ANNEXURE 5A: ENVIRONMENTAL AUTHORISATION
ANNEXURE 5B: WULA
ANNEXURE 5C: OTHER PERMITS

ANNEXURE 6: MAINTENANCE MANAGEMENT PLAN

Request for the relevant Competent Authority to define or adopt a Maintenance Management Plan for a watercourse in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), Environmental Impact Assessment Regulations, 2014 (as amended).

		(For official use only)
File Reference Number:		
Date Received by Department:		
Date Received by Component:		
Form Duly Signed and Dated:		Yes No

PROJECT TITLE

MAINTENANCE AND MANAGEMENT PLAN FOR WATERCOURSE/WETLAND-RELATED MAINTENANCE ACTIVITIES ON PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH, WESTERN CAPE PROVINCE

A. SCOPE AND IMPORTANT INFORMATION

1) This document is to be used to ensure that the request for adopting or defining a Maintenance Management Plan (MMP) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"), Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) is undertaken to the sufficient standard and requirements as defined by the competent authority, the Department of Environmental Affairs and Development Planning of the Western Cape Government (henceforth the Department). It is advised that the determination of applicability regarding the scale of the proposed maintenance/management activity(ies) be undertaken through a pre-application consultation with the Department.

2) **The geographical scope of the MMP is limited to watercourses as defined in the EIA Regulations, 2014(as amended).** The document does not relate to coastal activities or activities to be undertaken in an estuary.

3) **The use of this document for the development of a MMP for a watercourse will only be considered when the proposed maintenance activities constitute any one of the following listed activities identified in terms of the NEMA EIA Regulations, 2014 (as amended):**

EIA Regulations Listing Notice 1 of 2014 (as amended)

- Activity 19, Listing Notice 1: The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving-
  (a) will occur behind a development setback;
  (b) is for maintenance purposes undertaken in accordance with a maintenance management plan;
  (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;

(N.B. Points (d) and (e) does not apply as these activities fall within the coastal zone)

- Activity 27, Listing Notice 1: The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-
    i. The undertaking of a linear activity; or
    ii. Maintenance purposes undertaken in accordance with a MMP.

EIA Regulations Listing Notice 2 of 2014 (as amended)

- Activity 15, Listing Notice 2: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-
    I. The undertaking of a linear activity; or
    II. Maintenance purposes undertaken in accordance with a MMP.

- Activity 24, Listing Notice 2: The extraction or removal of peat or peat soils, including the disturbance of vegetation or soils in anticipation of the extraction or removal of peat or peat soils, but excluding where such extraction or removal is for the rehabilitation of wetlands in accordance with a MMP.

EIA Regulations Listing Notice 3 of 2014 (as amended)

☐ Activity 12, Listing Notice 3: The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a MMP.

i. Western Cape

i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;
ii. Within critical biodiversity areas identified in bioregional plans;
iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; or
v. On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.

(NB. Point iii does not apply as this activity falls within the coastal zone)

4) In deciding the request, the competent authority may define conditions related to auditing compliance with the MMP; monitoring requirements; reporting requirements, review; updating and amending the document and period for which the MMP is defined/adopted.

5) **The purpose of the MMP is to maintain both man-made and ecological infrastructure in a manner that either improves the current state of, and/or reduces the negative impacts on a watercourse** to ensure that ecosystems services are preserved/improved and to prevent further deterioration of the watercourse.

6) Notwithstanding the MMP possibly being defined or adopted by the Competent Authority, any other applicable statutory requirement must still be complied with (e.g. any obligations under

the National Water Act, 1998 (Act 36 of 1998) or the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)).

7) **The proponent must note that a MMP for a watercourse must be undertaken through consultation with the Department of Water and Sanitation and/or the relevant Catchment Management Agency (responsible water authority)**. This is to ensure compliance in terms of a Permissible Water Use as set out in the National Water Act, 1998 (Act No. 36 of 1998). It is recommended that this process for authorisation in terms of the National Water Act be clarified prior to the drafting and submission of the MMP.

8) The development of this document has been done in such a way so as to meet the requirements of both this Department as the competent authority in terms of the NEMA EIA Regulations, 2014 (as amended), as well as the requirements of the delegated water authority, regarding general authorisation considerations for sections 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998), to ensure alignment between the two authorities when defining or adopting the MMP.

9) In situations where a Water Use Licence Application (WULA) is required by the water authority regarding the proposed activities within a MMP, this will not prevent the proponent from submitting a request for a MMP to be defined or adopted by the Department.

10) Unless protected by law, all information contained in, and attached to this document, shall become public information on receipt by the competent authority.

11) A duly dated and originally signed copy of this document together with one hard copy and one electronic copy of the MMP must be posted, to the Department at the postal address given below, or delivered to the Registry Office of the Department.

12) A copy of the final defined/adopted MMP and cover letter **must** be submitted to the responsible water authority.

13) **NOTE: Adopting or defining the MMP does not absolve the** proponent **from complying with any applicable legislation or the general "duty of care" set out in Section 28(1) of the NEMA that states, *"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*." (Note: When interpreting this "duty of care" responsibility, cognisance must be taken of the national environmental management principles contained in Section 2 of the NEMA.**

14) **NOTE: The Department reserves the right to not adopt the MMP and require that an application be submitted to obtain Environmental Authorisation for the respective activities. Furthermore, consideration for the review should also be aligned to the periodic reviews of the General Authorisation for sections 21 (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) to ensure continued alignment and compliance.**

B. MAINTENANCE MANAGEMENT PRINCIPLES

1) The following are overarching principles to be used by landowners and managers when considering the development and implementation of a MMP:

a. The anticipation and prevention of negative impacts and risks, then minimisation, rehabilitation or 'repair', where a sequence of possible mitigation measures to avoid, minimize, rehabilitate and/or remedy negative impacts is explicitly considered;
b. Avoid and reduce unnecessary maintenance;
c. Maintenance and management of a watercourse must be informed by the condition of the physical and ecological processes that drive and maintain aquatic ecosystems within a catchment, relative to the desired state of the affected system;
d. Management actions must aim to prevent further deterioration to the condition of affected watercourses and, overall, be guided by a general commitment to improving and maintaining ecological infrastructure for the delivery of ecosystem services;
e. Managers and organs of state must identify, address and, where feasible, eliminate the factors that necessitate intrusive, environmentally-damaging maintenance; and
f. A process of continuous management improvement be applied, namely Planning; Implementing; Checking (monitoring, auditing, determine corrective action) and Acting (management review).

2) The following table provides a simple overview for the determination of the need for a MMP:

	Question	**If YES, a MMP may apply.**
2.1	Is there a watercourse on or adjacent to the property?	Yes
2.2	Has there been a history of flood damage or vandalism to the existing infrastructure or watercourse – erosion and/or sedimentation?	Yes
2.3	Is there infrastructure or any community at risk of being damaged by flooding?	Yes
2.4	Is the design of infrastructure considered inadequate in terms of managing the risk of flooding, erosion and/or sedimentation?	No
2.5	Would you consider an improved design for existing infrastructure to reduce maintenance needs?	Yes
2.6	Are there specific incidences where the watercourse is obstructed or blockages occur that alter the flow of the river during floods?	Yes
2.7	Is there an existing obstruction in the watercourse that has changed the flow of the river under normal conditions?	Yes
2.8	Is there a marked increase in the rate of erosion/sedimentation being experienced which threatens operations and assets?	Yes
2.9	Is there a presence of alien or bush encroachment vegetation within the watercourse and/or the presence of woody debris after flooding?	Yes

3) It is important to consider that the type of maintenance required will impact the level of assessment needed in terms of the impact the activity will have on the system and how best to mitigate the impact. Types of maintenance can broadly be classified in the following categories, with recognition that maintenance activities vary across the rural and urban context:

Maintenance Category	Types of maintenance activities (examples only)
Category A: Sediment removal or sediment deposition because of erosion	• Clearing sediment or placing sediment at Pump hole/trench, return flow (irrigation), Off-take weir, Stormwater outfall, Detention/retention ponds, Canalized urban rivers, Bridges, culverts and drifts • Prevent the formation of islands in the channel of the river • Dredging of in-stream dams
Category B: Emergency repairs – urgent action required to manage risk and damage to assets	• Repair to erosion of riverbank or servicing infrastructure (e.g. pipelines/roads) • Removal of material built up because of flooding/sedimentation and increasing risk to infrastructure • Address damage or replacement of infrastructure (e.g. bridge, pipeline, pump house) • Manage the condition of flood protection berms, and existing structures such as gabions, canalized and stormwater systems • Installing temporary gravel approaches at flood-damaged river crossings
Category C: Managing alien invasive and bush encroachment	• Clearing of alien invasive vegetation out of a watercourse to reduce maintenance requirements as they relate to erosion and sedimentation • Management of indigenous species categorized as bush encroachment, to improve hydrological flow and reduce associated flooding impacts
Category D: Rehabilitation activities to maintain ecological infrastructure	• Development and maintenance of ecological buffering systems to improve and/or restore functioning (e.g. wetlands and stormwater detention ponds) • Actively rehabilitating riparian zones through planting of locally indigenous species • Bank grading and movement/removal of berms and barriers to flow

4) The development of appropriate method statements to mitigate the impact of the maintenance needs, should be aligned within the framework of these considerations:
    a. Watercourses experience a natural process of sedimentation and erosion, with varying rates depending on the geomorphology and the integrity of the land-uses within the catchment;
    b. Manipulation of the watercourse results in increased erosion and/or deposition being experienced further downstream, perpetuating greater need for manipulation and more drastic and costly maintenance interventions;
    c. Locally indigenous riparian and wetland vegetation assists in the stabilization of riverbanks through effective root structures, while contributing to improve in-stream habitat and water quality conditions;
    d. Invasive alien and bush encroachment vegetation significantly impacts on the functioning of a watercourse, often leading to increased flood associated damage, with further implications and a reduction in water quality and availability;
    e. Persons undertaking maintenance activities have a responsibility to ensure a sense of duty of care is applied as prescribed within NEMA Section 28(1).

5) Within urban areas, sedimentation and erosion rates are significantly amplified as a result of development in urban areas and thus systems associated with watercourses in such areas can no longer be considered as 'natural'. In such a context, the drivers are often located outside the control of the landowner or responsible authority (i.e. Municipality). Therefore, the response taken to address the needs of a maintenance management plan for a watercourse within the urban environment may be limited in mitigating the requirement for maintenance to be undertaken.

C. REQUEST FOR THE COMPETENT AUTHORITY TO DEFINE OR ADOPT A MAINTENANCE MANAGEMENT PLAN FOR A WATERCOURSE IN TERMS OF THE NEMA, EIA REGULATIONS 2014 (AS AMENDED).

The following information must be submitted as part of the request for the competent authority to define or adopt the MMP:

1. PERSONAL DETAILS

Highlight the Departmental Sub-Region(s) in which the maintenance is to be undertaken. (mark the appropriate box with an 'X'). For Departmental details see Annexure A.

REGION 1 (City of Cape Town Metropolitan and West Coast District)	REGION 2 (Cape Winelands District, Overberg District)	REGION 3 (Eden & Central Karoo Districts)
☐	X	☐

Name of person/authority who will undertake responsibility for the activity:	Modderasrivier Boerdery (Pty) Ltd.		
Contact person (if other):	Mr CP du Plessis		
Postal address:	PO Box 138, Tulbach		
Telephone:	+27 84 657 6797	Postal code:	6820
Fax:	-	Cell:	+27 84 657 6797
Email:	admin@modderasrivier.co.za / info@modderasrivier.co.za		
Name of person who has prepared the MMP:	Toni Belcher		
Contact Person (if other):	-		
Postal address:	53 Dummer Street, Somerset West		
Telephone:	+27 82 8838055	Postal code:	7130
Fax:		Cell:	+27 82 883 8055
E-mail:	toni@bluescience.co.za		
Name of landowner(s) on whose behalf the plan has been developed:*	Modderasrivier Trust		
Contact person(s):	Mr CP du Plessis		
Postal address:	PO Box 138, Tulbach		
Telephone:	+27 84 657 6797	Postal code:	6820
Fax:	-	Cell:	+27 84 657 6797
E-mail:	admin@modderasrivier.co.za / info@modderasrivier.co.za		
Municipality for proposed project:	Witzenberg Local Municipality, which is part of the Cape Winelands District Municipality		
Farm name(s), erf(s) and portion number(s) etc*:	Portion 1 of the Roode Zands Kloof Farm No. 66		
Property size (ha)	155.74		
SG Code	C07500000000006600001		
Coordinates for river reach where maintenance activities are proposed	Upstream point: Modderas River	Upstream point: Modderas tributary	Downstream point: Modderas River
	Latitude: 33°11'27.72"S	Latitude: 33°12'30.74"S	Latitude: 33°12'54.54"S
	Longitude: 19° 7'28.00"E	Longitude: 19° 7'37.07"E	Longitude: 19° 7'26.89"E
Magisterial District or Town:	Tulbagh		
Name(s) of watercourse(s) in question:	Modderas/Roodezand River, a tributary of the Klein Berg River in the Berg River System		
***In instances where there is more than one landowner, please attach a list of landowners with their full names, contact details, farm name, farm number, portion number, Erf number, coordinates and signed declaration confirming approval for development and responsibility of the MMP**			

1. DECLARATION

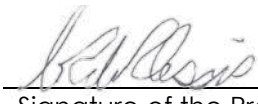
THE PERSON THAT WILL BE UNDERTAKING THE MAINTENANCE

I, Mr CP du Plessis	ID Number:	8	6	0	5	2	4	5	1	2	5	0	8	1

in my personal capacity or duly authorised thereto hereby declare/affirm that:

- the information provided or to be provided as part of this form, is true and correct;
- I am fully aware of my responsibilities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"), the Environmental Impact Assessment ("EIA") Regulations, as defined in Chapter 5 of NEMA (as amended) and any relevant Specific Environmental Management Acts and that failure to comply with these requirements may constitute an offence in terms of relevant environmental legislation;
- I am aware that is an offence in terms of Section 24F of the NEMA should I commence with a listed activity prior to obtaining an Environmental Authorisation;
- I am aware of my general duty of care in terms of Section 28 of the NEMA;
- I will provide the EAP and specialist, where applicable, and the competent authority with access to all information at my disposal that is relevant to the application;
- I will be responsible for the costs incurred in complying with the EIA Regulations, 2014 and other environmental legislation including but not limited to –
  - costs incurred for the appointment of the EAP or any person contracted by the EAP; and
  - costs in respect of any specialists, if any.

Note: If acting in a representative capacity, a certified copy of the resolution or power of attorney must be attached.



Signature of the Proponent:

22.09.2025

Date:

Modderasrivier Boerdery

Name of company (if applicable):

DECLARATION OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER ("EAP")/SPECIALIST

I, LINDSAY SPEIRS DUTOIT	EAP / Specialist Registration Number:	2	0	1	9	/	1	4	7	0

as the appointed EAP / Specialist hereby declare/affirm that:

- my EAP / Specialist Registration is current and up to date, and will inform the proponent and Department if the registration should lapse;
- the information provided or to be provided as part of this form, is true and correct;
- I have disclosed/will disclose, to the Proponent, the specialist (if any), the competent authority and registered interested and affected parties, all material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document prepared or to be prepared as part of the request for the adoption of a Maintenance Management Plan;
- I have ensured/will ensure that information containing all relevant facts in respect of the request for the adoption of a Maintenance Management Plan was/will be distributed or was/will be made available to registered interested and affected parties and that participation will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;
- I have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the competent authority;
- I have ensured/will ensure the inclusion of inputs and recommendations from any specialists in respect of the request for the adoption of a Maintenance Management Plan, where relevant;
- I have kept/will keep a register of all interested and affected parties that participated in the public participation process; and
- I am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014.

30 September 2025

Signature of the EAP/Specialist: Date:

EarthGrace Environmental Consultancy

Name of company (if applicable):

3. BACKGROUND AND INTRODUCTION

3.1. PROJECT INTRODUCTION AND ACTIVITY DESCRIPTION

Modderasrivier Boerdery (Pty) Ltd. wishes to enlarge Modderas Dam on Portion 1 of the Roode Zands Kloof Farm No. 66 near Tulbach. The farm is located approximately 8 km north of Tulbagh in the Western Cape. The purpose of enlarging the existing dam is to store enlistment water that has already been confirmed as existing lawful use. The dam is instream on the Modderas River which drains into the Roodezand River, a tributary of the Klein Berg River (Figure 1), within the middle Berg River System (Quaternary catchment G10E).

The dam is a Category II dam with a storage capacity of 200 000 m³ and a maximum wall height of 13.8 m. The dam is proposed to be enlarged to a maximum storage capacity of 310 000 m³ and a maximum wall height of about 15.1 m. The enlarged dam will increase the assurance of water supply on the farm while ensuring more effective and beneficial use of the existing lawful use. The enlarged Modderas Dam will continue to be filled with surface water runoff from its catchment area.

The landowner will need to periodically maintain the dam and associated water supply system, roads and other infrastructure crossing the watercourses, as well as the watercourses themselves within the property. This MMP has been compiled to guide maintenance works on infrastructure and within the watercourse on the property concerned.

Maintenance activities within the watercourses within the property would include:

- ☐ Maintenance of the dams and associated infrastructure within the property;
- ☐ Maintenance of the roads and pipelines where they cross watercourses;
- ☐ Maintenance of the watercourses within the property;
- ☐ Control of nuisance growth of indigenous reeds within the dams and watercourses; and
- ☐ Maintenance of invasive alien vegetation in the riparian zones of the watercourses.

Table 1. MMP process project team, roles, qualifications and registrations/associations

MMP Compiler	Expertise: Role	Qualifications	Registrations and Associations
Ms Toni Belcher	Aquatic Ecologist: ecological assessment & MMP compilation	M.Sc. Environmental Management; 30+ years-experience	Registered Natural Scientist -SACNASP No.005681; Member of **SA** Wetland Society and the IAIAsa[1]

[1] IAIAsa: International Association for Impact Assessment, South Africa

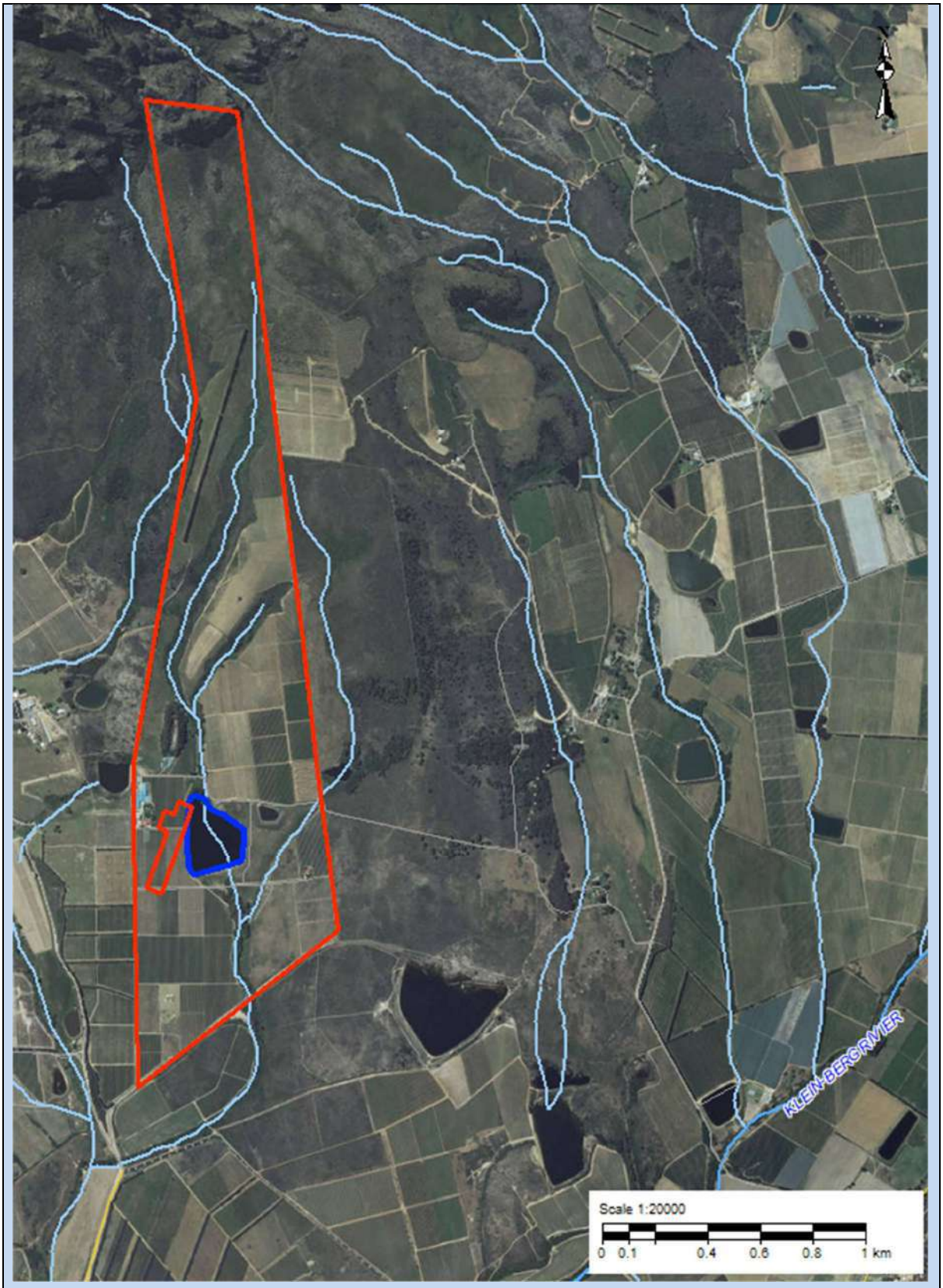


Figure 1. Orthophotograph taken in 2016 with the river system associated with the property shown, as well as the location of the dam.

3.2. DEFINITIONS OF TERMS AND ACRONYMS

Acronyms and technical terms used in the MMP are included at the end of the document.

4. ENGAGEMENT PROCESS

4.1 AUTHORITY ENGAGEMENT

Please indicate (with an 'x') which of the following authorities have been consulted to provide input based on the proposed maintenance activities:

- ***X*** *Department of Water and Sanitation/Breede Olifants Catchment Management Agency*
- ***X*** *CapeNature*
- ***X*** *Western Cape Department of Agriculture, Directorates: Sustainable Resource Management and Landcare*
- ***X*** *District Municipality* **(Cape Winelands)**
- ***X*** *Local Municipality* **(Breede Valley)**
- ***X*** *Department of Environmental Affairs & Development Planning*

4.2 PUBLIC PARTICIPATION

(i) Given written notice to the owner(s) or person(s) in control of the land if the person(s) undertaking the maintenance activity(ies) is not the owner or person in control of the land.	***~~Yes~~ / No***	Not applicable, the person undertaking the maintenance is the owner of the property.
(ii) Given written notice to non-participating adjacent landowners (up to 1km upstream and downstream from furthest upstream and downstream maintenance site and opposite side of the riverbanks) of the development of the MMP.	***~~Yes~~ / No***	Adjacent landowners were informed as part of the public participation process.
(iii) Stakeholder meeting held for all participating and non-participating landowners, in which details and methodology of MMP is presented. A minimum of two meetings are required, to present on the development of the plan and a final draft plan.	***~~Yes~~ / No***	Stakeholder meeting was not necessary. Interested parties are provided with opportunity to comment on MMP as part of public participation process.
(iv) Given written notice to any organ of state having jurisdiction in respect of any aspect of the activity(ies) proposed within the development of the MMP.	***Yes / ~~No~~***	Written notice provided to relevant organs of state as part of the public participation process.
(v) Provide written notice and confirmation to the relevant Water Users Association (WUA) or Irrigation Board (IB), of the development of the MMP	***Yes / ~~No~~***	The WUA for the area was notified.
(vi) Describe any other measures taken to inform the public about this MMP. A complete list of measures that are in place to deal with interactions with the public, if it becomes necessary and required by the competent authority during implementation of the project, must be provided.	***Yes / ~~No~~***	Written notice provided to the landowners, as part of the public participation process.

5. DATA COLLECTION AND ASSESSMENT

5.1. Map of the project area:

Portion 1 of the Roode Zands Kloof Farm No. 66 is located approximately 8 km north of Tulbagh in the Western Cape. The property lies on the wide valley floor of the Klein Berg River that flows into the middle reaches of the Berg River System. The Modderas River that drains the site comprises several small foothill streams.

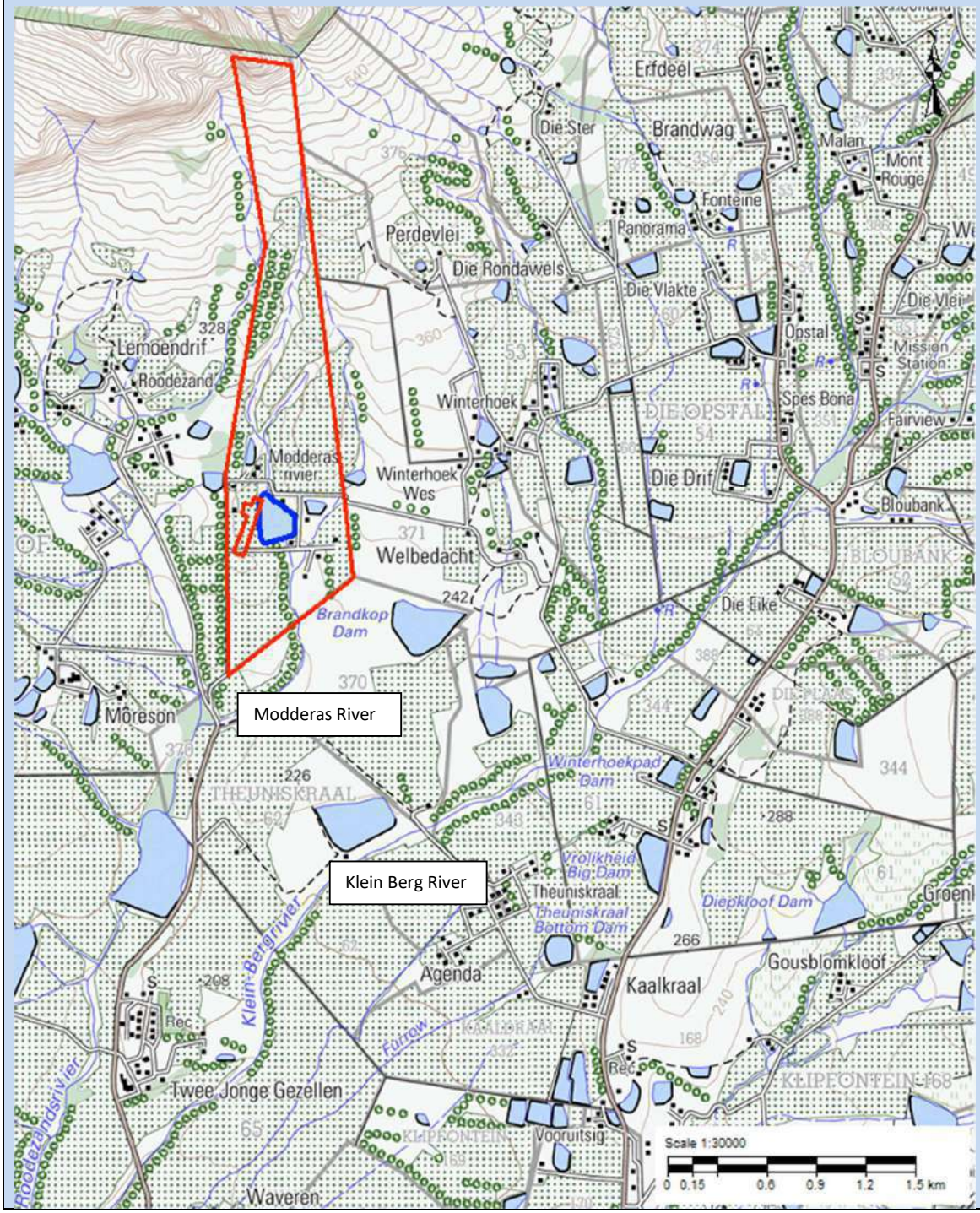


Figure 2. Locality Map for Portion 1 of the Roode Zands Kloof Farm No. 66 (red polygon) and the Modderas Dam (blue polygon).

5.2. General Description of Watercourse

Aquatic features on the property comprise non-perennial tributaries of the Roodezand River which drains into the Klein Berg River, a major tributary of the larger Berg River System. The Modderas River which drains into the Modderas Dam, originates in the foothills of the Groot Winterhoek Mountains and flows in a southerly direction through the property. The stream is joined by some other streams before its confluence with the Roodezant River. Seep wetlands are mapped along most of the streams within the property.

The Modderas Dam is located in the middle reaches of the Modderas River, at about 250 m above mean sea level and just upstream of where another tributary joins the stream. The streams do not have a significant catchment but are likely to be fed from groundwater draining from the longitudinal seep areas along the foothill zones of the watercourses. The surrounding landscape and the riparian zones of the watercourses have had a long history of modification, having been utilised for agriculture on the lower slopes, with the activities extending into the riparian zone of the watercourse.

Upstream of Modderas Dam, the watercourse comprises mostly wetland habitat with the riparian vegetation invaded with alien trees. Downstream of the dam, the cobble-bed stream drains through agricultural areas where it has been more significantly impacted by past cultivation activities. Much of the seep wetlands that would have occurred in this area have been cultivated. The main invasive alien vegetation currently occurring within the disturbed areas on the farm include black wattle (*Acacia mearnsii*), blackwood (*Acacia melanoxylon*), sesbania (*Sesbania punicea*) and bramble (*Rubus flagellaris*). Indigenous vegetation observed along the watercourses comprised *Psoralea pinnata, Searsia angustifolia, Morella serrata, Olea europaea subsp. africana, Podocarpus elongatus, Melianthus major, Pteridium aquilinum, Salvia chamelaeagnea, Elegia capensis, Zantedeschia aethiopica, Carpha glomerata, Juncus capensis, Ficinia nodosa, Cyprus textilis* and *Isolepis prolifera*.

Amphibians occurring in the area include Cape River Frog (*Amietia fuscigula*) Clicking Stream Frog (*Strongylopus grayii*), Mountain Rain Frig (*Breviceps montanus*) and Raucous Toad (*Sclerophys capensis*). All of the above are listed as Least Concern on the IUCN Red List of Threatened Species. Indigenous fish species recorded or expected in the larger Klein Berg River system are Cape galaxias (*Galaxias zebratus*), Cape kurper (*Sandelia capensis*) and Berg River redfin (*Pseudobarbus burgi*). Cape galaxias and Cape kurper are classified as "Data Deficient" while Berg River refin is listed as Endangered. It is possible that these small indigenous fishes did extend up into the smaller seasonal tributaries in winter, today however, with the reduction of winter flow and the number of barriers (instream dams) as well as predation by invasive fish the distribution of the fish is mostly limited to the mainstem of the river.

Table 2: Summary of water resources information associated with the activities

Descriptor	Name / Details	Notes
Water Management Area	Breede Olifants WMA	
Catchment Area	Modderas Tributary of the Klein Berg River	A tributary in the middle reaches of the Berg River System
Quaternary Catchment	G10E	
Present Ecological State (PES)	D (Largely Modified)	DWAF (2024) for the Klein Berg River
Ecological Importance and Sensitivity (EI&ES)	Ecological Importance – High Ecological Sensitivity – Very High	
Target Ecological Category	C (moderately modified)	GG No 42451, GN 655 dated 10 May 2019
Latitude	33°12'37.93"S	Location of the dam wall
Longitude	19° 7'23.46"E	

Figure 3. Views of the Modderas Stream upstream (top and centre) and downstream (bottom) of the dam

Figure 4. Views of the Modderas Dam (top) and Dam 2 proposed to be decommissioned (middle) as well as the tributary of the Modderas River near Dam 2(bottom)

5.3. Biodiversity Conservation Importance:

The study area is located largely within a wider area considered of Very High Aquatic Biodiversity Sensitivity. This is due to the Aquatic Critical Biodiversity Areas (CBAs) and National Freshwater Ecosystem Priority Area (NFEPA) Wetlands as well as a Strategic Water Source Area (SWSA) for surface water (Boland) occurring in the wider area.

The study area is not within a NFEPA River Sub-catchment. There are seep wetlands upstream of the dam that are mapped as natural NFEPA Wetlands. These wetlands are also mapped within the National Wetland Map version 5 (Figure 5).

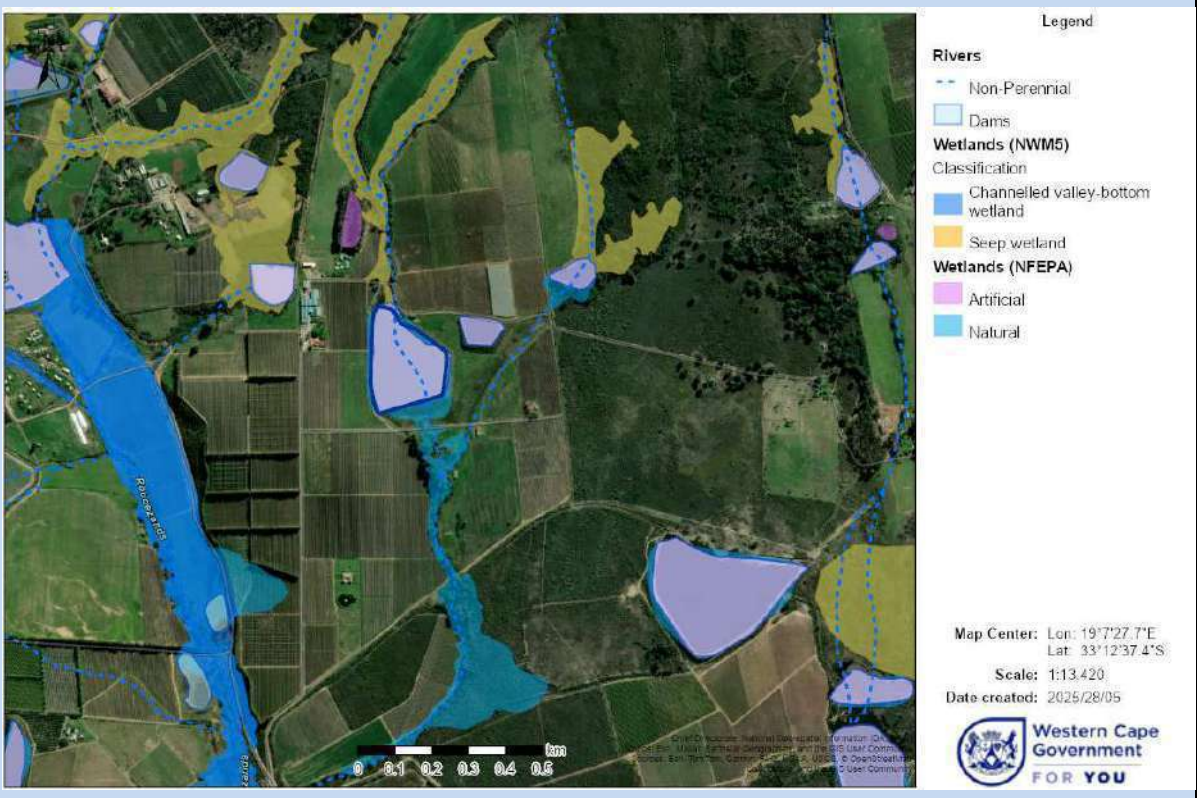


Figure 5. FEPA Wetlands and National Wetland Map for Modderas Dam and surrounding area (CapeFarmMapper, 2025))

In the 2023 WCBSP (Figure 6), The property lies downslope of the Winterhoek Mountain Catchment Area, a formally protected area. The Welbedacht Nature Reserve is also located about 300m to the east of the dam. Downstream of this, the river has been mapped as a terrestrial CBA.

Figure 6. The 2023 Western Cape Biodiversity Spatial Plan mapping for the site (CapeFarmMapper, 2025).

5.4. Climate and Hydrology

The area has a Mediterranean climate and receives about 639mm of rain per year, mostly during winter. The average rainfall and temperature values for the area can be seen in Figure 7. The lowest rainfall (10mm) is in February and the highest (111mm) is in June. The average midday temperatures range from about 10°C in July to 21°C in January and February. The annual average evaporation for the quaternary catchment area G10E, in which the property is located, is 1305mm.

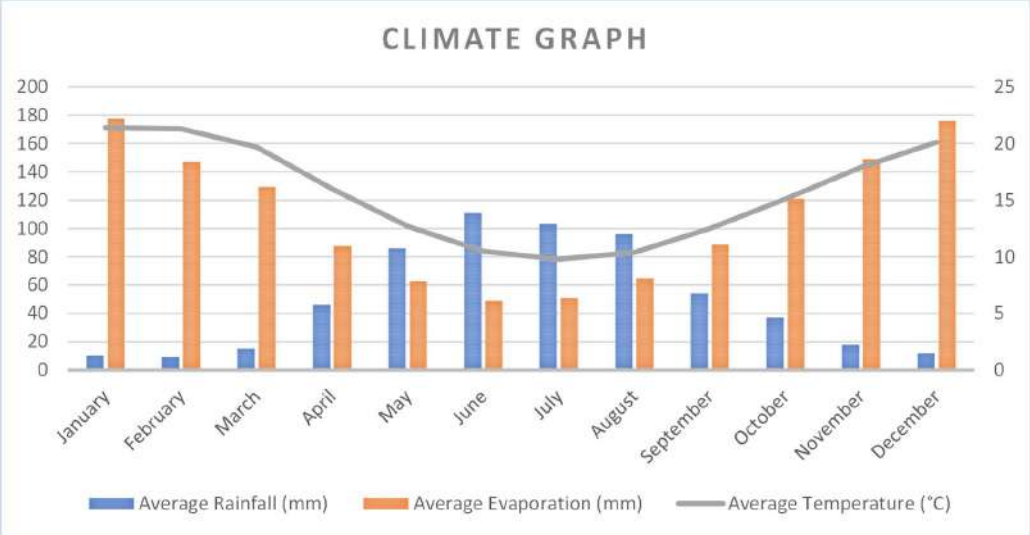


Figure 7. Average monthly rainfall, temperature and evaporation for the area (SA Atlas of Climatology and Agrohydrology - R.E. Schulze, 2009)

Low flow in the watercourses in the area is between December and April, with flow mostly occurring from June to October. As can be expected, this resembles the rainfall pattern for the area. The smaller watercourses are likely to only flow for short periods after rainfall events.

5.5. Geology and Geomorphology

The geology on the farm consists of phyllite, shale, schist and greywacke of the Porterville Formation, Malmesbury Group, which is partly covered by talus gravel. Glenrosa and/or Mispah soil forms dominate.

