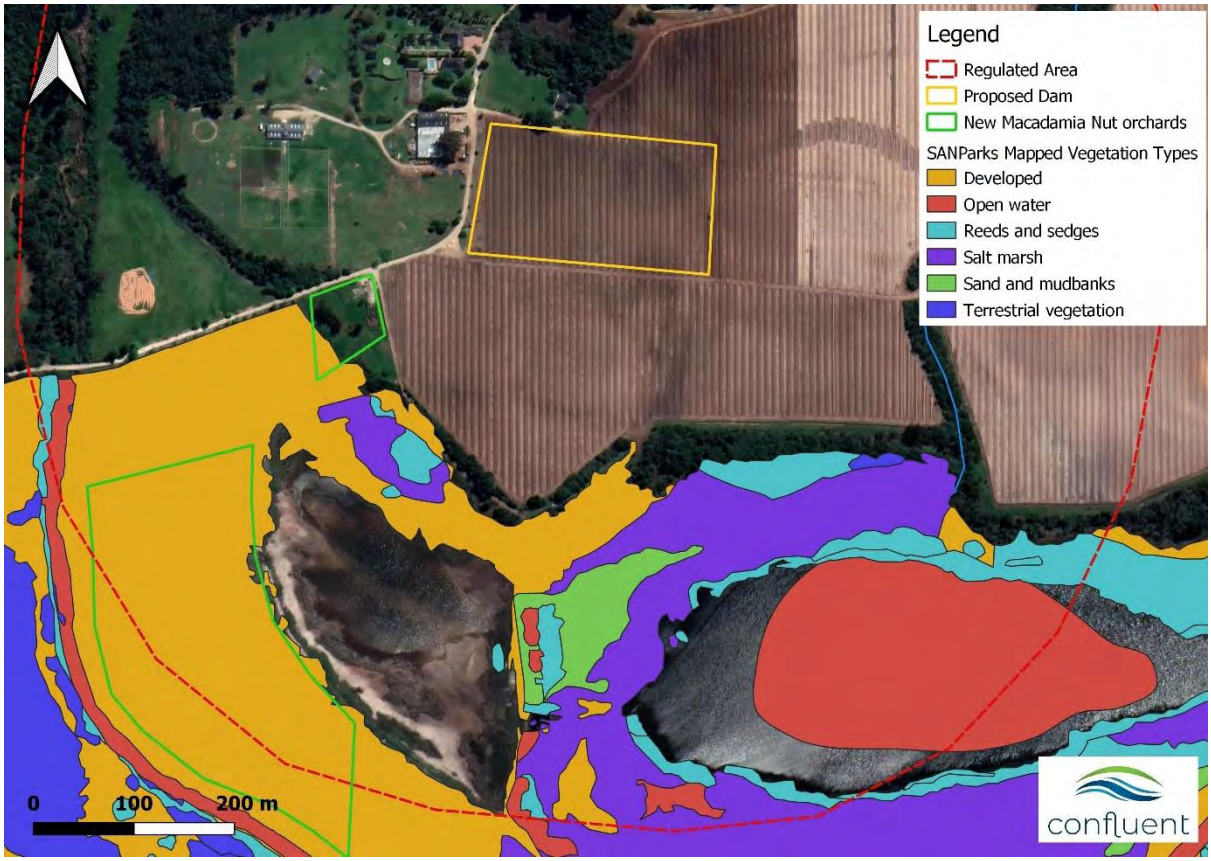

Figure 7. Mapped vegetation units based on 1998 survey by SANParks.

2.4 Historical perspective

The location of the proposed off-stream dam is in a historical agricultural field that shows no indication of any watercourse within the footprint of the proposed dam (Figure 8). Prior to recent conversion of fields to Macadamia nuts, the fields were mainly irrigated pasture, and hops were historically cultivated.

The 1991 image indicates other watercourses such as the Diep River, Swartvlei Lake and the unnamed drainage line to the east within agricultural fields. These were historically perennial and annual dryland pastures that were irrigated with quick coupler systems.

Appendix 2 shows an image from 1936 which clearly indicates historical clearing of the mapped vegetation types and conversion to agricultural fields.

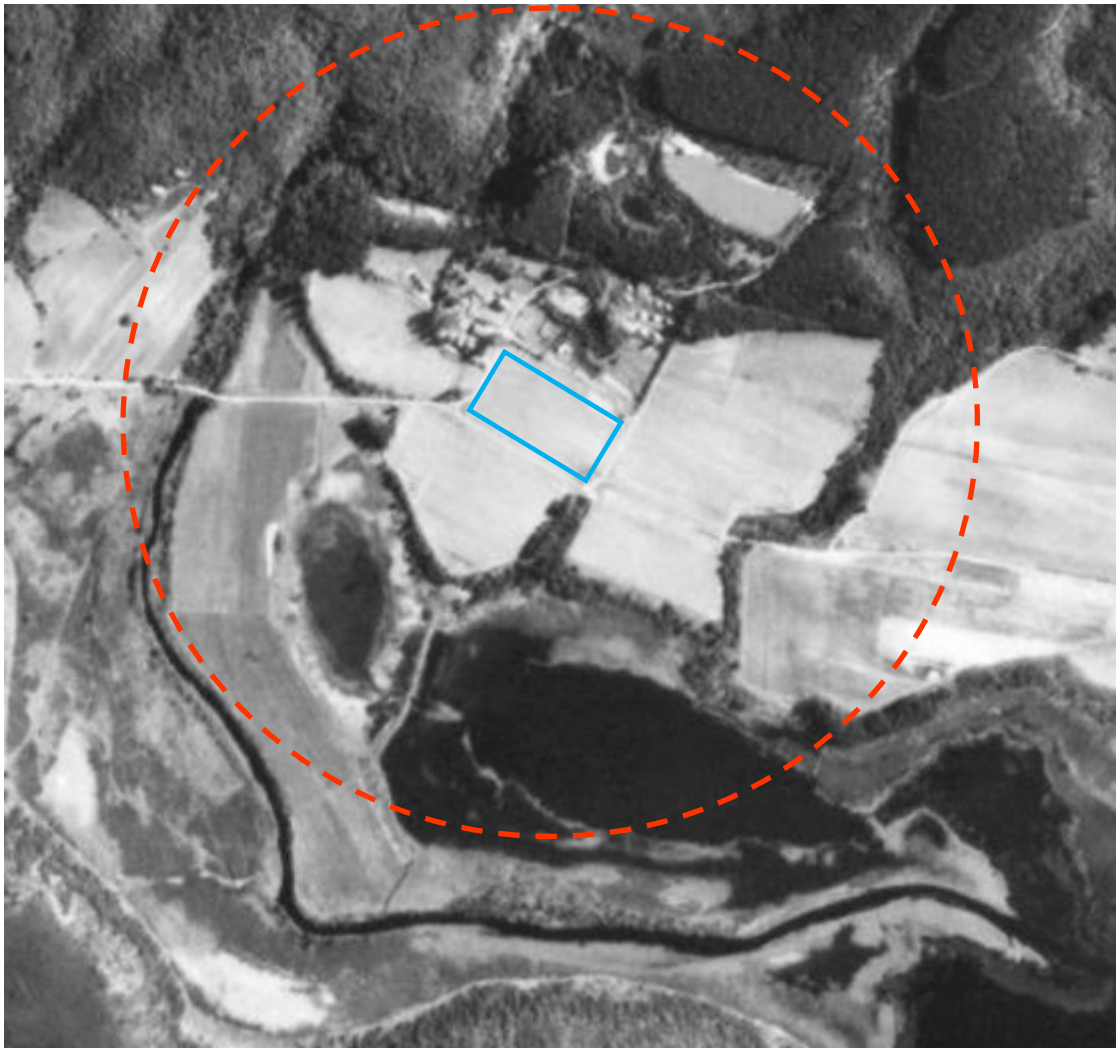

Figure 8. Historical aerial photo taken of 1/182 in 1991 showing the approximate location of the proposed dam in the Regulated Area.

3. SITE VISIT

The site was visited on 1 November and 1 December 2021 which is considered late spring to early summer. On both occasions it had rained within the preceding 24 hrs and the weather was overcast. The site of the proposed off-stream dam currently has soil ridges that were prepared for Macadamia nuts (Figure 9). There was no evidence of any hydrophilic wetland plants or visible wetness signatures in the proposed footprint of the dam. There are no drainage lines, channels, riparian vegetation, or any other aquatic feature associated with a watercourse in the site of the proposed off-stream dam. The remainder of the site visit focussed on the condition of watercourses within the regulated area of the proposed dam site.

Figure 9. Image of the historical agricultural field proposed as the site for the off-stream storage dam (courtesy M. Mackay).

3.1 Watercourse classification

Watercourses were classified using methods described by Ollis *et al.* (2013). The Diep River along the western boundary of the property is classified as a *Channelled Valley-Bottom Wetland.* The point at which the access road to the Swartvlei Equestrian Estate crosses the river has biomonitoring records between 2004 and 2021 which indicate that the system is classified as freshwater (max. Electrical Conductivity = 340 mS/m) according to the salinity classification categories (Ollis *et al*., 2013). The banks of the Diep River are dominated by dense growth of typical wetland plants (*Phragmites australis* and *Cliffortia odorata*) as opposed to tall growth of typically terrestrial trees, which characterise riparian zones of the river further upstream.

