# 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*

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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.

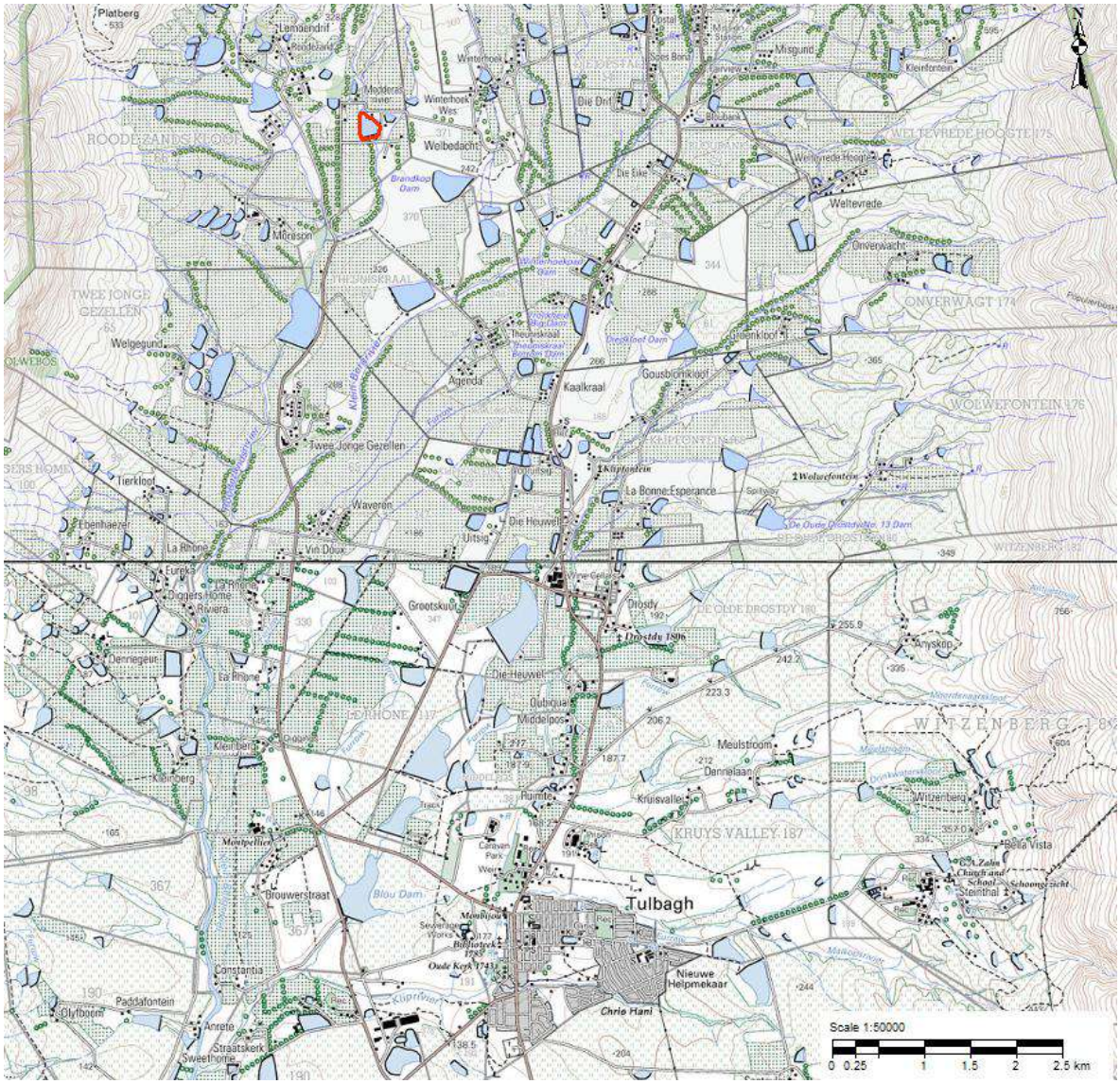


*Figure 1. Locality Map for the Modderas Dam (red polygon) near Tulbagh*

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<br>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.