The geomorphological and physical characteristics of the Modderas River are as follows:

Table 3: Geomorphological and Physical features

River	Modderas River
Valley Form	Lower foothill
Lateral mobility or entrenchment	Confined by topography – more confined in upper reaches becoming less confined
Channel form	Simple
Channel pattern	Moderate to low sinuosity
Channel type	Boulder/cobble bed
Hydrology	Non-perennial

5.6. Present Ecological Status

The instream habitat integrity of the Modderas River is considered to be moderately to largely modified, while the riparian habitat has been largely modified. This is mostly due to the impact of the dams on the flow of the watercourses as well as the encroachment of the surrounding land activities into the riparian habitat of the watercourses.

5.7. Ecological Importance and Sensitivity

The Modderas River is considered of moderate ecological importance and sensitivity. There are still aquatic habitat and biota that are sensitive to flow and water quality change. The watercourses also provide an important corridor in a relatively transformed landscape for the movement of biota and water. The watercourse also provides a link to the upstream Grootwinterhoek Wilderness Area and the adjacent Welbedacht CapeNature Stewardship site

5.8. Desired Ecological Condition

In terms of the proposed water resource classes for Berg Water Management Area, the Target Ecological Category for the larger Klein Berg River in DWS quaternary catchment G10E is a C category within a Class II (moderate protection and utilisation) integrated unit of analysis area (Berg Tributaries). The recommended ecological condition of the Modderas River is that it is improved and maintained within the ecological category of C (moderately modified).

5.9. Freshwater Impact Assessment

The impacts of the proposed activities included in this MMP are assessed considering the ecological condition and sensitivity of the associated watercourse applicable to this MMP. The nature of an MMP dictates that it only relates to **the maintenance of existing or approved structures**

or maintenance activities in the watercourse as and when required. The DEA&DP MMP Principles for undertaking the MMP activities, as included in this MMP, apply to all the MMP activities.

Activity 1a: Clearing of alien vegetation

Invasive alien species cause a decline in indigenous plant numbers, change the vegetation structure and reduce biotic and habitat diversity. The removal of invasive alien plants from aquatic habitats is desirable not only from an aquatic ecological perspective but also because they reduce the ability of that ecosystem to provide valued goods and services as alien vegetation reduces runoff and water availability; increases the instability and erosion potential of banks, modify water quality; reduce biodiversity; result in much hotter and more destructive fires which destroy indigenous seeds and are difficult to control; form barriers to the movement of biota and have economic consequences. The main invasive alien vegetation currently occurring within the disturbed areas on the farm include black wattle (*Acacia mearnsii*), blackwood (*Acacia melanoxylon*), sesbania (*Sesbania punicea*) and bramble (*Rubus flagellaris*).

Significance of impacts without mitigation: Low significance depends on the level of intervention required to remove the alien vegetation without impacting the remaining indigenous vegetation.

Proposed mitigation:

- Identify alien plants to be removed. If unsure, please contact the Western Cape Department of Agriculture: LandCare or CapeNature for assistance. Regular monitoring and control of alien vegetation should be undertaken to ensure that the plants are removed while still young saplings (usually, pulling of seedlings by hand is possible when the soil is wet). This also prevents the spread of the alien plants once seeds have been produced;
- Avoid trampling or clearing indigenous vegetation by using established paths where possible;
- Clear alien vegetation according to the described alien vegetation removal methods for each invasive species as provided in method statements or with the methods and herbicides/biological control recommended on the Working for Water programme and LandCare.
- Clear felled alien vegetation from the aquatic habitats. Larger tree stumps can be left to minimise erosion of the cleared area;
- Where necessary, revegetate cleared areas with suitable indigenous vegetation as suggested in this report. Planted areas require irrigation and care for 1-2 years following planting. This is particularly a requirement where most of the natural flow within the watercourses has been diverted for use or where the re-established vegetation is on the dry banks of the rivers. Planting at the start of the wet season can reduce the need for irrigation however areas that will be inundated in winter or subjected to flood flow should then be avoided; and
- Ongoing monitoring and clearing of the regrowth of alien plants must be undertaken.

Significance of impacts after mitigation: Very Low disturbance impact if mitigation measures are effectively implemented; if revegetation with indigenous species and follow-up control takes place, a low to medium positive impact could be expected.

Impact table:

Potential aquatic impact	Clearing of invasive alien vegetation			
Nature	Disturbance of aquatic habitat and vegetation		Status	-
Impact source(s)	Clearing of instream and riparian alien vegetation			
Impacted aquatic ecosystem	Aquatic habitat and biota at the site where clearing takes place			
Irreplaceability of resources	Moderate to low			
Magnitude	Extent	Local		
	Intensity	Low		
	Duration	Short term		
	Reversibility	Reversible		
	Probability	Medium to High		
Significance	Without mitigation	Low negative		L -
	With mitigation	Very Low negative to Low positive		VL- / L+
Cumulative impact	Without mitigation	Low		

	With mitigation	Very Low with the potential for a positive impact
Confidence	Medium/high	

Activity 1b: Clearing of nuisance growth of indigenous aquatic vegetation

Common *Phragmites australis* reeds and *Typha capensis* bulrushes are indigenous plants with an ecological function. They offer a degree of refuge and habitat for biota as well as providing essential ecological services such as reducing erosion, causing deposition of silt, cooling instream habitats and reducing wind, thereby reducing evaporation. It is thus essential that where natural vegetation exists, it should be retained as far as possible and disturbed areas should be rehabilitated. Therefore, the objective of this activity is to control the reeds or bulrushes and not to eradicate them out of the river channel.

Phragmites reed and *Typha* bulrush growth, in general, need to be managed in rivers within developed areas where the natural control measures such as floods or grazing have largely been removed and there is an elevated supply of nutrients. The removal of these plants is thus periodically undertaken to maintain an open channel and ensure that high flows in the channel are unimpeded. The control of indigenous reeds, in particular, needs to be undertaken very judiciously, with careful control and consideration for the environment. **Control** should only aim to remove excessive nuisance plant growth and build-up of material that can cause flooding. These reeds are indigenous and must not be **eradicated** as they provide valued goods and services.

The primary impact of clearing reeds and bulrushes is the disturbance of riparian and aquatic habitats. The control or clearing of these plants is probably only required within the dams and water infrastructure. Any clearing of nuisance reeds within the watercourses is recommended to be cleared by hand, which would result in a very low impact. Secondary impacts would be the potential to facilitate erosion and the potential to facilitate the invasion of the area by alien plant species within the cleared areas. Furthermore, the reduction in surface roughness can result in erosion of the channel.

Significance of impacts without mitigation: Low depending on the methods employed and the sensitivity of the aquatic ecosystem.

Proposed mitigation:
The following methods are proposed for the removal of *Phragmites* reeds:

- The removal of indigenous instream vegetation should, where possible, be conducted by hand-cutting/mowing and should avoid the large-scale disturbance of soil and removal of vegetated material on the banks or in the channel. Digging or hand pulling of the reeds is ineffective due to the plant's extensive root system and simply contributes to the expansion of *Phragmites* while causing turbidity in the water column;
- If machinery is utilized to remove the reeds and the associated sediment, the works in the channel should not impact the structural integrity of the water course and should not result in any erosion of the channel. Mechanical clearing of reeds should be less frequent than annually and should be limited in extent (the entire extent of the reed bed should not be cleared, only a portion thereof).

Methods for control of *Typha* bulrushes:

- The most successful method for control of *Typha* is through physically cutting the reeds in conjunction with flooding. Cutting should take place at the end of autumn when water levels are low, but when the cut area will be submerged in at least 10 cm of water when water levels rise again. Two subsequent cuttings of the bulrush will be required within the end of the growing season (late summer/autumn) to suppress the regrowth before the inundation;
- Pulling of bulrush can work where the plants are small seedlings.

The following mitigation measures should be adhered to in conjunction with the above clearing methods:

- Removal of indigenous instream indigenous vegetation should be limited to nuisance growth of reeds, bulrushes and aquatic weeds within the dams. Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat

the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity;
- Clearing should take place outside of the bird breeding season seasons (i.e. maintenance to be done during the period January to May) and should not be conducted more than once a year;
- Patches of reeds immediately upstream or downstream of formal road crossings can be routinely cut before the rainfall period so as not to cause blockages at these critical points, particularly of pipes and culverts;
- The reeds should be cut below the lowest leaf, and the remaining stump should not be longer than 15cm. If a brush cutter is used, mowing should be no lower than 12cm from the ground to minimise impacts on small animals and indigenous plants;
- If mowers are used, care should be taken that they do not damage banks or other indigenous vegetation such as sedges and rushes;
- The upstream and downstream impacts of any vegetation clearing activities should be minimized, such as the prevention of increased sedimentation downstream of the site by not undertaking the activity during the rainy period;
- If banks are disturbed by the activity, follow-up revegetation should be undertaken;
- Indigenous sedges and other grasses should be allowed to establish in cleared sections
- Any clearing works in the channel should not impede the movement of aquatic and riparian biota;
- A minimum base flow should be maintained in the river channel at all times; and
- Remove all cut reeds, and aquatic weeds and cleared alien vegetation from the channel and riparian zone. Cut vegetation should ideally be taken to a green / garden waste facility and not sent to a landfill.

Significance of impacts after mitigation: Low negative with potential for a low positive impact.

Impact table:

Potential aquatic impact	Clearing of indigenous aquatic vegetation			
Nature	Disturbance of aquatic habitat and vegetation		Status	-
Impact source(s)	Clearing of instream and riparian vegetation			
Impacted aquatic ecosystem	Aquatic habitat and biota at the site where clearing takes place			
Irreplaceability of resources	Moderate			
Magnitude	Extent	Local		
	Intensity	Medium to low		
	Duration	Short term		
	Reversibility	Reversible		
	Probability	High		
Significance	Without mitigation	Low negative		L-
	With mitigation	Very Low negative to Low positive		VL- / L+
Cumulative impact	Without mitigation	Medium		
	With mitigation	Very Low with the potential for a positive impact		
Confidence	Medium/high			

Activity 2: Repairs to infrastructure

The impact of repair work on the infrastructure within the watercourse will vary, largely depending on the level of repairs required and how the repairs are conducted. The sensitivity of the aquatic ecosystem is also an important consideration. This maintenance activity entails the smaller-scale repairing of infrastructure so that it can retain its original footprint and integrity, a like–for–like scenario. Any additions to infrastructure are, by definition, not within the scope of an MMP. Minor repairs will typically involve a localised disturbance of the river channel or banks while infrastructure is repaired. The disturbed areas following repairs can contribute towards high silt and sediment loads within the river as the material is not held by the roots of plants.

Significance of impacts without mitigation: Low

Proposed mitigation:

- Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity
- Work in summer (October/November to March/April) when the flow is low;
- Before construction, plan access routes and movement to and from the maintenance site – aim to use existing access routes where available;
- Demarcation should be conducted in consultation with the contractor or person responsible for the work to keep the disturbance area as small as possible;
- If excavation is required- remove topsoil and set it aside for post-construction rehabilitation. The stored topsoil should be stored away from the watercourse and any stormwater flow paths;
- If possible, use manual labour to do the repair work;
- Mix any concrete, other materials or potential contaminants away from the watercourse;
- If water run-off with high suspended solids and turbidity is observed coming from the disturbed areas associated with the work, temporary sediment trapping mechanisms should be put in place downstream of the activity to filter water from the site (such as hay bales);
- Good house-keeping practices should be followed, such as the use of machinery which does not leak oils or other substances, and if applicable adequate waste disposal and removal, as well as adequate provision and servicing of toilets. The site of the maintenance activity must be managed so that construction material (especially cement and fuel products) is not washed into the watercourse during storm events. Emergency spill kits should be kept on site;
- Any cleared sediment, vegetation or spoil material associated with the maintenance activity should be removed from the river channel and disposed of at an approved disposal site;
- The repaired infrastructure should not impact the structural integrity of the watercourse or alter the flow in the watercourse. Shape channel banks to have a gently sloping gradient; and
- Revegetate the disturbed area with indigenous vegetation as per the recommendations of this report and keep the area clear of alien vegetation.

Significance of impacts after mitigation: Very Low

Impact table:

Potential aquatic impact	Repairs to infrastructure			
Nature	Impaired water quality and localized disturbance of habitat		Status	-
Impact source(s)	Pollutants, disturbed silt and sediments associated with repair works			
Impacted aquatic ecosystem	Aquatic habitat and biota within the site and downstream			
Irreplaceability of resources	Moderate			
Magnitude	Extent	Local		
	Intensity	Moderate to low		
	Duration	Short term impacts but repetitive nature		
	Reversibility	Reversible		
	Probability	Possible		
Significance	Without mitigation	Low negative		L-
	With mitigation	Very Low negative		VL-
Cumulative impact	Without mitigation	Low		
	With mitigation	Low		
Confidence	Medium/high			

Activity 3: Sediment removal at infrastructure

During high flows, watercourses transport sediment particles and debris downstream. As the energy in the watercourse decreases (typically in pools or instream impoundments), the sediment and debris are deposited. If the watercourse channel becomes too full of sediment, it needs to be physically removed. Sediment and other materials often need to be removed to access infrastructure or to ensure that the infrastructure operates efficiently. The clearing of sediment at infrastructure can result in a localized disturbance within the riparian and aquatic habitats of the river. This disturbance can result in erosion and invasion by alien plants in the disturbed area.

Significance of impacts without mitigation: Medium to low

Proposed mitigation:

- Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity
- Material may be removed within the active channel during the dry season (October/November to March/April);
- The disturbed area around the infrastructure should be kept to a minimum and where possible existing access points to the infrastructure used;
- Minimise upstream/downstream impacts on the reach in which the site is located;
- Minimise impact on the structural integrity of the watercourse and avoid channelisation or canalization of the watercourse;
- Manual labour should be used to remove the sediment in the river where feasible;
- Where possible existing access points to the river channel should be used and any indigenous marginal vegetation that is established along the edges of the channel should preferably remain intact as it provides cover, habitat and food for the riverine biota;
- Disturbed areas should be kept clear of alien vegetation.
- Removed material should be taken out of the channel completely and should not be utilised to block the river flow or to create berms on the top of the stream banks.
- Disturbed areas on the banks of the river should be revegetated with indigenous plant species.

Significance of impacts after mitigation: Low

Impact table:

Potential aquatic impact	Sediment movement at infrastructure			
Nature	Disturbance of riparian and aquatic habitat with the potential of increased turbidity downstream if activity takes place while there is flow in the watercourse		Status	-
Impact source(s)	Direct mechanical disturbance of river bed and banks			
Impacted aquatic ecosystem	Aquatic habitat and biota within site			
Irreplaceability of resources	Moderate			
Magnitude	Extent	Local		
	Intensity	Moderate		
	Duration	Short term impacts but repetitive nature		
	Reversibility	Reversible		
	Probability	Probable		
Significance	Without mitigation	Medium to low negative		M/L--
	With mitigation	Low negative		L-
Cumulative impact	Without mitigation	Medium		
	With mitigation	Low		
Confidence	Medium/high			

Activity 4: Sediment removal from the channel for flood conveyance/channelisation

Larger scale deposition of sediment within watercourses can block or alter/impede flow in the watercourse, causing erosion and damage to the riverbanks and adjacent land or infrastructure. It may thus become necessary to remove sediment from the watercourse channel to prevent flood damage. Larger-scale sediment removal is likely to require advice from someone knowledgeable in river hydraulics to ensure that the work does not cause further damage to the integrity of the watercourse channel.

Significance of impacts without mitigation: Medium to Low

Proposed mitigation:

- Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity;

- The disturbed area should be kept to a minimum and where possible existing access points to the infrastructure should be used;
- Minimise impact on the structural integrity of the watercourse and avoid channelisation or canalization of the watercourse; rather maximise physical diversity by creating pools and shallow habitats;
- Material removal should start at the downstream-most point and work systematically upstream. Sand removal should not take place in the stream where there are eroded banks;
- Manual labour should be used where feasible for this activity;
- Disturbed areas should be kept clear of alien vegetation;
- Removed material should be taken out of the channel completely and should not be utilised to block the river flow or to create berms on the top of the stream banks;
- Disturbed areas on the banks of the river should be revegetated with indigenous plant species.

Significance of impacts after mitigation: Very Low

Impact table:

Potential aquatic impact	Sediment removal from the channel for flood conveyance/channelisation			
Nature	Disturbance of riparian and aquatic habitat		Status	-
Impact source(s)	Direct physical disturbance of riverbed and banks			
Impacted aquatic ecosystem	Aquatic habitat and biota within the site			
Irreplaceability of resources	Moderate			
Magnitude	Extent	Local		
	Intensity	Moderate to High		
	Duration	Short-term impacts but repetitive nature		
	Reversibility	Reversible		
	Probability	Probable		
Significance	Without mitigation	Medium to Low negative		M/L-
	With mitigation	Very Low negative		VL-
Cumulative impact	Without mitigation	Low		
	With mitigation	Very Low		
Confidence	Medium/high			

Activity 5: Repairs to riverbanks and associated bank stabilization infrastructure

The dynamic nature of a river results in erosion of the channel and banks and damage to infrastructure along the banks. The eroding or flood-damaged banks and adjacent areas may then need to be repaired to protect adjacent farmlands and infrastructure.

Significance of impacts without mitigation: Medium to Low, depending on the extent of work

Proposed mitigation:

- Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity
- Maintenance activities are best done during the dry/low flow period unless emergency work is required that should be undertaken immediately;
- If the flow in the river needs to be impeded or diverted to undertake the works, maintain a minimum base flow and do not impede the movement of aquatic and riparian biota;
- The disturbed area around the bank being repaired should be kept to a minimum and where possible present existing access points to the infrastructure must be used;
- Minimise the impact on the structural integrity of the watercourse and avoid increasing channelisation or canalization of the watercourse;
- Where possible, aim to create gently sloping banks down to the bed of the watercourse;
- Stockpiling of repair material must be placed outside of the channel and riparian zone;
- Manual labor is preferred to mechanical to minimise the physical disturbance;
- Removed material should be taken out of the channel completely; and
- Sediment brought in for filling should be from a local source and free of alien plant seed.

Significance of impacts after mitigation: Low

Impact table:

Potential impact on freshwater features	Repairs to riverbanks and associated bank stabilisation infrastructure			
Nature	Disturbance of riparian and aquatic habitat		Status	-
Impact source(s)	Direct mechanical disturbance of riverbed and banks			
Impacted aquatic ecosystem	Aquatic habitat and biota within site			
Irreplaceability of resources	Moderate			
Magnitude	Extent	Local		
	Intensity	High		
	Duration	Short term impacts but repetitive nature		
	Reversibility	Reversible		
	Probability	Highly Probable		
Significance	Without mitigation	Medium negative		M-
	With mitigation	Low negative		L-
Cumulative impact	Without mitigation	Medium		
	With mitigation	Low		
Confidence	Medium/high			

6. METHOD STATEMENTS

The following serves as a general guide to minimise the spatial impact of the maintenance activity:

- Repairs and maintenance should be undertaken within the dry season, except for emergency maintenance works.
- Where at all possible, existing access routes should be used. In cases where none exists, a route should be created through the most degraded area avoiding sensitive/indigenous vegetation.
- Responsible management of pollutants through ensuring handling and storage of any pollutants is away from the watercourse. When machinery is involved, ensure effective operation with no leaking parts and refuel outside of the riparian area, at a safe distance from the watercourse to manage any accidental spillages and pose no threat of pollution.
- Flow of the watercourse should not be blocked (temporary diversions may be allowed) nor should the movement of aquatic and riparian biota be prevented during maintenance actions.
- No new berms can be created.
- In circumstances which require the removal of any topsoil, this must be sufficiently restored through sustainable measures and practices.
- A concerted effort must be made to actively rehabilitate repaired or reshaped banks with indigenous local vegetation.
- No deepening of the watercourse beyond the original, pre-damage determined thalweg, unless such deepening is directly related to the naturally improved functioning and condition of such a watercourse.
- Where at all possible, limit the disturbance to the zone of the thalweg. This is due to the ecological importance of the low flow channel and respective habitat being allowed to re-establish improving the ecological condition.
- The build-up of debris/sediment removed from a maintenance site may:
    - be utilised for in-filling or other related maintenance actions related to managing erosion, which form part of an adopted MMP;
    - not be used to enlarge the height, width or any extent of existing berms;
    - not be deposited anywhere within the watercourse or anywhere along the banks of a river where such action is not part of the proposed maintenance activity (ies). Material that cannot be used for maintenance purposes must be removed from the riparian area to a suitable stockpile location or disposal site. Further action and consideration may be required where the possibility of contaminated material may occur, such as in urban watercourses.
- The use of foreign material, such as concrete, rubble, woody debris and/or dry land-based soil, is strictly prohibited from being used in maintenance actions unless for the specific purpose of repairs to existing infrastructure, coupled with appropriate mitigation measures.
- On completion of the maintenance action, the condition of the site in terms of relative topography should be similar to the pre-damaged state (i.e. the shape of the river bank should be similar or in a state which is improved to manage future damage). This ultimately dictates that the channel, banks and bed cannot be made narrower, higher or deepened respectively. Exceptions are considered for systems involved with the management of stormwater and improvements in water quality within the urban context.

ACTIVITY 1a: Clearing of alien vegetation

Invasive alien species cause a decline in indigenous plant numbers, change the vegetation structure and reduce biotic and habitat diversity. The removal of invasive alien plants from aquatic habitats is desirable not only from an aquatic ecological perspective but also because they reduce the ability of that ecosystem to provide valued goods and services as alien vegetation reduces runoff and water availability; increases the instability and erosion potential of banks, modify water quality; reduce biodiversity; result in much hotter and more destructive fires which destroy indigenous seeds and are difficult to control; form barriers to the movement of biota and have economic consequences.).

Description	**Activity 1a:** Clearing of alien vegetation within the river channel and riparian zone	
Actions	It is necessary to remove and control the alien vegetation in the river. The following general sequence of actions is required (Actions explained in detail below): **1.** Identify alien invasive species **2.** Cutting or pulling of target plants, or application of appropriate herbicide **3.** Treatment of plant remainders with appropriate herbicide or treatment of herbaceous plants that cannot be manually removed **4.** Removal of plant material from the riparian zone **5.** Follow-up work to prevent regrowth and the production of seeds remaining in the soil **6.** Revegetation of areas with indigenous vegetation where necessary	
Impacts of actions	The following impacts are anticipated as a result of undertaking the removal activity: Disturbance to aquatic habitat and vegetation	
Severity of impacts	**Disturbance of aquatic habitat vegetation**	If all mitigation measures are implemented, the severity of the impact will be **Low.**
Measures to mitigate the severity of the impact	**Disturbance of aquatic habitat vegetation**	• Identify alien plants to be removed. If unsure, please contact the Department of Agriculture or CapeNature for assistance. Regular monitoring and control of alien vegetation should be undertaken to ensure that the plants are removed while still young saplings that can more easily be removed (usually, pulling of seedlings by hand is possible when the soil is wet). This also prevents the spread of the alien plants once seeds have been produced; • Avoid trampling or clearing indigenous vegetation by using established paths where possible; • Clear alien vegetation according to the described alien vegetation removal methods for each invasive species as provided in the detailed method statements or with the methods and herbicides/biological control recommended on the Working for Water website: https://www.environment.gov.za/projectsprogrammes/wfw/resources • Clear felled alien vegetation from the river corridor. Larger tree stumps can be left to minimise erosion of the cleared area; • Where necessary, revegetate cleared areas with suitable indigenous vegetation as suggested in this report. Planted areas will require irrigation and care for 1-2 years following planting. This is particularly a requirement where most of the natural flow within the watercourses has been diverted for use or where the re-established vegetation is on the dry banks of the rivers. Planting the new vegetation at the start of the wet season can assist in ensuring that the new vegetation is kept wet; however one would need to then avoid planting new vegetation within the areas that will be inundated in winter or subjected to flood flows; and • Ongoing monitoring and clearing of the regrowth of alien plants within these areas will be required.
Remedial measures	**There are no additional remedial mitigation measures other than those listed above. As such, all mitigation measures as outlined above should be implemented in full.**	
Method of Access	Existing access roads should be utilised as far as possible.	
Time of maintenance management activity	The period of the maintenance management activity will vary depending on the level of infestation. The activity will be ongoing to control alien vegetation recovery and recruitment.	

Action 1 – Identify alien invasive species

Table 4. The following alien species were identified within the study area

Species	Legislation	Photograph
Port Jackson willows (*Acacia saligna)*	NEMBA category 1b	
Blackwood (*Acacia melanoxylon*)	NEMBA category 2	
Black wattle (*Acacia mearnsii)*	NEMBA category 2	
Red river gum *(Eucalyptus camaldulensis)*	NEMBA category 1b	
Beefwood (Casuarina cunninghamiana)	NEMBA Category 2	

Syringa (Melia azedarac)	NEMBA Category 1b	
Castor Oil *(Ricinus communis)*	NEMBA Category 2	
Bramble (*Rubus flagellaris*)	NEMBA Category 1b	

Action 2 – Cutting or pulling of target plants

Individual or sparsely distributed small (< 30 cm tall) invader plant saplings can be pulled by hand or using a puller/popper tool when the plants are between 30 cm and ± 50 cm tall. Alternatively, saplings may be cut using a lopper (long-handled secateur-like instrument) and the stumps painted with herbicide in the case of coppicing species.

Gloves are needed. Seedlings need to be gripped by the stem as close to the ground as possible and pulled out in one smooth motion - taking care to remove the entire root system, avoiding breaking off the plants at ground level as they will then regrow.

Mechanical felling (using a chainsaw) applies to all larger trees and, in most situations, during the initial clearing operation, includes their removal from the site. Coppicing should be prevented by the chemical treatment of the cut stumps immediately after cutting.

No uprooting of trees should take place anywhere where natural vegetation is required to develop, as the buried alien seed is brought to the surface where it germinates while the bare or uncovered soil encourages the alien seed to germinate.

Mechanical brush-cutting is not acceptable where natural vegetation is required as the remaining stumps of alien species are often stimulated to grow more vigorously, much like pruning a fruit tree, while the regrowth from the stumps is generally rapid and forms dense stands which require a concentrated application and use more chemicals.

All alien plants should be cut as close to the ground as possible since even small branches left on stumps can continue to grow (side stems should all be removed before applying herbicide to the cut stump). Another advantage of cutting low is that this increases the size of the stump area - which results in improved herbicide intake guaranteeing greater success.

While contractors usually select and provide their equipment, the following suggestions should be kept in mind. Hand tools such as hand saws and bow saws can be used where stems do not exceed

50 mm in diameter and should result in a clean-cut surface to allow for the more successful application and absorption of the herbicide.

With larger plants, moderately sized chainsaws in the 2.5 kW range become necessary. Note that only experienced operators may use chainsaws and that full PPE (Personal Protective Equipment) must be worn at all times (including ear protection). Chain saws are much more cost-efficient than hand tools if plants exceed a 50 mm stem diameter. In the case of dense infestations of tall, slender (50-80 mm diameter) plants, brush-cutters in the 2.5 to 3 kW class could be used. The site should not be cleared of all vegetation when chainsaws and brush cutters are to be used. Indigenous vegetation should be preserved. The impacts of trampling and accidental cutting of indigenous vegetation (grasses, sedges, shrubs etc.) should be avoided.

Note that if the contractor chooses to conduct the manual clearing operation with a chain saw, then all workers must attend a chain saw course (usually provided by the suppliers). All re-fuelling should be done over drip trays (to prevent spills). Any spilt fuel must be disposed of off the site at a suitable waste-receiving facility. Fuel should be properly stored away at all times.

The contractor should fully comply with all the provisions of the Occupational, Health and Safety Act.

The cut plant material must be removed immediately after cutting to avoid seed being released from the cut material and reinfesting the cleared area. Compaction of soil, such as through trampling or vehicle movement, should be avoided or kept to an absolute minimum by using existing tracks or paths.

Action 3 - Treatment of plant remainders with appropriate herbicide or of herbaceous plants that cannot be manually removed

Cut the larger trees; smaller trees and pull juveniles with an appropriate tool depending on the size of the plants. Apply herbicide containing a colourant onto the standing remains of the cut stumps and stems immediately after cutting. The herbicide is to be applied with a brush or appropriate device, ensuring no spillage occurs onto the surrounding vegetation or the ground. The applications of herbicides using a backpack pump and spaying onto stumps or foliage are not recommended as drift onto adjacent indigenous plants is highly likely, especially during windy conditions, however light.

The application of the herbicide is essential to ensure the dieback of the entire root system to prevent the re-growth or coppice (forming of new shoots from the stumps).

Large volumes of herbicide mix should not be carried around. Regular refilling of containers in specified areas outside vegetated areas is advised. Mixed herbicides should not be stored for longer than a day. During the day, the herbicides must be stored in a shaded area, preferably in a dark container.

A dye (e.g. EcoBlue) should also be mixed with the herbicide before application so that the treated stumps are marked. The recommended herbicide and a wetting agent should be used to ensure effective application.

Diesel must not be used as a wetting agent due to the potential for environmental contamination.

Unless stated, herbicide/dye mixing concentrations and application rates for the different species are available from the suppliers. Importantly, Material Safety Data Sheets (MSDSs) for all chemicals and herbicides used must be available on-site at all times. These documents contain vital information about environmental toxicity, health and safety regulations, flammability, storage instructions, procedures to follow in case of accidental ingestion and disposal methods.

All herbicides must be mixed on a drip tray or groundsheet in a demarcated area, out of direct sunlight, and well away from natural vegetation or surface water. The workers should under no circumstances rinse herbicide equipment in streams, pools or ponds. They should, as a matter of necessity, observe the instructions for the safe use, mixing and application of the herbicide.

The Department of Agriculture or the Working for Water Programme could be approached by landowners for the supply of the herbicide and advice about its application, which they will supply free of charge.

The most appropriate herbicide for the control of *Pennisetum clandestinum* (kikuyu grass) should be obtained and should be applied 2-3 times a year in the late summer on fresh growths in the areas that are affected.

Action 4 - Removal of plant material from the riparian zone

The cut plant material must be removed immediately after cutting to avoid seed being released from the cut material and reinfesting the cleared area. Compaction of soil, such as through trampling or vehicle movement, should be avoided or kept to an absolute minimum by using existing tracks or paths.

The plant material that does not contain any ripe seed can be chipped in a mechanical chipper and used to cover bare areas that require cover to suppress dust or weeds and to increase the organic content of the soil where needed. More chipped cut material can be removed per load than bulky unchipped material.

A free-standing self-propelled chipper can be used and can be rented from an agent. These chippers can cause injury if not operated correctly. They should only be operated by trained and fully equipped persons according to the manufacturer's instructions and safety precautions.

It is important to position the chipper in such a way as to ensure the easy flow of work and feeding of material into the chipper. A container, preferably a trailer or truck, should catch the material during chipping for removal and transportation to the area in which it can be used or stored. The material should not be disposed of at municipal solid waste disposal sites.

Larger, un-chippable stems and branches can either be sold for firewood or donated to local communities for that purpose or disposed of at a green/garden waste facility.

It is important to note that a cover of chips on the soil suppresses the regrowth of indigenous plants. Only areas where vegetation regrowth is to be restricted should be covered in wood chips. The material can also be stored in an area where it will not pose a fire hazard after it has dried out for use at a later stage.

Plant material that contains seeds should not be sold or distributed within the road reserve as this will distribute the seeds to other areas that will either be re-infested or become invaded. If the alien vegetation removal takes place when mature, viable seeds are present on the plant, then the chipped material should be separated and clearly marked and its use only takes place under conditions where the aliens will be easily and readily eradicated.

Action 5 – Control re-growth of alien vegetation

It has been well-documented that the single most important aspect governing the success of invasive plant control is follow-up work. Follow-up clearing should thus commence as soon as possible after initial clearing because if left unattended, the seedlings or untreated cut stumps and the re-growth from stumps will grow to form impenetrable thickets, which will be much more costly and difficult to eradicate.

Australian acacias produce enormous quantities of viable seeds in the absence of natural control mechanisms. This results in a build-up of seed banks in the soil because the seed does not lose much viability over time and germinates profusely following fires or after other disturbances, which leaves areas bare of vegetation.

In addition to removing competitive vegetation cover, fires break the seed dormancy by damaging the hard-protective seed coat of some plants, which allows the stimulatory ingress of water and air. The large seed bank is one of the most important obstacles to the long-term control of invasive alien species and its extent is often under-estimated. Furthermore, the rapid growth rate of the *Acacia* plants easily outcompetes that of the slower-growing indigenous riparian plants. The tall, dense vegetation of exotic invasive tall shrubs and low trees inhibits regrowth and reduces the density of the indigenous plants. The dense infestations result in an increased fuel load which implies hotter, more destructive wildfires that are more difficult to contain.

The following general sequence should be used to control the regrowth and germination of woody alien invasive species:

- Hand-pull all young plants 2-3 times a year;
- Cut the larger plants;
- Treat the plant remainders with an appropriate herbicide;
- Remove the plant material to the perimeters of the road reserves;
- Chip the cut material;
- Remove the chips from the site;
- Deposit the material in a designated area;
- The chipped material can be utilized for a particular purpose (i.e. for compost, weed or dust suppression) or it can be sold.

Action 6 – Re-vegetate with indigenous species

The following woody and perennial local indigenous plants are recommended for establishment along the watercourses, where the lateral zonation in which the plants should be established is also indicated and refers to Figure 8.

Pockets of the afore-mentioned indigenous riparian plants would need to be established within cleared areas so that seed can be dispersed naturally throughout the river system. Where possible, opportunities should be sought to re-establish a riparian zone along the length of the river system that is vegetated with the above-mentioned indigenous vegetation.

Table 5: Indigenous plant species recommended for revegetation along the watercourse

Species	Common name/s	Zone (see Figure 8)	Photograph
Podocarpus elongatus	Breede River yellowwood	Tree/shrub - Lower dry bank	
Olea europaea ssp. africana	Wild olive	Tree/shrub - Lower dry bank	
Searsia undulata	Kuni-bush	Tree/shrub – Upper to lower dry bank	

Searsia angustifolia	Willow karee	Tree/shrub – Upper to lower dry bank	
Salvia chamelaeagnea	Blue sage	Shrub - Upper to lower dry bank	
Passerina corymbosa	Common gonna bush	Shrub - Upper to lower dry bank	
Psoralea pinnata	Fountain bush	Shrub - Lower wet bank	
Cliffortia strobilifera	bog rice bush / vleibos	Upper wet bank	
Pteridium aquilinum	Common bracken	Lower bank, Wetted edge and wetland areas	

Melianthus major	Honey bush; kruidjie-roer-my-nie	Shrub – Upper dry bank	
Cenchrus caudatus	Riverbed grass	Dry bank zone	
Eragrotis curvula	Weeping lovegrass	Perennial grass - drybanks	
Cynodon dactylon	Fynkweek grass	Perennial grass - drybanks	
Ficinia nodosa	Knotted club-rush	Rush on wetted edge and wetland areas	
Juncus capensis	Cape rush	Wet bank/marginal zone in northern tributaries and mainstem	

Isolepis prolifera	Club rush	Wetted edge	
Zantedeschia aethiopica	Arum lily	Wetted edge, extending into terrestrial areas	

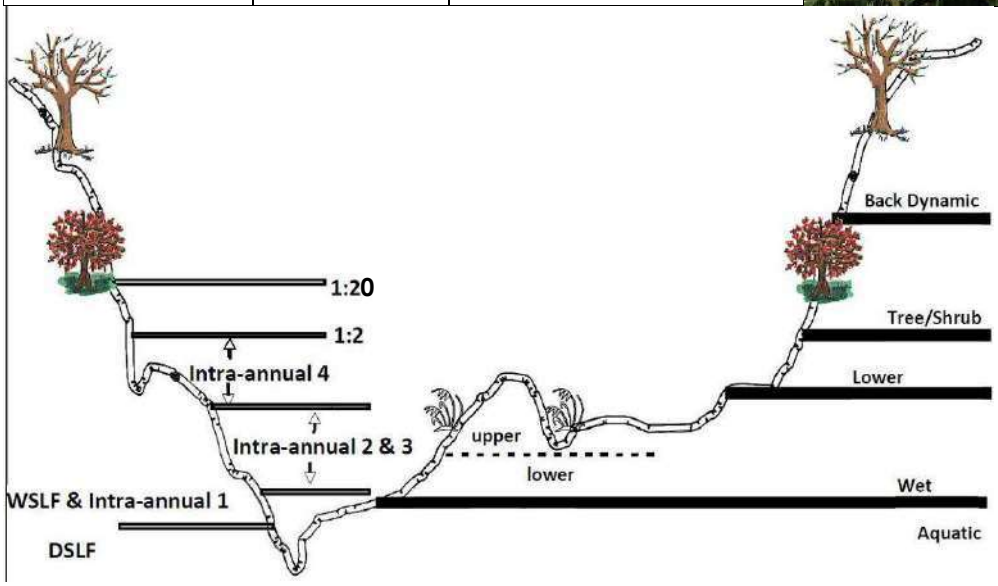


Figure 8: Schematic illustration showing generalised lateral plant community zones and their relationship to various components of the flow regime. WSLF = Wet Season Low Flow; DSLF = Dry Season Low Flow; four classes (1-4) of intra-annual flood categories, whilst 1:2 and 1:20 describe inter-annual return-period floods (Kemper & Boucher, 2000)

ACTIVITY 1b: Clearing of nuisance growth of reeds, and rushes

Common *Phragmites australis* reeds and *Typha capensis* bulrushes are indigenous plants with an ecological function. They offer a degree of refuge and habitat for biota as well as providing essential ecological services such as reducing erosion, causing deposition of silt, cooling instream habitats and reducing wind, thereby reducing evaporation. It is thus essential that where natural vegetation exists, it should be retained as far as possible and disturbed areas should be rehabilitated. Therefore, the objective of this activity is to control the reeds or bulrushes and not to eradicate them out of the river channel.

Phragmites reed and *Typha* bulrush growth in general needs to be managed in rivers within developed areas where the natural control measures such as floods or grazing have largely been removed and there is an elevated supply of nutrients. The removal of these plants is thus periodically undertaken to maintain an open channel and ensure that high flows in the channel are unimpeded. The control of indigenous reeds in particular needs to be undertaken very judiciously, with careful control and consideration for the environment. **Control** should only aim to remove excessive plant growth and build-up of material that can cause flooding. These reeds are indigenous and must not be **eradicated** as they provide valued goods and services.

The primary impact of clearing reeds and bulrushes is the disturbance of riparian and aquatic habitats. The control or clearing of these plants within the watercourse channels and in the dams is probably only required in the upper section where the river enters the town. Clearing of nuisance reeds is recommended to be cleared by hand, which would result in a very low impact. Secondary impacts would be the potential to facilitate erosion and the potential to facilitate the invasion of the area by alien plant species within the cleared areas. Furthermore, the reduction in surface roughness can result in erosion of the channel.