The watercourse to the east of the proposed dam is classified as a non-perennial drainage line. During the site visit there were no observable wetland features associated with this watercourse, and it had a densely vegetated riparian zone dominated by indigenous forest which included very old yellowwood trees. The regulated area as defined in GN 509 proposed dam does not include the drainage line.

Swartvlei is classified as a Temporary Open Closed Estuary (TOCE) which is largely regulated by the amount of river inflow received. TOCEs become isolated by a sand berm across the estuary mouth during periods of low river inflow. They remain closed until their basins fill up with sufficient water to breach the berm. However, reduced freshwater inflows (due to abstraction and damming in the catchment) coupled with extensive development in the EFZ have modified the frequency and water levels at which breaching occurs. Mouth management is now controlled by SANParks and the mouth is artificially breached when water levels reach 2 m.a.m.s.l.

The boundary between the freshwater and estuarine systems of the Diep River and Swartvlei Lake is not definable, because the degree of dominance by each system is dependent on respective water levels in the river and the lake which would influence soil water salinities. The latter is dependent on whether the estuary mouth is open or closed. System-specific vegetation would typically guide this distinction but cannot be used to distinguish a meaningful boundary because of present (Macadamia Nut orchard) and past (grazing pasture) agricultural activities that have largely replaced the natural vegetation. In ecological terms this area is referred to as an Ecotone where a mix of estuarine vegetation and terrestrial / freshwater species occurs within a floodplain area.

Table 2. Classification of the watercourses within 500 m of the proposed dam construction.

	Level 1	Level 2		Level 3	Level 4
Watercourse ID	**System**	**DWS Ecoregion**	**Vegetation**	**Landscape Unit**	**4A**
Diep River	Inland	20.02 South Eastern Coastal Belt	Multiple: Southern Cape Dune Fynbos; Knysna Sand Fynbos; Garden Route Shale Fynbos; Southern Afrotemperate Forest.	Valley floor	Channelled Valley-Bottom Wetland
Unnamed eastern drainage line	Inland	20.02 South Eastern Coastal Belt	Knysna Sand Fynbos and Garden Route Shale Fynbos	Valley floor	Drainage line with intermittent flow
Swartvlei Lake	Estuarine	20.02 South Eastern Coastal Belt	Non-terrestrial estuarine vegetation, salt marsh	Coastal Plain	Estuarine Lake

3.2 Wetland delineation

The delineation of wetland areas within the regulated area focussed primarily on the western arm of Swartvlei Lake and the potential zone of interaction with the Diep River which is classified as a channelled valley bottom wetland at this point.

Wetland extent was delineated using methods developed by DWAF (2005). The outer edge of the temporary zone is used to define the edge of the wetland. The outer edge is identified using four indicators:

1. Terrain Unit Indicator
   Identify parts of the landscape where wetlands are more likely to occur.
2. Soil Form Indicator
   Identification of soil form as defined by the Soil Classification Working Group.
3. Soil Wetness Indicator
   Identifies morphological 'signatures' developed in the soil profile because of prolonged or frequent saturation.
4. Vegetation Indicator
   Identifies hydrophilic vegetation associated with frequently saturated soils.

Soil wetness indicators are the primary indicator with the other three indicators being used in a confirmatory role. This is because vegetation can respond quickly to changes in soil

moisture and may be transformed (as is the case at the site), while soil wetness indicators are retained in the soil long after a wetland has been drained or altered.

3.2.1 Terrain Unit Indicator

The location of Swartvlei Lake and the lower reaches of the Diep River are low-lying with a very minor gradient, mostly below 5 m.a.m.s.l. The mapped wetland areas in Figure 4 correspond with the 5 m contour. This area drains the southern slopes of the foothills of the Outeniqua Mountains and is therefore a likely area where wetlands would occur.

3.2.2 Soil Form Indicator

The soil form is classified as the Tukulu soil form based on the following diagnostic horizons:

Topsoil: Orthic A

Subsoil: Neocutanic B with signs of wetness

The broader classification of soils at the site is ‘grey regic sands’. Regic is Greek for blanket, which conveys the idea of cover sands where little or no profile development has taken place due to their youth. The Tukulu soil form has a minor increase in clay with depth. The darker subsoil layers shown in Figure 10 are slightly enriched with clay, and slight mottling in this layer indicates wetness.

Figure 10. An excavated area showing a clear soil profile of the land between Swartvlei Lake and the Diep River.

3.2.3 Soil Wetness Indicators

Soil augering was conducted in transects across the two new Macadamia Nut orchards (not updated on satellite imagery yet) as indicated in Figure 11. At least 50 auger points were recorded to determine the edge of the Swartvlei Lake and the Diep River. Despite the high

sand content of soils at the site, typical soil wetness indicators such as mottling were present in the seasonal and termporary zones, and dark grey to black soil in permanent zones of saturation (Table 3).

Table 3. Description of typical soils augered for each wetland zone along the western shore of Swartvlei Lake and the Diep River.

Typical Soil Auger Samples	Wetland Zone
	Non wetland soil
	The temporary zone of the wetland showing few high chroma mottles within the brown soil matrix. The temporary zone is defined by short periods of saturation for a duration of less than 3 months per year.
	The seasonal zone of the wetland showing grey-brown soil with many high chroma mottles and gleyed areas. The seasonal zone typically has a significant wet period for at least 3 months per year.

	The permanent zone of the wetland / estuary is characterised by a permanent dark to light grey matrix with no high chroma mottles. Soil in this zone is permanently wet.

3.2.4 Vegetation Indicators

Indigenous vegetation associated with both freshwater and estuarine wetland areas was observed in delineated wetland areas. Dominant species have been listed in Table 4. Much of the estuarine vegetation along the shoreline of Swartvlei Lake has been historically and recently disturbed due to agriculture, although isolated patches of several of the estuarine species listed in Table 4 are growing between Macadamia Nut ridges.

Table 4. Wetland / estuarine indicator plant species recorded from the Diep River and Swartvlei Lake shore.

Species	Common name	Estuarine / Freshwater
Diep River		
Phragmites australis	Fluitjiesriet / clubrush	Estuarine or freshwater
Cliffortia odorata	Wild vine	Freshwater
Cliffortia strobolifera	Vleibos	Freshwater
Cyperus textilis	Mat sedge	Freshwater
Zantedeschia aethiopica	Arum lilly	Freshwater
Swartvlei Shoreline		
Salicornia meyeriana	Glasswort	Estuarine
Triglochlin striata	Streaked arrow grass	Estuarine or freshwater
Spartina maritima	Salt grass	Estuarine
Stenotaphrum secundatum	St. Augustine grass	Naturalised Estuarine
Paspalum vaginatum	Swamp coach	Estuarine

3.2.5 Delineation

Based on the factors described above, the wetland area of the Diep River, and western shoreline of Swartvlei Lake in the vicinity of recently planted fields was delineated. The delineation focussed on these areas because little to no buffer has been accommodated in parts of the field layout, which is addressed in this report. While the current field layout reflects the historical agricultural use of these fields (pasture for grazing), the movement of soil, more intensive management of soil and pests, and installation of irrigation pipelines required for establishment of Macadamia Nuts represents a greater risk to the adjacent lake and wetland ecosystem than the historical agricultural use.