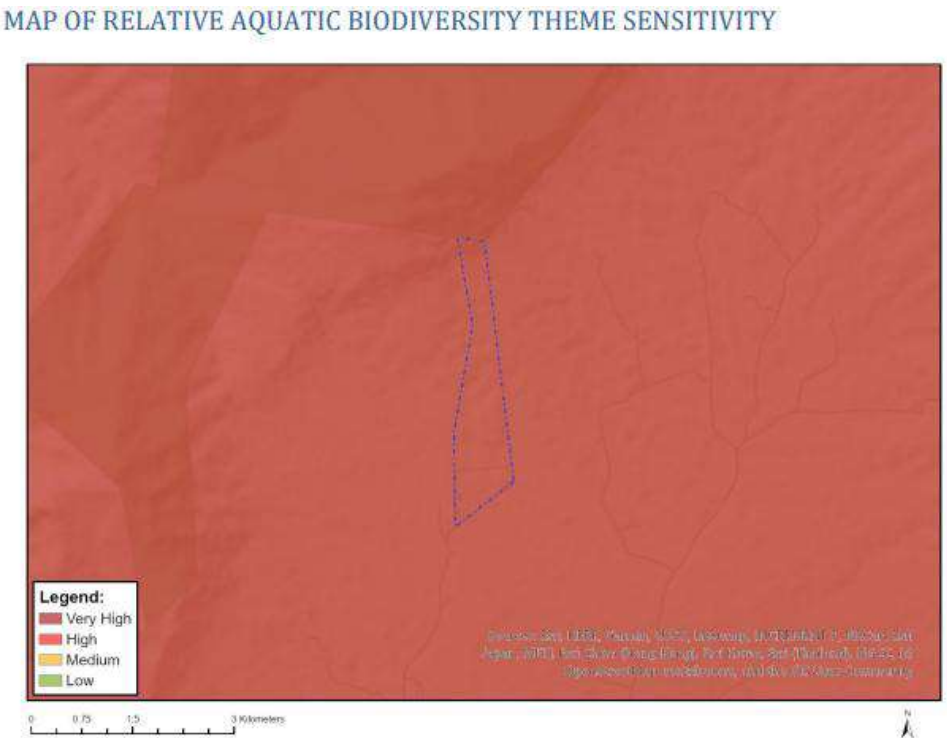


*Figure 2. DFFE Screening Map for the area in terms of Aquatic Biodiversity Combined Sensitivity*

| 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.