Indigenous Species to be controlled when there is nuisance growth that places infrastructure and flood conveyance of a watercourse at risk:

Species (Common name)	Photograph	Species (Common name)	Photograph
Typha capensis (Bulrush)		*Phragmites australis* (Common reed)	

Description	Activity 1b: Control of indigenous *Phragmites australis* reeds and *Typha capensis* bulrush	
Actions	Methods for the removal of *Phragmites* reeds: The removal of indigenous instream vegetation should where possible be conducted by hand-cutting/mowing and should avoid the large-scale disturbance of soil and removal of vegetated material on the banks or in the channel. Digging or hand pulling of the reeds is ineffective due to the plant's extensive root system and simply contributes to the expansion of *Phragmites* while causing turbidity in the water column. If machinery is utilized to remove the reeds and the associated sediment, the works in the channel should not impact the structural integrity of the watercourse and should not result in any erosion of the channel. Mechanical clearing of reeds should be less frequent than annually and should be limited in extent (the entire extent of the reed bed should not be cleared, only a portion thereof). Methods for control of *Typha* bulrushes: The most successful method for control of *Typha* is through a physical cutting in conjunction with flooding. Cutting should thus take place at the end of autumn when water levels are low but when the cut area will be submerged in at least 10 cm of water when water levels rise again in the wet winter period. Two subsequent cuttings of the bulrush will be required at the end of the growing season to suppress the regrowth before the inundation.	
Impacts of actions	The following impacts are anticipated as a result of undertaking the inspection activity: Disturbance to aquatic habitat and vegetation	
Severity of impacts	Disturbance of aquatic habitat	If all mitigation measures are implemented, the severity of the impact will be Low.
Measures to mitigate the severity of the impact	Disturbance to the local vegetation	The following mitigation measures should be adhered to in conjunction with the above clearing methods: • Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity • Removal of indigenous instream indigenous vegetation should be limited to nuisance growth of reeds, bulrushes and aquatic weeds (and not the removal of palmiet); • Clearing should take place outside of the bird breeding season seasons (i.e. maintenance to be done during the period January to May) and should not be conducted more than once a year; • Patches of reeds immediately upstream or downstream of formal road crossings can be routinely cut before the rainfall period so as not to cause blockages at these critical points, particularly of pipes and culverts; • The reeds should be cut below the lowest leaf, and the remaining stump should not be longer than 15cm. If a brush cutter is used, mowing should be no lower than 12cm from the ground to minimise impacts on small animals and indigenous plants; • If mowers are used, care should be taken that they do not damage banks or other indigenous vegetation such as sedges and rushes; • The upstream and downstream impacts of any vegetation clearing activities should be minimized, such as the prevention of increased sedimentation downstream of the site by not undertaking the activity during the rainy period; • If banks are disturbed by the activity, follow-up revegetation should be undertaken; • Indigenous sedges and other grasses should be allowed to establish in cleared sections • Any clearing works in the channel should not impede the movement of aquatic and riparian biota; • A minimum base flow should be maintained in the river channel at all times; and • Remove all cut reeds, aquatic weeds and clear alien vegetation from the dam or channel and riparian zone. Cut vegetation should ideally be taken to a green / garden waste facility and not sent to a landfill.
Remedial measures if mitigation inadequate	There are no additional remedial mitigation measures other than those listed above. As such, all mitigation measures as outlined above should be implemented in full.	
Method of Access	Existing access should be utilised as far as possible.	
Period of activity	Varies depending on the level of infestation. The activity will be ongoing to control nuisance vegetation recovery and recruitment.	

ACTIVITY 2: Repairs to infrastructure

The impacts of repair work on infrastructure along the river vary, largely depending on the type of infrastructure, the level of repairs required and how the repairs are conducted. The sensitivity of the aquatic ecosystem is also an important consideration. This maintenance activity entails the smaller scale repairing of infrastructure such as at the dams, weirs or culverts within the watercourse so that they retain their original footprint and integrity, a like–for–like scenario. Any additions to infrastructure are, by definition, not within the scope of an MMP. Minor repairs will typically involve a localised disturbance of the river channel or banks while infrastructure is repaired. Furthermore, disturbed areas following repairs can contribute towards high silt and sediment loads within the river as the material is not held by the roots of plants.

Description	**Activity 2: Repairs to or replacement of damaged infrastructure**	
Actions		• Demarcate the disturbance footprint • Conduct repairs • Reshape and rehabilitate the disturbed footprint
Impacts		The following impacts are anticipated because of undertaking the inspection activity: Impaired water quality; Disturbance of aquatic habitat
Severity of impacts	**Impaired water quality & habitat disturbance**	If all mitigation measures are implemented, the severity of the impact will be **Low.**
Measures to mitigate the severity of the impact	**Impaired water quality & habitat disturbance**	• Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity • Schedule work during the dry/low flow period when flow in the stream is at its lowest; • Before construction, plan access route and movement to and from the maintenance site – aim to use existing access routes where available; • Demarcation should be conducted in consultation with the contractor or persons responsible for the work to keep the disturbance area as small as possible; • If excavation is required- remove topsoil and set it aside for post-construction rehabilitation. The stored topsoil should be stored away from the watercourse and any stormwater flow paths; • If possible, use manual labour to do the repair work; • Mix any concrete, other materials or potential contaminants away from the watercourse and transport them to a specific point of use without spilling; • If water run-off with high suspended solids and turbidity is observed coming from the disturbed areas associated with the work, temporary sediment trapping mechanisms should be put in place downstream of the activity to filter water from the construction site (such as hay bales); • Good housekeeping practices should be followed, such as the use of machinery which does not leak oils or other substances, and if applicable adequate waste disposal and removal, as well as the adequate provision and servicing of toilets. The site of the maintenance activity must be managed so that construction material (especially cement and fuel products) is not washed into the watercourse during storm events. Emergency spill kits should be kept on site; • Any cleared sediment, vegetation or spoil material associated with the maintenance activity should be removed from the river channel and preferably disposed of at an approved disposal site; • The maintained infrastructure should not impact the structural integrity of the watercourse nor result in any alteration to the flow and sediment carrying capacity of the watercourse. Shape channel banks to have a gently sloping gradient down to the watercourse bed (the cutting of the banks, which is the current practice, is not encouraged); and • Revegetate the disturbed area with indigenous vegetation as per the recommendations of this report and keep the area clear of alien vegetation.
Remedial measures		**There are no additional remedial mitigation measures other than those listed above. As such, all mitigation measures as outlined above should be implemented in full.**
Access to the site		Existing access should be utilised as far as possible.
Period of activity		The time of the maintenance management activity will vary depending on the level of repairs required.

ACTIVITY 3: Sediment removal at infrastructure

The impact of repair work on the infrastructure within the watercourse will vary, largely depending on the level of repairs required and how the repairs are conducted. The sensitivity of the aquatic ecosystem is also an important consideration. This maintenance activity entails the smaller-scale repairing of infrastructure so that it can retain its original footprint and integrity, a like–for–like scenario. Any additions to infrastructure are, by definition, not within the scope of an MMP. Minor repairs will typically involve a localised disturbance of the river channel or banks while infrastructure is repaired. The disturbed areas following repairs can contribute towards high silt and sediment loads within the river as the material is not held by the roots of plants.

Description	**Activity 3:** Sediment removal at infrastructure	
Actions	• Access the site with a team or machinery • Remove the sediment from the location of the infrastructure • Deposit sediment downstream of infrastructure (if less than $10m^3$) • Remove to a suitable stockpile location outside the riparian zone • Revegetate any riparian areas disturbed by the activities	
Impacts of actions	The following impacts are anticipated as a result of undertaking the inspection activity: Disturbance of aquatic habitat and vegetation	
Severity of impacts	**Disturbance of aquatic habitat and vegetation**	If all mitigation measures are implemented, the severity of the impact will be **Low**
Measures to mitigate the severity of the impact	**Disturbance of aquatic habitat and vegetation**	• Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity • Material may be removed within the active channel only during the dry/low flow period; • The disturbed area around the infrastructure should be kept to a minimum and where possible existing access points to the infrastructure used; • Minimise upstream/downstream impacts on the reach in which the site is located; • Minimise impact on the structural integrity of the watercourse and avoid channelisation or canalization of the watercourse; • Manual labour should be used to remove the sediment in the river where feasible; • Where possible existing access points to the river channel should be used and any indigenous marginal vegetation that is established along the edges of the channel should preferably remain intact as it provides cover, habitat and food for the riverine biota; • Disturbed areas should be kept clear of alien vegetation. • Removed material should be taken out of the channel completely and should not be utilised to block the river flow or to create berms on the top of the stream banks. • Disturbed areas on the banks of the river should be revegetated with indigenous plant species
Remedial measures	**No additional remedial mitigation measures other than those listed above. As such, all mitigation measures as outlined above should be implemented in full.**	
Method of Access	Existing accesses should be utilised as far as possible.	
Period of activity	The time of maintenance management activity should take place within one day or longer, depending on the level of sediment removal required.	

ACTIVITY 4: Sediment removal from the channel for flood conveyance/channelization

Deposited sediment within watercourses can cause a blockage and alter or impede flow. During higher flows, these blockages can potentially impede or divert flow in the watercourse, diverting the energy of the flow into the banks and causing damage to the adjacent land or infrastructure.

Description	**Activity 4:** Sediment removal from the channel for flood conveyance/channelization	
Actions	• Access the site with a team or machinery • Remove the sediment from the channel • Remove to a suitable stockpile location outside the riparian zone • Revegetate any riparian areas disturbed by the activities	
Impacts of actions	The removal of sediment from the channel can result in disturbance within the riparian and instream aquatic habitats of the river. This disturbance can result in further degradation as a result of erosion and invasion by alien plants occurring in the disturbed area.	
Severity of impacts	**Disturbance of aquatic habitat and vegetation**	If all mitigation measures are implemented, the severity of the impact will be **Low**
Measures to mitigate the severity of the impact	**Disturbance of aquatic habitat and vegetation**	• Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity • Material may be removed within the active channel only during the dry/low flow period; • The disturbed area should be kept to a minimum and where possible existing access points to the infrastructure should be used; • Minimise impact on the structural integrity of the watercourse and avoid channelisation or canalization of the watercourse rather maximise physical diversity by creating pools and shallow habitats; • Material removal should start at the downstream-most point and work systematically upstream. Sand removal should not take place in the stream where there are eroded banks; • Manual labour should be used where feasible for this activity; • Disturbed areas should be kept clear of alien vegetation; • Removed material should be taken out of the channel completely and should not be utilised to block the river flow or to create berms on the top of the stream banks; • Disturbed areas on the banks of the river should be revegetated with indigenous plant species
Remedial measures	**No additional remedial mitigation measures other than those listed above. As such, all mitigation measures as outlined above should be implemented in full.**	
Method of Access	Existing accesses should be utilised as far as possible.	
Period of activity	The time period of maintenance management activity should take place within one day or longer, depending on the extent of work required.	

ACTIVITY 5: Repairs to flood damaged riverbanks and associated infrastructure

The dynamic nature of a river results in erosion of the channel and banks and damage to infrastructure along the banks. The eroding or flood-damaged banks and adjacent areas may then need to be repaired to protect adjacent farmlands and infrastructure.

Description	**Activity 5:** Sediment movement in the channel or on banks for repairs to berms or banks	
Actions	• Access the site with a team or machinery • Move material into the area/ bank requiring filling or repairs • Shape bank • Revegetate any riparian areas disturbed by the activities	
Impacts of actions	Due to the volumes of material involved, the movement of material to reshape a bank or repair a berm is most commonly often conducted by machinery. The resulting disturbance through using machinery to push material onto a berm or reshape a bank is intense. In addition to the material moved by the machinery, the route along which the machinery moves is also heavily impacted. This disturbance can result in further degradation as a result of erosion and invasion by alien plants occurring at the disturbed area.	
Severity of impacts	**Disturbance of aquatic habitat and vegetation**	If all mitigation measures are implemented, the severity of the impact will be **Low**
Measures to mitigate the severity of the impact	**Disturbance of aquatic habitat and vegetation**	• Where this activity needs to be carried out within sections of the Modderas River and its smaller tributary where there is wetland habitat the input of an aquatic or rehabilitation specialist must be obtained before undertaking the activity • Maintenance activities are best done during the dry or low flow period unless emergency work is required that should be undertaken immediately; • If the flow in the river needs to be impeded or diverted to undertake the works, maintain a minimum base flow and do not impede the movement of aquatic and riparian biota; • The disturbed area around the bank being repaired should be kept to a minimum and where possible present existing access points to the infrastructure must be used; • Minimise the impact on the structural integrity of the watercourse and avoid increasing channelisation or canalization of the watercourse; • Where possible, aim to create gently sloping banks down to the bed of the watercourse; • Stockpiling of material for the repairs should be placed outside of the channel and riparian zone where possible; • Manual labor is preferred to the use of mechanical equipment to minimise physical disturbance around the activity location; • Removed material should be taken out of the channel completely; and • Any sediment brought in for filling purposes should be from a local source and free of invasive alien plant seed.
Measures if measures are inadequate	**No additional remedial mitigation measures other than those listed above. As such, all mitigation measures as outlined above should be implemented in full.**	
Access to the site	Existing accesses should be utilised as far as possible.	
Period of activity	The time of maintenance management activity should take place within one day, or longer, depending on the extent of work required.	

7. MONITORING AND REPORTING

The landowner is responsible for overseeing the monitoring of the maintenance and management activities under the auspices of this MMP. The table on the following page lists ongoing monitoring that would take place in the river to proactively address any potential impacts to the ecological integrity of the river associated with the MMP as well as the specific monitoring required during MMP activities.

Form A (attached) must be completed by the relevant person(s) before maintenance activities are undertaken and Form B after a maintenance activity has been completed. A copy of each completed Form A & B must be kept on record by the landowner.

Form A should be completed at least 7 working days before the commencement of any maintenance activity and Form B at least 3 working days following the completion of the maintenance activity(ies). At least two photographs are required from two different points of perspective (A and B) looking at the site (coordinates of these points are required). When listing the activity type and reference code, this must be done by specifically listing the relevant details within the MMP.

It is important to note that for any activities undertaken outside the scope of the MMP, in terms of the action outlined within the given method statement, the responsible person(s) will be subject to Section 24(F) of NEMA and that appropriate enforcement and compliance requirements will follow.

DEA&DP may, within a reasonable notice period, request to evaluate the maintenance activities and assess the maintenance sites as per the adopted MMP.

Part of the watercourse that is monitored	Frequency of Monitoring	Monitoring Procedure	How results are analysed and presented	Comments
Bed and banks of the Modderas River and its tributaries within the property	Immediately before commencement of activities and after activities are complete.	Photographs of the maintenance management activity will be taken as a record of the correct undertaking of the specific maintenance management activity. The photographs should be taken from two different points of perspective (A and B) looking at the site (coordinates of these points are required).	The record of the site visit undertaken during the maintenance management activities will include the following: • Completed Forms A and B for before and after maintenance activity that indicates what activity in terms of this MMP was undertaken at the site; • The correct implementation as well as non-conformance of the MMP are outlined; • Recommendations to ensure conformance with the MMP in future maintenance management activities if required. • Photographs of all maintenance management activities undertaken at the site.	Records should be kept in a file that must include the measured results, together with reporting of maintenance activities, any corrective action, recommendations and photographs.
	Ongoing monitoring of the river channel	Monitoring for signs of: • Erosion of the river banks, • Damage to infrastructure requiring repairs, • Problematic sediment or debris build-up that may block the channel and result in localised flooding – this would also include large alien trees that have fallen over; • Growth or regrowth of alien plant species; and • Areas where revegetation with suitable local indigenous vegetation is required.	Monitoring of erosion, damage to infrastructure, sediment/debris deposition and growth of alien invasive species should inform corrective measures in this regard.	A record should be kept of erosion control measures, sediment removal and alien species control.

REPORTING FOR INTENT TO UNDERTAKE MAINTENANCE ACTIVITIES – FORM A				
Section A: Landowner Details				
Name	**Surname**	**Farm No.**	**Erf No.**	**Today's Date**
Section B: Details of proposed maintenance activity				
WUA/GA reference number and DEA&DP reference number for MMP.	**Activity Type:**	**Reference code (*make reference to MMP*)**	**Footprint area (m^2)**	**Volume of material (m^3)**
Equipment to be used:	**Description of method for planned activity:**			**Date when work will commence:**
Date of last flood event for site:	**Note any further damage and comments regarding the state of the site**			
Section C: Photographs of activity location before maintenance				
Before A **Coordinates:** **S** **E**				
Before B **Coordinates:** **S** **E** **Date of photos taken:**				

REPORTING FOR COMPLETION OF MAINTENANCE ACTIVITIES – FORM B				
Section A: Landowner Details				
Name	**Surname**	**Farm No.**	**Erf No.**	**Today's Date**
Section B: Details of proposed maintenance activity				
WUA/GA reference number and DEA&DP reference number for MMP.	**Activity Type:**	**Reference code (*make reference to MMP*)**	**Footprint area (m^2)**	**Volume of material (m^3)**
Equipment that was used:	**Description of method for completed activity and if commence date changed**			**Date activity completed**
Date of last flood event for site:	**Note any challenges or difficulties experienced in following the MMP method statement**			
Section C: Photographs of activity location after maintenance				
After A **Coordinates:** **S** **E**				
After B **Coordinates:** **S** **E** **Date of photos taken:**				

DEFINITIONS

"Activity" means an activity identified in any notice published by the Minister or MEC in terms of section 24D(1)(a) of the Act as a listed activity or specified activity. Activity in this document refers to the activities as listed in Listing Notice 1, 2 and 3 of the Environmental Impact Assessment Regulations, 2014 (as amended).

"Bush Encroachment" means stands of plants of the kinds specified in column 1 of Table 4 of the Conservation of Agricultural Resources Act (Act No. 43 of 1983) where individual plants are closer to each other than three times the mean crown diameter**.**

"Diverting" as defined in the General Authorisation, in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998) for Water Uses as defined in Section 21(c) and 21(i) (GN. 509 of 26 August 2016), means to, in any manner, cause the instream flow of water to be rerouted temporarily or permanently.

"Ecological Infrastructure" refers to naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction.

"Estuary" has the meaning assigned to it in the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008)

"Flood event" is the event where land is inundated by the overflowing of water from a river channel and where this event causes significant damage to infrastructure or results in watercourse erosion and/or sediment deposition.

NOTE that flooding can be a natural phenomenon in many river or wetland systems which, due to encroachment and human modification of the form and function of the affected system, may have evolved into a potential hazard to life or property.

"Flow-altering" as defined in the General Authorisation, in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998) for Water Uses as defined in Section 21(c) and 21(i) (GN. 509 of 26 August 2016), means to, in any manner, alter the instream flow route, speed or quantity of water temporarily or permanently.

"General Authorisation" in this document refers to the General Authorisation in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998) for Water Uses as defined in Section 21(c) or Section 21(i) (GN. 509 of 26 August 2016).

"Impeding" as defined in the General Authorisation, in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998) for Water Uses as defined in Section 21(c) and 21(i) (GN. 509 of 26 August 2016), means to, in any manner, hinder or obstruct the instream flow of water temporarily or permanently, but excludes the damming of flow so as to cause storage of water.

"Indigenous vegetation" refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

"Maintenance" means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.

"Maintenance Management Plan" means a management plan for maintenance purposes defined or adopted by the competent authority.

"**River Management Plans**" as defined in the General Authorisation, in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998) for Water Uses as defined in Section 21(c) and 21(i) (GN. 509 of 26 August 2016), any river management plan developed for the purposes of river or storm water management in any municipal/metropolitan area or described river section, river reach, entire river or sub quaternary catchment that considers the river in a catchment context.

"River reach", a length of river characterised by a particular channel pattern and channel morphology, resulting from a uniform set of local constraints on channel form. A river reach is typically hundreds of meters in length.

"Stretch" a section of watercourse, delineated between two or more mapped coordinates, within which proposed maintenance activities are to take place as guided by a MMP.

"Thalweg" refers to the line of lowest elevation within a valley or watercourse.

"Watercourse" means:

(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998); and

a reference to a watercourse includes, where relevant, its bed and banks.

"Wetland" means, land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

ACRONYMS

CBA	Critical Biodiversity Area
DEA&DP	Department of Environmental Affairs & Development Planning
DWS	Department of Water & Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
GA	General Authorisation, in terms of the National Water Act, 1998 (Act No. 36 of 1998)
GN	Government Notice
IB	Irrigation Board
MEC	Member of Executive Council
MMP	Maintenance Management Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
SANParks	South African National Parks Authority
WUA	Water Users Association
WULA	Water Use Licence Application

Ecosystem Guidelines for Environmental Assessment in the Western Cape, Edition 2, 2016. Available at: www.bgis.org.za

Wetland offsets: A best practice guideline for South Africa, 2016. Available at: http://www.wrc.org.za

Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries, 2014. Available at: http://www.wrc.org.za

National Water Act, 1998 (Act No. 36 of 1998). Available at: http://www.gov.za/documents/national-water-act

General Authorisation, in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in Section 21(c) or Section 21(i).

ANNEXURE A

DEPARTMENTAL DETAILS	
CAPE TOWN OFFICE: **DIRECTORATE: DEVELOPMENT MANAGEMENT (REGION 1)** (City of Cape Town, West Coast District, Cape Winelands District & Overberg District)	**GEORGE REGIONAL OFFICE:** **DIRECTORATE: DEVELOPMENT MANAGEMENT (REGION 3)** (Central Karoo District & Garden Route District)
The completed Form must be sent via electronic mail to: DEADPEIAAdmin@westerncape.gov.za Queries should be directed to the Directorate: Development Management (Region 1) at: E-mail: DEADPEIAAdmin@westerncape.gov.za Tel: (021) 483-5829 Western Cape Government Department of Environmental Affairs and Development Planning Attention: Directorate: Development Management (Region 1) Private Bag X 9086 Cape Town, 8000	The completed Form must be sent via electronic mail to: DEADPEIAAdmin.George@westerncape.gov.za Queries should be directed to the Directorate: Development Management (Region 3) at: E-mail: DEADPEIAAdmin.George@westerncape.gov.za Tel: (044) 814-2006 Western Cape Government Department of Environmental Affairs and Development Planning Attention: Directorate: Development Management (Region 3) Private Bag X 6509 George, 6530

WESTERN CAPE DEPARTMENT OF AGRICULTURE DETAILS

Director: Sustainable Resource Management, LandCare Programme
Western Cape Department of Agriculture
Private Bag X1
Elsenburg
7607

Main Building, Elsenburg, Muldersvlei Road
Tel: 021 808 5090

ANNXURE 7 : FRESHWATER ASSESSMENT

AQUATIC IMPACT ASSESSMENT REPORT FOR THE PROPOSED ENLARGEMENT OF MODDERAS DAM N PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH

August 2025

Prepared By:

Ms Toni Belcher

Tel: 082 883 8055

E-mail: toni@bluescience.co.za

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1. SPECIALIST DETAILS, EXPERTISE AND DECLARATION

1.1. QUALIFICATIONS OF SPECIALIST CONSULTANT

Name: Antonia Belcher

Contact details: 53 Dummer St, Somerset West, 7130; Phone: 082 883 8055;
Email: toni@bluescience.co.za

Profession: Aquatic Scientist (P. Sci. Nat. 400040/10)

Fields of Expertise: Specialist in freshwater assessments, monitoring and reporting

Years in Profession: 30+ years

Toni Belcher worked for the Department of Water Affairs and Forestry for more than 17 years. During this period she worked for the Directorate Water Quality Management, the Institute for Water Quality Studies and the Western Cape Regional Office and has built up a wide skills base on water resource management and water resource quality for rivers, estuaries and the coastal marine environment. Since leaving the Department in 2007, she has been working in her private capacity and was co-owner of BlueScience (Pty) Ltd, working in the field of water resource management and has been involved in more than 500 aquatic ecosystem assessments for environmental impact assessment and water use authorisation purposes. In 2006 she was awarded a Woman in Water award for Environmental Education and was a runner up for the Woman in Water prize for Water Research.

Professional Qualifications:

1984	Matriculation Lawson Brown High School
1987	B.Sc. – Mathematics, Applied Mathematics University of Port Elizabeth
1989	B.Sc. (Hons) – Oceanography University of Port Elizabeth
1998	M.Sc. – Environmental Management (cum laude) Potchefstroom University

Key Skills: Areas of specialisation: Aquatic ecosystem assessments, Monitoring and evaluation of water resources, Water resource legislation and authorisations, River classification and Resource Quality Objectives, River Reserve determination and implementation, Water Quality Assessments, Biomonitoring, River and Wetland Rehabilitation Plans, Catchment management, River maintenance management, Water education.

Summary of Experience:

1987 – 1988	Part-time field researcher, Department of Oceanography, University of Port Elizabeth
1989 – 1990	Mathematics tutor and administrator, Master Maths, Randburg and Braamfontein Colleges, Johannesburg
1991 – 1995	Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria
1995 – 1999	Hydrologist and Assistant Director, Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria
1999 – 2007	Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town
2007 – 2012	Self-employed – Aquatic Specialist
2013 – 2020	Senior Aquatic Specialist and part-owner, BlueScience
2020 – 2025	Self-employed– Aquatic Specialist
Present	Senior Aquatic Specialist and part-owner, BlueScience

1.2. DECLARATION OF INDEPENDENCE

I, A**ntonia Belcher,** as the appointed specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
    - other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
    - ~~am not independent, but another specialist that meets the general requirements set out in Regulation 13 of GN No. 326 have been appointed to review my work (Note: a declaration by the review specialist must be submitted);~~
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the Applicant, the Department and registered interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;
- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations, 2014 (as amended).

Date: 25 May 2025

Name of company: BlueScience (Pty) Ltd

Signature of the specialists: 

2. INTRODUCTION

2.1. BACKGROUND TO STUDY

Modderasrivier Trust wishes to enlarge Modderas Dam on Portion 1 of the Roode Zands Kloof Farm No. 66. The farm is located approximately 8 km north of Tulbagh in the Western Cape. The purpose of enlarging the existing dam is to store enlistment water that has already been confirmed as existing lawful use. The dam is a Category II dam with a storage capacity of 200 000 m³ and a maximum wall height of 13.8 m.

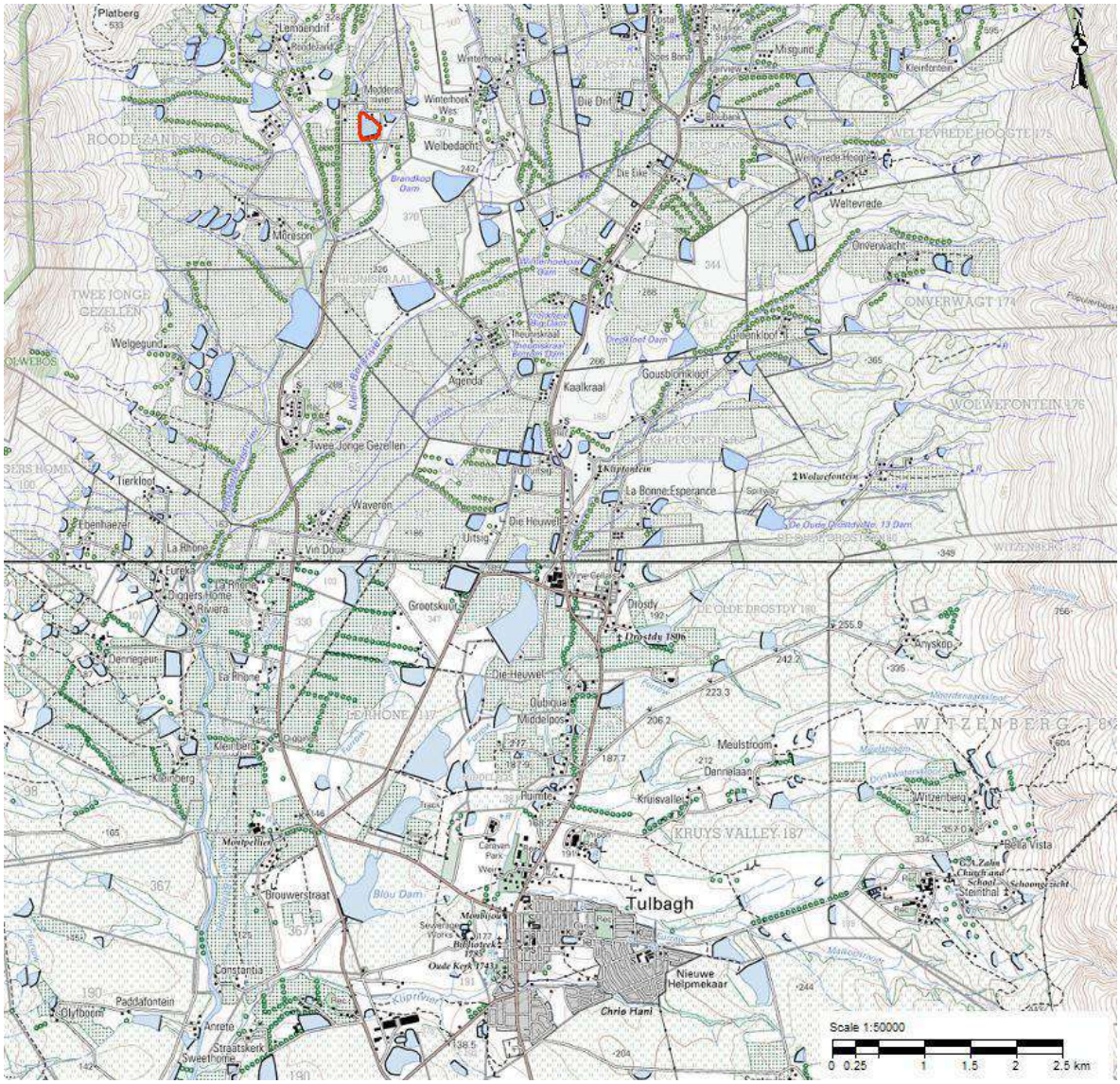

Figure 1. Locality Map for the Modderas Dam (red polygon) near Tulbagh

The dam is proposed to be enlarged to a maximum storage capacity of 310 000 m³ and a maximum wall height of about 15.1 m. The enlarged dam will increase the assurance of water supply on the farm while ensuring more effective and beneficial use of the existing lawful use. The enlarged Modderas Dam will continue to be filled with surface water runoff from its catchment area. This report is

intended to provide input into the authorisation process in terms of the potential aquatic ecosystem impacts and provide recommended mitigation to reduce any impact.

Table 1. Summary of water resource information related to the activity undertaken

Descriptor	Name / Details	Notes
Water Management Area	Breede Olifants WMA	
Catchment Area	Modderas Tributary of the Klein Berg River	A tributary in the middle reaches of the Berg River System
Quaternary Catchment	G10E	
Present Ecological State	D (Largely Modified)	DWAF (2024) for the Klein Berg River
Ecological Importance and Sensitivity	Ecological Importance – High Ecological Sensitivity – Very High	
Target Ecological Category	C (moderately modified)	GG No 42451, GN 655 dated 10 May 2019
Latitude	33°12'37.93"S	Location of the dam wall
Longitude	19° 7'23.46"E	

The study area is located largely within a wider area considered of Very High Aquatic Biodiversity Sensitivity (Figure 2). This is due to the Aquatic Critical Biodiversity Areas (CBAs) and Freshwater Ecosystem Priority Area (FEPA) Wetlands as well as a Strategic Water Source Area for surface water (Boland) occurring in the wider area. The potential impact of the activities on the wetland areas and the Strategic Water Source Areas is assessed in this report.

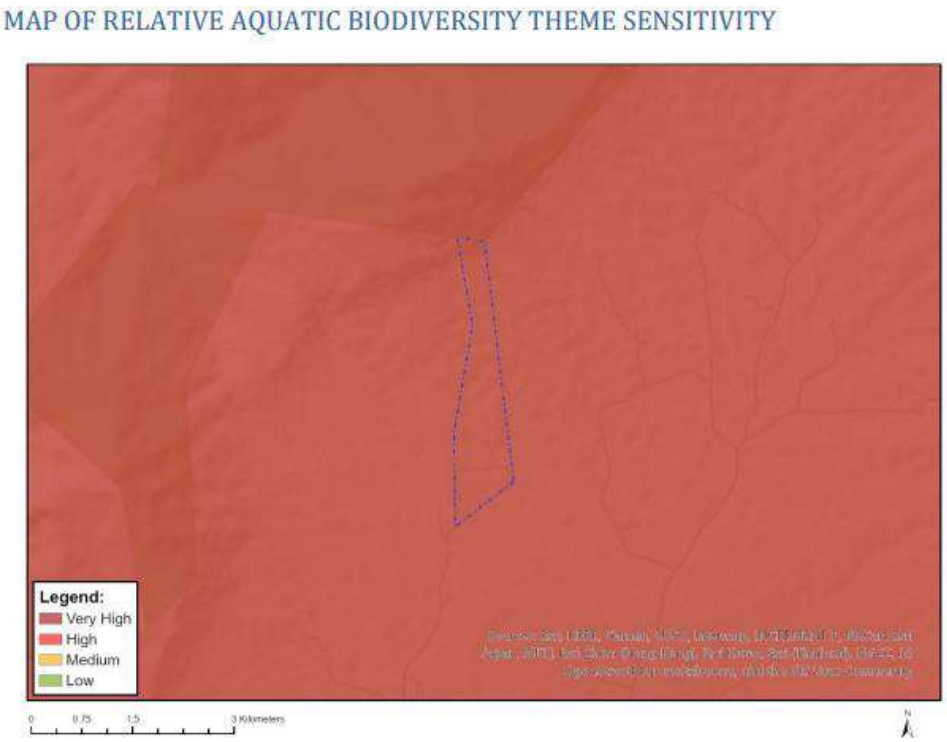

Figure 2. DFFE Screening Map for the area in terms of Aquatic Biodiversity Combined Sensitivity

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Wetlands_Channelled valley-bottom
Very High	SWSA (sw)_Boland

2.2 OVERVIEW OF THE STUDY AREA

The property lies on the wide valley floor of the Klein Berg River. The dam is instream on the Modderas River which drains into the Roodezand River, a tributary of the Klein Berg River, within the middle Berg River System (Quaternary catchment G10E).

Within the farm, much of the natural vegetation on the valley floor has been transformed by past agricultural activities (Figure 3). The Modderas River at the site comprises several small foothill streams with a defined riparian zone of indigenous and alien trees and shrubs that lie within the already significantly modified on the valley floor.

Figure 3. Topographical map of the study site and the surrounding area

2.3. TERMS OF REFERENCE

The suggested work and agreed-upon tasks for this assessment are as follows:

The suggested work and agreed-upon tasks for this assessment are as follows:

Task: Aquatic biodiversity and risk assessment for the proposed dam on Portion 1 of the of the Roode Zands Kloof Farm No. 66 near Tulbagh

1. Conduct a desktop analysis and mapping of aquatic features using Google Earth and Planet GIS as well as available sources of data and mapping such as on the Freshwater Biodiversity Information System maps, National Wetland Mapping, Freshwater Ecosystem Priority Areas and aquatic Critical Biodiversity Areas / Ecological Support Areas mapping. If there is little existing information available for the aquatic features within the study area, data will be utilised for similar adjacent aquatic ecosystems and any more detailed assessments of the aquatic features within the wider area. The National Screening Tool will also be accessed.

2. Undertake a situation assessment that will comprise a single site visit/field assessment and will include mapping and describing the freshwater areas, as well as an assessment of the importance, conservation value, sensitivity and current state of the aquatic ecosystems delineated within the site.

3. An Aquatic Specialist Assessment Report will be compiled for the site as per the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (GN 43110 of 20 March 2020). The report will include:

- A baseline description of the aquatic features and ecosystems within the site; their ecological importance and sensitivity, present condition and a recommended target ecological state.
- The proposed activities are to be assessed in terms of their impact on the aquatic ecosystems' condition and functioning.
- DWS Risk Assessment will be undertaken.
- Mitigation measures are to be recommended to address the potential aquatic ecosystem impacts of the proposed activities.

2.4. Use of the Report

This report reflects the professional judgement of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

3. METHODOLOGY ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment as well as by a more detailed assessment of

the freshwater features at the site. The site was visited for a single day on 15 April 2025 at the start of the rainy season. The timing of the assessment, although not ideal, was considered adequate for this assessment. Historical imagery, taken in the wet and dry periods, was also consulted to assist with the assessment.

During the field visit, characterisation and integrity assessments of the freshwater features were undertaken. The SANBI Biodiversity GIS, Cape FarmMapper and Freshwater Biodiversity Information System websites were also consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping, freshwater features mapped in the Freshwater Ecosystem Priority Areas maps and freshwater biota present. This information/data was used to inform the water resource protection-related recommendations.

Consideration of the Reserve or environmental water requirement determination was undertaken at a rapid level (Rapid Reserve) utilising the guidelines for the South African methodologies for water resource protection as outlined in the documentation "Resource Directed Measures for Protection of Water Resources" (DWAF, 1999). Hydrology utilised for the assessment was obtained from Water Resources 2012.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following limitations apply to the techniques and methodology utilised to undertake this study:

- Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments;
- The river health assessment was carried out using the South African Department of Water and Sanitation developed methodologies. River Health assessments were carried out to provide information on the ecological condition and ecological importance and sensitivity of the river systems impacted.
- The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by DWAF (2005) was followed for the delineation of the riparian and wetland areas.
- The ecological importance and sensitivity assessment were conducted according to the guidelines, as developed by DWAF (1999).
- The species mentioned in this report do not comprise a comprehensive list of all species which occur at the site. They are mentioned for descriptive purposes.

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

4. DESCRIPTION OF THE SITE AND SURROUNDING AREA

4.1 VISUAL CHARACTERISTICS

The Modderas River rises on the lower slopes of the Groot Winterhoek Mountains (altitude of about 565 m above mean sea level) and drops down to join the Roodezant River at an altitude of about 207m above mean sea level over a distance of about 3.88 km (average slope of 1%). The dam is located in the middle reaches of the river, at about 250 m above mean sea level and just upstream of where another tributary joins the stream.