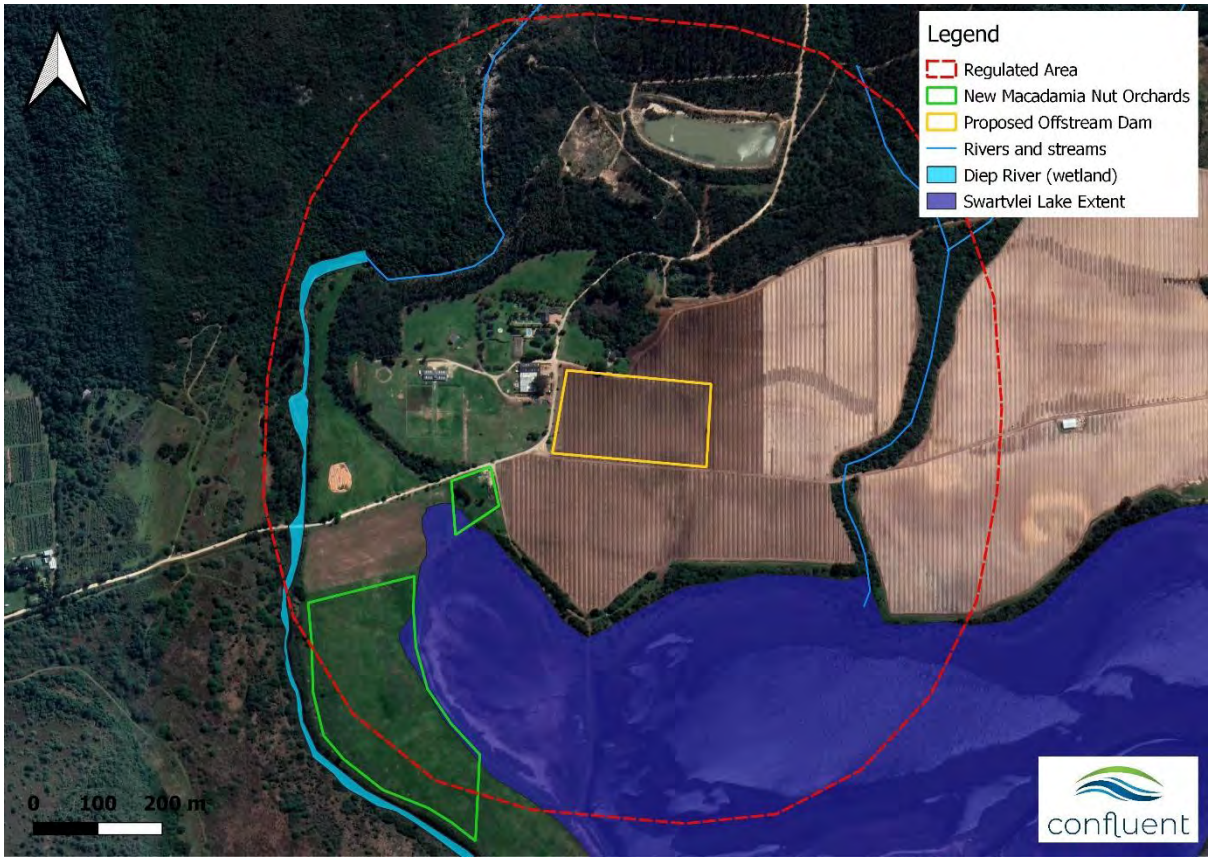

Figure 11. Delineated wetland areas within the regulated area of the proposed off-stream dam.

3.3 Present Ecological State (PES)

3.3.1 Methods

The methods used to determine the PES for the Diep River within the regulated area of the dam construction are provided in Appendix 2. These followed the Level 1 WET-Health assessment tool developed by Macfarlane *et al*., (2008).

3.3.2 Diep River PES

The assessment applied to the Diep River within the regulated area of the proposed off-stream dam including sections of approximately 500 m upstream and downstream. This area included the narrow strip of historical pasture (now Macadamia nuts) approximately 150 m wide between the Diep River and the western shoreline of Swartvlei Lake.

Hydrology considers the movement, distribution and volumes of water within a system. This is the most modified aspect of the three modules assessed (Table 5). Base flows are moderately reduced due to abstraction of water for historical and present irrigation purposes. The historical instream weir / dam on portion 1/182 is used for this purpose (Figure 12). Flood peaks are reduced to an extent due to impoundments on the Diep River. Minor impacts to the river channel are present due to the access road crossing and instream dam / weir on the property. The middle reaches of the Diep River catchment contain areas of extensive agriculture (pasture-based dairy farming) upstream of the area assessed which would increase sediment loads during periods of high rainfall. As the gradient reduces in the wetland area this sediment settles out of suspension resulting in deposition on the bed. The

Sections of the Diep River bed and banks have been colonised by black wattle which are large in some cases. These trees have a negative impact on vegetation composition (displacing indigenous vegetation), groundwater levels, and channel structure. Overall, the Present Ecological State of the Diep River at this point is determined to be **C, Moderately Modified**.

Table 5. Results of the WET-Health assessment to determine the Present Ecological State (PES) of the Diep River

Present Ecological State
HYDROLOGY
Moderate reduction in base flows due to abstraction of water for historical and present irrigation.
Minor decrease in flood peaks due to instream dam collecting surface water.
Minor modifications to river channel due to road crossing and weir.
Moderate downstream and minor upstream impact of instream dam.
Hydrology PES Category: C, Moderately Modified
GEOMORPHOLOGY
Deposition has occurred in the riverbed due to erosion from upstream agricultural return flows.
Geomorphology PES Category: A, Unmodified Natural
VEGETATION
Minor to moderate invasion of wetland / riparian areas with alien trees including Black Wattle.
Removal / transformation due to historical pasture and grazing.
Minor sedimentation instream smothering macrophytes
Vegetation PES Category: B, Largely Natural
OVERALL PES: C, Moderately Modified

b. Wetland habitat beyond the fenced field

a. *Phragmites australis* near road crossing

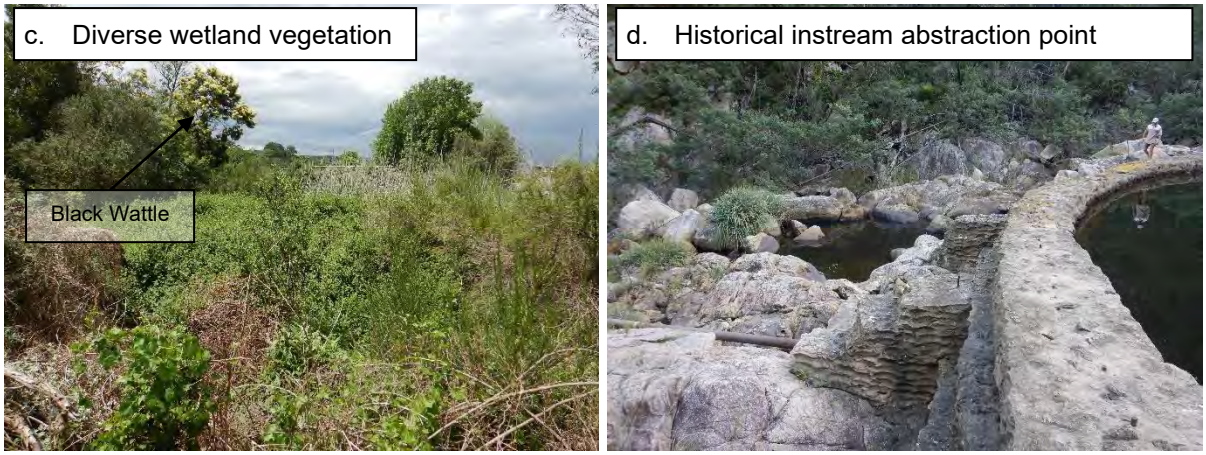

Figure 12. Photos of aspects of the Diep River showing low-lying wetland areas (a,b,c) and the abstraction point upstream (d).

3.3.3 Swartvlei Lake PES

The Present Ecological State (PES) of the Swartvlei Estuarine Lake as a whole system is categorised as **B, in a good state which is largely natural, with few modifications**. Recommended mitigation measures to improve this state are to restore base flows from the catchment, and to improve mouth management practices (Van Niekerk *et al.,* 2015). The current PES of Swartvlei was determined as part of a nationwide assessment of the PES of estuaries conducted by Van Niekerk *et al.* (2015). While this finding provides useful baseline information about the estuary which better informs broad-scale management, it does not provide the resolution required for smaller-scale site assessment.

Localised impacts affecting the Present Ecological State of Swartvlei Lake include:

- Increased sedimentation and turbidity related to ripping and ridging of soil into rows for establishment of Macadamia Nut orchards. This is particularly relevant in areas with limited buffering such as the narrow strip between the Diep River and the lake shore (Figure 13).
- Creation of new preferential flow paths through orchard rows which can have a localised impact on wetland hydrology and water quality. The landowner has planted dense pasture mixes along the orchard floor to reduce this impact (recognised best practice), but in waterlogged areas the growth is limited leaving soil exposed to runoff (Figure 13).
- Potential water quality concerns due to agricultural return flows and leaching (containing nutrients and pesticides) entering the lake through groundwater and surface runoff, particularly where limited buffers are present and cultivation is in waterlogged areas. The soil (grey regic sands) has a very high sand content which encourages rapid infiltration of water through the profile, increasing the risk of polluting groundwater.
- While the historical land use was grazed pasture for at least 80 years, indigenous salt marsh vegetation and some of the adjacent fynbos appear to have been interspersed throughout the field. This vegetation was removed during the redistribution of soil, and a large variety of weeds have been introduced in the process (e.g. black wattle (*Acacia mearnsii*), jointed charlock (*Raphanus raphanistrum*)) reducing the indigenous diversity of plants.

- Macadamia nut trees have been planted in areas where waterlogging of the soil regularly occurs adjacent to Swartvlei Lake. This is not sustainable for the trees in the long-term as trees that are in poorly drained soil are continually at risk of developing phytophthora fungus on the roots which causes root rot and death of the trees. Particularly as the trees grow larger and roots extend deeper than the soil ridges. Furthermore, waterlogged areas proximal to the lake will have elevated salinity which could also affect tree growth. Trees planted in the strip between the Diep River and Swartvlei shoreline have all died, indicating that local environmental factors may be unsuitable for cultivation (the landowner indicated frost in this instance). The presence of typical salt marsh vegetation between Macadamia rows such as *Triglochlin striata* (streaked arrow grass) and *Salicornia spp.* (glasswort) indicates that the soil is both waterlogged, and saline (Figure 13).

The salinity of standing water between Macadamia Nut rows in both new orchards was measured *in situ* with a handheld multiparameter Hanna meter. The Electrical Conductivity (EC) of standing water in the northern field was 14.98 mS/cm (14 980 uS/cm) and the southern field was 81.07 mS/cm (81 070 uS/cm).

Simplified methods to determine the PES of a section of estuary, or a lake have not been developed in South Africa and are still limited to rivers and wetlands. Based on the above impacts the conversion of pasture to Macadamia Nut orchards has had a, detrimental impact on the PES of Swartvlei Lake, albeit very localised.