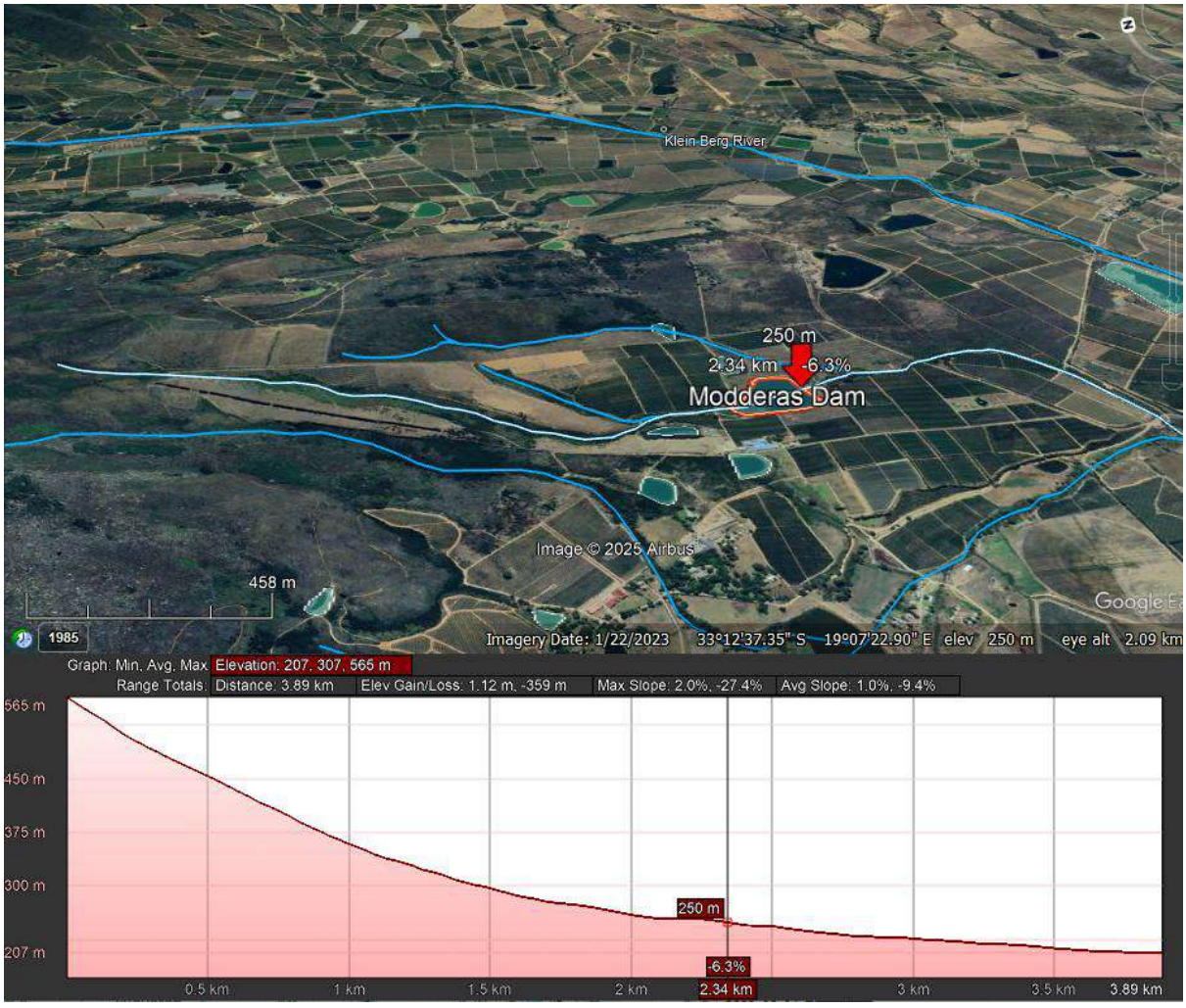


***Figure 4. Elevation profile from Google Earth, showing the slope of the Modderas River with the red arrow on the image corresponding to the vertical black line on the graph. Note the orientation of the Google Earth image has been rotated by about 270 degrees.***

## 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.

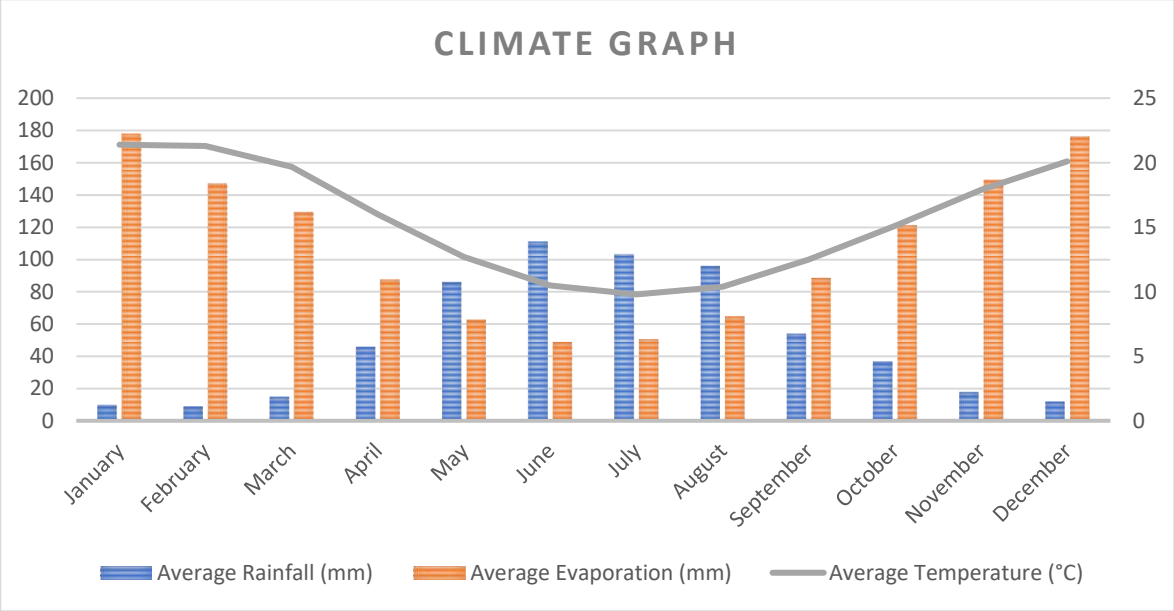


*Figure 5. Average monthly rainfall, temperature and evaporation for the area (SA Atlas of Climatology and Agrohydrology - R.E. Schulze, 2009)*

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.