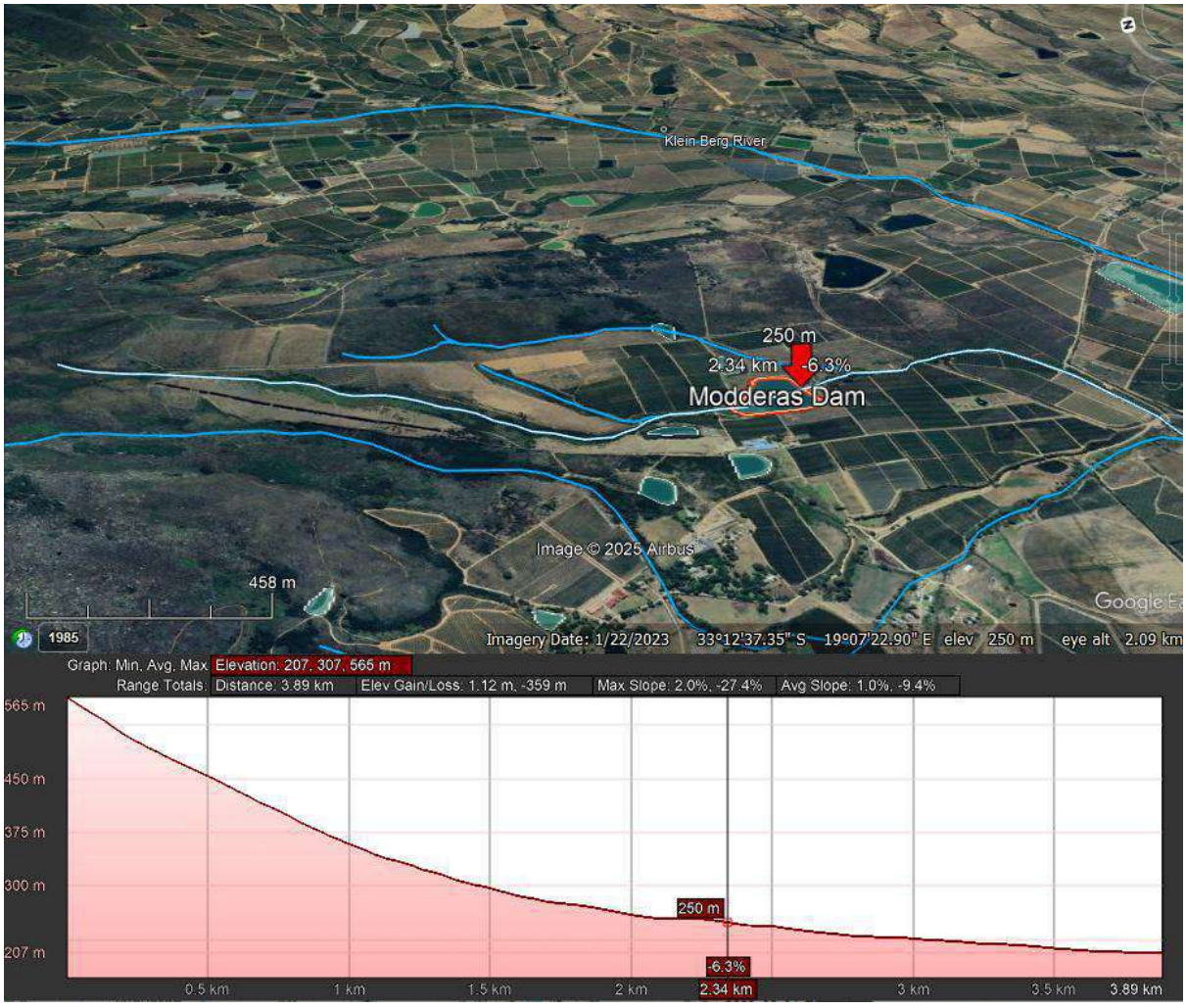

Figure 4. Elevation profile from Google Earth, showing the slope of the Modderas River with the red arrow on the image corresponding to the vertical black line on the graph. Note the orientation of the Google Earth image has been rotated by about 270 degrees.

4.2 CLIMATE AND HYDROLOGY

The area has a Mediterranean climate and receives about 639mm of rain per year, mostly during winter. The average rainfall and temperature values for the area can be seen in Figure 5. The lowest rainfall (10mm) is in February and the highest (111mm) is in June. The average midday temperatures

range from about 10°C in July to 21°C in January and February. The annual average evaporation for the quaternary catchment area G10E, in which the property is located, is 1305mm.

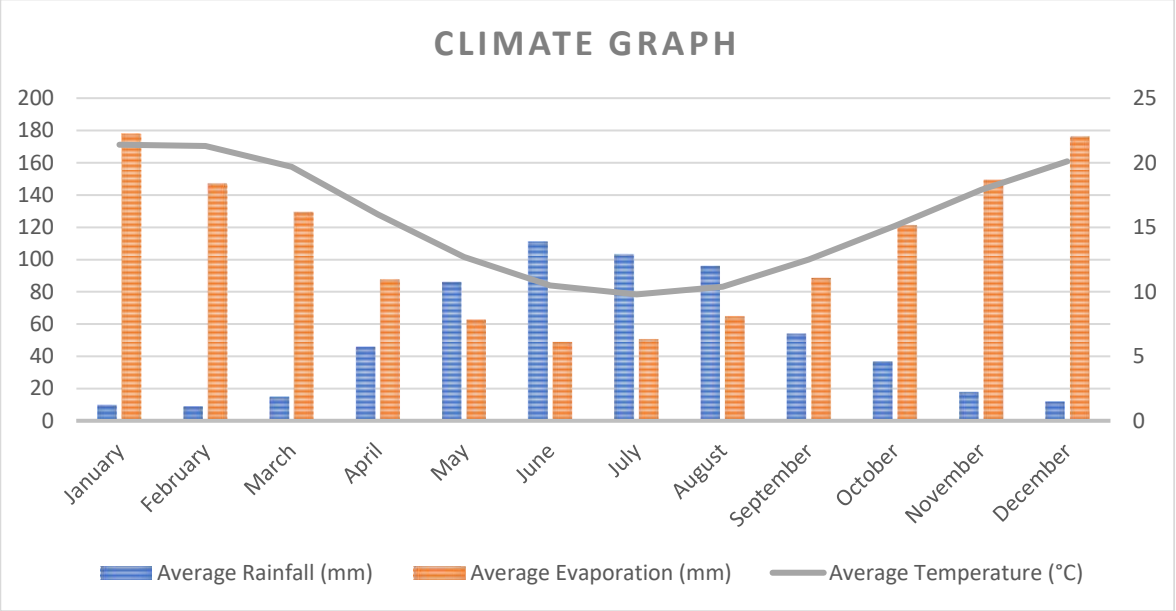

Figure 5. Average monthly rainfall, temperature and evaporation for the area (SA Atlas of Climatology and Agrohydrology - R.E. Schulze, 2009)

Low flow in the watercourses in the area is between December and April, with flow mostly occurring from June to October. As can be expected, this resembles the rainfall pattern for the area. The smaller watercourses are likely to only flow for short periods after rainfall events.

A major fractured aquifer occurs within the area, with the water table typically occurring at depths of about 11 m below ground level and a yield of more than 5 litres a second. Due to the underlying geology, both the surface and groundwater quality tend to have relatively low levels of salinity with natural electrical conductivity concentrations of less than 70 mS/m. The recharge of the aquifer is estimated to be about 70mm/a and the aquifer is of high susceptibility and vulnerability to pollution from anthropogenic activities.

4.3 Geology, Soil and Vegetation

The geology on the farm consists of phyllite, shale, schist and greywacke of the Porterville Formation, Malmesbury Group, which is partly covered by talus gravel. Glenrosa and/or Mispah soil forms dominate.

The natural vegetation type mapped as occurring within the area is Breede Shale Fynbos on the foot slopes, becoming Breede Shale Renosterveld and Breede Alluvium Fynbos on the valley floor. All three of these vegetation types are considered Endangered vegetation types. Within the areas where the work has been undertaken, a mix of natural and transformed vegetation cover occurs. The river still

contains natural riparian vegetation within its upper reaches on the farm, but similarly to the terrestrial vegetation, comprises a mix of indigenous and alien vegetation within the lower reaches.

4.4 AQUATIC ECOSYSTEMS

Aquatic features on the property comprise non-perennial tributaries of the Roodezand River which drains into the Klein Berg River, a major tributary of the larger Berg River System. The Modderas River which drains into the Modderas Dam, originates in the foothills of the Groot Winterhoek Mountains and flows in a southerly direction through the property. The stream is joined by some other streams before its confluence with the Roodezant River. A seep wetlands are mapped along most of the streams within the property.

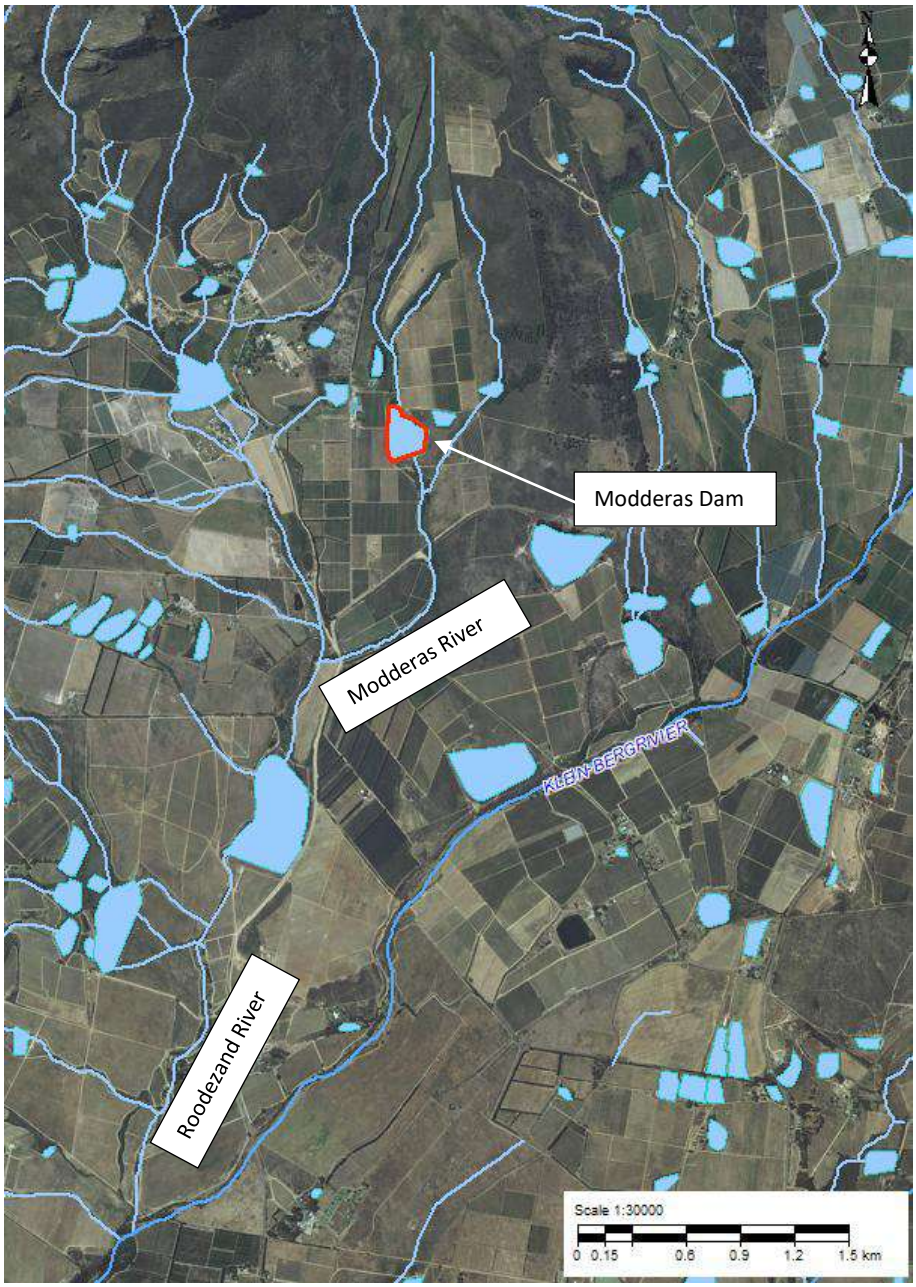

Figure 6. Orthophotograph taken in 2016 with the river system associated with Modderas Dam.

4.5. AQUATIC BIODIVERSITY IMPORTANCE

There are three mapping initiatives which are relevant to the proposed dam enlargement in terms of demarcating important aquatic biodiversity conservation areas. Provincial Fine-Scale Mapping has produced the 2023 Western Cape Biodiversity Spatial Plan. The map aims to guide sustainable development by bringing together biodiversity information for decision-makers so that they can ensure appropriate land use, accommodate important biodiversity features in their planning and promote integrated management of natural resources. Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA) and Critical ESAs (CESA) are considered priority areas which should be maintained in a natural to near-natural state.

The property lies downslope of the Winterhoek Mountain Catchment Area, a formally protected area. The Welbedacht Nature Reserve is also located about 300m to the east of the dam. Downstream of this, the river has been mapped as a terrestrial CBA (Figure 7).

The second mapping initiative is the National Freshwater Ecosystem Priority Areas (NFEPA) mapping which provides strategic spatial priorities for conserving freshwater ecosystems in South Africa. This mapping serves to identify features such as FEPA wetlands, rivers or estuaries and classifies them based on type (for example: natural or artificial; hillslope seep or valley bottom etc.). The ecological condition of the feature is not dealt with in these maps. Certain river sub-catchments are identified as priority areas due to the importance of the river/freshwater features within the sub-catchment. Sub-catchments classified as River FEPAs are required to be maintained in a largely natural ecological state.

The study area is not within a FEPA River Sub-catchment (Figure 8). There are seep wetlands upstream of the dam that are mapped as natural FEPA Wetlands. These wetlands are also mapped within the National Wetland Map version 5 (Figure 9), which is the third mapping initiative that provides a national map of the extent and ecosystem types of the estuarine and inland wetlands.

Figure 7. 2023 Western Cape Biodiversity Spatial Plan in the vicinity of the dam (CapeFarmMapper, 2025)

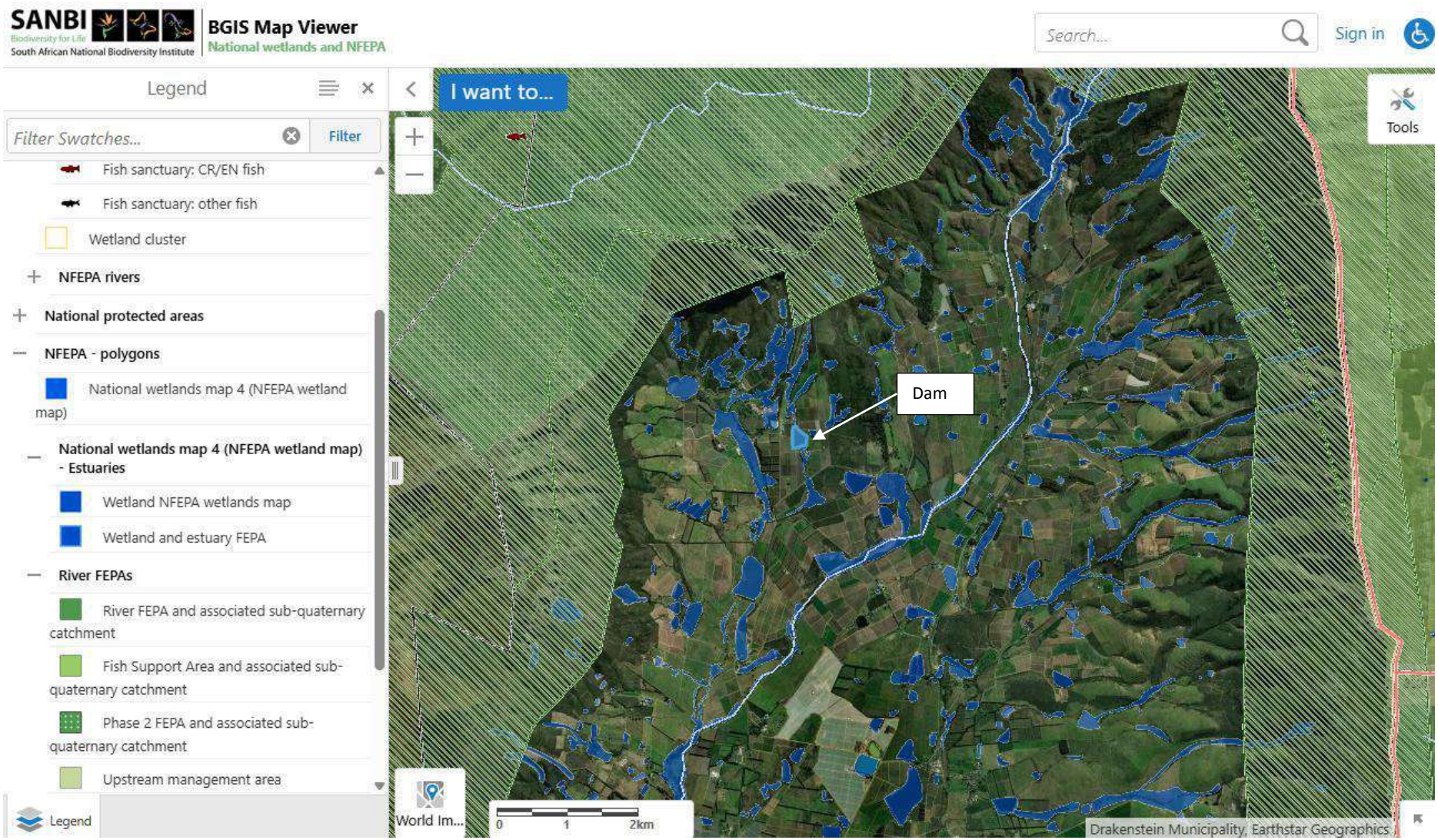

Figure 8. National Freshwater Ecosystem Priority Areas mapping for the dam (blue polygon) and surrounding area (SANBI Biodiversity GIS, 2025)

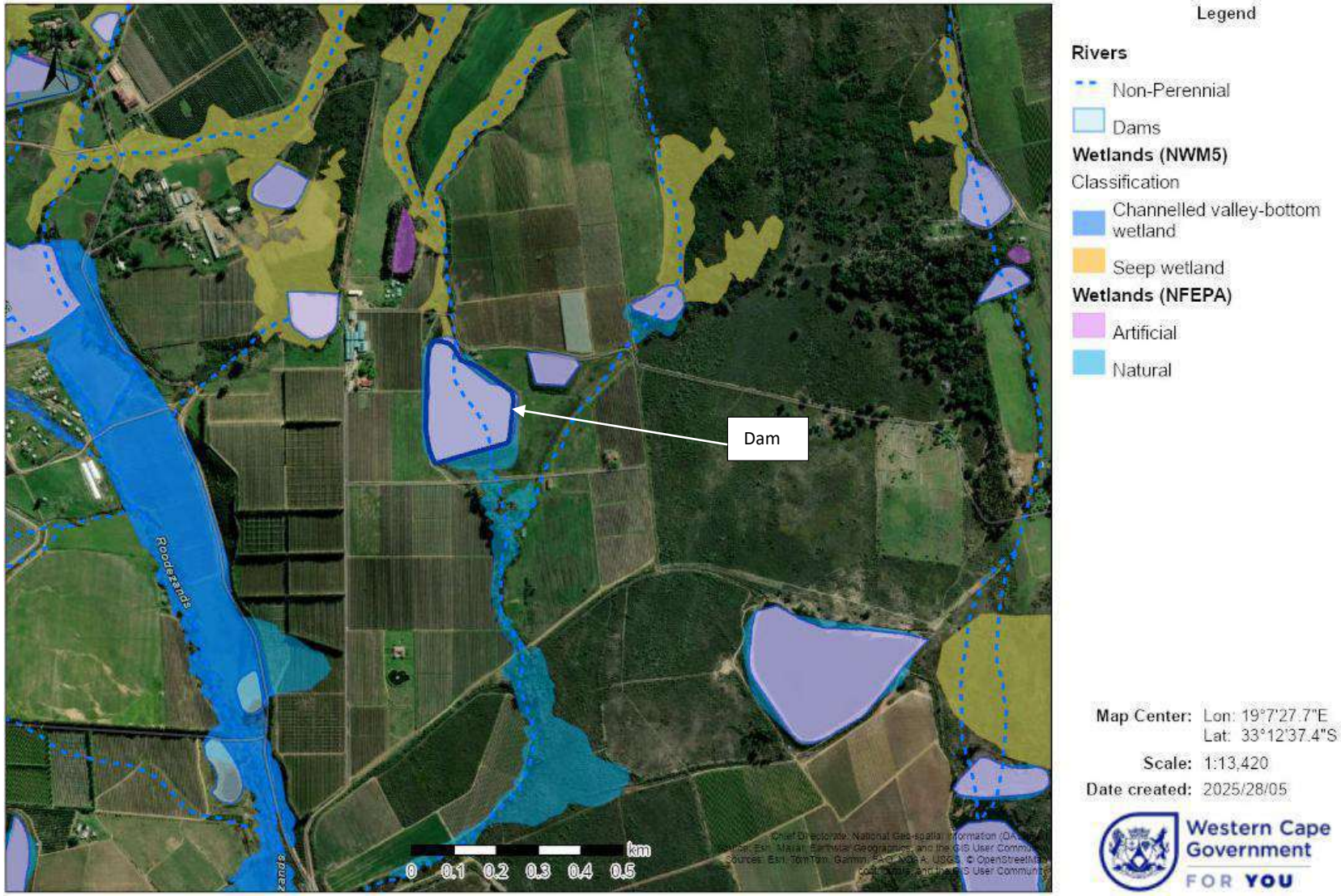

Figure 9. FEPA Wetlands and National Wetland Map for the dam and surrounding area (CapeFarmMapper, 2025))

5. ASSESSMENT OF FRESHWATER FEATURES AND THEIR SIGNIFICANCE

Index for Habitat Integrity (IHI) and Site Characterisation Assessments were utilised to provide information on the ecological condition of the river assessed. No detailed assessments were undertaken in terms of stream geomorphology, fish and aquatic biota. Results of the Site Characterisation Assessment were used to provide a desktop estimate of aquatic habitat integrity.

The Modderas River is fed by some feeder streams and seeps that drain the lower slopes of the Groot Winterhoek Mountains. The streams do not have a significant catchment but are likely to be fed from groundwater draining from the longitudinal seep areas along the foothill zones of the watercourses. The surrounding landscape and the riparian zones of the watercourses have had a long history of modification, having been utilised for agriculture on the lower slopes, with the activities extending into the riparian zone of the watercourse.

Upstream of Modderas Dam, the watercourse comprises mostly wetland habitat with the riparian vegetation invaded with alien trees. Downstream of the dam, the cobble-bed stream drains through agricultural areas where it has been more significantly impacted by past cultivation activities. Much of the seep wetlands that would have occurred in this area have been cultivated.

The main invasive alien vegetation currently occurring within the disturbed areas on the farm include black wattle (*Acacia mearnsii*), blackwood (*Acacia melanoxylon*), sesbania (*Sesbania punicea*) and bramble (*Rubus flagellaris*). Indigenous vegetation observed along the watercourses comprised *Psoralea pinnata, Searsia angustifolia, Morella serrata, Olea europaea subsp. africana, Podocarpus elongatus, Melianthus major, Pteridium aquilinum, Salvia chamelaeagnea, Elegia capensis, Zantedeschia aethiopica, Carpha glomerata, Juncus capensis, Ficinia nodosa, Cyprus textilis* and *Isolepis prolifer*.

Amphibians occurring in the area include Cape River Frog (*Amietia fuscigula*) Clicking Stream Frog (*Strongylopus grayii*), Mountain Rain Frig (*Breviceps montanus*) and Raucous Toad (*Sclerophys capensis*). All of the above are listed as Least Concern on the IUCN Red List of Threatened Species. Indigenous fish species recorded or expected in the larger Klein Berg River system are Cape galaxias (*Galaxias zebratus*), Cape kurper (*Sandelia capensis*) and Berg River redfin (*Pseudobarbus burgi*). Cape galaxias and Cape kurper are classified as "Data Deficient" while Berg River refin is listed as Endangered. It is possible that these small indigenous fishes did extend up into the smaller seasonal tributaries in winter, today however, with the reduction of winter flow and the number of barriers (instream dams) as well as predation by invasive fish the distribution of the fish is mostly limited to the mainstem of the river.

Past imagery of the site, taken in 1948 (Figure 12), indicates that the farm and streams had already been significantly modified at that time. Past agricultural activities extended into stream channels and the associated wetland habitats. The Modderas Dam had not yet been constructed. A later image, taken in 1972 (Figure 13), shows the property also shows the farm almost entirely modified with more formal cultivated areas extending into the watercourses. The Modderas Dam as well as the adjacent dams had been constructed. Images 14 and 15 provide more recent Google Earth images from 2002 and 2023 of the farm and watercourses and maintenance of the status quo in terms of the land use, the dams and the condition of the adjacent watercourses.

Figure 10. Views of the Modderas Stream upstream (top and centre) and downstream (bottom) of the dam

Figure 11. Views of the Modderas Dam (top) and the Alternative Dam 2 (middle) as well as the tributary of the Modderas River near Dam 2(bottom)

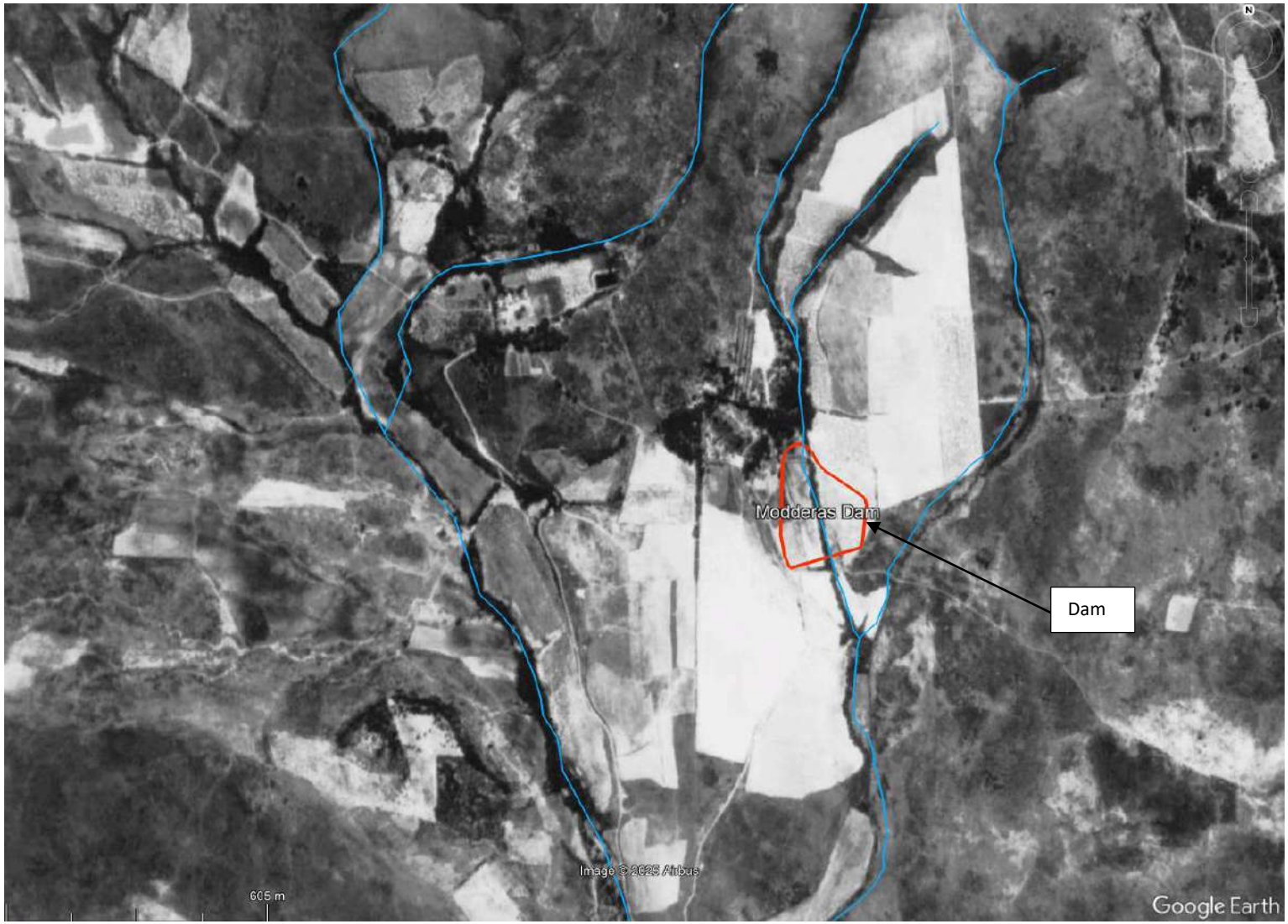

Figure 12. Aerial image taken in 1948 and overlaid in Google Earth with the location of the dam and watercourses shown

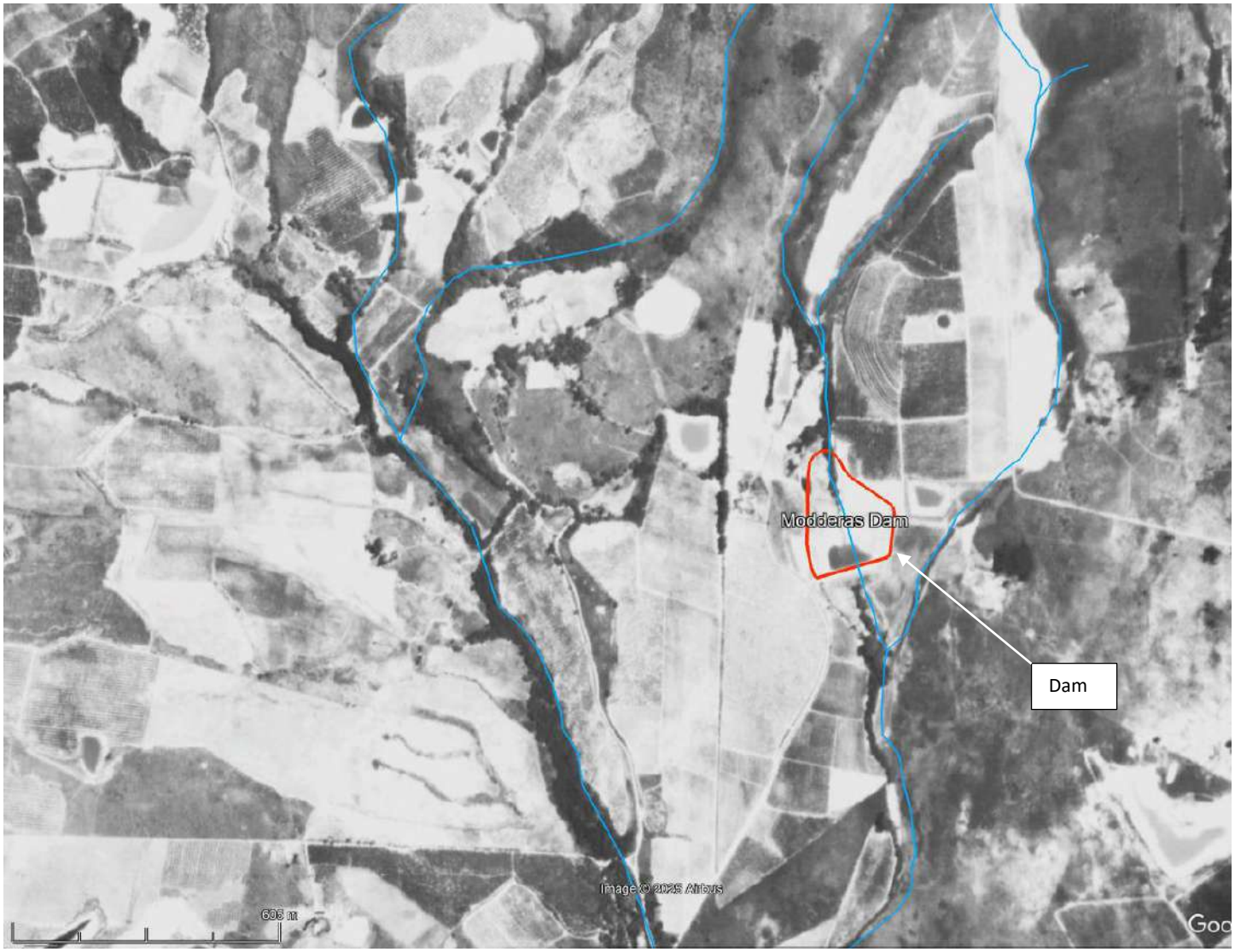

Figure 13. Aerial image taken in 1972 and overlaid in Google Earth with the location of the dam and watercourses shown

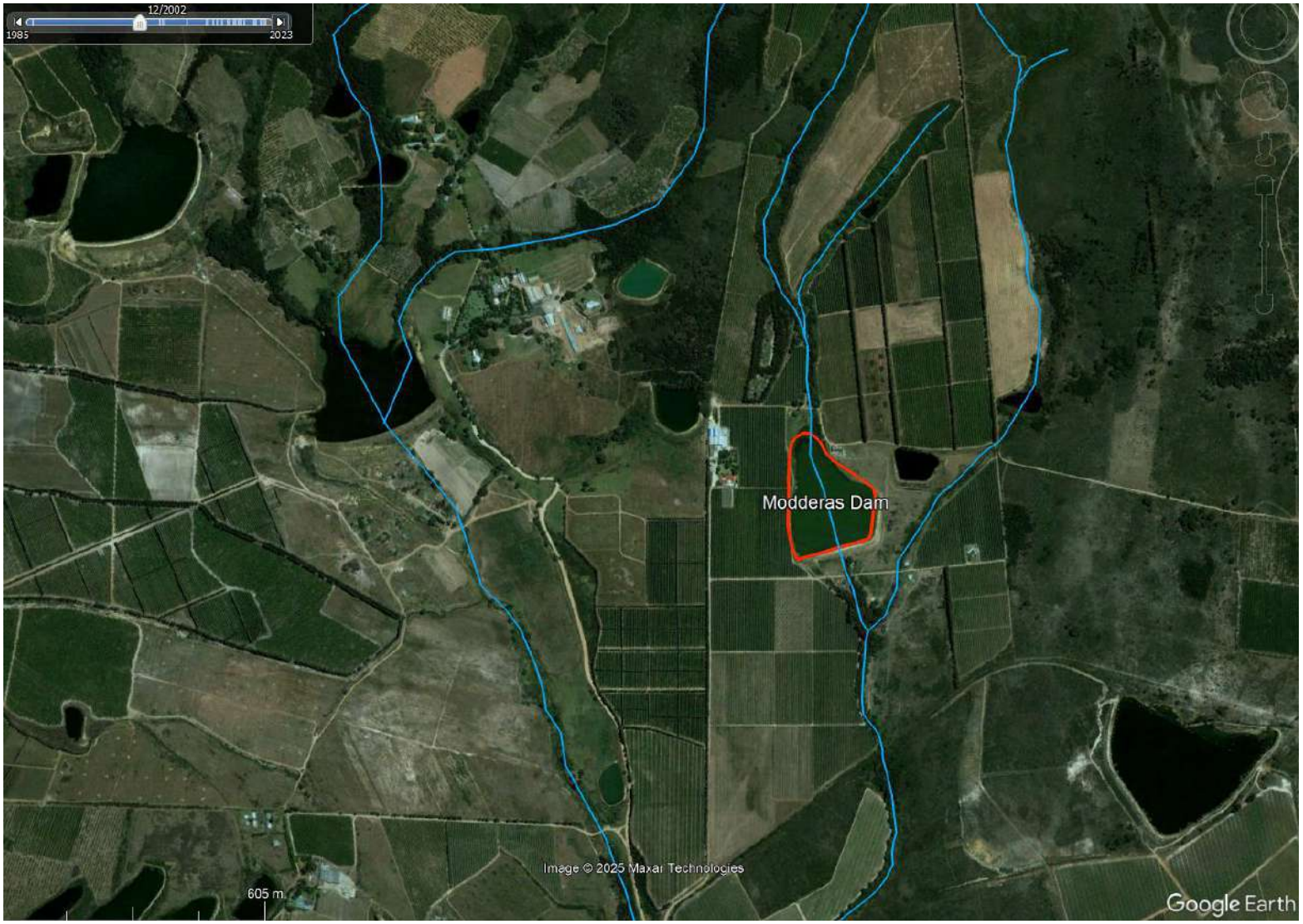

Figure 14. Google Earth from 2002 shown with the location of the dam and watercourses shown

Figure 15. Google Earth from 2023 shown with the location of the dam and watercourses shown

5.1. River classification

In order to assess the condition and ecological importance and sensitivity of the river, it is necessary to understand how the watercourse might have appeared under unimpacted conditions. This is achieved by classifying rivers according to their ecological characteristics, in order that they can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river conditions should only be done between rivers that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers provides the basis for assessing river conditions to allow comparison between similar river types. The primary classification of rivers is a division into Ecoregions. Rivers within an Ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation. For this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used.

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an Ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota.

Table 2: Characteristics of the Southern Folded Mountains Ecoregion

Main Attributes	Characteristics (dominant types in bold)
Terrain Morphology	Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to High Relief; **Closed Hills; Mountains; Moderate and High Relief**
Vegetation types	Patches Afromontane Forest; Spekboom Succulent Thicket; **Little Succulent Karoo;** **Grassy Fynbos; Mountain Fynbos;** South and South West Coast Renosterveld; Central Mountain Renosterveld; Eastern Mixed Nama Karoo; Central Nama Karoo; Great Nama Karoo;
MAP (mm) (modify)	200 to 1500
Rainfall seasonality	Very late summer to winter to all year
Mean annual temp. (°C)	10 to 20
Median annual simulated runoff (mm) for quaternary catchment	<5 to >250

5.2. Site Characterisation

From the Site Characterisation assessment, the geomorphological and physical characteristics of the tributary that was assessed can be classified together as follows:

Table 3: Geomorphological and Physical features

River	Modderas River
Valley Form	Lower foothill
Lateral mobility or entrenchment	Confined by topography – more confined in upper reaches becoming less confined
Channel form	Simple
Channel pattern	Moderate to low sinuosity
Channel type	Boulder/cobble bed
Hydrology	Non-perennial

5.3. INDEX OF HABITAT INTEGRITY

Evaluation of Index of Habitat Integrity (IHI) provides a measure of the degree to which a river has been modified from its natural state. This assessment was undertaken for the Modderas River. The results are provided in Table 5.

The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of the degradation of a river. The severity of each impact is ranked using a scale from 0 (no impact) to 25 (critical impact). The IHI assessment is based on an evaluation of the impacts of two components of the river, the riparian zone and the instream habitat. Assessments are made separately for both components, but data for the riparian zone are interpreted primarily in terms of the potential impact on the instream component. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (Table 4).

Table 4: Habitat Integrity categories (From DWAF, 1999)

CATEGORY	DESCRIPTION	SCORE (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In worst instances, basic ecosystem functions have been destroyed and changes are irreversible.	0

The instream habitat integrity of the Modderas River is considered to be moderately to largely modified, while the riparian habitat has been largely modified. This is mostly due to the impact of the dams on the flow of the watercourses as well as the encroachment of the surrounding land activities into the riparian habitat of the watercourses. The results are summarised in Table 5.