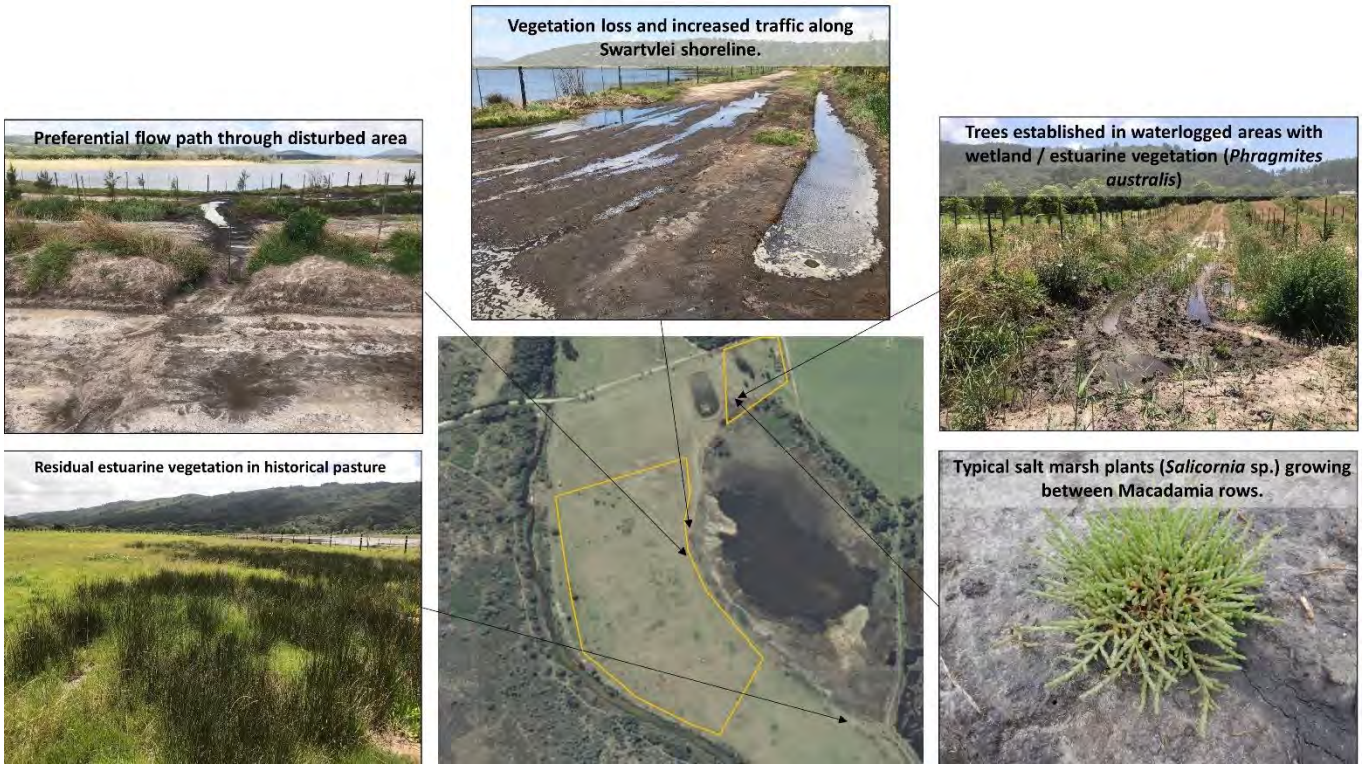

Figure 13. Photos taken in recently established Macadamia Nut orchards adjacent to Swartvlei Lake (yellow outlines indicate approximate field areas).

3.4 Ecological Importance and Sensitivity (EIS)

3.4.1 Diep River EIS Methods

The methods used to determine the EIS for the Diep River are provided in Appendix 4. These followed the methods developed by Rountree *et al*., (2013).

3.4.2 Diep River EIS

The EIS of the wetland section of the Diep River was determined to be **Very High**. The river makes up approximately one third of the catchment of Swartvlei Lake with a catchment area of c. 98.3 km^2. The wetland section therefore plays a critical role in terms of maintaining water quality in Swartvlei. The functions of sediment trapping, nutrient removal, flow maintenance, and flood attenuation cannot be over-emphasised as Swartvlei Lake is known to respond negatively to these adverse impacts.

While the right (eastern) bank of the Diep River belongs to Swartvlei Equestrian Estate, the left (western) bank is managed by SANParks as part of the GRNP and includes a popular hike called the Cape Dune Molerate trail.

Although no Red Data species are known to occur in the wetland, the unique setting of the wetland adjacent to the GRNP increases the likelihood of rare or endangered species occurring. Populations of unique species occur within the wetland area without doubt as they have been sampled as part of a monitoring programme conducted by the water affairs department.

In its full extent, the Diep River creates an important corridor and link between the coastal plain and upland areas in the Outeniqua foothills and mountains. Further value is as a link between marine and freshwater environments which is necessary for increasingly threatened species such as catadromous freshwater eels (*Anguilla mossambicus*) which swim down the Diep River and out to sea when the estuary mouth is open.

Coastal lake systems are rare in South Africa, with only the Wilderness Lakes and Swartvlei, along with Lake Sibaya classified as such. Therefore, the wetland area of the Diep River where it enters and interacts with Swartvlei Lake is considered a highly unique wetland type.

Table 6. Ecological Importance and Sensitivity of the Diep River at Swartvlei Equestrian Estate.

Ecological importance and sensitivity	Score 0-4	Confidence 1-5	Motivation
Biodiversity support	**3.3**		
Presence of Red Data species	2	3	No recorded Red Data fish species
Populations of unique species	4	5	Definite populations of Western Cape endemics (e.g. *Sandelia capensis*) and freshwater species that spawn in the sea (e.g. *Anguilla mossambicus*).
Migration/feeding/breeding sites	4	5	Freshwater connection to marine, and coastal connection to uplands.
Landscape scale	**3.4**		
Protection status of wetland	3	5	Mostly on private land, although a small area is within the Garden Route National Park (GRNP).
Protection status of vegetation type	4	5	At least 6 mapped vegetation types representing a range of protection levels, but increasing the biodiversity importance.
Regional context of the ecological	3	4	Reasonably good condition in comparison to some

integrity			of the other coastal river systems.
Size and rarity of the wetland types present	4	5	A unique setting of the wetland type as SA has very few coastal / estuarine lakes with freshwater inflows.
Diversity of habitat types	3	4	Fairly uniform wetland structure (apart from variable plant communities), but alternates to more riverine conditions further upstream.
Sensitivity of the wetland	**3.6**		
Sensitivity to changes in floods	4	5	Floods required to scour sediments
Sensitivity to changes in low flows	3	5	As a perennial system, the majority of fauna are dependent on flowing water.
Sensitivity to changes in water quality	4	5	Fauna and some flora are dependent on oligotrophic (low nutrient), high clarity, low sediment load water quality.
Hydrofunctional Importance	**3.3**	**5**	Very important role in flood attenuation, streamflow regulation, sediment trapping, nutrient assimilation and erosion control for Swartvlei Lake downstream.
Direct human benefits	**2.1**	**5**	Important for human use of water through abstraction of water for agriculture upstream, tourism and recreation (SANParks section), education and research.
ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)	**3.3**	**VERY HIGH**	

3.4.3 Swartvlei Lake EIS

According to Turpie *et al*. (2002), the Swartvlei Estuary is ranked 7th most important of South Africa's estuaries. There are many reasons that Swartvlei is considered to have a Very High EIS, some of these are discussed below.

As a coastal lake, Swartvlei is a rare system in South Africa. Apart from the Wilderness Lakes, the only other similar systems are those found on the Mozambique coastal plain such as Lake Sibaya.

The Swartvlei estuary is home to one of only 3 populations of Knysna seahorses (*Hippocampus capensis*), an IUCN red listed species classified as Endangered. As such it is imperative that water quality and habitat be protected through careful management of the estuary, lake and catchment.

Swartvlei's sensitivity to water quality changes was demonstrated when salinity increased substantially in the lake following the flooding of 2007, followed by a prolonged drought period with low freshwater inflows. The result was a lake-wide die-off of the rooted macrophyte, *Stuckenia pectinata,* in 2011. The plant couldn't tolerate the elevated salinity. There were knock on effects with a die-back of invertebrates that live in the weed and a complete decline in waterfowl. Loss of this vegetation has even caused severe erosion on the road along the eastern shore (Russell and Randall, 2017).

While Macadamia nuts do not increase the risk of salinity, their cultivation must be carefully managed to avoid introducing nutrients into this naturally very low nutrient lake, which has been described as having the lowest rate of primary productivity in Africa (Whitfield *et al*., 1983). Due to the low primary productivity, littoral vegetation cycling is very important,

accounting for 86% of the lake's energy base. Shoreline vegetation is therefore a critical component of the lake's food web and must be preserved.

3.5 Buffer Zones

Recommended buffer zones for both the Diep River and Swartvlei Lake were determined using the site-based buffer zone tool developed by Macfarlane and Bredin for wetlands and estuaries (2017), which is the more detailed of the two available models.

3.5.1 Diep River

The buffer zone determined for the wetland area of the Diep River was **20 m**.

3.5.2 Swartvlei Lake

The buffer zone determined for Swartvlei Lake provides two scenarios:

Unmitigated land-use = 50 m

Mitigated land-use = 20 m

The type of mitigation measures required to justify a reduced buffer of 20 m include minimal applications of fertilisers, herbicides, and pesticides, minimal applications of gypsum for the removal of salts (unavoidable unless using organic methods), use of drip irrigation (currently in practice), maintenance of dense grass and forb cover (preferably indigenous species) between orchard rows to reduce runoff (partially in practice), and planting rows along the contours so that water is not directed towards the lake (partially in place).

Given that not all the negative impacts can be mitigated the reduction to 20 m cannot be justified, but provided mitigation measures recommended in this report are implemented, the buffer can be reduced to **35 m**.

It is important to note that these buffer widths are determined from the delineated edge of the lake / wetland indicated in Figure 11.

Another important management line to consider is that of the 2 m.a.m.s.l. contour. As the Swartvlei Estuary mouth is artificially breached when the water level reaches this height, it is a certainty that water levels will periodically reach this height. While it is expected that the delineation using soil wetness indicators would detect this, it is important to ensure that the buffer is measured from either the delineated edge, or 2 m contour, whichever is greater. This will ensure that risks to water quality and shoreline habitat are significantly reduced.

3.5.3 Mapped Buffer Areas

The buffer areas recommended in the previous section are mapped and presented in Figure 14. The buffers clearly overlay significant areas of the newly established Macadamia Nut Orchards along the Swartvlei Lake side of the fields. The buffer generally aligns fairly well with the edge of the orchard along the Diep River wetland area. The full implementation of buffers would result in the clearance and rehabilitation of 1.42 ha on the larger field adjacent to the Diep River, and 0.3 ha on the smaller field. The buffers indicated in Figure 13 do not incorporate the 2 m contour which would still need to be assessed before the buffers can be finalised.

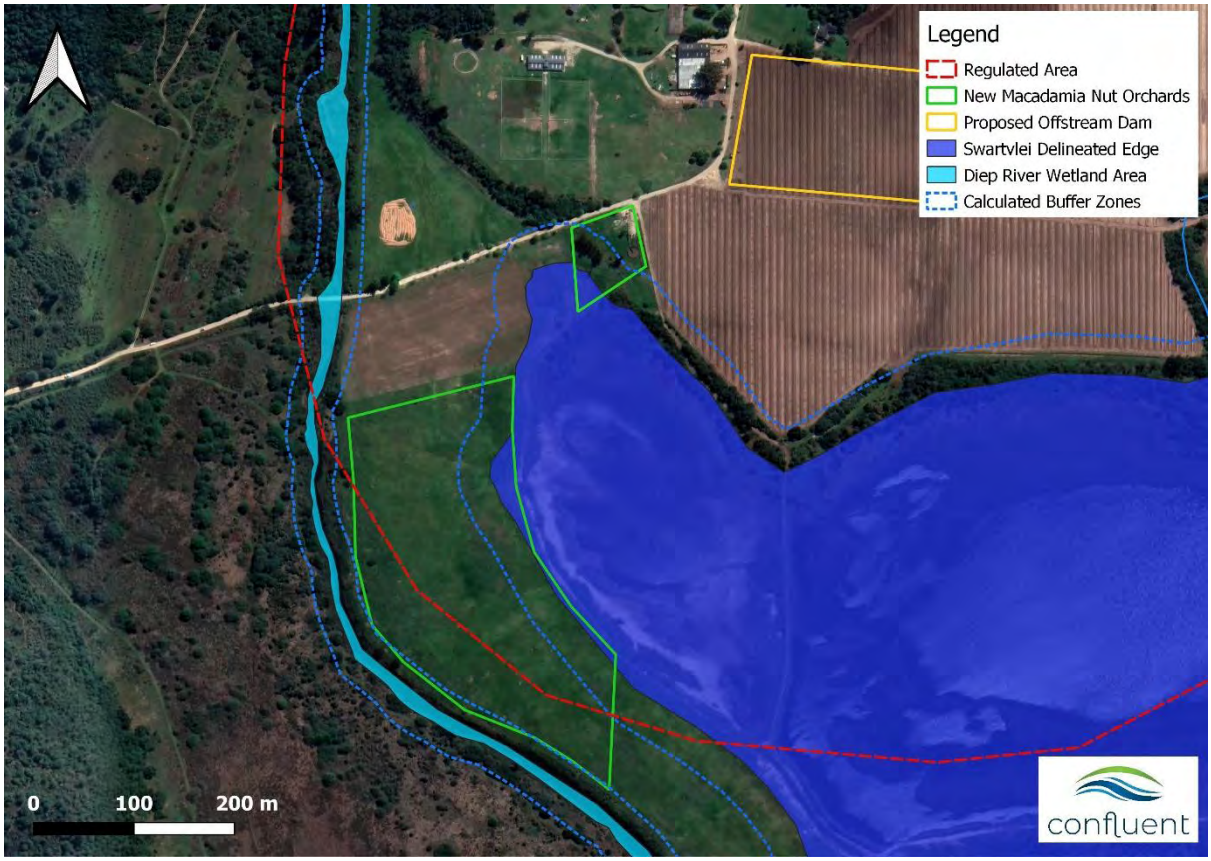

Figure 14. Map showing watercourse buffers in relation to newly established Macadamia Nut Orchards.

3.5.4 Management of Buffer Areas

Buffer areas should be restored to their previous state as pasture or better. Plants listed in Table 7 are recommended.

- Roads are not to be constructed in the buffer zone areas.
- Existing roads within buffer areas must be rehabilitated by replacing and re-levelling any soil that has been removed. Following this, they should be revegetated with suitable indigenous species.
- Macadama Nut and Beefwood (Casuarina) trees, and irrigation pipes within the buffer area must be removed and the area should be rehabilitated by relevelling the soil to the original contours. Following this, the soil must be revegetated with suitable indigenous species.
- In the longer term, fencing should run along the edge of the buffer and not the edge of the lake or wetland to increase the value of buffers for the movement of wildlife and birds. The location of fencing is historical.
- Buffers must be managed to be free of alien vegetation. Common weeds that have established in the Macadamia Nut orchard include Black Wattle and Jointed Charlock. The latter is known to harbour insect pest species that can be problematic in orchards.

- Work to rehabilitate buffer zones should preferably be undertaken during late autumn to winter to avoid disturbing breeding species (April to August).

Table 7. Recommended plants to be established in buffer areas.

Species name	Common name	Buffer areas along Swartvlei	Proposed dam's embankment
Salicornia meyeriana	Glasswort	✓	
Triglochlin striata	Streaked arrow grass	✓	
Spartina maritima	Salt grass	✓	
Stenotaphrum secundatum	St. Augustine grass	✓	
Paspalum vaginatum	Swamp coach	✓	
Cynodon dactylon	Bermuda grass		✓
Carprobrotus acinaciformis	Sour fig	✓	✓

3.5.5 Wildlife, fencing, and buffers

Buffers are also recommended with the movement and protection of wildlife in mind. The gazetted RQOs for Swartvlei state that "barriers to flow and movement of fauna in the system should be eliminated as far as possible". During the site visit, two large tortoises were seen adjacent to the Diep River. Tortoises can be killed by heavy machinery and their eggs are buried underground in clutches (like turtles) which can be destroyed during earth moving. This is just one of the species that is sensitive to more intensive agricultural production. It is therefore recommended that fencing be pulled back from the watercourse edges where it currently is, to the recommended buffer edge where it will enclose the orchard as opposed to the entire strip of land. This will provide greater opportunity for movement of wildlife, increasing the value of buffers.

Figure 15. One of two tortoises seen walking along the Diep River with the current fenceline visible.

4. IMPACT ASSESSMENT

4.1 Impact Assessment Methods

Methods used in the impact assessment are explained in detail in Appendix 5.

4.2 Impact Assessment: Proposed Off-stream Dam

4.2.1 Layout and Design Phase

Although no alternative locations have been provided for the assessment, the present location and layout of the proposed dam poses no concerns from the perspective of aquatic ecosystems or surface water. The dam's location is off-stream, in historical agricultural land, and the southern embankment is approximately 200 m from the edge of Swartvlei Lake.

4.2.2 Construction Phase

The risk of soil losses in disturbed areas or from soil stockpiles entering watercourses is considered relatively low given the distance of the proposed dam from any watercourses. However, during intense rainfall, preferential flow paths form which can transport sediment across large distances. Mitigation measures are recommended in Table 8 and reference is made to Figure 16. These are proactive interventions which should be discussed and implemented by the project team before construction begins as they are often overlooked when construction is underway.

Table 8. Construction phase impact of sedimentation in watercourses.

Project phase	**Construction**			
Impact	**Sedimentation of watercourses**			
Description of impact	**Soil losses from stockpiled material and disturbed areas due to runoff in heavy rainfall.**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Earth material to be used in construction of the dam must be stockpiled and bunded with sandbags as far as possible from watercourses, on an area of relatively flat ground. See suggested area in Figure 16. • Silt fencing should be erected prior to commencing construction at all known drainage areas that could lead from the construction area. Silt fencing must be installed as per guidelines in Appendix 6. • Trucks bringing or removing soil from the site must not be overloaded as the road crossing of the Diep River is narrow and unsuitable for frequent traffic of heavy vehicles.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Widescale disturbance of soil has occurred across the property due to conversion from forestry to Macadamias and Avocados. Therefore the cumulative impact must be mitigated using the recommended measures.			