Table 5: Index of Habitat Integrity Assessment results and criteria assessed

INSTREAM HABITAT INTEGRITY	Modderas River	RIPARIAN ZONE HABITAT INTEGRITY	Modderas River
Water Abstraction (Impact 1 - 25)	15	Vegetation Removal (Impact 1 - 25)	10
Flow Modification (Impact 1 - 25)	13	Exotic Vegetation (Impact 1 - 25)	11
Bed Modification (Impact 1 - 25)	10	Bank Erosion (Impact 1 - 25)	7
Channel Modification (Impact 1 - 25)	8	Channel Modification (Impact 1 - 25)	7
Water Quality (Impact 1 - 25)	8	Water Abstraction (Impact 1 - 25)	14
Inundation (Impact 1 - 25)	8	Inundation (Impact 1 - 25)	7
Exotic Macrophytes (Impact 1 - 25)	5	Flow Modification (Impact 1 - 25)	12
Exotic Fauna (Impact 1 - 25)	4	Water Quality (Impact 1 - 25)	6
Rubbish Dumping (Impact 1 - 25)	4		
INTEGRITY CLASS	**C/D**	**INTEGRITY CLASS**	**D**

5.4. Ecological Importance and Sensitivity (EIS)

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

Table 6: Scale used to assess biotic and habitat determinants indicating either importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table 7: Results of the EIS assessment for the watercourse assessed

Biotic Determinants	Modderas River
Rare and endangered biota	1
Unique biota	1
Intolerant biota	2
Species/taxon richness	1
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	1
Refuge value of habitat type	2
Sensitivity of habitat to flow changes	2
Sensitivity of flow related water quality changes	1.5
Migration route/corridor for instream and riparian biota	1.5
National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas, PNEs	2
EIS CATEGORY	**Moderate**

Table 8: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	median
Very high	Reaches unique on a national and international level based on unique biodiversity. These rivers are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Reaches unique on a national scale based on their biodiversity. These rivers may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Reaches unique on a provincial or local scale due to biodiversity. These rivers are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Reaches not unique on any scale. These rivers are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

The Modderas River is considered of moderate ecological importance and sensitivity.

5.5. Recommended Ecological Management Category

In terms of the proposed water resource classes for Berg Water Management Area, the Target Ecological Category for the larger Klein Berg River in DWS quaternary catchment G10E is a C category within a Class II (moderate protection and utilisation) integrated unit of analysis area (Berg Tributaries). The recommended ecological condition of the Modderas River is that it is improved and maintained within the ecological category of C (moderately modified). The Resource Quality Objectives for the Klein Berg River (Government Gazette No 42451, dated 10 May 2019) are provided below:

Resource Name	Biophysical Node Name	TEC	Component	Sub-component	Indicator	RQO Narrative	RQO Numeric
Klein Berg River	Biii4	C	Quantity	Low flows High flows	Maintenance low flows Maintenance high flows	Flows sufficient to maintain the river in a C category	Months: Oct, Nov, Dec, Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep Maintenance flows (million cubic metres) Low: 1.422, 1.110, 0.754, 0.398, 0.305, 0.291, 0.338, 0.618, 1.002, 1.391, 1.744, 1.619 High: 0.638, 0.141, 0.000, 0.000, 0.000, 0.000, 0.000, 0.802, 1.516, 0.831, 2.913, 0.831
			Quality	Nutrients	Phosphate (PO_4-P)	Nutrient levels must be maintained in the river at a mesotrophic or better condition.	≤ 0.075 milligrams/litre (50th percentile)
					Total inorganic nitrogen (TIN)		≤ 1.75 milligrams/litre (50th percentile)
				Salts	Electrical conductivity (EC)	Salt concentrations need to be maintained at levels that do not adversely affect aquatic ecosystems	≤ 55 milliSiemens/metre (95th percentile)
				System variables	pH range	pH, temperature, and dissolved oxygen are important for the maintenance of ecosystem health.	6.5 ≤ pH ≤ 8.5 (5th and 95th percentiles)
					Water temperature		2°C difference from ambient water temperature
					Dissolved oxygen		≥ 6 milligrams litre (5th percentile)
				Toxins	Ammonia	Toxicity levels must not pose a threat to aquatic ecosystems.	≤ 0.073 milligrams per litre (95th percentile)
					Atrazine		≤ 0.079 milligrams per litre (95th percentile)
					Endusulfan		≤ 0.0013 milligrams per litre (95th percentile)
				Pathogens	Escherichia coli	Concentrations of waterborne pathogens should be maintained in an Acceptable category for intermediate contact recreation.	≤ 2500 counts/100ml (95th percentile)
			Habitat	Riparian vegetation	VEGRAI level 3 score.	Vegetation condition	> 62% = C category
			Biota	Fish	FRAI score	Fish condition	> 58% = C/D category

5.6. Environmental Water Requirements

This section provides a consideration of the environmental water requirement (EWR) or instream flow requirements associated with the enlargement of the Modderas Dam where the dam is to be filled from runoff from the catchment of the dam. The catchment information at the site is provided below.

Table 9: Catchment area and Mean Annual Runoff for the G10E quaternary catchment and the Modderas Dam

Catchment	Catchment Area (km^2)	Mean Annual Precipitation (mm)	MAR (10^6m^3)	% of quaternary G10E
G10E	394[1]	640[1]	76.38[1]	100
Modderas Dam	± 1	640[2]	0.24	0.3%

[1] WR2012; [2] SA Atlas of Climatology and Agrohydrology - R.E. Schulze, 2009

The EWR for the Klien Berg River based on the RQO for flow provided in the previous section was extrapolated to the Modderas Dam. The Recommended Ecological Category (REC) for the watercourses concerned, based on the present ecological status and the ecological importance and sensitivity of these aquatic ecosystems as well as the Berg River Classification is a C category.

The recommended EWR for the river is 20.3% of the nMAR. The distribution curve (Figure 16), Ecological Reserve summary tables (Table 17), rule curves (Table 18) and recommended downstream environmental flows (Table 21) were generated for the tributary downstream of Modderas Dam.

The monthly flow distribution curve (Figure 16) shows that under natural conditions (black line in the figure) there would be little to no flow in the tributary during the lowest flowing months of November/December to March/April. It should be noted that the flow distribution is generated for the larger quaternary catchment that includes the Klein Berg River. One can therefore expect the flow in the tributary to be much lower. Water would typically be available for use from the watercourses in the area during the months of May to September (difference between the black line and blue line).

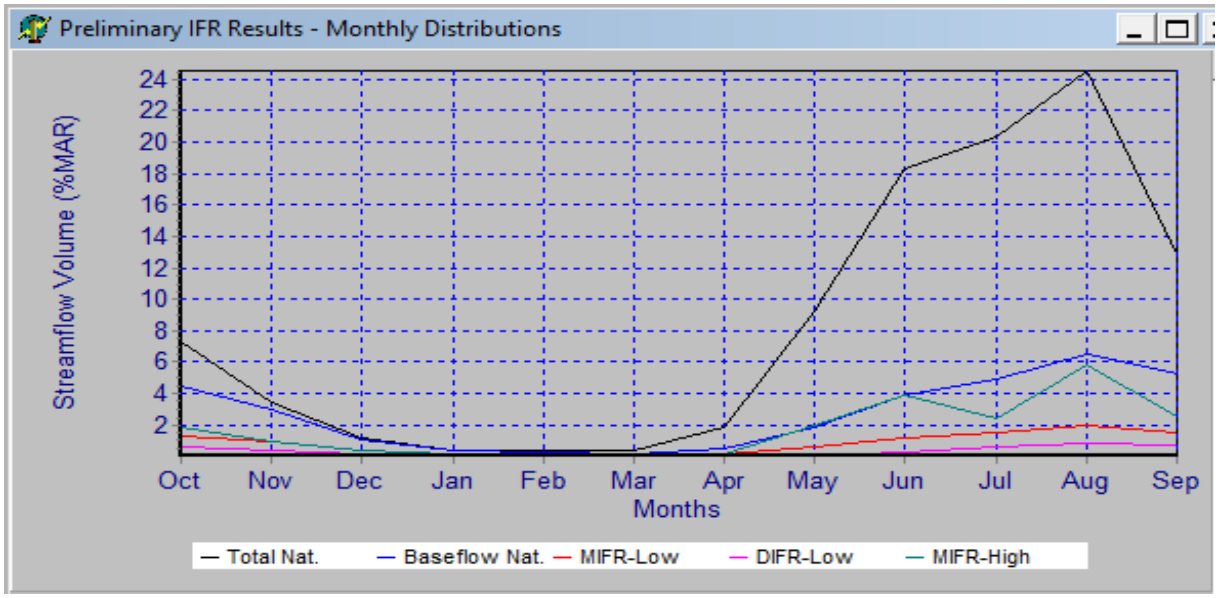

Figure 16: Monthly Distribution curve for the area, where: black line is the natural flow distribution; the blue line is the natural baseflow (mostly groundwater contribution); MIFR – Low is the Maintenance Low Flow Environmental requirement (red line on graph); DIFR – Low is the Drought Low Flow Environmental requirement (pink line on graph); and MIFR – High is the Maintenance High flow environmental requirement -larger floods and freshets– within year (green line on graph)

Table 10. Environmental flow requirement for the Tributary at the Modderas Dam

Summary of Desktop (Version 2) estimate for the Incremental catchment of the Tributary at Modderas Dam (33°12'37.89"S; 19° 7'23.06"E): Quaternary G10E	
MAR = 2.374	Ecological Category = C
S.Dev. = 1.244	
CV = 0.524	Total IFR = 0.482 (20.31 %MAR)
Q75 = 0.010	Maint. Lowflow = 0.228 (9.62 %MAR)
Q75/MMF = 0.050	Drought Lowflow = 0.089 (3.76 %MAR)
BFI Index = 0.322	Maint. Highflow = 0.254 (10.70 %MAR)
CV(JJA+JFM) Index = 3.148	
	Distribution Type : W.Cape(wet)

Monthly Distributions (Mill. cu. m.)							
Month	Natural Flows			Modified Flows (IFR)			
	Mean	SD	CV	Maint Low flows	Drought	Maint. High Flows	Maint. Total Flows
Oct	0.172	0.059	0.341	0.031	0.014	0.013	0.044
Nov	0.08	0.039	0.481	0.021	0.009	0.002	0.023
Dec	0.026	0.015	0.57	0.008	0.004	0	0.008
Jan	0.01	0.009	0.978	0.003	0.001	0	0.003
Feb	0.009	0.031	3.534	0.002	0.001	0	0.002
Mar	0.007	0.013	1.792	0.002	0.001	0	0.002
Apr	0.045	0.094	2.115	0.004	0.001	0	0.004
May	0.22	0.346	1.57	0.013	0.002	0.033	0.047
Jun	0.436	0.541	1.242	0.027	0.006	0.065	0.092
Jul	0.482	0.5	1.037	0.035	0.015	0.024	0.059
Aug	0.583	0.502	0.862	0.045	0.02	0.094	0.139
Sep	0.304	0.202	0.666	0.037	0.016	0.024	0.061

Table 11: Rule curve for the environmental flow requirement for the Tributary at Modderas Dam

Summary of Desktop (Version 2) estimate for the Incremental catchment of the Tributary at Modderas Dam (33°12'37.89"S; 19° 7'23.06"E): Quaternary G10E; Regional Type : W.Cape(wet); Ecological Category = C; Data are given in m^3/s mean monthly flow										
Month	10%	20%	30%	40%	50%	60%	70%	80%	90%	99%
Oct	0.022	0.022	0.022	0.021	0.021	0.019	0.017	0.013	0.009	0.006
Nov	0.012	0.012	0.012	0.012	0.011	0.011	0.009	0.008	0.005	0.004
Dec	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.001
Jan	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Feb	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Mar	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Apr	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0	0
May	0.022	0.022	0.022	0.021	0.02	0.019	0.013	0.009	0.005	0.001
Jun	0.046	0.046	0.045	0.045	0.044	0.042	0.038	0.03	0.018	0.005
Jul	0.035	0.033	0.031	0.03	0.028	0.025	0.023	0.019	0.013	0.007
Aug	0.087	0.08	0.074	0.069	0.064	0.054	0.05	0.041	0.026	0.011
Sep	0.038	0.035	0.033	0.031	0.029	0.026	0.022	0.017	0.011	0.007
Reserve Flows without High Flows										
Oct	0.016	0.016	0.016	0.016	0.015	0.014	0.013	0.01	0.007	0.005
Nov	0.011	0.011	0.011	0.011	0.011	0.01	0.009	0.007	0.005	0.004
Dec	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.001
Jan	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Feb	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Mar	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Apr	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0	0
May	0.007	0.007	0.007	0.007	0.007	0.006	0.005	0.004	0.002	0.001
Jun	0.015	0.015	0.015	0.015	0.015	0.014	0.013	0.01	0.006	0.002
Jul	0.019	0.019	0.019	0.018	0.018	0.017	0.016	0.014	0.01	0.006
Aug	0.024	0.024	0.024	0.024	0.024	0.023	0.021	0.018	0.013	0.008
Sep	0.02	0.02	0.02	0.019	0.019	0.018	0.016	0.013	0.009	0.006
Natural Duration curves										
Oct	0.09	0.08	0.073	0.069	0.065	0.056	0.053	0.045	0.038	0.027
Nov	0.049	0.04	0.035	0.03	0.026	0.025	0.023	0.02	0.018	0.015
Dec	0.016	0.012	0.011	0.009	0.009	0.008	0.007	0.006	0.005	0.004
Jan	0.007	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Feb	0.006	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0
Mar	0.007	0.003	0.002	0.002	0.001	0.001	0.001	0	0	0
Apr	0.04	0.02	0.014	0.007	0.005	0.004	0.003	0.002	0.001	0
May	0.3	0.108	0.071	0.047	0.037	0.019	0.013	0.009	0.005	0.001
Jun	0.457	0.282	0.179	0.139	0.07	0.053	0.045	0.036	0.018	0.008
Jul	0.48	0.29	0.198	0.156	0.104	0.078	0.065	0.051	0.043	0.012
Aug	0.435	0.369	0.306	0.229	0.123	0.109	0.093	0.075	0.067	0.046
Sep	0.21	0.118	0.107	0.102	0.096	0.09	0.085	0.075	0.069	0.055

Based on the EWR determination undertaken above, the following recommendations are made with regard to the percentage of flow that should remain in the Tributary downstream of Modderas Dam:

Table 12. Recommended Average Monthly Environmental flow downstream of Modderas Dam

Month	Average monthly EWR		EWR as % of average natural monthly flow
	l/s	Mm^3/month	%
Oct	17	0.044	25.6
Nov	9	0.023	28.8
Dec	3	0.008	30.8
Jan	1	0.003	30.0
Feb	1	0.002	22.2
Mar	1	0.002	28.6
Apr	2	0.004	8.9
May	18	0.047	21.4
June	35	0.092	21.1
July	23	0.059	12.2
Aug	54	0.139	23.8
Sept	24	0.061	20.1

It should be noted that the environmental flow requirements for the Modderas Tributary are based on the simulated hydrology that has been modelled for the period 1920 to 2010 under natural conditions and are given as average monthly flows. The confidence in the hydrology on which the environmental flow requirement has been determined is low. It would only be improved through monitoring of the flow in the watercourse. It should also be noted that the EWR does not represent the extreme dry or wet periods or take into consideration downstream water use. For this reason, it would not make sense to use the actual flow volumes listed in Table 12 to stipulate the EWR to be released from the dam but rather to implement the EWR as a percentage of an actual measured inflow into the dam. The percentages are included in Table 12 above.

The most practical way in which the EWR can be met, which requires the least management and intervention by the landowner is to ensure that the EWR requirement is rather met by the smaller tributary that joins the Modderas Tributary just downstream of Modderas Dam. The smaller tributary has a catchment of about 61 ha and an estimated runoff of about 150 000 m^3. The runoff from this tributary is thus about 40% of the MAR of the Modderas Tributary downstream of the dam. The tributary also drains a relatively undeveloped catchment (there is a small dam in the lower reach) that lies within the Grootwinterhoek Wilderness Area and the Welbedacht Capenature Stewardship site before entering the landowners property. This stream would thus be able to deliver a near-natural runoff contribution to the Modderas Tributary and provide for the EWR if the flow is not abstracted or impeded on the landowner's property. The lower reach of the smaller tributary also contains good wetland habitat that would benefit from the unimpeded flow in tributary.

It is thus recommended that the flow from this tributary is not impeded or diverted within the landowner's property such that the flow in the tributary provides for the EWR in the Modderas Tributary downstream of the Modderas Dam. This recommendation aligns with the proposed decommissioning of Dam D2 which receives water from the smaller tributary.

6. LEGISLATIVE AND CONSERVATION PLANNING REQUIREMENTS

The proposed activity needs to take cognisance of legislative requirements, policies, strategies, guidelines and principles from a municipal to a national level. Nationally, two sets of legislation are important to the proposed activity from a freshwater resource perspective. These are the National Environmental Management Act (NEMA) and the National Water Act (NWA).

6.1 NEMA AND ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS

NEMA is the overarching piece of legislation for environmental management in South Africa and includes provisions that must be considered to give effect to the general objective of integrated environmental management. These provisions are contained in Section 24 (4) (a)(b) of the Act and will be considered during the EIA process. Activities listed in terms of chapter 5 of NEMA in Government Notice No. R.983, 984, and 985, dated 4 December 2014, as amended, trigger a mandatory Basic Assessment, or even a full scoping EIA process, before development.

6.2 NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The purpose of the National Water Act, 1998 (NWA) is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by an individual and rights which are not automatically coupled to land rights, but prospective users must apply for authorisation and register as users. The NWA also provides measures to prevent, control and remedy pollution of surface and groundwater sources.

The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact water resources through the categorisation of 'listed water uses' encompassing water abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where Department of Water and Sanitation (DWS), is the administering body in this regard. Defined water use activities require the approval of DWS / BGCMA in the form of a General Authorisation or Water Use Licence authorisation. There are restrictions on the extent and scale of listed activities for which General Authorisations apply.

The works undertaken at the site relate to Section 21 (b) – storage of water; Section 21 (c) – diverting or impeding flow in a watercourse; and Section 21 (i) – changing the bed, banks, course or characteristics of watercourse water uses that could be considered existing lawful use or adequately dealt with under the approved MMP for the river.

Section 22 (3) of the NWA allows for a responsible authority (DWS) to dispense with the requirement for a Water Use License if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other Law.

6.2.1. General Authorisation in terms of Section 39 of the NWA

The proposed works within and adjacent to the rivers, streams and wetland areas are deemed to be changing the characteristics of the associated aquatic ecosystems as well as impeding flow in the watercourses and therefore require authorisation. The authorisation of water use activities for Sections 21 (c) - change to the bed, banks and characteristics of a watercourse and 21 (i)- impeding and diverting the flow, will need to be applied for. According to the preamble to Part 6 of the NWA, "*This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette…*" *"The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary…"*

The General Authorisations for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA have recently been revised (Government Notice R4167 of 2023). Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of the General Authorisations (GA).

A risk assessment (for Section 21(c) and (i) water uses only) has been undertaken to inform the water use authorisation process if required and is included for information purposes in this aquatic ecosystem impact assessment report.

6.2.2. Regulations Requiring that a Water Use be Registered, GN R. 1352 (1999)

Regulations requiring the registration of water users were promulgated by the minister of DWS in terms of the provision made in Section 26 (1)(c), read together with Section 69 of the NWA, 1998. Section 26 (1)(c) of the Act allows for registration of all water uses, including existing lawful water use, in terms of Section 34(2). Section 29(1)(b)(vi) also states that in the case of a general authorisation, the responsible authority may attach a condition requiring the registration of such water use. The regulations (Art. 3) oblige any water user, as defined under Section 21 of the Act, to register such use with the responsible authority and effectively apply for a Registration Certificate as contemplated under Art. 7(1) of the Regulations.

6.2.3. Water use authorisation in relation to the class and Ecological Reserve

Irrespective of the type of water use application, either a new water use application or an application to declare a water use activity an existing lawful use, several aspects relating to the proposed water use will need to be considered by the Department to make a decision. Section 27 of the Act determines the considerations for issuing general authorisations and water use licenses:

" 27. (1) In issuing a general authorisation or licence a responsible authority must take into account all relevant factors, including

a) existing lawful water uses;
b) the need to redress the results of past racial and gender discrimination;
c) efficient and beneficial use of water in the public interest;
d) the socio economic impact
e) of the water use or uses if authorised; or
f) of the failure to authorise the water use or uses;
g) any catchment management strategy applicable to the relevant water resource;
h) the likely effect of the water use to be authorised on the water resource and other water users;
i) the class and the resource quality objectives of the water resource;
j) investments already made and to be made by the water user in respect of the water use in question;
k) the strategic importance of the water use to be authorised;
l) the quality of water in the water resource which may be required for the Reserve and for meeting international obligations; and
m) the probable duration of any undertaking for which a water use is to be authorised."

Thus, amongst the other requirements listed above, in issuing a water use authorisation the Department must consider the Reserve (Section 27(j)) or, in the absence of the Reserve, the Department must consider the preliminary determination of the Reserve. The Reserve is defined in the NWA as:

"(xviii)``Reserve'' means the quantity and quality of water required

(a) to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997), for people who are now or who will, in the reasonably near future, be

(i) relying upon;
(ii) taking water from; or
(iii) being supplied from, the relevant water resource; and

(b) to protect aquatic ecosystems to secure ecologically sustainable development and use of the relevant water resource; "

The preliminary determination of the Reserve and the responsible authority for implementing the Reserve are addressed under Sections 17 and 18 of the NWA as follows:

" 17. (1) Until a system for classifying water resources has been prescribed or a class of a water resource has been determined, the Minister

a) may, for all or part of a water resource; and
(b) must, before authorising the use of water under section 22(5), make a preliminary determination of the Reserve.
(2) A determination in terms of section 16(1) supersedes a preliminary determination. "

" 18. The Minister, the Director General, an organ of state and a water management institution, must give effect to the Reserve as determined in terms of this Part when exercising any power or performing any duty in terms of this Act. "

The applicant is not applying for any increased amount of water to be taken from the Existing Lawful Use (volume still to be confirmed). The application is only for the additional storage (approximately 60%) of the lawful allocated water. The additional storage of water for which the applicant is applying triggers the need to consider and comply with the provisions of the ecological Reserve. The water use associated with the water infrastructure that had been replaced might be an existing lawful use but the additional water storage must be licensed.

The Reserve determination provided in this report (if accepted by DWS) is based on a high-confidence study commissioned by the DWS in 2023 and should be taken into consideration when water use is considered for authorisation. In general, it can be stated that flow variability and volume are almost of equal importance in giving effect to the ecological Reserve and protecting river ecosystems.

The determination (scaling from the downstream point) of the Reserve is thus important as the result from such a determination informs the size and apportionment of the diversion weir/structure. To ensure compliance with the Reserve requirements, from a practical point of view, the general principle should be to have passive compliance mechanisms in place to minimise the need for control and police compliance.

7. AQUATIC IMPACT ASSESSMENT

7.1. Assessment of Proposed Activities

The aquatic ecosystem assessment in Section 5.3 determined the river to be moderately to largely modified within its instream habitat and largely modified within its riparian zone. The river is of moderate ecological importance and sensitivity with a target ecological condition of moderately modified. Removal of invasive alien vegetation along the riverbanks would assist in improving the ecological integrity of the river over the long term.

The potential aquatic ecosystem impacts of the proposed enlarged dam on the Modderas Stream are assessed below. The assessment is for the preferred alternative (enlarging existing 200 000 m^3 Modderas Dam to 310 000 m^3 and decommissioning of Dam D2 of 31 000 m^3).

Figure 17. Diagram of the proposed enlargement of the Modderas Dam

The potential aquatic ecosystem impacts associated with the proposed dam enlargement are:

- Modify flow in the watercourse downstream of the dam
- Disturbance and modification of aquatic habitat within the dam basin of the enlarged dam
- Short-term water quality impacts during the construction works
- Indirect impact on aquatic biota.

The Modderas Dam is an instream dam on the lower Modderas Tributary of the Klein Berg River. The tributary contributes less than 1% of the flow to the Klein Berg River. The enlargement dam would likely however be a greater than 1 MAR dam which implies it will likely not spill every year, only in wetter-than-average years. Environmental flow mitigation will be necessary to maintain the downstream watercourse. There is a tributary that joins the Modderas River downstream of the dam which contributes about 40% of the flow in the lower river. The dam to be decommissioned (Dam D2) receives water from a diversion from this tributary. There is thus potential to rather ensure the EWR contribution for the lower river is from the tributary. There is a small instream dam on this stream but it is on the adjacent property that may reduce the ability to utilise this watercourse to mitigate the flow impact and implementation of the recommended environmental flow requirement.

With regards to the proposed decommissioning of Dam D2, the dam has long been in existence. The embankment of the dam and the adjacent area comprise largely natural vegetation cover. The area immediately to the east of the dam also comprises a wider riparian and seep area associated with the

smaller tributary of the Modderas River. With the decommissioning of the dam, it is important the disturbance of these areas be avoided and that the dam basin simply be filled with soil that is free of alien vegetation seed.

The summary impact tables are included in Section 10 of this report.

Significance of impacts without mitigation: **Medium to low negative** impact because the flow in the watercourse is already impacted by the existing dam. Raising the dam wall would however increase the periods of no flow in the downstream watercourse.

Proposed mitigation:

With regards to the implementation of the EWR in the lower Modderas Tributary, it is recommended that the smaller tributary that drains past Dam D2 be utilised to meet the environmental flow requirement as recommended in Section5.6 of this report.

There should also be ongoing removal and control of invasive alien vegetation along the river corridors and in the wetland areas within the property, and in particular within the Modderas Tributary that is proposed to provide for the EWR downstream of Modderas Dam. Removal of invasive vegetation and revegetation of the aquatic habitats could be informed by an adopted Maintenance Management Plan (MMP) for the property.

The construction works at the dam should take place during the dry period (October/November to March/April) to prevent any flow and water quality (sedimentation) impacts and should be carried out in conjunction with an approved EMP that addresses aspects such as prevention and containment of any contaminated runoff and chemical spills from the construction site; provision of ablution facilities at the construction site that are at least 30m from the watercourse, and mitigation of excessive sedimentation arising from the works.

Disturbance of the natural vegetation cover upstream of the dam and immediately downstream of the dam within the watercourse should be avoided. Any disturbed areas that are located immediately outside of the dam basin should be rehabilitated by reshaping the area to resemble that of the surrounding natural landscape and where necessary, these areas should be planted with suitable local indigenous vegetation.

The disturbed areas at the dam should also be monitored for the growth of invasive alien vegetation and any recruitment of alien plants should be removed. Longer-term maintenance activities associated with the operation of the dam should follow an adopted MMP for the property.

No stocking of the dam with alien fish should be allowed. Any stocking of the dam would need to get prior approval from CapeNature.

Significance of impacts after mitigation: With the implementation of environmental water requirements in the Mooderas River, as well as the recommended rehabilitation of the aquatic

habitats on the property, the significance of the impact could be reduced to being of **Low negative** significance.

7.2. CONSIDERATION OF ALTERNATIVES

Various alternatives were investigated that including repair and enlargement of Dam D2, a new instream dam upstream on the Modderas River; and four options for raising of Modderas Dam wall with Option 1 an upstream wall raising being the preferred option from an economic perspective.

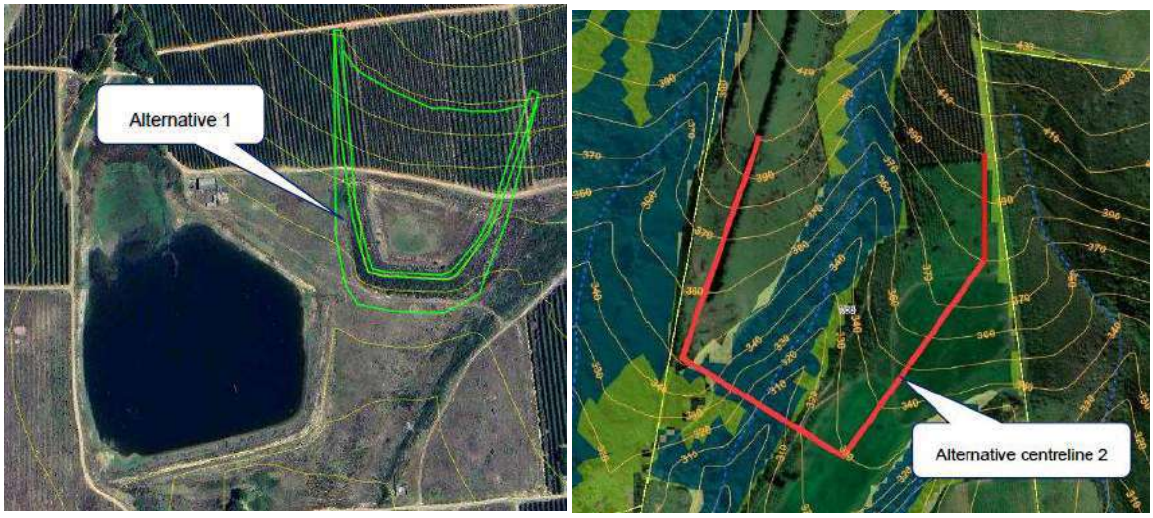

Figure 18. Location of the two dam location alternatives considered.

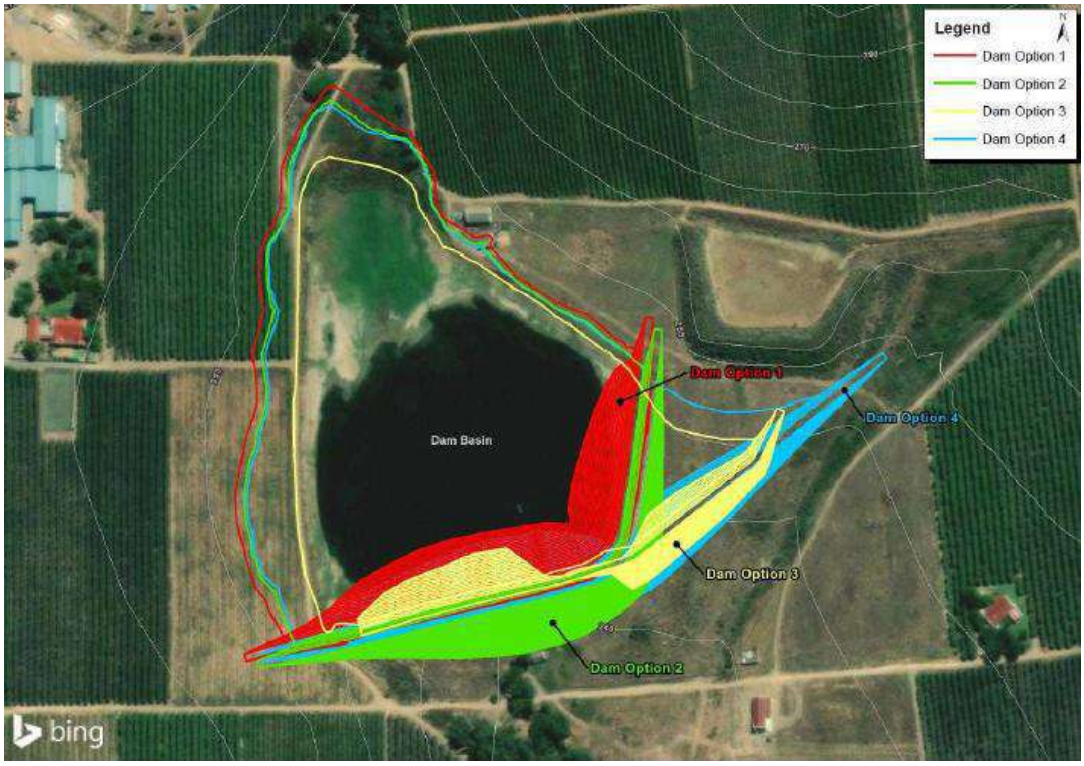

Figure 19. The various dam layout alternatives considered.

In terms of the various dam alternatives considered, the two dam locations would have a more significant impact than the proposed dam enlargement as they would be located in more sensitive wetland areas. Of the various dam alternatives, Option 1 (the preferred option) would also have the least impact as the enlarged wall is located further from the more intact tributary of the Modderas River.

The No-go Alternative would imply that no additional storage of water could be created within the property. This alternative would have the least potential impact but would not provide the opportunities to:

- Facilitate implementation of the Environmental Flow Release (the existing dam has no release requirement); and
- Rehabilitate the associated aquatic habitats.

If the recommendations relating to the above-mentioned opportunities are implemented, a low negative or even a positive impact could be expected.

7.3. CUMULATIVE IMPACTS

The Cumulative impact has the potential to be of low significance for the proposed enlargement of the existing dam if properly mitigated. With the recommended rehabilitation measures for Tributary and associated wetland areas, and implementation of the EWR recommendations a potential improvement in the aquatic ecosystem integrity of the tributary could be expected.

8. IMPACT ASSESSMENT TABLE

The Summary Impact Table for the proposed enlargement of Modderas Dam, decommissioning of Dam D2 and the No-Go Alternative is provided in Table 13.

Table 13. Summary Impact Table for the Proposed Project Activities and Alternatives

Project Activity or Alternative:	**Enlarged Modderas Dam**	**Decommissioning of Dam D2**	**No-Go alternative**
PLANNING, DESIGN AND DEVELOPMENT PHASE			
Potential impact and risk:	Modification of aquatic habitat at dam site; water quality impacts as well as potential for some flow modification		No construction phase
Nature of impact:	Negative	Negative	
Severity of impact:	Medium	Low	
Extent of impact:	Local	Site	
Duration of impact:	Long term	Short term	
Consequence of impact	Slightly modified aquatic habitat at and downstream of the dam	Disturbance of habitats at dam	
Probability of occurrence:	Highly probable	Probable	

Degree impact may cause irreplaceable loss of resources:	Medium	None	
Degree impact can be reversed:	Partially reversible	Reversible	
Indirect impacts:	Water quality	Water quality	
Cumulative impact prior to mitigation:	Medium	Low	
Significance rating of impact before mitigation	Medium	Low	
Degree impact can be avoided:	Medium to Low	High	
Degree impact can be managed:	High to Medium	High	
Degree impact can be mitigated:	High	High	
Proposed mitigation:	Provided in previous section		
Residual impacts:	Localised modification of aquatic habitat		
Cumulative impact post mitigation:	Medium to Low	Low	
Significance rating of impact after mitigation	Medium to Low	Low	

Project Activity or Alternative:	**Enlarged Modderas Dam**	**Decommissioning of Dam D2**	**No-Go alternative**
OPERATIONAL PHASE			
Potential impact and risk:	Ongoing disturbance of aquatic habitat for operation/maintenance activities; flow impact, increased potential for alien vegetation growth and erosion	Possible alien plant invasion in disturbed dam basin	Ongoing disturbance of aquatic habitat for operation/maintenance activities
Nature of impact:	Negative	Negative	Negative
Severity of impact:	Low	Low	Low
Extent of impact:	Local	Site	Site
Duration of impact:	Long term	Short term	Short term
Consequence of impact	Slightly modified aquatic habitat at and downstream of the enlarged dam	None	Some habitat modification and disturbance at original dam
Probability of occurrence:	Probable	Unlikely	Probable
Degree impact may cause irreplaceable loss of resources:	Marginal loss	No loss	Marginal loss
Degree impact can be reversed:	Partially reversible	Reversible	Partially Reversible
Indirect impacts:	Alien vegetation growth		
Cumulative impact prior to mitigation:	Medium to Low	Low	Medium to Low
Significance rating of impact before mitigation	Medium to Low	Low	Medium to Low
Degree impact can be avoided:	High to Medium	High	Medium
Degree impact can be managed:	High	High	High
Degree impact can be mitigated:	High	High	Medium
Proposed mitigation:	Provided in previous section		
Residual impacts:	Modification of aquatic habitat related to operation of dam		
Cumulative impact post mitigation:	Low	Low	Low
Significance rating of impact after mitigation	Low	Very Low	Low

9. RISK ASSESSMENT

A risk assessment was carried out for the activity undertaken. The full risk assessment matrix can be seen in Appendix C. The risk rating is considered to be Moderate to Low. A water use application will be submitted for the associated Section 21 c&i water use as well as for the storage of water in the dam.

Table 14. Risk assessments for the activity under consideration

PROJECT:	**ENLARGEMENT OF MODDERAS DAM N PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH**		
Name of assessor:	Toni Belcher		
Date of assessment:	25/05/2025		
RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities (version 2.0): SUMMARY			
[ASSUMING THAT ALL PROPOSED IMPACT CONTROL MEASURES ARE EFFECTIVELY IMPLEMENTED]			
Phase	**Activity**	**Impact**	**Risk Rating**
CONSTRUCTION	Enlargement of Modderas Dam with the proposed upstream enlargement	Habitat modification and disturbance during construction	M
		Water quality impacts as a result of construction activities	L
	Decommissioning of Dam D2	Habitat modification and disturbance during construction	L
		Water quality impacts as a result of construction activities	L
	Construction of pipeline	Habitat modification and disturbance during construction	L
		Water quality impacts as a result of construction activities	L
OPERATIONAL	Maintenance of water supply scheme	Habitat disturbance during maintenance	L
		Water quality impacts as a result of maintenance activities	L
	Operation of water supply scheme	Habitat modification due to changes in flow	L
		Water quality impacts due to changes in flow	L
		Flow modification due to increased abstraction and storage	L

10. CONCLUSIONS AND RECOMMENDATIONS

Aquatic features on the property comprise a perennial stream, the Modderas River, which is a tributary of the Klein Berg River in the larger Berg River System. The stream is joined by another stream before its confluence with the Roodezand River. Seep wetlands are mapped as feeding the streams in their upper reaches.

The property lies downslope of the Winterhoek Mountain Catchment Area, a formally protected area. The Welbedacht Nature Reserve is also located about 300m to the east of the dam. Downstream of

this, the Modderas River has been mapped as a terrestrial CBA. The study area is not within a FEPA Sub-catchment. The seep wetlands mentioned above are however mapped as natural FEPA Wetlands. These wetlands are also mapped within the National Wetland Map version 5.

The instream habitat integrity of the Modderas River is considered to be moderately modified, while the riparian habitat has been moderately to largely modified. The river is considered of moderate ecological importance and sensitivity. The recommended ecological condition of the Modderas River is that it is maintained within the ecological category of C (moderately modified).

The impact assessment is for the preferred alternative (enlarging existing 200 000 m^3 Modderas Dam to 310 000 m^3 and decommissioning of Dam D2 of 31 000 m^3). The potential aquatic ecosystem impacts associated with the proposed dam enlargement are:

- Modify flow in the watercourse downstream of the dam
- Disturbance and modification of aquatic habitat within the dam basin of the enlarged dam
- Short-term water quality impacts during the construction works
- Indirect impact on aquatic biota.

The Modderas Dam is an instream dam on the lower Modderas Tributary of the Klein Berg River. The tributary contributes less than 1% of the flow to the Klein Berg River. The enlargement dam would likely however be a greater than 1 MAR dam which implies it will likely not spill every year, only in wetter-than-average years. Environmental flow mitigation will be necessary to maintain the downstream watercourse. There is a tributary that joins the Modderas River downstream of the dam which contributes about 40% of the flow in the lower river. The dam to be decommissioned (Dam D2) receives water from a diversion from this tributary. There is thus potential to rather ensure the EWR contribution for the lower river is from the tributary. There is a small instream dam on this stream but it is on the adjacent property that may reduce the ability to utilise this watercourse to mitigate the flow impact and implementation of the recommended environmental flow requirement.

With regards to the proposed decommissioning of Dam D2, the dam has long been in existence. The embankment of the dam and the adjacent area comprise largely natural vegetation cover. The area immediately to the east of the dam also comprises a wider riparian and seep area associated with the smaller tributary of the Modderas River.

The following mitigation measures are recommended:

- The area immediately to the east of Dam D2 which is to be decommissioned comprises a wider riparian and seep area associated with the smaller tributary of the Modderas River. With decommissioning of the dam, it is important the disturbance of these areas be avoided and that the dam basin simply be filled with soil that is free of alien vegetation seed.

- With regards to the implementation of the EWR in the lower Modderas Tributary, it is recommended that the smaller tributary that drains past Dam D2 be utilised to meet the environmental flow requirement.

- A programme should be put in place for the ongoing removal and control of invasive alien vegetation along the river corridors and in the wetland areas within the property, and in particular within the Modderas Tributary that is proposed to provide for the EWR downstream of Modderas Dam. Removal of invasive vegetation and revegetation of the aquatic habitats could be informed by an adopted Maintenance Management Plan (MMP) for the property.

- The construction works at the dam should take place during the dry period (October/November to March/April) to prevent any flow and water quality (sedimentation) impacts and should be carried out in conjunction with an approved EMP that addresses aspects such as prevention and containment of any contaminated runoff and chemical spills from the construction site; provision of ablution facilities at the construction site that are at least 30m from the watercourse, and mitigation of excessive sedimentation arising from the works.

- Disturbance of the natural vegetation cover upstream of the dam and immediately downstream of the dam within the watercourse should be avoided. Any disturbed areas that are located immediately outside of the dam basin should be rehabilitated by reshaping the area to resemble that of the surrounding natural landscape and where necessary, these areas should be planted with suitable local indigenous vegetation.

- The disturbed areas at the dam should also be monitored for the growth of invasive alien vegetation and any recruitment of alien plants should be removed. Longer-term maintenance activities associated with the operation of the dam should follow an adopted MMP for the property.

- No stocking of the dam with alien fish should be allowed. Any stocking of the dam would need to get prior approval from CapeNature.

- Indigenous vegetation observed along the watercourse that is suitable for revegetation of cleared areas comprises *Psoralea pinnata, Searsia angustifolia, Morella serrata, Olea europaea subsp. africana, Podocarpus elongatus, Melianthus major, Pteridium aquilinum, Salvia chamelaeagnea, Elegia capensis, Zantedeschia aethiopica, Carpha glomerata, Juncus capensis, Ficinia nodosa, Cyprus textilis* and *Isolepis prolifera*.

Given the above findings, there is no reason why the constructed dam and garden cannot be retained. The risk rating is considered to be Moderate. A water use application will be submitted for the associated water use as well as for the storage of water in the dam.

11. REFERENCES

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APPENDIX A: FRESHWATER IMPACT ASSESSMENT METHODOLOGY

These criteria are drawn from the EIA Regulations published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) and the latest basic assessment report template provided by the Department of Environmental Affairs and Development Planning (DEA&DP) and the DEA&DP Guidelines for involving Biodiversity Specialists in EIA Processes, 2005. These criteria include:

Nature of the impact: This is an appraisal of the type of effect (positive or negative) the construction, operation and maintenance of development would have on the affected environment. This description should include what is to be affected.

Extent of the impact: Extent defines the physical extent or spatial scale of the impact. The impact could:

- **Site-specific:** limited to the site.
- **Local:** limited to the site and the immediate surrounding area (1-10km)
- **Regional:** covers an area that includes an entire geographic region or extends beyond one region to another.
- **National:** across national boundaries and may have national implications.

Duration of the impact: The specialist should indicate whether the lifespan of the impact would be:

- **Short term:** 0-5 years.
- **Medium-term:** 5-15 years.
- **Long term:** beyond the operational phase, but not permanently).
- **Permanent:** where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.

Consequence of Impact: Indicate how the activity will affect the environment.

Probability of occurrence: Probability describes the likelihood of the impact occurring. The likelihood can be described as:

- **Improbable/unlikely:** low likelihood of the impact occurring.
- **Probable:** distinct possibility the impact will occur.
- **Highly probable:** most likely that the impact will occur.
- **Definite:** impact will occur regardless of any prevention measures.

Irreplaceable loss of resources: Describes the degree to which resources will be irreplaceably lost due to the proposed activity. It can be **no loss of resources**, **marginal loss**, **significant loss** or **complete loss of resources**.

Reversibility: This refers to the degree to which an impact can be reversed.

- **Fully reversible:** where the impact can be completely reversed.
- **Partly reversible:** where the impact can be partially reversed.
- **Irreversible:** where the impact is permanent.

Indirect impacts: Indirect impacts are secondary impacts and usually occur at a different place or time. Specialists will need to elaborate on any indirect or secondary impacts of proposed activities. If there are no indirect impacts specialist will need to briefly explain so.

Cumulative impact: An effect which in itself may not be significant but may become significant if added to other existing or potential impacts that may result from activities associated with the proposed development. Cumulative impacts before and post-mitigation must be assessed. The cumulative effect can be:

- **Negligible:** the impact would result in negligible to no cumulative effect.
- **Low:** the impact would result in insignificant cumulative effects.
- **Medium:** the impact would result in minor cumulative effects.
- **High:** the impact would result in significant cumulative effects.

Significance rating of impacts before and after mitigation: Based on a synthesis of the information contained in the above-described procedure, the significance of the potential impacts must be assessed using the following significance criteria:

- **No impact.**
- **Low negative:** where it would have negligible effects and would require little or no mitigation.
- **Low positive:** the impact will have minor positive effects.
- **Medium negative:** the impact will have moderate negative effects and will require moderate mitigation.
- **Medium positive:** the impact will have moderate positive effects.
- **High negative:** the impact will have significant effects and will require significant mitigation measures to achieve an accepted level of impact.
- **High positive:** the impact will have significant positive effects.
- **Very high negative:** the impact will have highly significant effects and are unlikely to be able to be mitigated adequately.
- **High positive:** the impact will have highly significant positive effects.

Degree to which impact can be avoided: This indicates the degree to which an impact can be avoided. The degree of avoidance can either be **high** (impact is completely avoidable), **moderate** (impact is avoidable with moderate mitigation), **low** (the impact is difficult to avoid and will require significant mitigation measures) or **unavoidable** (the impact is cannot be avoided even with significant mitigation measures). Can the impact be avoided and if so, how can it be avoided (example: demarcation of no-go areas).

Degree to which impact can be managed: This indicates the degree to which an impact can be managed. The degree of management can either be **high** (impact is completely manageable), **moderate** (impact is manageable with moderate mitigation), **low** (the impact is difficult to manage and will require significant mitigation measures) or **unmanageable** (the impact is cannot be managed even with significant mitigation measures). How can the impact be managed over time (example: clearance of alien vegetation).

Degree to which an impact can be mitigated: This indicates the degree to which an impact can be reduced. The degree of mitigation can either be **high** (the impact can be **fully** mitigated), **moderate** (the impact can be **partly mitigated**) or **not mitigated at all**. Residual impacts

APPENDIX B: INDIGENOUS VEGETATION RECOMMENDED FOR REVEGETATION

Species	Common name/s	Zone	
Fuirena hirsuta	Sedge	Lower wet bank	
Fincinia nodosa	Knob club rush	Lower wet bank	
Cyprus textilis	Mat sedge	Lower wet bank	
Isolepis marginata	Course club-rush	Lower wet bank	
Isolepis prolifera	Vleigras	Lower wet bank and into aquatic	

Juncus lomatophyllus	Aalwynbiesie	Lower wet bank and into aquatic	
Eleocharis dracaena	Finger sedge	Wet bank	
Juncus capensis	rush	Wet bank	
Cliffortia strobilifera	Bog Rice Bush	Upper wet bank	

Psoralea pinnata	Fountain bush	Wet bank and lower dry bank	
Pteridium aquilinum	Bracken fern	Wet bank and lower dry bank	
Restio paniculata	Cape reed	Lower wet bank	
Wachendorfia thyrsiflora	Blood root	Lower wet bank	

Carpha glomerata		Lower wet bank	
Zantedeschia aethiopica	Arum lily	Wet bank and lower dry bank	
Podocarpus elongatus	Breede River yellowwood	Tree/shrub – riparian zone	
Olea europaea ssp. africana	Wild olive	Tree/shrub– riparian zone	

Brabejum stellatifolium	Wild almond	Lower dry bank and upper wet bank	
Kiggelaria africana	Wild peach	Tree/shrub– riparian zone	
Searsia angustifolia	Willow karee	Tree/shrub– riparian zone	
Searsia undulata	Kuni-bush	Tree/shrub– riparian zone	

APPENDIX C: RISK ASSESSMENT

PROJECT: ENLARGEMENT OF MODDERAS DAM N PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.0

Name of Assessor: Toni Belcher **Signature:** 

SACNASP Registration Number: 5681 **Date:** 25/05/2025

Risk to be scored for all relevant phases of the project (**factoring in specified control measures**). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Ecological Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Enlargement of Modderas Dam with the proposed upstream enlargement	Habitat modification and disturbance during construction	Modderas River	C/D	Moderate	1	2	3	3	3	6	2	4	12	3	36	100%	36	M	High
		Water quality and flow impacts as a result of construction activities	Modderas River	C/D	Moderate	2	3	2	2	2	6	2	4	12	3	36	80%	28.8	L	High
CONSTRUCTION	Decommissioning of Dam D2	Habitat modification and disturbance during construction	Modderas River	C/D	Moderate	1	2	0	3	3	6	1	2	9	3	27	80%	21.6	L	High
		Water quality impacts as a result of construction activities	Modderas River	C/D	Moderate	1	2	0	2	2	4	1	1	6	3	18	80%	14.4	L	High
CONSTRUCTION	Construction of pipeline	Habitat modification and disturbance during construction	Modderas River	C/D	Moderate	1	1	1	2	1	4	1	1	6	3	18	60%	10.8	L	High
		Water quality impacts as a result of construction activities	Modderas River	C/D	Moderate	1	2	1	1	1	4	1	1	6	3	18	60%	10.8	L	High
OPERATIONAL	Maintenance of water supply scheme	Habitat disturbance during maintenance	Modderas River	C/D	Moderate	1	2	1	2	2	4	1	1	6	3	18	40%	7.2	L	High
		Water quality impacts as a result of maintenance activities	Modderas River	C/D	Moderate	1	3	1	1	1	6	1	1	8	3	24	40%	9.6	L	High
	Operation of water supply scheme	Habitat modification due to operation of scheme	Modderas River	C/D	Moderate	2	2	2	2	2	4	2	4	10	3	30	40%	12	L	High
		Water quality impacts due to operation of scheme	Modderas River	C/D	Moderate	2	2	1	1	1	4	1	1	6	3	18	40%	7.2	L	High
		Flow modification associated with increased storage	Modderas River	C/D	Moderate	3	2	2	3	2	6	2	4	12	3	36	40%	14.4	L	High

AQUATIC IMPACT ASSESSMENT REPORT FOR THE PROPOSED ENLARGEMENT OF MODDERAS DAM ON PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH

December 2025

Prepared By:

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E-mail: toni@bluescience.co.za

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1. SPECIALIST DETAILS, EXPERTISE AND DECLARATION

1.1. QUALIFICATIONS OF SPECIALIST CONSULTANT

Name: Antonia Belcher

Contact details: 53 Dummer St, Somerset West, 7130; Phone: 082 883 8055;
Email: toni@bluescience.co.za

Profession: Aquatic Scientist (P. Sci. Nat. 400040/10)

Fields of Expertise: Specialist in freshwater assessments, monitoring and reporting

Years in Profession: 30+ years

Toni Belcher worked for the Department of Water Affairs and Forestry for more than 17 years. During this period she worked for the Directorate Water Quality Management, the Institute for Water Quality Studies and the Western Cape Regional Office and has built up a wide skills base on water resource management and water resource quality for rivers, estuaries and the coastal marine environment. Since leaving the Department in 2007, she has been working in her private capacity and was co-owner of BlueScience (Pty) Ltd, working in the field of water resource management and has been involved in more than 500 aquatic ecosystem assessments for environmental impact assessment and water use authorisation purposes. In 2006 she was awarded a Woman in Water award for Environmental Education and was a runner up for the Woman in Water prize for Water Research.

Professional Qualifications:

1984	Matriculation Lawson Brown High School
1987	B.Sc. – Mathematics, Applied Mathematics University of Port Elizabeth
1989	B.Sc. (Hons) – Oceanography University of Port Elizabeth
1998	M.Sc. – Environmental Management (cum laude) Potchefstroom University

Key Skills: Areas of specialisation: Aquatic ecosystem assessments, Monitoring and evaluation of water resources, Water resource legislation and authorisations, River classification and Resource Quality Objectives, River Reserve determination and implementation, Water Quality Assessments, Biomonitoring, River and Wetland Rehabilitation Plans, Catchment management, River maintenance management, Water education.

Summary of Experience:

1987 – 1988	Part-time field researcher, Department of Oceanography, University of Port Elizabeth
1989 – 1990	Mathematics tutor and administrator, Master Maths, Randburg and Braamfontein Colleges, Johannesburg
1991 – 1995	Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria
1995 – 1999	Hydrologist and Assistant Director, Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria
1999 – 2007	Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town
2007 – 2012	Self-employed – Aquatic Specialist
2013 – 2020	Senior Aquatic Specialist and part-owner, BlueScience
2020 – 2025	Self-employed– Aquatic Specialist
Present	Senior Aquatic Specialist and part-owner, BlueScience

1.2. DECLARATION OF INDEPENDENCE

I, A**ntonia Belcher,** as the appointed specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
    - other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
    - ~~am not independent, but another specialist that meets the general requirements set out in Regulation 13 of GN No. 326 have been appointed to review my work (Note: a declaration by the review specialist must be submitted);~~
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the Applicant, the Department and registered interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;
- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations, 2014 (as amended).

Date: 25 May 2025

Name of company: BlueScience (Pty) Ltd

Signature of the specialists: 

2. INTRODUCTION

2.1. BACKGROUND TO STUDY

Modderasrivier Trust wishes to enlarge Modderas Dam on Portion 1 of the Roode Zands Kloof Farm No. 66. The farm is located approximately 8 km north of Tulbagh in the Western Cape. The purpose of enlarging the existing dam is to store enlistment water that has already been confirmed as existing lawful use. The dam is a Category II dam with a storage capacity of 200 000 m³ and a maximum wall height of 13.8 m.

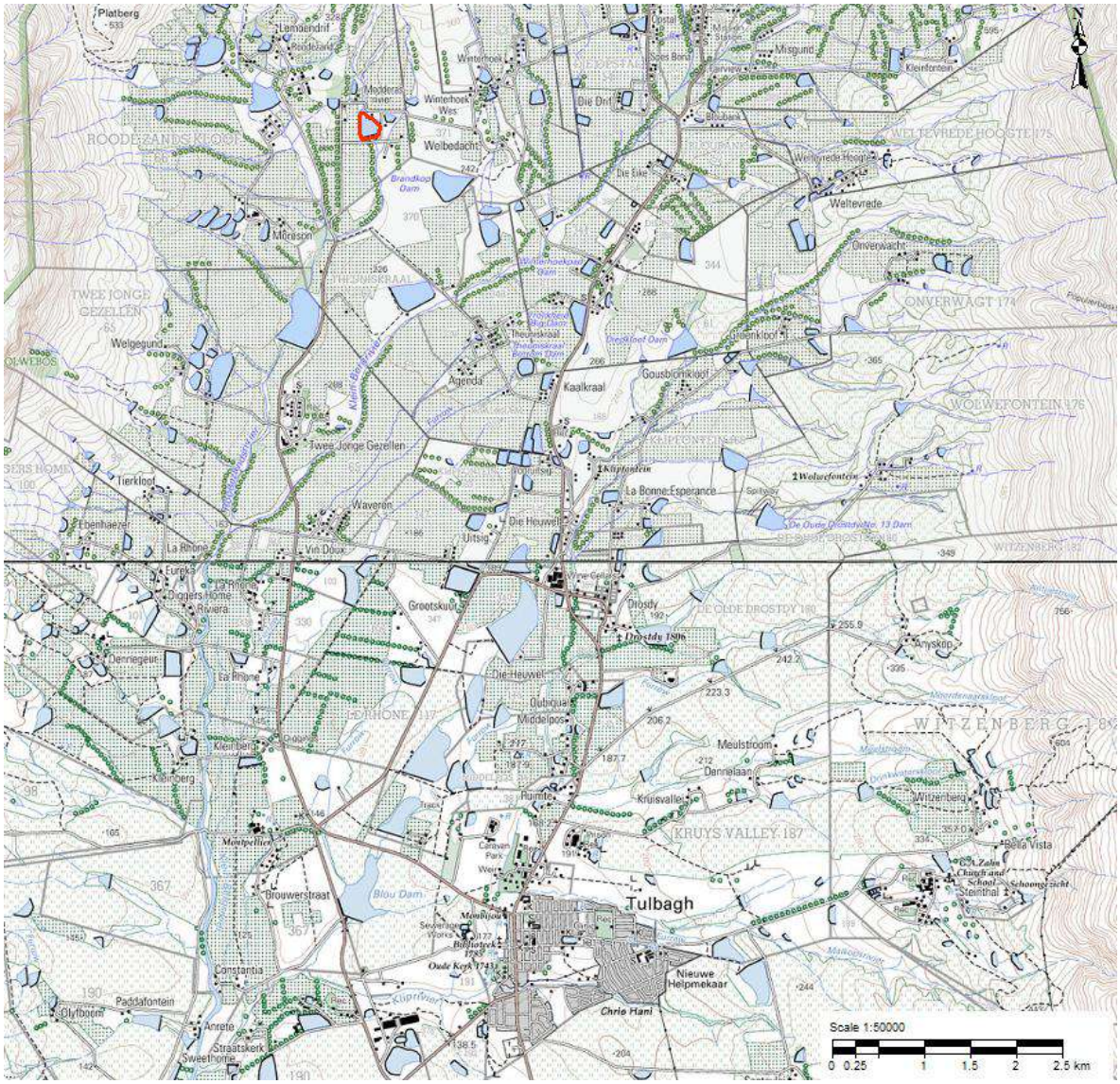

Figure 1. Locality Map for the Modderas Dam (red polygon) near Tulbagh

The dam is proposed to be enlarged to a maximum storage capacity of 310 000 m³ and a maximum wall height of about 15.1 m. The enlarged dam will increase the assurance of water supply on the farm while ensuring more effective and beneficial use of the existing lawful use. The enlarged Modderas Dam will continue to be filled with surface water runoff from its catchment area. This report is

intended to provide input into the authorisation process in terms of the potential aquatic ecosystem impacts and provide recommended mitigation to reduce any impact.

Table 1. Summary of water resource information related to the activity undertaken

Descriptor	Name / Details	Notes
Water Management Area	Breede Olifants WMA	
Catchment Area	Modderas Tributary of the Klein Berg River	A tributary in the middle reaches of the Berg River System
Quaternary Catchment	G10E	
Present Ecological State	D (Largely Modified)	DWAF (2024) for the Klein Berg River
Ecological Importance and Sensitivity	Ecological Importance – High Ecological Sensitivity – Very High	
Target Ecological Category	C (moderately modified)	GG No 42451, GN 655 dated 10 May 2019
Latitude	33°12'37.93"S	Location of the dam wall
Longitude	19° 7'23.46"E	

The study area is located largely within a wider area considered of Very High Aquatic Biodiversity Sensitivity (Figure 2). This is due to the Aquatic Critical Biodiversity Areas (CBAs) and Freshwater Ecosystem Priority Area (FEPA) Wetlands as well as a Strategic Water Source Area for surface water (Boland) occurring in the wider area. The potential impact of the activities on the wetland areas and the Strategic Water Source Areas is assessed in this report.

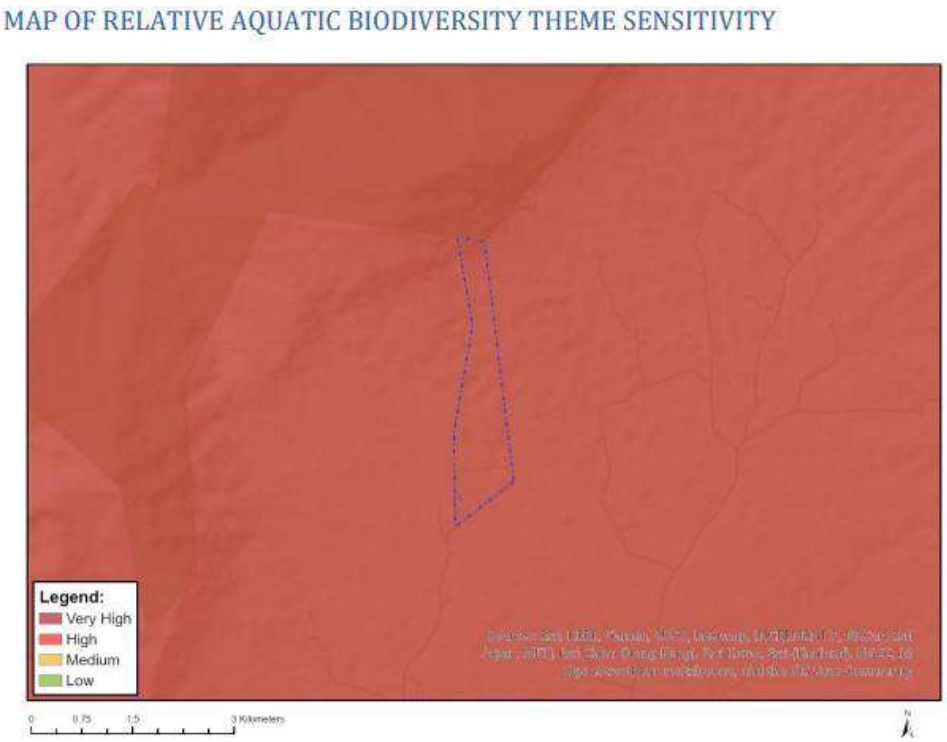

Figure 2. DFFE Screening Map for the area in terms of Aquatic Biodiversity Combined Sensitivity

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Wetlands_Channelled valley-bottom
Very High	SWSA (sw)_Boland

2.2 OVERVIEW OF THE STUDY AREA

The property lies on the wide valley floor of the Klein Berg River. The dam is instream on the Modderas River which drains into the Roodezand River, a tributary of the Klein Berg River, within the middle Berg River System (Quaternary catchment G10E).

Within the farm, much of the natural vegetation on the valley floor has been transformed by past agricultural activities (Figure 3). The Modderas River at the site comprises several small foothill streams with a defined riparian zone of indigenous and alien trees and shrubs that lie within the already significantly modified on the valley floor.

Figure 3. Topographical map of the study site and the surrounding area

2.3. TERMS OF REFERENCE

The suggested work and agreed-upon tasks for this assessment are as follows:

The suggested work and agreed-upon tasks for this assessment are as follows:

Task: Aquatic biodiversity and risk assessment for the proposed dam on Portion 1 of the of the Roode Zands Kloof Farm No. 66 near Tulbagh

1. Conduct a desktop analysis and mapping of aquatic features using Google Earth and Planet GIS as well as available sources of data and mapping such as on the Freshwater Biodiversity Information System maps, National Wetland Mapping, Freshwater Ecosystem Priority Areas and aquatic Critical Biodiversity Areas / Ecological Support Areas mapping. If there is little existing information available for the aquatic features within the study area, data will be utilised for similar adjacent aquatic ecosystems and any more detailed assessments of the aquatic features within the wider area. The National Screening Tool will also be accessed.

2. Undertake a situation assessment that will comprise a single site visit/field assessment and will include mapping and describing the freshwater areas, as well as an assessment of the importance, conservation value, sensitivity and current state of the aquatic ecosystems delineated within the site.

3. An Aquatic Specialist Assessment Report will be compiled for the site as per the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (GN 43110 of 20 March 2020). The report will include:

- A baseline description of the aquatic features and ecosystems within the site; their ecological importance and sensitivity, present condition and a recommended target ecological state.
- The proposed activities are to be assessed in terms of their impact on the aquatic ecosystems' condition and functioning.
- DWS Risk Assessment will be undertaken.
- Mitigation measures are to be recommended to address the potential aquatic ecosystem impacts of the proposed activities.

2.4. Use of the Report

This report reflects the professional judgement of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

3. METHODOLOGY ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment as well as by a more detailed assessment of

the freshwater features at the site. The site was visited for a single day on 15 April 2025 at the start of the rainy season. The timing of the assessment, although not ideal, was considered adequate for this assessment. Historical imagery, taken in the wet and dry periods, was also consulted to assist with the assessment.

During the field visit, characterisation and integrity assessments of the freshwater features were undertaken. The SANBI Biodiversity GIS, Cape FarmMapper and Freshwater Biodiversity Information System websites were also consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping, freshwater features mapped in the Freshwater Ecosystem Priority Areas maps and freshwater biota present. This information/data was used to inform the water resource protection-related recommendations.

Consideration of the Reserve or environmental water requirement determination was undertaken at a rapid level (Rapid Reserve) utilising the guidelines for the South African methodologies for water resource protection as outlined in the documentation "Resource Directed Measures for Protection of Water Resources" (DWAF, 1999). Hydrology utilised for the assessment was obtained from Water Resources 2012.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following limitations apply to the techniques and methodology utilised to undertake this study:

- Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments;
- The river health assessment was carried out using the South African Department of Water and Sanitation developed methodologies. River Health assessments were carried out to provide information on the ecological condition and ecological importance and sensitivity of the river systems impacted.
- The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by DWAF (2005) was followed for the delineation of the riparian and wetland areas.
- The ecological importance and sensitivity assessment were conducted according to the guidelines, as developed by DWAF (1999).
- The species mentioned in this report do not comprise a comprehensive list of all species which occur at the site. They are mentioned for descriptive purposes.

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

4. DESCRIPTION OF THE SITE AND SURROUNDING AREA

4.1 VISUAL CHARACTERISTICS

The Modderas River rises on the lower slopes of the Groot Winterhoek Mountains (altitude of about 565 m above mean sea level) and drops down to join the Roodezant River at an altitude of about 207m above mean sea level over a distance of about 3.88 km (average slope of 1%). The dam is located in the middle reaches of the river, at about 250 m above mean sea level and just upstream of where another tributary joins the stream.

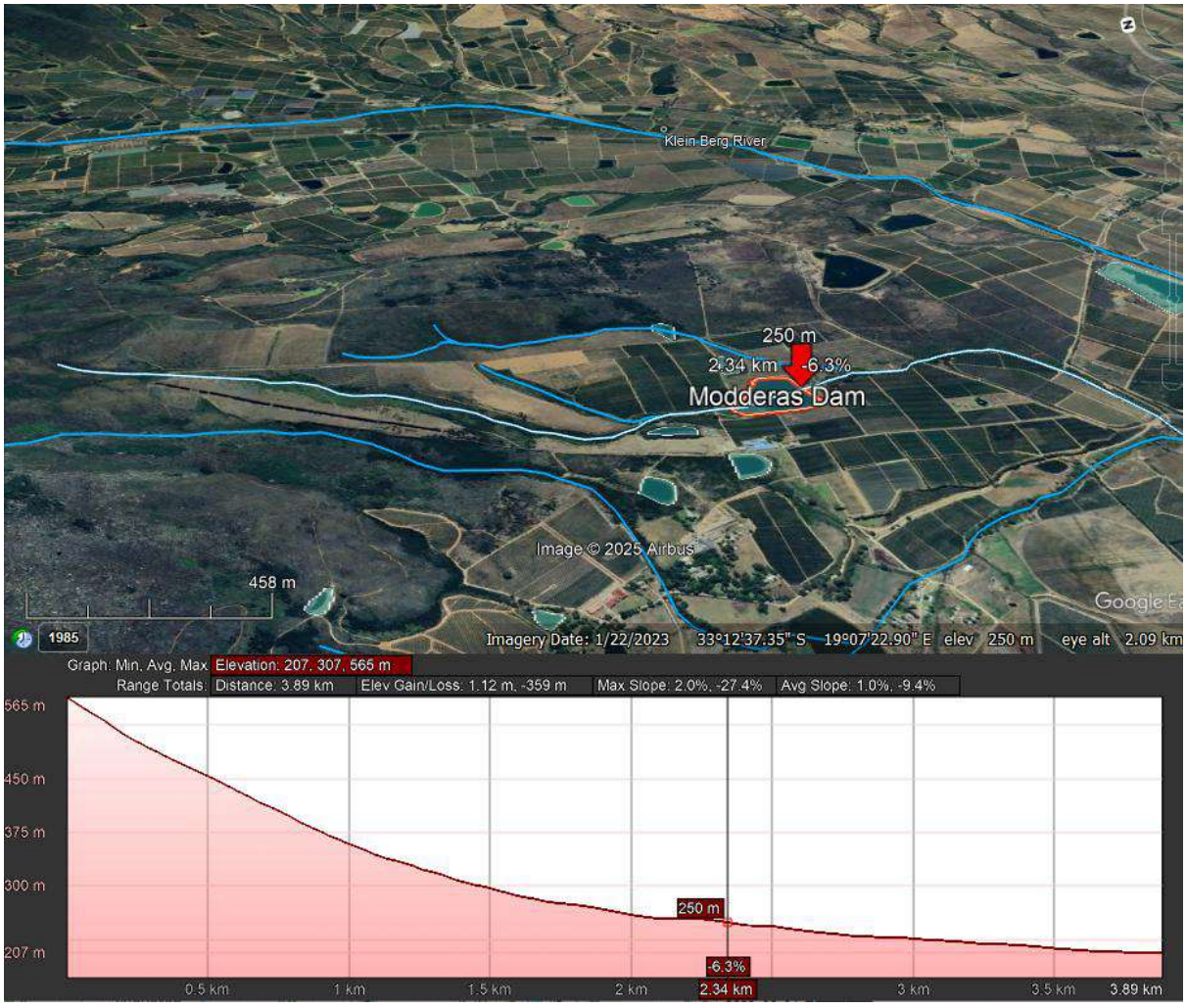

Figure 4. Elevation profile from Google Earth, showing the slope of the Modderas River with the red arrow on the image corresponding to the vertical black line on the graph. Note the orientation of the Google Earth image has been rotated by about 270 degrees.

4.2 CLIMATE AND HYDROLOGY

The area has a Mediterranean climate and receives about 639mm of rain per year, mostly during winter. The average rainfall and temperature values for the area can be seen in Figure 5. The lowest rainfall (10mm) is in February and the highest (111mm) is in June. The average midday temperatures

range from about 10°C in July to 21°C in January and February. The annual average evaporation for the quaternary catchment area G10E, in which the property is located, is 1305mm.

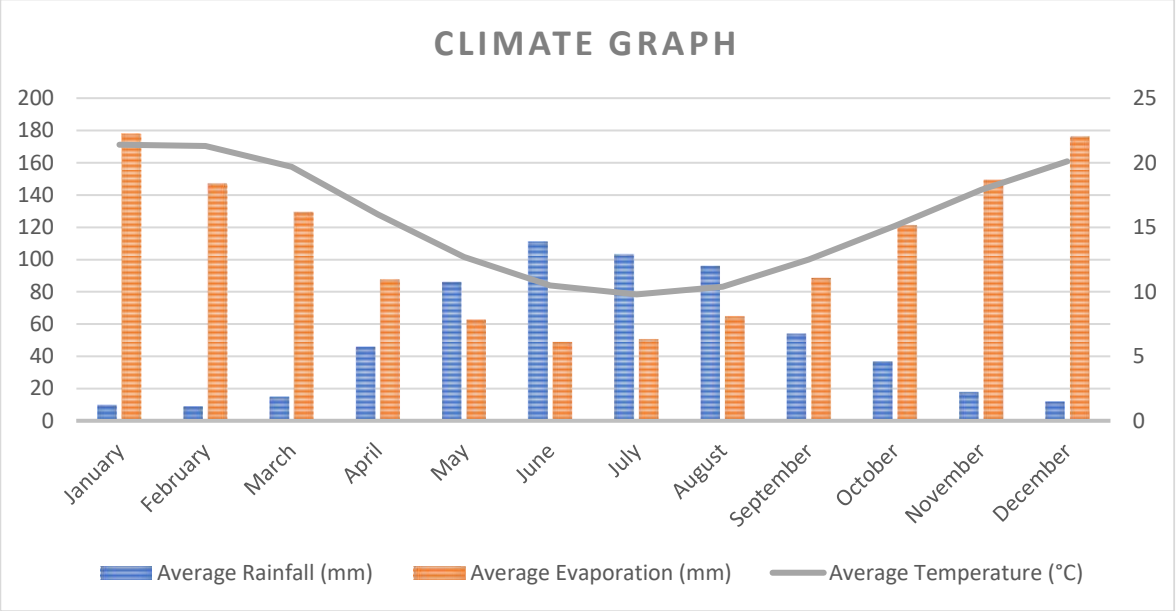

Figure 5. Average monthly rainfall, temperature and evaporation for the area (SA Atlas of Climatology and Agrohydrology - R.E. Schulze, 2009)

Low flow in the watercourses in the area is between December and April, with flow mostly occurring from June to October. As can be expected, this resembles the rainfall pattern for the area. The smaller watercourses are likely to only flow for short periods after rainfall events.

A major fractured aquifer occurs within the area, with the water table typically occurring at depths of about 11 m below ground level and a yield of more than 5 litres a second. Due to the underlying geology, both the surface and groundwater quality tend to have relatively low levels of salinity with natural electrical conductivity concentrations of less than 70 mS/m. The recharge of the aquifer is estimated to be about 70mm/a and the aquifer is of high susceptibility and vulnerability to pollution from anthropogenic activities.

4.3 Geology, Soil and Vegetation

The geology on the farm consists of phyllite, shale, schist and greywacke of the Porterville Formation, Malmesbury Group, which is partly covered by talus gravel. Glenrosa and/or Mispah soil forms dominate.

The natural vegetation type mapped as occurring within the area is Breede Shale Fynbos on the foot slopes, becoming Breede Shale Renosterveld and Breede Alluvium Fynbos on the valley floor. All three of these vegetation types are considered Endangered vegetation types. Within the areas where the work has been undertaken, a mix of natural and transformed vegetation cover occurs. The river still

contains natural riparian vegetation within its upper reaches on the farm, but similarly to the terrestrial vegetation, comprises a mix of indigenous and alien vegetation within the lower reaches.

4.4 AQUATIC ECOSYSTEMS

Aquatic features on the property comprise non-perennial tributaries of the Roodezand River which drains into the Klein Berg River, a major tributary of the larger Berg River System. The Modderas River which drains into the Modderas Dam, originates in the foothills of the Groot Winterhoek Mountains and flows in a southerly direction through the property. The stream is joined by some other streams before its confluence with the Roodezant River. A seep wetlands are mapped along most of the streams within the property.

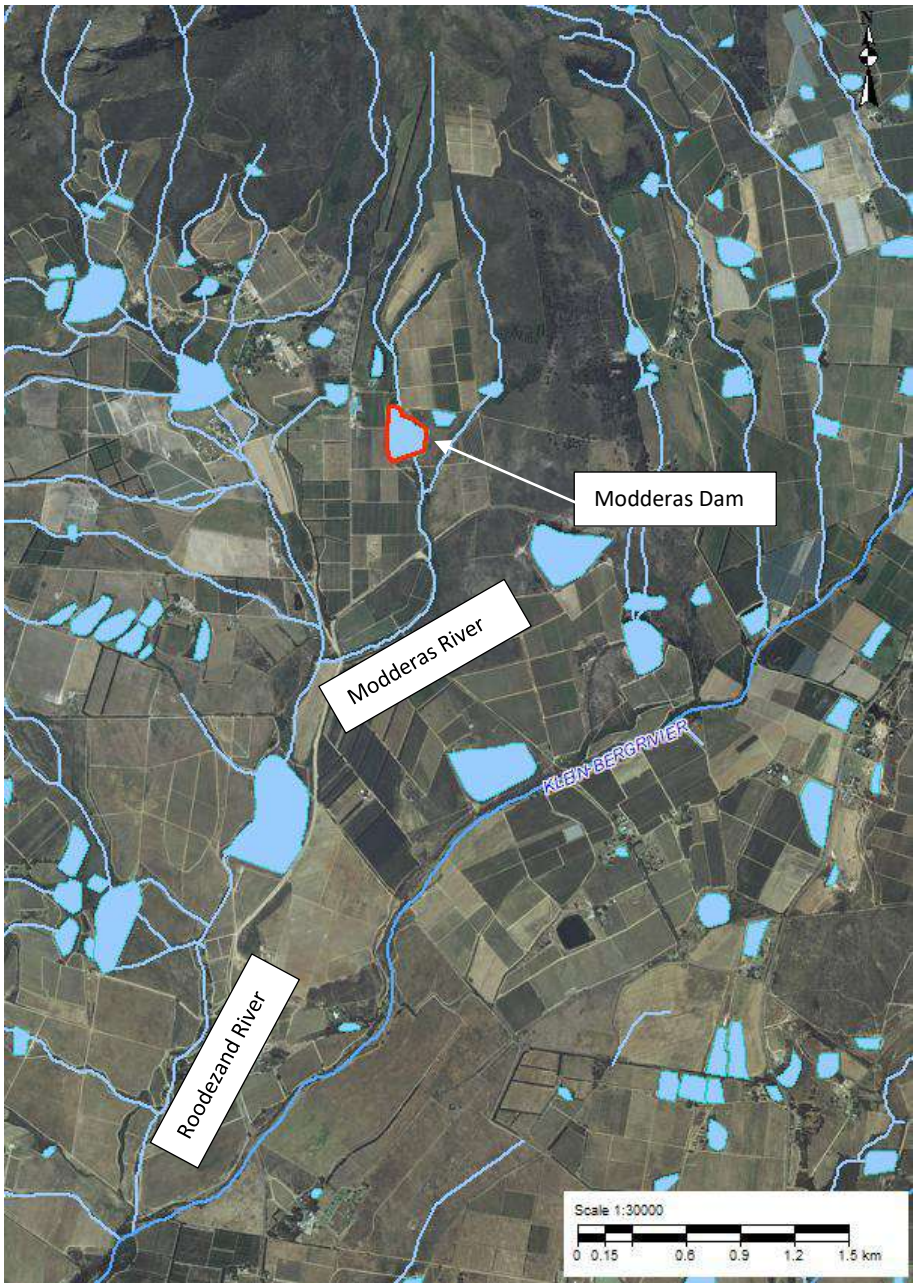

Figure 6. Orthophotograph taken in 2016 with the river system associated with Modderas Dam.

4.5. AQUATIC BIODIVERSITY IMPORTANCE

There are three mapping initiatives which are relevant to the proposed dam enlargement in terms of demarcating important aquatic biodiversity conservation areas. Provincial Fine-Scale Mapping has produced the 2023 Western Cape Biodiversity Spatial Plan. The map aims to guide sustainable development by bringing together biodiversity information for decision-makers so that they can ensure appropriate land use, accommodate important biodiversity features in their planning and promote integrated management of natural resources. Critical Biodiversity Areas (CBA), Ecological Support Areas (ESA) and Critical ESAs (CESA) are considered priority areas which should be maintained in a natural to near-natural state.

The property lies downslope of the Winterhoek Mountain Catchment Area, a formally protected area. The Welbedacht Nature Reserve is also located about 300m to the east of the dam. Downstream of this, the river has been mapped as a terrestrial CBA (Figure 7).