Figure 16. Annotated image showing proposed equipment laydown and soil stockpiling area. Shaded areas are considered as no-go areas for these activities.

The impact of workers and contractor's activities can be negative if they are not adequately briefed on relevant aspects of waste disposal and expected conduct whilst on site. Mitigation measures are recommended in Table 9.

Table 9. Construction phase impacts of workers on site.

Project phase	**Construction**			
Impact	**Construction workers on site**			
Description of impact	**Potential pollution of the natural environment with rubbish, dumped material, or human waste**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Before construction begins, workers must be briefed that no hunting, littering, or dumping is permitted. • Workers must be shown designated areas for equipment laydown, material stockpiling, and vehicle refueling (indicated in Fig. 16). • Adequate toilet facilities must be provided for workers, as well as a designated rest area with bins that are cleaned out regularly.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Brief	Impact will not last longer than 1 year	Immediate	Impact will self-remedy immediately
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable			

The proposed dumping of excavated material into redundant dams is not considered a major impact, provided a search and rescue effort is made to collect any sensitive wetland plants, or amphibians and check for bird's nests prior to dumping (Figure 17). This can be done by an aquatic specialist and should be arranged 2-4 weeks prior to commencement of the activity. The impact is further explained in Table 10.

Figure 17. Example of small area of wetland habitat in one of the redundant dams.

Table 10. Construction phase impacts of dumping excavated soil into redundant dams.

Project phase	**Construction**			
Impact	**Depositing excavated soil into redundant dams**			
Description of impact	**Loss of wetland vegetation and habitat**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• BEFORE any soil is dumped into redundant dams, a search and rescue effort must be undertaken to collect any sensitive wetland plants or frogs that will be smothered by the dumped material. • The ideal time to dump discarded soil into old dams would be during late autumn to winter months. • At the conclusion of dumping, bare areas of soil will be vulnerable to colonisation by alien plants as all the old dams are surrounded by extensive aras of Acacia mearnsii (black wattle). Therefore the bare soil should be seeded with an indigenous grass that occurs in the area such as kweek (Cynodon dactylon).**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Brief	Impact will not last longer than 1 year	Brief	Impact will not last longer than 1 year
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	No applicable			

Once the construction phase has come to an end, it will be necessary to establish vegetation cover on all disturbed and exposed areas of soil to prevent erosion. Measures to mitigate this impact are explained in Table 11. Emphasis is placed on the use of suitable indigenous vegetation as opposed to conventional pasture grasses, such as those in Table 7.

Table 11. Construction phase impact of erosion of exposed soil at conclusion of works

Project phase	**Construction**			
Impact	**Erosion of soil from recently established embankments**			
Description of impact	**Erosion and soil loss from new embankments prior to vegetation establishment**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Once completed, all disturbed areas of bare soil including the embankment around the dam must be revegetated to reduce the impact of erosion from these areas. • Vegetation should consist of fast growing, indigenous grasses and groundcover that will establish rapid, high density cover. Species such as Kweek (Cynodon dactylon) and Carbprobrotus sp. are suitable. • The area must be weeded during establishment of new plants to ensure black wattle and other invasive plants do not become established. • On steep areas of the embankments it may be necessary to peg soil saver matting over the soil and seed, and plant plugs of Carprobrotus directly into the mat. This will provide greater protection to soil while the plants establish and is a biodegradeable product.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Very low	Natural and/ or social functions and/ or processes are slightly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Likely	The impact may occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	Low	The affected environment will not be able to recover from the impact -
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable.			

4.2.3 Operational Phase Impacts

A common practice is to release exotic fish into farm dams to try and deal with water quality issues and to provide recreation through fishing. Provided the fish are a species indigenous to the area that is perfectly acceptable. However, the introduction of alien fish species is not recommended, and in some cases is illegal. Alien fish species should not be introduced to the dam because of the potential threat to the food web and water quality in Swartvleil. E.g. Carp stir up lake sediments through feeding to the extent that water quality deteriorates and light limitation becomes a problem for primary producers. Mitigation measures are provided in Table 12.

Table 12. Operational phase impacts of alien fish introduction.

Project phase	**Operation**			
Impact	**Introdurction of alien fishs species into the dam for recreation**			
Description of impact	**If they escape from the dam into nearby natural watercourses the ecological consequences can be dire.**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Do not introduce fish to the dam that are not indigenous to the area. Even introducing fish such as Barbel from other parts of the country has had negative consequences for local fish populations. Ensure that the introduction of any fish species is lawful in terms of the National Environmental Management Act: Biodiversity Act.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Immediate	Impact will self-remedy immediately
Extent	Local	Extending across the site and to nearby settlements	Very limited	Limited to specific isolated parts of the site
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Likely	The impact may occur	Highly unlikely / none	Expected never to happen
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable			

Water to be stored in the proposed off-stream dam is pumped from the abstraction point above a weir on the Diep River. Should an excessive quantity of water be abstracted, above the limit of the permissible water use, it would have negative impacts for aquatic species downstream. The impact and mitigation measures are described in Table 13.

Table 13. Operational phase impact of over-abstraction of water from the Diep River.

Project phase	**Operation**			
Impact	**Overabstraction of water from the Diep River**			
Description of impact	**Reduced freshwater flows for aquatic biota and increased salinity in Swartvlei Lake**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• Ensure a meter is installed at the abstraction point from the Diep River to measure annual abstraction amounts which are stored in the proposed dam. • Obtain confirmation from the BGCMA of the Existing Lawful Use to take water on the property (which will be stored partially in the proposed dam). Ensure that this volume is known by all relevant farm managers and is not exceeded.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Medium term	Impact will last between 5 and 10 years	Immediate	Impact will self-remedy immediately
Extent	Local	Extending across the site and to nearby settlements	Very limited	Limited to specific isolated parts of the site
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	No applicable			

Impacts associated with general management of the orchards are considered along with recommended mitigation measures in Table 14.

Table 14. Operational phase impacts of aspects of orchard management.

Project phase	**Operation**			
Impact	**Management of orchards for the protection of water resources and improved biodiversity**			
Description of impact	**Use of pesticides, planting orchard floors, orchard layouts**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• Should rows of windbreak trees be required for the protection of Macadamia / Avocado trees, or along borders, consider the use of valuable indigenous trees such as nitrogen-fixing Keurbooms (Virgilia spp.) which will attract natural enemies of insect pests. • Species composition of the orchard floor is one aspect of IPM (Integrated Pest Management) which can also improve the runoff quality of water from the orchard during rainfall events. A diverse, dense assemblage of indigenous grasses and forbs provides habitat for insect pests which will occupy this area instead of feeding on the trees. The other benefit of a dense orchard floor cover is the reduction of flow velocities during surface runoff, which will reduce soil loss and erosion. While kikuyu grass is very dense and fast growing, it has little biodiversity value and is invasive. It would be preferable to introduce additional species such as Cynodon dactylon (Bermuda grass), Tephrosia capensis (a nitrogen fixing legume), Tristachya leucothrix (Hairy trident grass) and Eragrostis capensis (hartjiesgras). • Develop an Integrated Pest Management Plan (IPM) with the assistance of a consultant (if there isn't one already). The aim is to ensure that the correct pesticides are applied at the lowest possible rates and non-target impacts in terrestrial and aquatic habitats are kept to a minimum. • Consider the impact of fencing. It can greatly fragment the landscape limiting the movement of wildlife. Fencing across watercourses must allow for the movement of wildlife. Orchards should be fenced, not watercourses.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	On-going	Impact will last between 15 and 20 years	Short term	Impact will last between 1 and 5 years
Extent	Limited	Limited to the site and its immediate surroundings	Limited	Limited to the site and its immediate surroundings
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Confidence	Medium	Determination is based on common sense and general knowledge	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	Extensive fragmentation through fencing will restrict wildlife movement and reproductive success, excessive use of pesticides can impact negatively on sensitive aquatic biota such as frogs and fish.			
Cumulative impacts				

5. CONCLUSIONS

5.1 Proposed off-stream dam

As the site of the proposed off-stream dam is not physically located within any part of a watercourse and is located at least 200 m from the nearest edge of Swartvlei Lake, the potential impacts and risk to the aquatic environment are considered low, and construction of the dam is supported.

Several mitigation measures have been recommended for the Construction and Operational phases of the proposed dam. These must be implemented to ensure that construction of the dam is managed with minimal environmental impact, and that the condition of Swartvlei Lake is preserved through all phases of the development.

It is further recommended that an Environmental Control Officer (ECO) be appointed to inspect the site on a weekly basis during construction. This will ensure that any anticipated or unanticipated impacts can be mitigated and that mitigation measures will be implemented.

5.2 Management of wetlands in the regulated area

This assessment has highlighted the need to provide greater protection to wetland areas within the regulated area of the proposed dam. Buffer areas identified in this report coincide fairly well with areas identified as Critical Biodiversity Area 1 in the WCBSP.

The strip of land that was formerly pasture between the Diep River and Swartvlei should ideally not be intensively managed agriculturally. The establishment and management of Macadamia Nuts requires more intensive intervention, maintenance, and disturbance than the previous dryland pasture. Nonetheless, the area is historical pasture and agriculture can therefore continue in this area in terms of NEMA. Although recently planted Macadamia trees are within the footprint of historical fields, these did not historically include an adequate riparian buffer to protect Swartvlei Lake. This is current best practice. Given the risk of increasing impacts to Swartvlei Lake, it is strongly recommended that buffers be established and managed as recommended to improve the sustainability of the orchards and to preserve the lake.