The second mapping initiative is the National Freshwater Ecosystem Priority Areas (NFEPA) mapping which provides strategic spatial priorities for conserving freshwater ecosystems in South Africa. This mapping serves to identify features such as FEPA wetlands, rivers or estuaries and classifies them based on type (for example: natural or artificial; hillslope seep or valley bottom etc.). The ecological condition of the feature is not dealt with in these maps. Certain river sub-catchments are identified as priority areas due to the importance of the river/freshwater features within the sub-catchment. Sub-catchments classified as River FEPAs are required to be maintained in a largely natural ecological state.

The study area is not within a FEPA River Sub-catchment (Figure 8). There are seep wetlands upstream of the dam that are mapped as natural FEPA Wetlands. These wetlands are also mapped within the National Wetland Map version 5 (Figure 9), which is the third mapping initiative that provides a national map of the extent and ecosystem types of the estuarine and inland wetlands.

Figure 7. 2023 Western Cape Biodiversity Spatial Plan in the vicinity of the dam (CapeFarmMapper, 2025)

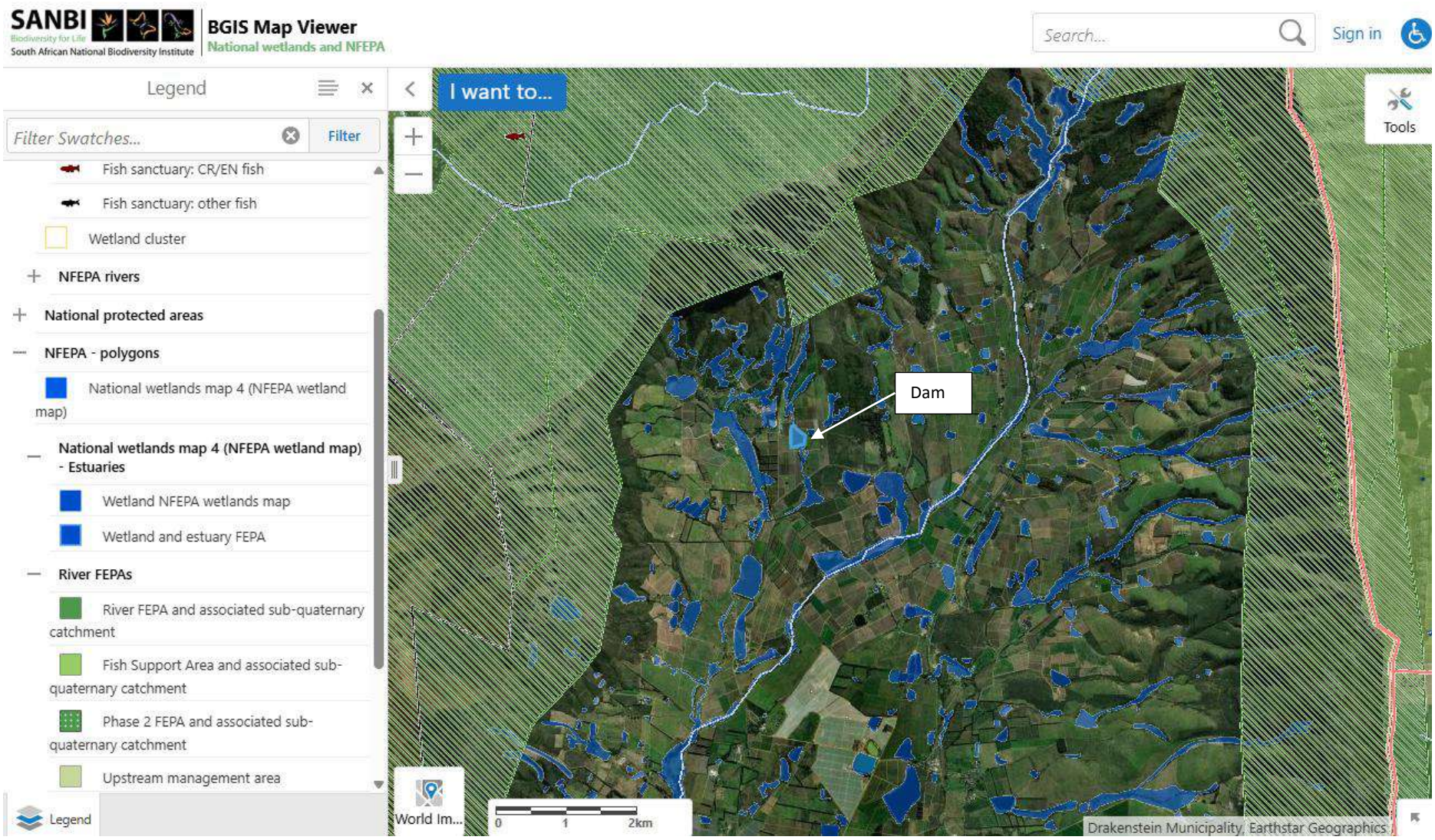

Figure 8. National Freshwater Ecosystem Priority Areas mapping for the dam (blue polygon) and surrounding area (SANBI Biodiversity GIS, 2025)

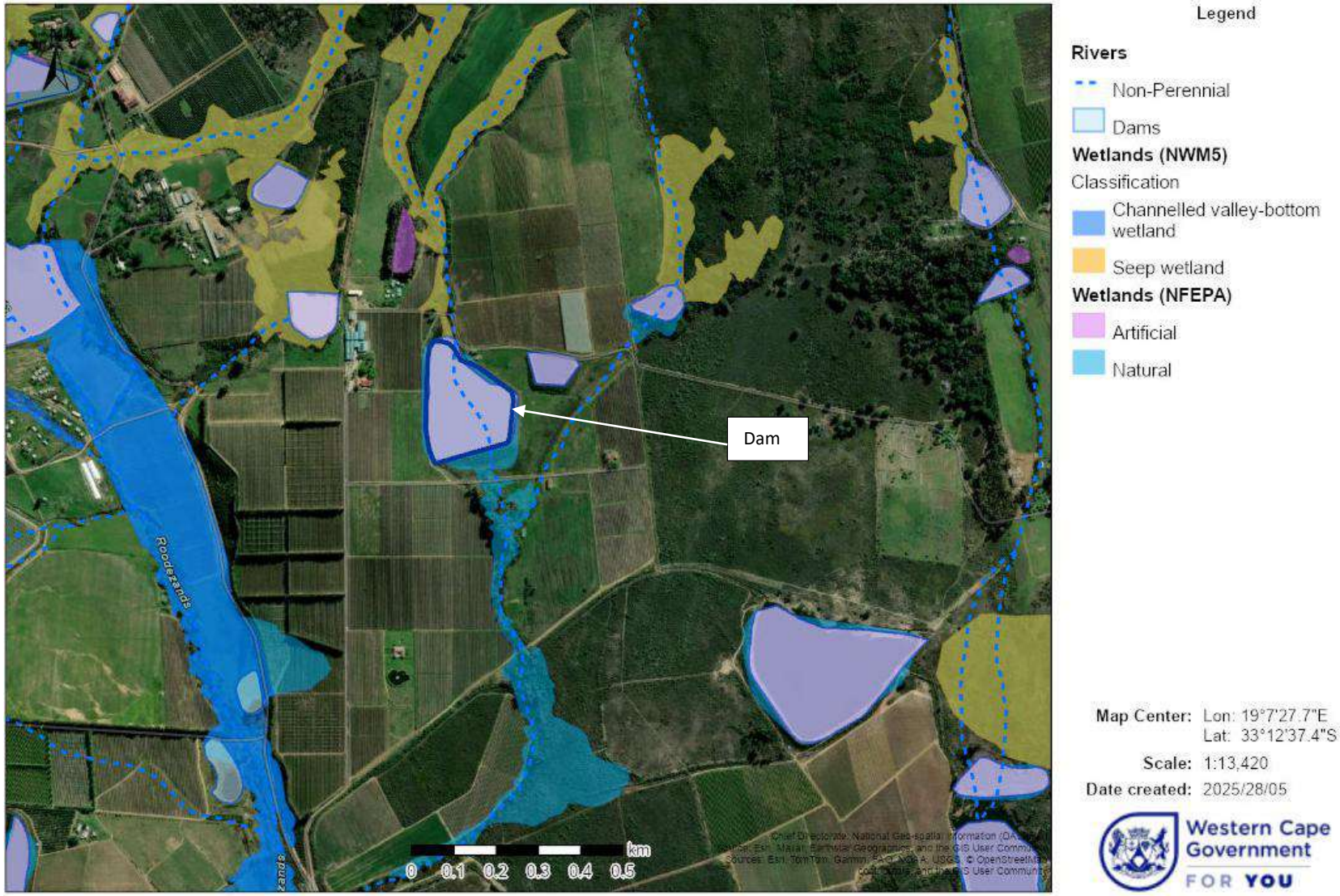

Figure 9. FEPA Wetlands and National Wetland Map for the dam and surrounding area (CapeFarmMapper, 2025))

5. ASSESSMENT OF FRESHWATER FEATURES AND THEIR SIGNIFICANCE

Index for Habitat Integrity (IHI) and Site Characterisation Assessments were utilised to provide information on the ecological condition of the river assessed. No detailed assessments were undertaken in terms of stream geomorphology, fish and aquatic biota. Results of the Site Characterisation Assessment were used to provide a desktop estimate of aquatic habitat integrity.

The Modderas River is fed by some feeder streams and seeps that drain the lower slopes of the Groot Winterhoek Mountains. The streams do not have a significant catchment but are likely to be fed from groundwater draining from the longitudinal seep areas along the foothill zones of the watercourses. The surrounding landscape and the riparian zones of the watercourses have had a long history of modification, having been utilised for agriculture on the lower slopes, with the activities extending into the riparian zone of the watercourse.

Upstream of Modderas Dam, the watercourse comprises mostly wetland habitat with the riparian vegetation invaded with alien trees. Downstream of the dam, the cobble-bed stream drains through agricultural areas where it has been more significantly impacted by past cultivation activities. Much of the seep wetlands that would have occurred in this area have been cultivated.

The main invasive alien vegetation currently occurring within the disturbed areas on the farm include black wattle (*Acacia mearnsii*), blackwood (*Acacia melanoxylon*), sesbania (*Sesbania punicea*) and bramble (*Rubus flagellaris*). Indigenous vegetation observed along the watercourses comprised *Psoralea pinnata, Searsia angustifolia, Morella serrata, Olea europaea subsp. africana, Podocarpus elongatus, Melianthus major, Pteridium aquilinum, Salvia chamelaeagnea, Elegia capensis, Zantedeschia aethiopica, Carpha glomerata, Juncus capensis, Ficinia nodosa, Cyprus textilis* and *Isolepis prolifer*.

Amphibians occurring in the area include Cape River Frog (*Amietia fuscigula*) Clicking Stream Frog (*Strongylopus grayii*), Mountain Rain Frig (*Breviceps montanus*) and Raucous Toad (*Sclerophys capensis*). All of the above are listed as Least Concern on the IUCN Red List of Threatened Species. Indigenous fish species recorded or expected in the larger Klein Berg River system are Cape galaxias (*Galaxias zebratus*), Cape kurper (*Sandelia capensis*) and Berg River redfin (*Pseudobarbus burgi*). Cape galaxias and Cape kurper are classified as "Data Deficient" while Berg River refin is listed as Endangered. It is possible that these small indigenous fishes did extend up into the smaller seasonal tributaries in winter, today however, with the reduction of winter flow and the number of barriers (instream dams) as well as predation by invasive fish the distribution of the fish is mostly limited to the mainstem of the river.

Past imagery of the site, taken in 1948 (Figure 12), indicates that the farm and streams had already been significantly modified at that time. Past agricultural activities extended into stream channels and the associated wetland habitats. The Modderas Dam had not yet been constructed. A later image, taken in 1972 (Figure 13), shows the property also shows the farm almost entirely modified with more formal cultivated areas extending into the watercourses. The Modderas Dam as well as the adjacent dams had been constructed. Images 14 and 15 provide more recent Google Earth images from 2002 and 2023 of the farm and watercourses and maintenance of the status quo in terms of the land use, the dams and the condition of the adjacent watercourses.

Figure 10. Views of the Modderas Stream upstream (top and centre) and downstream (bottom) of the dam

Figure 11. Views of the Modderas Dam (top) and the Alternative Dam 2 (middle) as well as the tributary of the Modderas River near Dam 2(bottom)

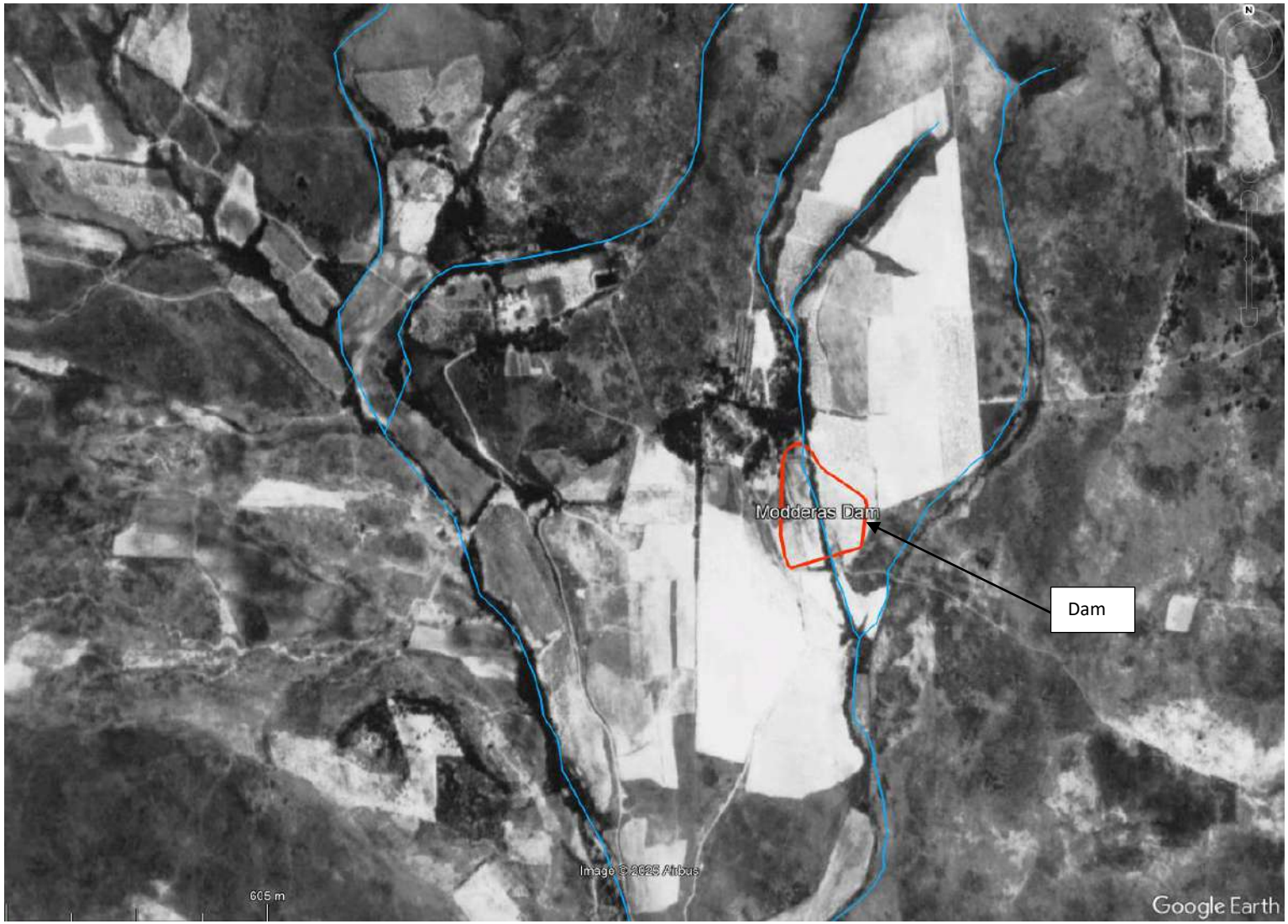

Figure 12. Aerial image taken in 1948 and overlaid in Google Earth with the location of the dam and watercourses shown

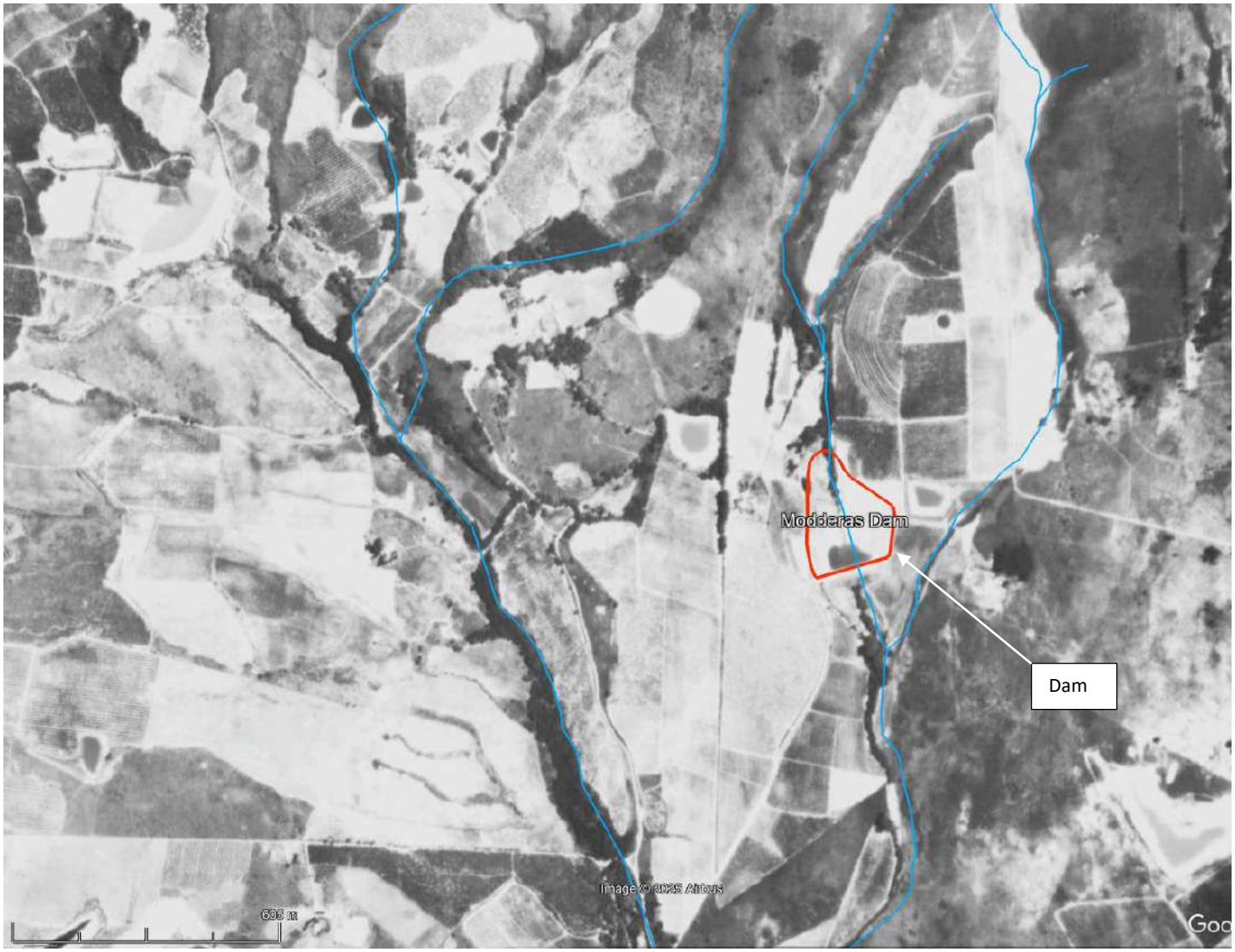

Figure 13. Aerial image taken in 1972 and overlaid in Google Earth with the location of the dam and watercourses shown

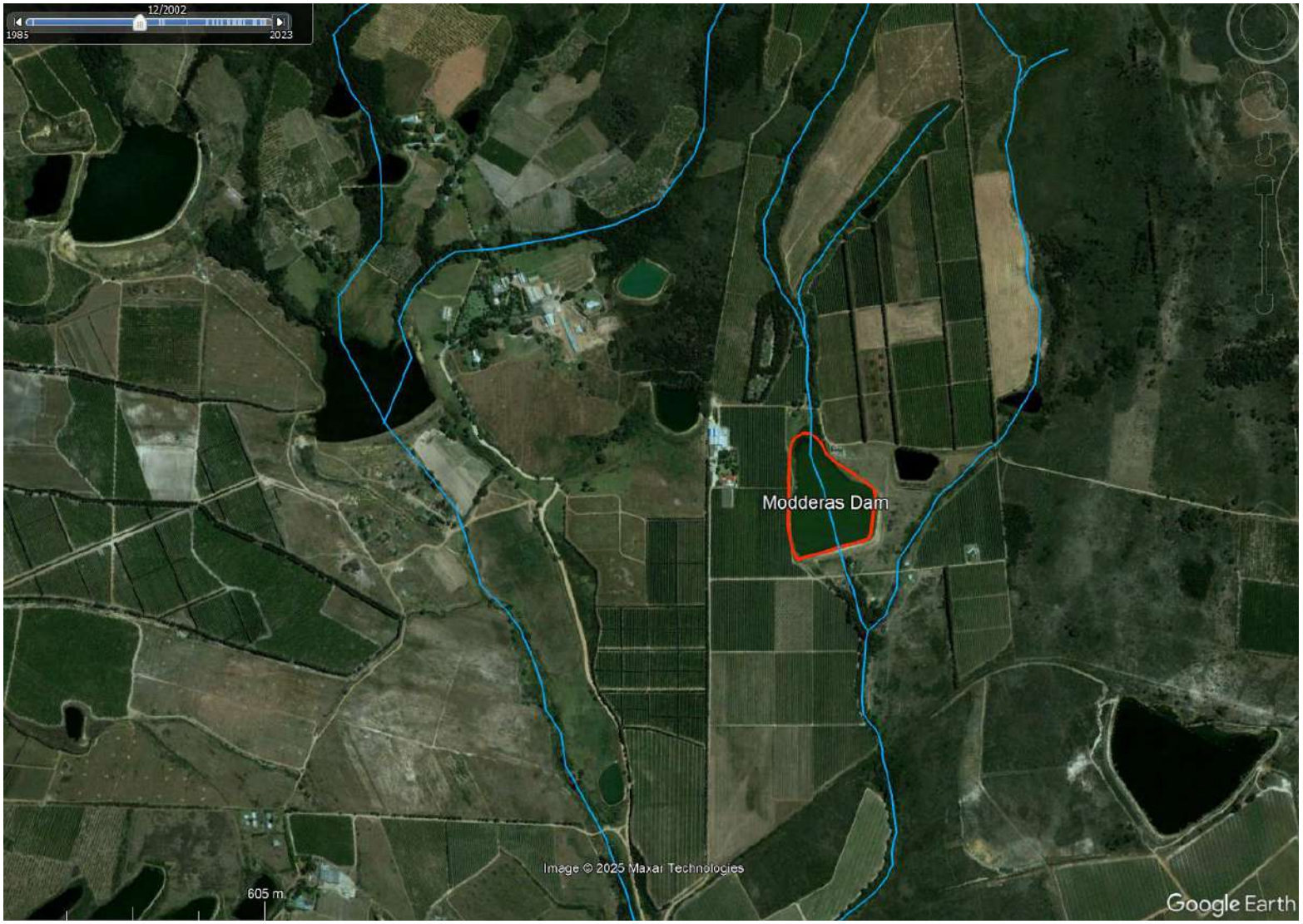

Figure 14. Google Earth from 2002 shown with the location of the dam and watercourses shown

Figure 15. Google Earth from 2023 shown with the location of the dam and watercourses shown

5.1. River classification

In order to assess the condition and ecological importance and sensitivity of the river, it is necessary to understand how the watercourse might have appeared under unimpacted conditions. This is achieved by classifying rivers according to their ecological characteristics, in order that they can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river conditions should only be done between rivers that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers provides the basis for assessing river conditions to allow comparison between similar river types. The primary classification of rivers is a division into Ecoregions. Rivers within an Ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation. For this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used.

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an Ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota.

Table 2: Characteristics of the Southern Folded Mountains Ecoregion

Main Attributes	Characteristics (dominant types in bold)
Terrain Morphology	Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to High Relief; **Closed Hills; Mountains; Moderate and High Relief**
Vegetation types	Patches Afromontane Forest; Spekboom Succulent Thicket; **Little Succulent Karoo;** **Grassy Fynbos; Mountain Fynbos;** South and South West Coast Renosterveld; Central Mountain Renosterveld; Eastern Mixed Nama Karoo; Central Nama Karoo; Great Nama Karoo;
MAP (mm) (modify)	200 to 1500
Rainfall seasonality	Very late summer to winter to all year
Mean annual temp. (°C)	10 to 20
Median annual simulated runoff (mm) for quaternary catchment	<5 to >250

5.2. Site Characterisation

From the Site Characterisation assessment, the geomorphological and physical characteristics of the tributary that was assessed can be classified together as follows:

Table 3: Geomorphological and Physical features

River	Modderas River
Valley Form	Lower foothill
Lateral mobility or entrenchment	Confined by topography – more confined in upper reaches becoming less confined
Channel form	Simple
Channel pattern	Moderate to low sinuosity
Channel type	Boulder/cobble bed
Hydrology	Non-perennial

5.3. Index of Habitat Integrity

Evaluation of Index of Habitat Integrity (IHI) provides a measure of the degree to which a river has been modified from its natural state. This assessment was undertaken for the Modderas River. The results are provided in Table 5.

The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of the degradation of a river. The severity of each impact is ranked using a scale from 0 (no impact) to 25 (critical impact). The IHI assessment is based on an evaluation of the impacts of two components of the river, the riparian zone and the instream habitat. Assessments are made separately for both components, but data for the riparian zone are interpreted primarily in terms of the potential impact on the instream component. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (Table 4).

Table 4: Habitat Integrity categories (From DWAF, 1999)

CATEGORY	DESCRIPTION	SCORE (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In worst instances, basic ecosystem functions have been destroyed and changes are irreversible.	0

The instream habitat integrity of the Modderas River is considered to be moderately to largely modified, while the riparian habitat has been largely modified. This is mostly due to the impact of the dams on the flow of the watercourses as well as the encroachment of the surrounding land activities into the riparian habitat of the watercourses. The results are summarised in Table 5.

Table 5: Index of Habitat Integrity Assessment results and criteria assessed

INSTREAM HABITAT INTEGRITY	Modderas River	RIPARIAN ZONE HABITAT INTEGRITY	Modderas River
Water Abstraction (Impact 1 - 25)	15	Vegetation Removal (Impact 1 - 25)	10
Flow Modification (Impact 1 - 25)	13	Exotic Vegetation (Impact 1 - 25)	11
Bed Modification (Impact 1 - 25)	10	Bank Erosion (Impact 1 - 25)	7
Channel Modification (Impact 1 - 25)	8	Channel Modification (Impact 1 - 25)	7
Water Quality (Impact 1 - 25)	8	Water Abstraction (Impact 1 - 25)	14
Inundation (Impact 1 - 25)	8	Inundation (Impact 1 - 25)	7
Exotic Macrophytes (Impact 1 - 25)	5	Flow Modification (Impact 1 - 25)	12
Exotic Fauna (Impact 1 - 25)	4	Water Quality (Impact 1 - 25)	6
Rubbish Dumping (Impact 1 - 25)	4		
INTEGRITY CLASS	**C/D**	**INTEGRITY CLASS**	**D**

5.4. Ecological Importance and Sensitivity (EIS)

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

Table 6: Scale used to assess biotic and habitat determinants indicating either importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table 7: Results of the EIS assessment for the watercourse assessed

Biotic Determinants	Modderas River
Rare and endangered biota	1
Unique biota	1
Intolerant biota	2
Species/taxon richness	1
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	1
Refuge value of habitat type	2
Sensitivity of habitat to flow changes	2
Sensitivity of flow related water quality changes	1.5
Migration route/corridor for instream and riparian biota	1.5
National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas, PNEs	2
EIS CATEGORY	**Moderate**

Table 8: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	median
Very high	Reaches unique on a national and international level based on unique biodiversity. These rivers are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Reaches unique on a national scale based on their biodiversity. These rivers may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Reaches unique on a provincial or local scale due to biodiversity. These rivers are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Reaches not unique on any scale. These rivers are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

The Modderas River is considered of moderate ecological importance and sensitivity.

5.5. Recommended Ecological Management Category

In terms of the proposed water resource classes for Berg Water Management Area, the Target Ecological Category for the larger Klein Berg River in DWS quaternary catchment G10E is a C category within a Class II (moderate protection and utilisation) integrated unit of analysis area (Berg Tributaries). The recommended ecological condition of the Modderas River is that it is improved and maintained within the ecological category of C (moderately modified). The Resource Quality Objectives for the Klein Berg River (Government Gazette No 42451, dated 10 May 2019) are provided below:

Resource Name	Biophysical Node Name	TEC	Component	Sub-component	Indicator	RQO Narrative	RQO Numeric
Klein Berg River	Biii4	C	Quantity	Low flows High flows	Maintenance low flows Maintenance high flows	Flows sufficient to maintain the river in a C category	Months: Oct / Nov / Dec / Jan / Feb / Mar / Apr / May / Jun / Jul / Aug / Sep Maintenance flows (million cubic metres) Low: 1.422 / 1.110 / 0.754 / 0.398 / 0.305 / 0.291 / 0.338 / 0.618 / 1.002 / 1.391 / 1.744 / 1.619 High: 0.638 / 0.141 / 0.000 / 0.000 / 0.000 / 0.000 / 0.000 / 0.802 / 1.516 / 0.831 / 2.913 / 0.831
			Quality	Nutrients	Phosphate (PO_4-P)	Nutrient levels must be maintained in the river at a mesotrophic or better condition.	≤ 0.075 milligrams/litre (50th percentile)
					Total inorganic nitrogen (TIN)		≤ 1.75 milligrams/litre (50th percentile)
				Salts	Electrical conductivity (EC)	Salt concentrations need to be maintained at levels that do not adversely affect aquatic ecosystems	≤ 55 milliSiemens/metre (95th percentile)
				System variables	pH range	pH, temperature, and dissolved oxygen are important for the maintenance of ecosystem health.	6.5 ≤ pH ≤ 8.5 (5th and 95th percentiles)
					Water temperature		2°C difference from ambient water temperature
					Dissolved oxygen		≥ 6 milligrams litre (5th percentile)
				Toxins	Ammonia	Toxicity levels must not pose a threat to aquatic ecosystems.	≤ 0.073 milligrams per litre (95th percentile)
					Atrazine		≤ 0.079 milligrams per litre (95th percentile)
					Endusulfan		≤ 0.0013 milligrams per litre (95th percentile)
				Pathogens	Escherichia coli	Concentrations of waterborne pathogens should be maintained in an Acceptable category for intermediate contact recreation.	≤ 2500 counts/100ml (95th percentile)
			Habitat	Riparian vegetation	VEGRAI level 3 score.	Vegetation condition	> 62% = C category
			Biota	Fish	FRAI score	Fish condition	> 58% = C/D category

5.6. Environmental Water Requirements

This section provides a consideration of the environmental water requirement (EWR) or instream flow requirements associated with the enlargement of the Modderas Dam where the dam is to be filled from runoff from the catchment of the dam. The catchment information at the site is provided below.

Table 9: Catchment area and Mean Annual Runoff for the G10E quaternary catchment and the Modderas Dam

Catchment	Catchment Area (km^2)	Mean Annual Precipitation (mm)	MAR (10^6m^3)	% of quaternary G10E
G10E	394[1]	640[1]	76.38[1]	100
Modderas Dam	± 1	640[2]	0.24	0.3%

[1] WR2012; [2] SA Atlas of Climatology and Agrohydrology - R.E. Schulze, 2009

The EWR for the Klien Berg River based on the RQO for flow provided in the previous section was extrapolated to the Modderas Dam. The Recommended Ecological Category (REC) for the watercourses concerned, based on the present ecological status and the ecological importance and sensitivity of these aquatic ecosystems as well as the Berg River Classification is a C category.

The recommended EWR for the river is 20.3% of the nMAR. The distribution curve (Figure 16), Ecological Reserve summary tables (Table 17), rule curves (Table 18) and recommended downstream environmental flows (Table 21) were generated for the tributary downstream of Modderas Dam.

The monthly flow distribution curve (Figure 16) shows that under natural conditions (black line in the figure) there would be little to no flow in the tributary during the lowest flowing months of November/December to March/April. It should be noted that the flow distribution is generated for the larger quaternary catchment that includes the Klein Berg River. One can therefore expect the flow in the tributary to be much lower. Water would typically be available for use from the watercourses in the area during the months of May to September (difference between the black line and blue line).

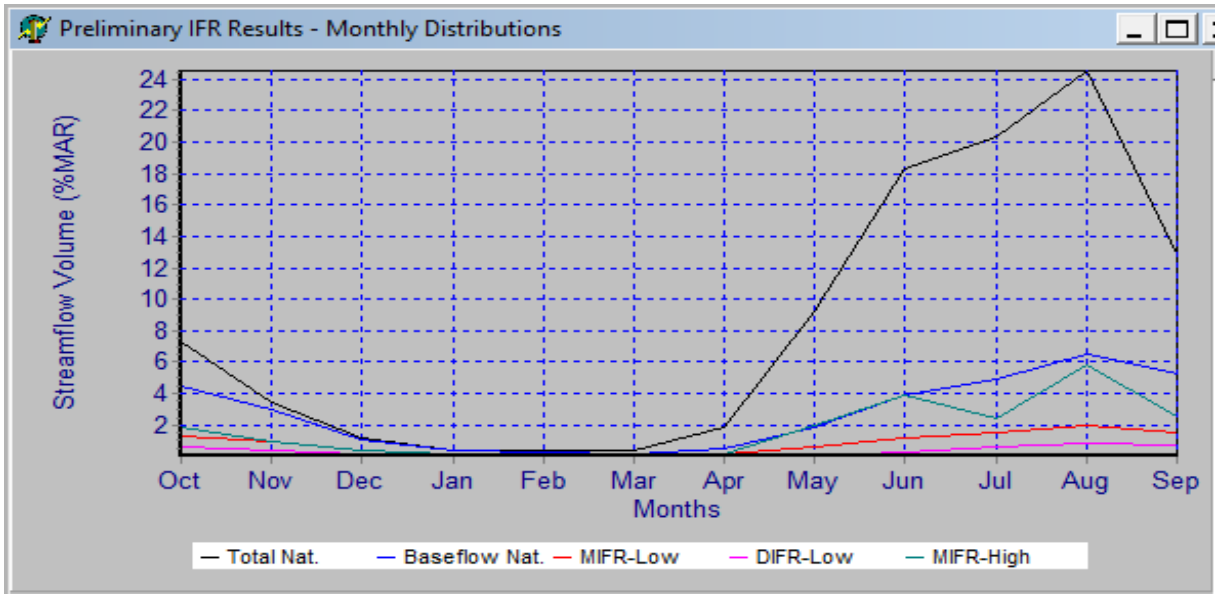

Figure 16: Monthly Distribution curve for the area, where: black line is the natural flow distribution; the blue line is the natural baseflow (mostly groundwater contribution); MIFR – Low is the Maintenance Low Flow Environmental requirement (red line on graph); DIFR – Low is the Drought Low Flow Environmental requirement (pink line on graph); and MIFR – High is the Maintenance High flow environmental requirement -larger floods and freshets– within year (green line on graph)

Table 10. Environmental flow requirement for the Tributary at the Modderas Dam

Summary of Desktop (Version 2) estimate for the Incremental catchment of the Tributary at Modderas Dam (33°12'37.89"S; 19° 7'23.06"E): Quaternary G10E	
MAR = 2.374	Ecological Category = C
S.Dev. = 1.244	
CV = 0.524	Total IFR = 0.482 (20.31 %MAR)
Q75 = 0.010	Maint. Lowflow = 0.228 (9.62 %MAR)
Q75/MMF = 0.050	Drought Lowflow = 0.089 (3.76 %MAR)
BFI Index = 0.322	Maint. Highflow = 0.254 (10.70 %MAR)
CV(JJA+JFM) Index = 3.148	
	Distribution Type : W.Cape(wet)

Monthly Distributions (Mill. cu. m.)							
Month	Natural Flows			Modified Flows (IFR)			
	Mean	SD	CV	Maint Low flows	Drought	Maint. High Flows	Maint. Total Flows
Oct	0.172	0.059	0.341	0.031	0.014	0.013	0.044
Nov	0.08	0.039	0.481	0.021	0.009	0.002	0.023
Dec	0.026	0.015	0.57	0.008	0.004	0	0.008
Jan	0.01	0.009	0.978	0.003	0.001	0	0.003
Feb	0.009	0.031	3.534	0.002	0.001	0	0.002
Mar	0.007	0.013	1.792	0.002	0.001	0	0.002
Apr	0.045	0.094	2.115	0.004	0.001	0	0.004
May	0.22	0.346	1.57	0.013	0.002	0.033	0.047
Jun	0.436	0.541	1.242	0.027	0.006	0.065	0.092
Jul	0.482	0.5	1.037	0.035	0.015	0.024	0.059
Aug	0.583	0.502	0.862	0.045	0.02	0.094	0.139
Sep	0.304	0.202	0.666	0.037	0.016	0.024	0.061

Table 11: Rule curve for the environmental flow requirement for the Tributary at Modderas Dam

Summary of Desktop (Version 2) estimate for the Incremental catchment of the Tributary at Modderas Dam (33°12'37.89"S; 19° 7'23.06"E): Quaternary G10E; Regional Type : W.Cape(wet); Ecological Category = C; Data are given in m^3/s mean monthly flow										
Month	10%	20%	30%	40%	50%	60%	70%	80%	90%	99%
Oct	0.022	0.022	0.022	0.021	0.021	0.019	0.017	0.013	0.009	0.006
Nov	0.012	0.012	0.012	0.012	0.011	0.011	0.009	0.008	0.005	0.004
Dec	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.001
Jan	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Feb	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Mar	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Apr	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0	0
May	0.022	0.022	0.022	0.021	0.02	0.019	0.013	0.009	0.005	0.001
Jun	0.046	0.046	0.045	0.045	0.044	0.042	0.038	0.03	0.018	0.005
Jul	0.035	0.033	0.031	0.03	0.028	0.025	0.023	0.019	0.013	0.007
Aug	0.087	0.08	0.074	0.069	0.064	0.054	0.05	0.041	0.026	0.011
Sep	0.038	0.035	0.033	0.031	0.029	0.026	0.022	0.017	0.011	0.007
Reserve Flows without High Flows										
Oct	0.016	0.016	0.016	0.016	0.015	0.014	0.013	0.01	0.007	0.005
Nov	0.011	0.011	0.011	0.011	0.011	0.01	0.009	0.007	0.005	0.004
Dec	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.001
Jan	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Feb	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Mar	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0
Apr	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0	0
May	0.007	0.007	0.007	0.007	0.007	0.006	0.005	0.004	0.002	0.001
Jun	0.015	0.015	0.015	0.015	0.015	0.014	0.013	0.01	0.006	0.002
Jul	0.019	0.019	0.019	0.018	0.018	0.017	0.016	0.014	0.01	0.006
Aug	0.024	0.024	0.024	0.024	0.024	0.023	0.021	0.018	0.013	0.008
Sep	0.02	0.02	0.02	0.019	0.019	0.018	0.016	0.013	0.009	0.006
Natural Duration curves										
Oct	0.09	0.08	0.073	0.069	0.065	0.056	0.053	0.045	0.038	0.027
Nov	0.049	0.04	0.035	0.03	0.026	0.025	0.023	0.02	0.018	0.015
Dec	0.016	0.012	0.011	0.009	0.009	0.008	0.007	0.006	0.005	0.004
Jan	0.007	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Feb	0.006	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0
Mar	0.007	0.003	0.002	0.002	0.001	0.001	0.001	0	0	0
Apr	0.04	0.02	0.014	0.007	0.005	0.004	0.003	0.002	0.001	0
May	0.3	0.108	0.071	0.047	0.037	0.019	0.013	0.009	0.005	0.001
Jun	0.457	0.282	0.179	0.139	0.07	0.053	0.045	0.036	0.018	0.008
Jul	0.48	0.29	0.198	0.156	0.104	0.078	0.065	0.051	0.043	0.012
Aug	0.435	0.369	0.306	0.229	0.123	0.109	0.093	0.075	0.067	0.046
Sep	0.21	0.118	0.107	0.102	0.096	0.09	0.085	0.075	0.069	0.055

Based on the EWR determination undertaken above, the following recommendations are made with regard to the percentage of flow that should remain in the Tributary downstream of Modderas Dam:

Table 12. Recommended Average Monthly Environmental flow downstream of Modderas Dam

Month	Average monthly EWR		EWR as % of average natural monthly flow
	l/s	Mm^3/month	%
Oct	17	0.044	25.6
Nov	9	0.023	28.8
Dec	3	0.008	30.8
Jan	1	0.003	30.0
Feb	1	0.002	22.2
Mar	1	0.002	28.6
Apr	2	0.004	8.9
May	18	0.047	21.4
June	35	0.092	21.1
July	23	0.059	12.2
Aug	54	0.139	23.8
Sept	24	0.061	20.1

It should be noted that the environmental flow requirements for the Modderas Tributary are based on the simulated hydrology that has been modelled for the period 1920 to 2010 under natural conditions and are given as average monthly flows. The confidence in the hydrology on which the environmental flow requirement has been determined is low. It would only be improved through monitoring of the flow in the watercourse. It should also be noted that the EWR does not represent the extreme dry or wet periods or take into consideration downstream water use. For this reason, it would not make sense to use the actual flow volumes listed in Table 12 to stipulate the EWR to be released from the dam but rather to implement the EWR as a percentage of an actual measured inflow into the dam. The percentages are included in Table 12 above.

The most practical way in which the EWR can be met, which requires the least management and intervention by the landowner is to ensure that the EWR requirement is rather met by the smaller tributary that joins the Modderas Tributary just downstream of Modderas Dam. The smaller tributary has a catchment of about 61 ha and an estimated runoff of about 150 000 m^3. The runoff from this tributary is thus about 40% of the MAR of the Modderas Tributary downstream of the dam. The tributary also drains a relatively undeveloped catchment (there is a small dam in the lower reach) that lies within the Grootwinterhoek Wilderness Area and the Welbedacht Capenature Stewardship site before entering the landowners property. This stream would thus be able to deliver a near-natural runoff contribution to the Modderas Tributary and provide for the EWR if the flow is not abstracted or impeded on the landowner's property. The lower reach of the smaller tributary also contains good wetland habitat that would benefit from the unimpeded flow in tributary.

It is thus recommended that the flow from this tributary is not impeded or diverted within the landowner's property such that the flow in the tributary provides for the EWR in the Modderas Tributary downstream of the Modderas Dam. This recommendation aligns with the proposed decommissioning of Dam D2 which receives water from the smaller tributary.

6. LEGISLATIVE AND CONSERVATION PLANNING REQUIREMENTS

The proposed activity needs to take cognisance of legislative requirements, policies, strategies, guidelines and principles from a municipal to a national level. Nationally, two sets of legislation are important to the proposed activity from a freshwater resource perspective. These are the National Environmental Management Act (NEMA) and the National Water Act (NWA).

6.1 NEMA AND ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS

NEMA is the overarching piece of legislation for environmental management in South Africa and includes provisions that must be considered to give effect to the general objective of integrated environmental management. These provisions are contained in Section 24 (4) (a)(b) of the Act and will be considered during the EIA process. Activities listed in terms of chapter 5 of NEMA in Government Notice No. R.983, 984, and 985, dated 4 December 2014, as amended, trigger a mandatory Basic Assessment, or even a full scoping EIA process, before development.

6.2 NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The purpose of the National Water Act, 1998 (NWA) is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by an individual and rights which are not automatically coupled to land rights, but prospective users must apply for authorisation and register as users. The NWA also provides measures to prevent, control and remedy pollution of surface and groundwater sources.

The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact water resources through the categorisation of 'listed water uses' encompassing water abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where Department of Water and Sanitation (DWS), is the administering body in this regard. Defined water use activities require the approval of DWS / BGCMA in the form of a General Authorisation or Water Use Licence authorisation. There are restrictions on the extent and scale of listed activities for which General Authorisations apply.

The works undertaken at the site relate to Section 21 (b) – storage of water; Section 21 (c) – diverting or impeding flow in a watercourse; and Section 21 (i) – changing the bed, banks, course or characteristics of watercourse water uses that could be considered existing lawful use or adequately dealt with under the approved MMP for the river.

Section 22 (3) of the NWA allows for a responsible authority (DWS) to dispense with the requirement for a Water Use License if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other Law.

6.2.1. General Authorisation in terms of Section 39 of the NWA

The proposed works within and adjacent to the rivers, streams and wetland areas are deemed to be changing the characteristics of the associated aquatic ecosystems as well as impeding flow in the watercourses and therefore require authorisation. The authorisation of water use activities for Sections 21 (c) - change to the bed, banks and characteristics of a watercourse and 21 (i)- impeding and diverting the flow, will need to be applied for. According to the preamble to Part 6 of the NWA, "*This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette…*" *"The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary…"*

The General Authorisations for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA have recently been revised (Government Notice R4167 of 2023). Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of the General Authorisations (GA).

A risk assessment (for Section 21(c) and (i) water uses only) has been undertaken to inform the water use authorisation process if required and is included for information purposes in this aquatic ecosystem impact assessment report.

6.2.2. Regulations Requiring that a Water Use be Registered, GN R. 1352 (1999)

Regulations requiring the registration of water users were promulgated by the minister of DWS in terms of the provision made in Section 26 (1)(c), read together with Section 69 of the NWA, 1998. Section 26 (1)(c) of the Act allows for registration of all water uses, including existing lawful water use, in terms of Section 34(2). Section 29(1)(b)(vi) also states that in the case of a general authorisation, the responsible authority may attach a condition requiring the registration of such water use. The regulations (Art. 3) oblige any water user, as defined under Section 21 of the Act, to register such use with the responsible authority and effectively apply for a Registration Certificate as contemplated under Art. 7(1) of the Regulations.

6.2.3. Water use authorisation in relation to the class and Ecological Reserve

Irrespective of the type of water use application, either a new water use application or an application to declare a water use activity an existing lawful use, several aspects relating to the proposed water use will need to be considered by the Department to make a decision. Section 27 of the Act determines the considerations for issuing general authorisations and water use licenses:

" 27. (1) In issuing a general authorisation or licence a responsible authority must take into account all relevant factors, including

a) existing lawful water uses;
b) the need to redress the results of past racial and gender discrimination;
c) efficient and beneficial use of water in the public interest;
d) the socio economic impact
e) of the water use or uses if authorised; or
f) of the failure to authorise the water use or uses;
g) any catchment management strategy applicable to the relevant water resource;
h) the likely effect of the water use to be authorised on the water resource and other water users;
i) the class and the resource quality objectives of the water resource;
j) investments already made and to be made by the water user in respect of the water use in question;
k) the strategic importance of the water use to be authorised;
l) the quality of water in the water resource which may be required for the Reserve and for meeting international obligations; and
m) the probable duration of any undertaking for which a water use is to be authorised."

Thus, amongst the other requirements listed above, in issuing a water use authorisation the Department must consider the Reserve (Section 27(j)) or, in the absence of the Reserve, the Department must consider the preliminary determination of the Reserve. The Reserve is defined in the NWA as:

"(xviii)``Reserve'' means the quantity and quality of water required

(a) to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997), for people who are now or who will, in the reasonably near future, be

(i) relying upon;
(ii) taking water from; or
(iii) being supplied from, the relevant water resource; and

(b) to protect aquatic ecosystems to secure ecologically sustainable development and use of the relevant water resource; "

The preliminary determination of the Reserve and the responsible authority for implementing the Reserve are addressed under Sections 17 and 18 of the NWA as follows:

" 17. (1) Until a system for classifying water resources has been prescribed or a class of a water resource has been determined, the Minister

a) may, for all or part of a water resource; and
(b) must, before authorising the use of water under section 22(5), make a preliminary determination of the Reserve.
(2) A determination in terms of section 16(1) supersedes a preliminary determination. "

" 18. The Minister, the Director General, an organ of state and a water management institution, must give effect to the Reserve as determined in terms of this Part when exercising any power or performing any duty in terms of this Act. "

The applicant is not applying for any increased amount of water to be taken from the Existing Lawful Use (volume still to be confirmed). The application is only for the additional storage (approximately 60%) of the lawful allocated water. The additional storage of water for which the applicant is applying triggers the need to consider and comply with the provisions of the ecological Reserve. The water use associated with the water infrastructure that had been replaced might be an existing lawful use but the additional water storage must be licensed.

The Reserve determination provided in this report (if accepted by DWS) is based on a high-confidence study commissioned by the DWS in 2023 and should be taken into consideration when water use is considered for authorisation. In general, it can be stated that flow variability and volume are almost of equal importance in giving effect to the ecological Reserve and protecting river ecosystems.

The determination (scaling from the downstream point) of the Reserve is thus important as the result from such a determination informs the size and apportionment of the diversion weir/structure. To ensure compliance with the Reserve requirements, from a practical point of view, the general principle should be to have passive compliance mechanisms in place to minimise the need for control and police compliance.

7. AQUATIC IMPACT ASSESSMENT

7.1. Assessment of Proposed Activities

The aquatic ecosystem assessment in Section 5.3 determined the river to be moderately to largely modified within its instream habitat and largely modified within its riparian zone. The river is of moderate ecological importance and sensitivity with a target ecological condition of moderately modified. Removal of invasive alien vegetation along the riverbanks would assist in improving the ecological integrity of the river over the long term.

The potential aquatic ecosystem impacts of the proposed enlarged dam on the Modderas Stream are assessed below. The assessment is for the preferred alternative (enlarging existing 200 000 m^3 Modderas Dam to 310 000 m^3 and decommissioning of Dam D2 of 31 000 m^3).

Figure 17. Diagram of the proposed enlargement of the Modderas Dam

The potential aquatic ecosystem impacts associated with the proposed dam enlargement are:

- Modify flow in the watercourse downstream of the dam
- Disturbance and modification of aquatic habitat within the dam basin of the enlarged dam
- Short-term water quality impacts during the construction works
- Indirect impact on aquatic biota.

The Modderas Dam is an instream dam on the lower Modderas Tributary of the Klein Berg River. The tributary contributes less than 1% of the flow to the Klein Berg River. The enlargement dam would likely however be a greater than 1 MAR dam which implies it will likely not spill every year, only in wetter-than-average years. Environmental flow mitigation will be necessary to maintain the downstream watercourse. There is a tributary that joins the Modderas River downstream of the dam which contributes about 40% of the flow in the lower river. The dam to be decommissioned (Dam D2) receives water from a diversion from this tributary. There is thus potential to rather ensure the EWR contribution for the lower river is from the tributary. There is a small instream dam on this stream but it is on the adjacent property that may reduce the ability to utilise this watercourse to mitigate the flow impact and implementation of the recommended environmental flow requirement.

With regards to the proposed decommissioning of Dam D2, the dam has long been in existence. The embankment of the dam and the adjacent area comprise largely natural vegetation cover. The area immediately to the east of the dam also comprises a wider riparian and seep area associated with the

smaller tributary of the Modderas River. With the decommissioning of the dam, it is important the disturbance of these areas be avoided and that the dam basin simply be filled with soil that is free of alien vegetation seed.

The summary impact tables are included in Section 10 of this report.

Significance of impacts without mitigation: **Medium to low negative** impact because the flow in the watercourse is already impacted by the existing dam. Raising the dam wall would however increase the periods of no flow in the downstream watercourse.

Proposed mitigation:

With regards to the implementation of the EWR in the lower Modderas Tributary, it is recommended that the smaller tributary that drains past Dam D2 be utilised to meet the environmental flow requirement as recommended in Section 5.6 of this report. In the decommissioning of Dam D2, the dam should simply be left as is but no longer store water (i.e divert water to it and abstract from it). Only the natural rainfall and runoff into the dam should be retained in the dam and allowed to seep out. There is quite a bit of natural vegetation in and around the dam that it would be best to not disturb.

There should also be ongoing removal and control of invasive alien vegetation along the river corridors and in the wetland areas within the property, and in particular within the Modderas Tributary that is proposed to provide for the EWR downstream of Modderas Dam. Removal of invasive vegetation and revegetation of the aquatic habitats could be informed by an adopted Maintenance Management Plan (MMP) for the property.

The construction works at the dam should take place during the driest months of the year to prevent any flow and water quality (sedimentation) impacts and should be carried out in conjunction with an approved EMP that addresses aspects such as prevention and containment of any contaminated runoff and chemical spills from the construction site; provision of ablution facilities at the construction site that are at least 30m from the watercourse, and mitigation of excessive sedimentation arising from the works.

Disturbance of the natural vegetation cover upstream of the dam and immediately downstream of the dam within the watercourse should be avoided. Any disturbed areas that are located immediately outside of the dam basin should be rehabilitated by reshaping the area to resemble that of the surrounding natural landscape and where necessary, these areas should be planted with suitable local indigenous vegetation.

The disturbed areas at the dam should also be monitored for the growth of invasive alien vegetation and any recruitment of alien plants should be removed. Longer-term maintenance activities associated with the operation of the dam should follow an adopted MMP for the property.

No stocking of the dam with alien fish should be allowed. Any stocking of the dam would need to get prior approval from CapeNature.

Significance of impacts after mitigation: With the implementation of environmental water requirements in the Mooderas River, as well as the recommended rehabilitation of the aquatic habitats on the property, the significance of the impact could be reduced to being of **Low negative** significance.

7.2. Consideration of Alternatives

Various alternatives were investigated that including repair and enlargement of Dam D2, a new instream dam upstream on the Modderas River; and four options for raising of Modderas Dam wall with Option 1 an upstream wall raising being the preferred option from an economic perspective.

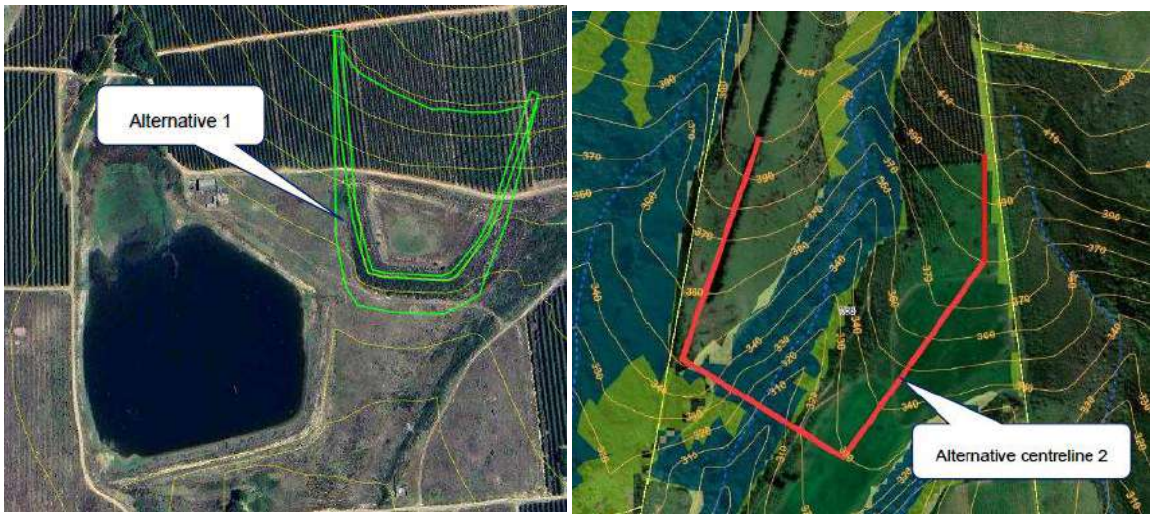

Figure 18. Location of the two dam location alternatives considered.

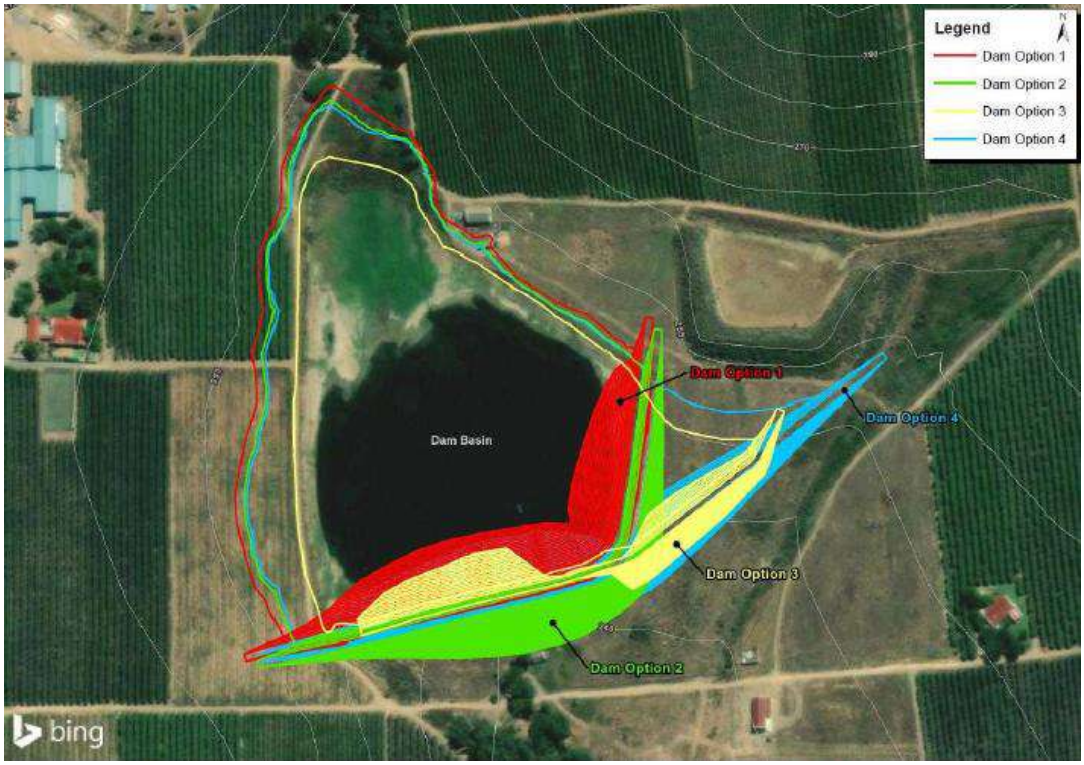

Figure 19. The various dam layout alternatives considered.

In terms of the various dam alternatives considered, the two dam locations would have a more significant impact than the proposed dam enlargement as they would be located in more sensitive wetland areas. Of the various dam alternatives, Option 1 (the preferred option) would also have the least impact as the enlarged wall is located further from the more intact tributary of the Modderas River.

The No-go Alternative would imply that no additional storage of water could be created within the property. This alternative would have the least potential impact but would not provide the opportunities to:

- Facilitate implementation of the Environmental Flow Release (the existing dam has no release requirement); and
- Rehabilitate the associated aquatic habitats.

If the recommendations relating to the above-mentioned opportunities are implemented, a low negative or even a positive impact could be expected.

7.3. CUMULATIVE IMPACTS

The Cumulative impact has the potential to be of low significance for the proposed enlargement of the existing dam if properly mitigated. With the recommended rehabilitation measures for Tributary and associated wetland areas, and implementation of the EWR recommendations a potential improvement in the aquatic ecosystem integrity of the tributary could be expected.

8. IMPACT ASSESSMENT TABLE

The Summary Impact Table for the proposed enlargement of Modderas Dam, decommissioning of Dam D2 and the No-Go Alternative is provided in Table 13.

Table 13. Summary Impact Table for the Proposed Project Activities and Alternatives

Project Activity or Alternative:	Enlarged Modderas Dam	Decommissioning of Dam D2	No-Go alternative
PLANNING, DESIGN AND DEVELOPMENT PHASE			
Potential impact and risk:	Modification of aquatic habitat at dam site; water quality impacts as well as potential for some flow modification		No construction phase
Nature of impact:	Negative	Negative	
Severity of impact:	Medium	Low	
Extent of impact:	Local	Site	
Duration of impact:	Long term	Short term	
Consequence of impact	Slightly modified aquatic habitat at and downstream of the dam	Disturbance of habitats at dam	
Probability of occurrence:	Highly probable	Probable	
Degree impact may cause irreplaceable loss of resources:	Medium	None	
Degree impact can be reversed:	Partially reversible	Reversible	
Indirect impacts:	Water quality	Water quality	
Cumulative impact prior to mitigation:	Medium	Low	
Significance rating of impact before mitigation	Medium	Low	
Degree impact can be avoided:	Medium to Low	High	
Degree impact can be managed:	High to Medium	High	
Degree impact can be mitigated:	High	High	
Proposed mitigation:	Provided in previous section		
Residual impacts:	Localised modification of aquatic habitat		
Cumulative impact post mitigation:	Medium to Low	Low	
Significance rating of impact after mitigation	Medium to Low	Low	

Project Activity or Alternative:	Enlarged Modderas Dam	Decommissioning of Dam D2	No-Go alternative
OPERATIONAL PHASE			
Potential impact and risk:	Ongoing disturbance of aquatic habitat for operation/maintenance activities; flow impact, increased potential for alien vegetation growth and erosion	Possible alien plant invasion in disturbed dam basin	Ongoing disturbance of aquatic habitat for operation/maintenance activities
Nature of impact:	Negative	Negative	Negative
Severity of impact:	Low	Low	Low
Extent of impact:	Local	Site	Site
Duration of impact:	Long term	Short term	Short term

Consequence of impact	Slightly modified aquatic habitat at and downstream of the enlarged dam	None	Some habitat modification and disturbance at original dam
Probability of occurrence:	Probable	Unlikely	Probable
Degree impact may cause irreplaceable loss of resources:	Marginal loss	No loss	Marginal loss
Degree impact can be reversed:	Partially reversible	Reversible	Partially Reversible
Indirect impacts:	Alien vegetation growth		
Cumulative impact prior to mitigation:	Medium to Low	Low	Medium to Low
Significance rating of impact before mitigation	Medium to Low	Low	Medium to Low
Degree impact can be avoided:	High to Medium	High	Medium
Degree impact can be managed:	High	High	High
Degree impact can be mitigated:	High	High	Medium
Proposed mitigation:	Provided in previous section		
Residual impacts:	Modification of aquatic habitat related to operation of dam		
Cumulative impact post mitigation:	Low	Low	Low
Significance rating of impact after mitigation	Low	Very Low	Low

9. RISK ASSESSMENT

A risk assessment was carried out for the activity undertaken. The full risk assessment matrix can be seen in Appendix C. The risk rating is considered to be Moderate to Low. A water use application will be submitted for the associated Section 21 c&i water use as well as for the storage of water in the dam.

Table 14. Risk assessments for the activity under consideration

PROJECT:	**ENLARGEMENT OF MODDERAS DAM N PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH**	
Name of assessor:	Toni Belcher	
Date of assessment:	25/05/2025	

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities (version 2.0): SUMMARY

[ASSUMING THAT ALL PROPOSED IMPACT CONTROL MEASURES ARE EFFECTIVELY IMPLEMENTED]

Phase	Activity	Impact	Risk Rating
CONSTRUCTION	Enlargement of Modderas Dam with the proposed upstream enlargement	Habitat modification and disturbance during construction	M
		Water quality impacts as a result of construction activities	L
	Decommissioning of Dam D2	Habitat modification and disturbance during construction	L
		Water quality impacts as a result of construction activities	L
	Construction of pipeline	Habitat modification and disturbance during construction	L
		Water quality impacts as a result of construction activities	L
OPERATIONAL	Maintenance of water supply scheme	Habitat disturbance during maintenance	L
		Water quality impacts as a result of maintenance activities	L
	Operation of water supply scheme	Habitat modification due to changes in flow	L
		Water quality impacts due to changes in flow	L
		Flow modification due to increased abstraction and storage	L

10. CONCLUSIONS AND RECOMMENDATIONS

Aquatic features on the property comprise a perennial stream, the Modderas River, which is a tributary of the Klein Berg River in the larger Berg River System. The stream is joined by another stream before its confluence with the Roodezand River. Seep wetlands are mapped as feeding the streams in their upper reaches.

The property lies downslope of the Winterhoek Mountain Catchment Area, a formally protected area. The Welbedacht Nature Reserve is also located about 300m to the east of the dam. Downstream of this, the Modderas River has been mapped as a terrestrial CBA. The study area is not within a FEPA Sub-catchment. The seep wetlands mentioned above are however mapped as natural FEPA Wetlands. These wetlands are also mapped within the National Wetland Map version 5.

The instream habitat integrity of the Modderas River is considered to be moderately modified, while the riparian habitat has been moderately to largely modified. The river is considered of moderate

ecological importance and sensitivity. The recommended ecological condition of the Modderas River is that it is maintained within the ecological category of C (moderately modified).

The impact assessment is for the preferred alternative (enlarging existing 200 000 m^3 Modderas Dam to 310 000 m^3 and decommissioning of Dam D2 of 31 000 m^3). The potential aquatic ecosystem impacts associated with the proposed dam enlargement are:

- Modify flow in the watercourse downstream of the dam
- Disturbance and modification of aquatic habitat within the dam basin of the enlarged dam
- Short-term water quality impacts during the construction works
- Indirect impact on aquatic biota.

The Modderas Dam is an instream dam on the lower Modderas Tributary of the Klein Berg River. The tributary contributes less than 1% of the flow to the Klein Berg River. The enlargement dam would likely however be a greater than 1 MAR dam which implies it will likely not spill every year, only in wetter-than-average years. Environmental flow mitigation will be necessary to maintain the downstream watercourse. There is a tributary that joins the Modderas River downstream of the dam which contributes about 40% of the flow in the lower river. The dam to be decommissioned (Dam D2) receives water from a diversion from this tributary. There is thus potential to rather ensure the EWR contribution for the lower river is from the tributary. There is a small instream dam on this stream but it is on the adjacent property that may reduce the ability to utilise this watercourse to mitigate the flow impact and implementation of the recommended environmental flow requirement.

With regards to the proposed decommissioning of Dam D2, the dam has long been in existence. The embankment of the dam and the adjacent area comprise largely natural vegetation cover. The area immediately to the east of the dam also comprises a wider riparian and seep area associated with the smaller tributary of the Modderas River.

The following mitigation measures are recommended:

- The area immediately to the east of Dam D2 which is to be decommissioned comprises a wider riparian and seep area associated with the smaller tributary of the Modderas River. With decommissioning of the dam, it is important the disturbance of these areas be avoided and that the dam basin simply be filled with soil that is free of alien vegetation seed.

- With regards to the implementation of the EWR in the lower Modderas Tributary, it is recommended that the smaller tributary that drains past Dam D2 be utilised to meet the environmental flow requirement as recommended in Section 5.6 of this report. In the decommissioning of Dam D2, the dam should simply be left as is but no longer store water (i.e divert water to it and abstract from it). Only the natural rainfall and runoff into the dam should be retained in the dam and allowed to seep out. There is quite a bit of natural vegetation in and around the dam that it would be best to not disturb.

- A programme should be put in place for the ongoing removal and control of invasive alien vegetation along the river corridors and in the wetland areas within the property, and in particular within the Modderas Tributary that is proposed to provide for the EWR downstream of Modderas Dam. Removal of invasive vegetation and revegetation of the aquatic habitats could be informed by an adopted Maintenance Management Plan (MMP) for the property.

- The construction works at the dam should take place during the driest months of the year to prevent any flow and water quality (sedimentation) impacts and should be carried out in conjunction with an approved EMP that addresses aspects such as prevention and containment of any contaminated runoff and chemical spills from the construction site; provision of ablution facilities at the construction site that are at least 30m from the watercourse, and mitigation of excessive sedimentation arising from the works.

- Disturbance of the natural vegetation cover upstream of the dam and immediately downstream of the dam within the watercourse should be avoided. Any disturbed areas that are located immediately outside of the dam basin should be rehabilitated by reshaping the area to resemble that of the surrounding natural landscape and where necessary, these areas should be planted with suitable local indigenous vegetation.

- The disturbed areas at the dam should also be monitored for the growth of invasive alien vegetation and any recruitment of alien plants should be removed. Longer-term maintenance activities associated with the operation of the dam should follow an adopted MMP for the property.

- No stocking of the dam with alien fish should be allowed. Any stocking of the dam would need to get prior approval from CapeNature.

- Indigenous vegetation observed along the watercourse that is suitable for revegetation of cleared areas comprises *Psoralea pinnata, Searsia angustifolia, Morella serrata, Olea europaea subsp. africana, Podocarpus elongatus, Melianthus major, Pteridium aquilinum, Salvia chamelaeagnea, Elegia capensis, Zantedeschia aethiopica, Carpha glomerata, Juncus capensis, Ficinia nodosa, Cyprus textilis* and *Isolepis prolifera*.

Given the above findings, there is no reason why the proposed dam enlargement should not be approved. The risk rating is considered to be Moderate. A water use application will be submitted for the associated water use as well as for the storage of water in the dam.

11. REFERENCES

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APPENDIX A: FRESHWATER IMPACT ASSESSMENT METHODOLOGY

These criteria are drawn from the EIA Regulations published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) and the latest basic assessment report template provided by the Department of Environmental Affairs and Development Planning (DEA&DP) and the DEA&DP Guidelines for involving Biodiversity Specialists in EIA Processes, 2005. These criteria include:

Nature of the impact: This is an appraisal of the type of effect (positive or negative) the construction, operation and maintenance of development would have on the affected environment. This description should include what is to be affected.

Extent of the impact: Extent defines the physical extent or spatial scale of the impact. The impact could:

- **Site-specific:** limited to the site.
- **Local:** limited to the site and the immediate surrounding area (1-10km)
- **Regional:** covers an area that includes an entire geographic region or extends beyond one region to another.
- **National:** across national boundaries and may have national implications.

Duration of the impact: The specialist should indicate whether the lifespan of the impact would be:

- **Short term:** 0-5 years.
- **Medium-term:** 5-15 years.
- **Long term:** beyond the operational phase, but not permanently).
- **Permanent:** where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.

Consequence of Impact: Indicate how the activity will affect the environment.

Probability of occurrence: Probability describes the likelihood of the impact occurring. The likelihood can be described as:

- **Improbable/unlikely:** low likelihood of the impact occurring.
- **Probable:** distinct possibility the impact will occur.
- **Highly probable:** most likely that the impact will occur.
- **Definite:** impact will occur regardless of any prevention measures.

Irreplaceable loss of resources: Describes the degree to which resources will be irreplaceably lost due to the proposed activity. It can be **no loss of resources**, **marginal loss**, **significant loss** or **complete loss of resources**.

Reversibility: This refers to the degree to which an impact can be reversed.

- **Fully reversible:** where the impact can be completely reversed.
- **Partly reversible:** where the impact can be partially reversed.
- **Irreversible:** where the impact is permanent.

Indirect impacts: Indirect impacts are secondary impacts and usually occur at a different place or time. Specialists will need to elaborate on any indirect or secondary impacts of proposed activities. If there are no indirect impacts specialist will need to briefly explain so.

Cumulative impact: An effect which in itself may not be significant but may become significant if added to other existing or potential impacts that may result from activities associated with the proposed development. Cumulative impacts before and post-mitigation must be assessed. The cumulative effect can be:

- **Negligible:** the impact would result in negligible to no cumulative effect.
- **Low:** the impact would result in insignificant cumulative effects.
- **Medium:** the impact would result in minor cumulative effects.
- **High:** the impact would result in significant cumulative effects.

Significance rating of impacts before and after mitigation: Based on a synthesis of the information contained in the above-described procedure, the significance of the potential impacts must be assessed using the following significance criteria:

- **No impact.**
- **Low negative:** where it would have negligible effects and would require little or no mitigation.
- **Low positive:** the impact will have minor positive effects.
- **Medium negative:** the impact will have moderate negative effects and will require moderate mitigation.
- **Medium positive:** the impact will have moderate positive effects.
- **High negative:** the impact will have significant effects and will require significant mitigation measures to achieve an accepted level of impact.
- **High positive:** the impact will have significant positive effects.
- **Very high negative:** the impact will have highly significant effects and are unlikely to be able to be mitigated adequately.
- **High positive:** the impact will have highly significant positive effects.

Degree to which impact can be avoided: This indicates the degree to which an impact can be avoided. The degree of avoidance can either be **high** (impact is completely avoidable), **moderate** (impact is avoidable with moderate mitigation), **low** (the impact is difficult to avoid and will require significant mitigation measures) or **unavoidable** (the impact is cannot be avoided even with significant mitigation measures). Can the impact be avoided and if so, how can it be avoided (example: demarcation of no-go areas).

Degree to which impact can be managed: This indicates the degree to which an impact can be managed. The degree of management can either be **high** (impact is completely manageable), **moderate** (impact is manageable with moderate mitigation), **low** (the impact is difficult to manage and will require significant mitigation measures) or **unmanageable** (the impact is cannot be managed even with significant mitigation measures). How can the impact be managed over time (example: clearance of alien vegetation).

Degree to which an impact can be mitigated: This indicates the degree to which an impact can be reduced. The degree of mitigation can either be **high** (the impact can be **fully** mitigated), **moderate** (the impact can be **partly mitigated**) or **not mitigated at all**. Residual impacts

APPENDIX B: INDIGENOUS VEGETATION RECOMMENDED FOR REVEGETATION

Species	Common name/s	Zone	
Fuirena hirsuta	Sedge	Lower wet bank	
Fincinia nodosa	Knob club rush	Lower wet bank	
Cyprus textilis	Mat sedge	Lower wet bank	
Isolepis marginata	Course club-rush	Lower wet bank	
Isolepis prolifera	Vleigras	Lower wet bank and into aquatic	

Juncus lomatophyllus	Aalwynbiesie	Lower wet bank and into aquatic	
Eleocharis dracaena	Finger sedge	Wet bank	
Juncus capensis	rush	Wet bank	
Cliffortia strobilifera	Bog Rice Bush	Upper wet bank	

Psoralea pinnata	Fountain bush	Wet bank and lower dry bank	
Pteridium aquilinum	Bracken fern	Wet bank and lower dry bank	
Restio paniculata	Cape reed	Lower wet bank	
Wachendorfia thyrsiflora	Blood root	Lower wet bank	

Carpha glomerata		Lower wet bank	
Zantedeschia aethiopica	Arum lily	Wet bank and lower dry bank	
Podocarpus elongatus	Breede River yellowwood	Tree/shrub – riparian zone	
Olea europaea ssp. africana	Wild olive	Tree/shrub– riparian zone	

Brabejum stellatifolium	Wild almond	Lower dry bank and upper wet bank	
Kiggelaria africana	Wild peach	Tree/shrub– riparian zone	
Searsia angustifolia	Willow karee	Tree/shrub– riparian zone	
Searsia undulata	Kuni-bush	Tree/shrub– riparian zone	

APPENDIX C: RISK ASSESSMENT

PROJECT: ENLARGEMENT OF MODDERAS DAM N PORTION 1 OF THE ROODE ZANDS KLOOF FARM NO. 66, TULBAGH

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.0

Name of Assessor: Toni Belcher **Signature:** 

SACNASP Registration Number: 5681 **Date:** 25/05/2025

Risk to be scored for all relevant phases of the project (**factoring in specified control measures**). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
						Abiotic Habitat (Drivers)			Biota (Responses)											
			Name/s	PES	Ecological Importance	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Enlargement of Modderas Dam with the proposed upstream enlargement	Habitat modification and disturbance during construction	Modderas River	C/D	Moderate	1	2	3	3	3	**6**	2	4	**12**	**3**	**36**	100%	**36**	**M**	High
		Water quality and flow impacts as a result of construction activities	Modderas River	C/D	Moderate	2	3	2	2	2	**6**	2	4	**12**	**3**	**36**	80%	**28.8**	**L**	High
CONSTRUCTION	Decommissioning of Dam D2	Habitat modification and disturbance during construction	Modderas River	C/D	Moderate	1	2	0	3	3	**6**	1	2	**9**	**3**	**27**	80%	**21.6**	**L**	High
		Water quality impacts as a result of construction activities	Modderas River	C/D	Moderate	1	2	0	2	2	**4**	1	1	**6**	**3**	**18**	80%	**14.4**	**L**	High
CONSTRUCTION	Construction of pipeline	Habitat modification and disturbance during construction	Modderas River	C/D	Moderate	1	1	1	2	1	**4**	1	1	**6**	**3**	**18**	60%	**10.8**	**L**	High
		Water quality impacts as a result of construction activities	Modderas River	C/D	Moderate	1	2	1	1	1	**4**	1	1	**6**	**3**	**18**	60%	**10.8**	**L**	High
OPERATIONAL	Maintenance of water supply scheme	Habitat disturbance during maintenance	Modderas River	C/D	Moderate	1	2	1	2	2	**4**	1	1	**6**	**3**	**18**	40%	**7.2**	**L**	High
		Water quality impacts as a result of maintenance activities	Modderas River	C/D	Moderate	1	3	1	1	1	**6**	1	1	**8**	**3**	**24**	40%	**9.6**	**L**	High
	Operation of water supply scheme	Habitat modification due to operation of scheme	Modderas River	C/D	Moderate	2	2	2	2	2	**4**	2	4	**10**	**3**	**30**	40%	**12**	**L**	High
		Water quality impacts due to operation of scheme	Modderas River	C/D	Moderate	2	2	1	1	1	**4**	1	1	**6**	**3**	**18**	40%	**7.2**	**L**	High
		Flow modification associated with increased storage	Modderas River	C/D	Moderate	3	2	2	3	2	**6**	2	4	**12**	**3**	**36**	40%	**14.4**	**L**	High