A survey must be done of the two recently planted Macadamia Orchards as indicated in Figure 11 to map the location of the 2 m.a.m.s.l. contour. This will be used to inform the final buffer along Swartvlei Lake at this location. This information is also in the interests of the landowner because once established, the trees in waterlogged areas may die off or at least be less productive.

6. APPENDIX

6.1 Extract from Resource Quality Objectives

Table 15. RQOs and numerical limits Swartvlei estuary (DWS, 2018).

IUA	Quat #	Estuary	Node	Component	Sub-component	Indicator	RQO Narrative	RQO Numeric											
G15 Coastal	K40D	Swartvlei Estuary	gx110	Quantity	Flow	MMR/MAR (% Nat)	Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality	Months	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
								MMR/MAR (% Nat)	89.5	87.6	80.9	78.7	81.3	86.8	86.8	88.5	85.9	88.4	90.9	90.2	86.6
				Quality	Nutrients	DIN	Inorganic nutrient concentrations not to exceed TPCs for macrophytes and microalgae	River inflow, NOx-N not to exceed 50 µg/ℓ over two consecutive months, NH_3-N not to exceed 10 µg/ℓ over two consecutive months; Estuary: Average NOx-N <50 µg/ℓ, no single measure >100 µg/ℓ, average NH_3-N <10 µg/ℓ, no single measure >100 µg/ℓ; Lake: average NO_x-N <50 µg/ℓ, no single measure >100 µg/ℓ, average NH_3-N <20 µg/ℓ												
						DIP		River inflow, PO_4-P not to exceed 10 µg/ℓ over two consecutive months; Estuary: average PO_4-P <10 µg/ℓ, no single sample >50 µg/ℓ; Lakes: average PO_4-P <20 µg/ℓ												
					Salinity	Salinity	Salinity distribution not to exceed TPCs for fish, invertebrates, macrophytes and microalgae	Estuary in the closed state: average salinity <12; Lake average salinity +2 from baseline (2013)											
					System variables	Turbidity	System variables (temperature, pH, turbidity, dissolved oxygen, suspended solids and turbidity) not to exceed TPCs for biota	Average <5 NTU (low flow) throughout											
						Oxygen		>5 mg/l throughout											
						pH		River inflow: 6.0 < pH < 7.0, Estuary: 6.0 < pH < 8.5, Lake: 7.0 < pH < 8.5											
					Pathogens	Enterococci	Concentrations of waterborne pathogens should be maintained in an Acceptable category for full contact recreation	≤185 Enterococci/100 ml) (90th percentile)											
						Escherichia coli		≤500 E. coli/100 ml (90th percentile)											
				Habitat	Hydrodynamics	Mouth state	Maintain connectivity with marine environment at a level that ensures water quality and habitat remains suitable for biota typically found in the estuary	Closed mouth state should not increase by >10% from established baseline											
					Sediment	Sediment characteristics, Channel shape/size	Flood regime is sufficient to maintain natural bathymetry and sediment characteristics	Channel shape/size, sediment grain size and organic matter must not change by >30% from established baseline											
				Biota	Microalgae	Biomass and community composition of phytoplankton and benthic microalgae community	Maintain the composition and richness of phytoplankton and benthic microalgae groups and medium-low biomass	Maintain low/median phytoplankton/benthic microalgae biomass: phytoplankton not to exceed 3.5 µg/ℓ (median), phytoplankton not to exceed 20 µg/ℓ and/or cell density not to exceed 10 000 cells/ml (once-off); benthic microalgae not to exceed 23 mg/m2 (median); prevent formation of phytoplankton blooms											

Table 16. Supplementary information for Swartvlei Estuary RQOs (DWS, 2018).

IUA	Class	Estuary	Node	Quat.	REC	Current	Target	Context of the RQO	References
G15-Coastal	II	Swartvlei	gxi10	K40D	EC: B %nMAR: 90.9	PES: B %nMAR: 90.9	EC: B %nMAR: 77.8	Motivation for achieving REC/TEC • The Swartvlei estuary is rated as "highly important" from a biodiversity conservation perspective (ranked 7th out of 273 estuaries in South Africa), and is included in the Garden Route National Park MPA. The REC, PES and TEC for the system are all the same (B category), however future demands for freshwater in the Swartvlei catchment mean that flows are likely to drop slightly in future (from 90.9 to 77.8% of natural) and that thus there is a very real threat that the health of this system may decline in future. Thus, it is imperative that DWS and other stakeholders (local, provincial and other national government agencies) assist in addressing other pressures on this system to ensure that this highly important system remains in a B category. Key threats to the system include reduction in freshwater runoff (due to afforestation and alien invasive plants), loss of connectivity in the system, sedimentation, loss and degradation of floodplain habitats, overfishing, impaired water quality and disturbance caused by recreational activities. Additional (non-flow related) interventions to achieve the REC: • To achieve and maintain the REC, the mouth must be allowed to remain closed up 3.5 m above MSL. This is difficult due to housing developments at elevations lower than 3.5 m MSL, thus a compromise as close to 3.5 m MLS must be agreed with all stakeholders. • In addition, barriers to flow and movement of fauna in the system should be eliminated as far as possible. This includes eliminating or at least reducing blockages caused by the N2 and railway line that extend right cross the estuary • Strict control should be maintained over recreational activities on the estuary to ensure that these do not impact negatively on sensitive fauna such as water fowl.	DWA (2009) RDM report for the Swartvlei estuary

Table 17. RQOs for groundwater quality and quantity in priority catchments of GC-2 (DWS, 2018).

IUA	GRU	Quat(s)	Aquifer	Component	Sub-Component	Indicator	RQO Narrative	RQO Numeric
G15 Coastal	GC-2	K40D	Cenozoic coastal deposits	Quantity	Abstraction	Seasonal abstraction: water level recovers from abstraction impact during wet season, under consideration of climate change and drought cycles. Permanent abstraction: water level decline stabilises under consideration of aquifer response time.	Groundwater use should be sustainable for all users and the environment	n/a
					Groundwater level	Water level	Minimum water level in abstraction boreholes within 2.5km from the ocean to avoid saline intrusion	>0.5 mamsl
					Discharge	Relative water levels between groundwater and surface water (in mamsl)	The natural gradient between groundwater and surface water should be maintained	n/a
					Discharge	Buffer zones	No groundwater abstraction around wetland and river FEPAs in accordance with the implementation manual for FEPAs.	250m
				Quality	Nutrients	NO_3 (as N)	Groundwater should be fit for domestic use after treatment; and groundwater quality shall not show a deteriorating trend from natural background	<11.0 mg/l
					Salts	EC		<170 mS/m
					Pathogens	E-coli		0 counts / 100 ml
					Pathogens	Total Coliform		10 counts / 100ml

6.2 Historical image from 1936

6.3 Methods used to determine the PES

The Diep River was assessed using the Level 1 WET-Health assessment tool developed by Macfarlane *et al*. (2008). The tool aims to assess the integrity of a wetland which is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. The method combines an assessment of hydrological, geomorphological and vegetation health in three modules.

Data collection involved a desktop review of the extent and intensity of catchment land use impacts and was undertaken using historical and recent aerial imagery of the site (Chief Directorate: National Geo-spatial Information and satellites). Fieldwork onsite involved the identification and recording of observable impacts to the wetland at the site of relevant activities as well as at reference points upstream and downstream of the activities. The magnitude of observed impacts to the hydrological, geomorphological and vegetation components of the wetland were calculated and combined as per the tool to provide a measure of the overall wetland condition of the wetland. The condition ranges in scale from 1-10 and resultant scores were then used to assign the wetland into one of six PES categories as shown in Table 18.

Table 18.Wetland Present Ecological State (PES) categories and impact descriptions.

Ecological Category	Description	Impact Score
A	Unmodified, natural.	0 – 0.9
B	Largely natural with few modifications / in good health. A small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged.	1 – 1.9
C	Moderately modified / fair condition. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	2 – 3.9
D	Largely modified / poor condition. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	4 – 5.9
E	Seriously modified / very poor condition. The loss of natural habitat, biota and basic ecosystem functions is extensive.	6 – 7.9
F	Critically modified / totally transformed. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	8 - 10

6.4 Methods used to determine the EIS

The revised method for the determination of the EIS of a wetland considers the three following ecological aspects (Rountree *et al.*, 2013):

- **Ecological importance and sensitivity**
  - Biodiversity support including rare species and feeding/breeding/migration;
  - Protection status, size and rarity in the landscape context;
  - Sensitivity of the wetland to floods, droughts and water quality fluctuations.
- **Hydro-functional importance**
  - Flood attenuation;
  - Streamflow regulation;
  - Water quality enhance through sediment trapping and nutrient assimilation;
  - Carbon storage
- **Direct human benefits**
  - Water for human use and harvestable resources;
  - Cultivated foods;
  - Cultural heritage;
  - Tourism, recreation, education and research.

Each criterion is scored between 0 and 4, and the average of each subset of scores is used to derive a score for each of the three components listed above. The highest score is used to determine the overall Importance and Sensitivity category of the wetland system (Table 19).

Table 19.Ecological importance and sensitivity categories for wetlands. Interpretation of average scores for biotic and habitat determinants.

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

6.5 Impact Assessment Methods

Criteria are ascribed for each predicted impact. These include the intensity (size or degree scale), which also includes the type of impact, being either a positive or negative impact; the duration (temporal scale); and the extent (spatial scale), as well as the probability (likelihood). The methodology is quantitative, whereby professional judgement is used to identify a rating for each criterion based on a seven-point scale (Table 20) and the significance is auto-generated using a spreadsheet through application of the calculations.

For each predicted impact, certain criteria are applied to establish the likely **significance** of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

These criteria include the **intensity** *(*size or degree scale), which also includes the **nature** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale). These numerical ratings are used in an equation whereby the **consequence** of the impact can be calculated. Consequence is calculated as follows:

Consequence = type x (intensity + duration + extent)

To calculate the significance of an impact, the **probability** (or likelihood) of that impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as negligible, minor, moderate or major, and the type would be either positive or negative.

Table 20. Assessment criteria for the evaluation of impacts

Criteria	Numeric Rating	Category	Description
Duration	**1**	**Immediate**	Impact will self-remedy immediately
	2	**Brief**	Impact will not last longer than 1 year
	3	**Short term**	Impact will last between 1 and 5 years
	4	**Medium term**	Impact will last between 5 and 10 years
	5	**Long term**	Impact will last between 10 and 15 years
	6	**On-going**	Impact will last between 15 and 20 years
	7	**Permanent**	Impact may be permanent, or in excess of 20 years
Extent	**1**	**Very limited**	Limited to specific isolated parts of the site
	2	**Limited**	Limited to the site and its immediate surroundings
	3	**Local**	Extending across the site and to nearby settlements
	4	**Municipal area**	Impacts felt at a municipal level
	5	**Regional**	Impacts felt at a regional level
	6	**National**	Impacts felt at a national level
	7	**International**	Impacts felt at an international level
Intensity	**1**	**Negligible**	Natural and/ or social functions and/ or processes are negligibly altered
	2	**Very low**	Natural and/ or social functions and/ or processes are slightly altered
	3	**Low**	Natural and/ or social functions and/ or processes are somewhat altered
	4	**Moderate**	Natural and/ or social functions and/ or processes are moderately altered
	5	**High**	Natural and/ or social functions and/ or processes are notably altered
	6	**Very high**	Natural and/ or social functions and/ or processes are majorly altered
	7	**Extremely high**	Natural and/ or social functions and/ or processes are severely altered
Probability	**1**	**Highly unlikely / None**	Expected never to happen
	2	**Rare / improbable**	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
	3	**Unlikely**	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
	4	**Probable**	Has occurred here or elsewhere and could therefore occur
	5	**Likely**	The impact may occur
	6	**Almost certain / Highly probable**	It is most likely that the impact will occur
	7	**Certain / Definite**	There are sound scientific reasons to expect that the impact will definitely occur

When assessing impacts, broader considerations are also considered. These include the level of confidence in the assessment rating; the reversibility of the impact; and the irreplaceability of the resource as set out in (Table 21, Table 22, and Table 23), respectively.

Table 21. Definition of confidence ratings.

Category	Description
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Table 22. Definition of reversibility ratings.

Category	Description
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact

Table 23. Definition of irreplaceability ratings.

Category	Description
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere

6.6 Silt Fence Guidelines

Proper installation of soil erosion control fences is necessary for them to be effective. These guidelines must be followed:

- Geotextile fences must be installed perpendicular to the direction of water flow and along a line of uniform elevation or contour. In other words they should not waiver up and down the slope, but should be in a straight line across the slope. If this guideline is not followed, water will flow along the fence to the lowest point creating stress and potential collapse at this point;
- Use synthetic UV resistant geotextile fabric able to withstand at least 6 months of sun exposure. The product *Grassfence* (available from Kaytech) is specifically made for this application and is available in rolls 500mm and 700mm wide. The material must be able to allow water to move through it, so materials like bidim are not suitable, but 80% shadecloth can be used if necessary;
- Silt fences can be staked using wooden stakes. Metal droppers are preferable but will be stolen. The stakes should be arranged in straight lines across the area to be rehabilitated, at most 3m apart and firmly driven into the ground. A steel wire along the top of the stakes and also along the ground must then be secured and to which the geotextile is fastened, top and bottom;
- A 250 to 350 cm wide and 10 cm deep trench must be dug upslope of the location of the fence and the bottom half of the geotextile then laid into the trench;
- The trench must be backfilled and the soil compacted over the geotextile;
- The height of the silt fence should be between 20 and 30 cm;
- The distance between silt fences should be 8-10m. This results in 4 silt fences at the site, with the lowest one following the line of the lowest uncleared vegetation;
- Geotextile should be in a continuous roll to avoid joins which weaken the structure. Where joins are unavoidable both fabric ends should be wound around stakes to prevent it from unravelling (See Figure 19);

- Terminal ends of the silt fence should run slightly uphill to prevent runoff from going around the ends of the fences.
- Silt fences will be removed once vegetation has established on exposed areas.

Figure 18. Installation of the soil erosion control fence. A: Installing the standards and wires and preparing the trench. B: Fitting the geotextile, tying it on with wire. C: Filling in the trench over the geotextile. D: Applying a mulch against the completed fence (Photos courtesy Ken Coetzee).

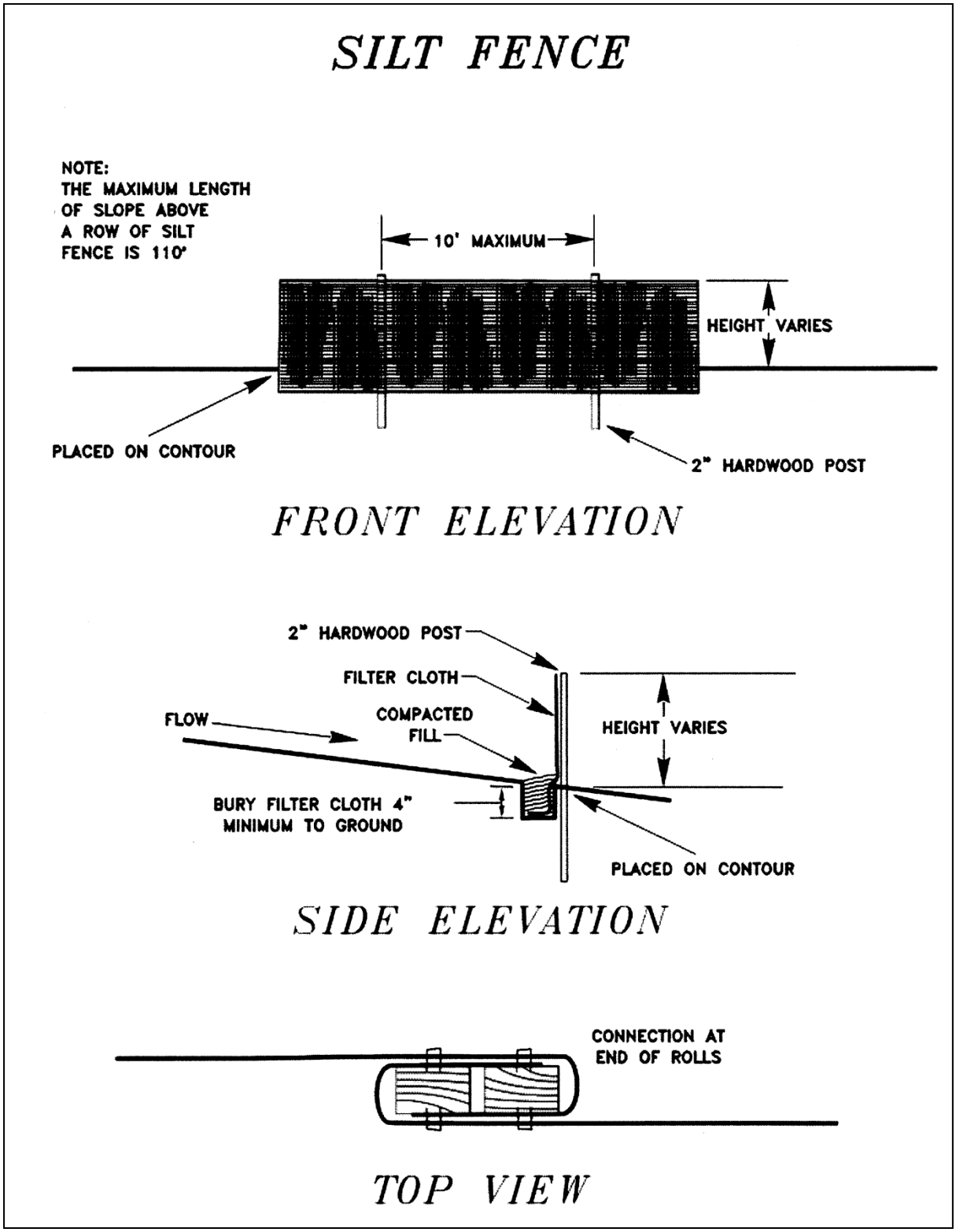

Figure 19. Example of methods recommended to install silt fencing (Measurements in inches; Source: Department of Environmental Protection, West Virginia)

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