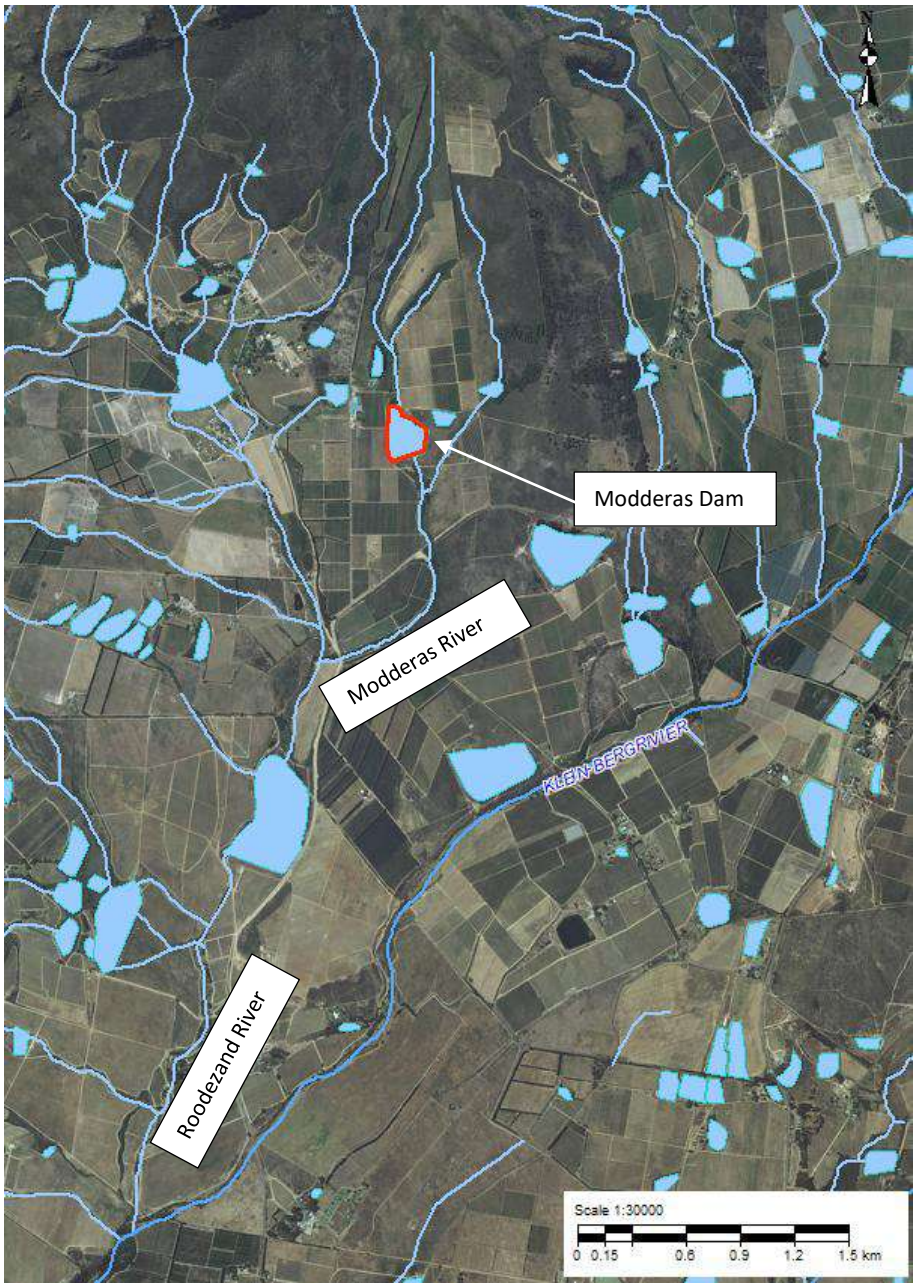


*Figure 6. Orthophotograph taken in 2016 with the river system associated with Modderas Dam.*

## 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)*

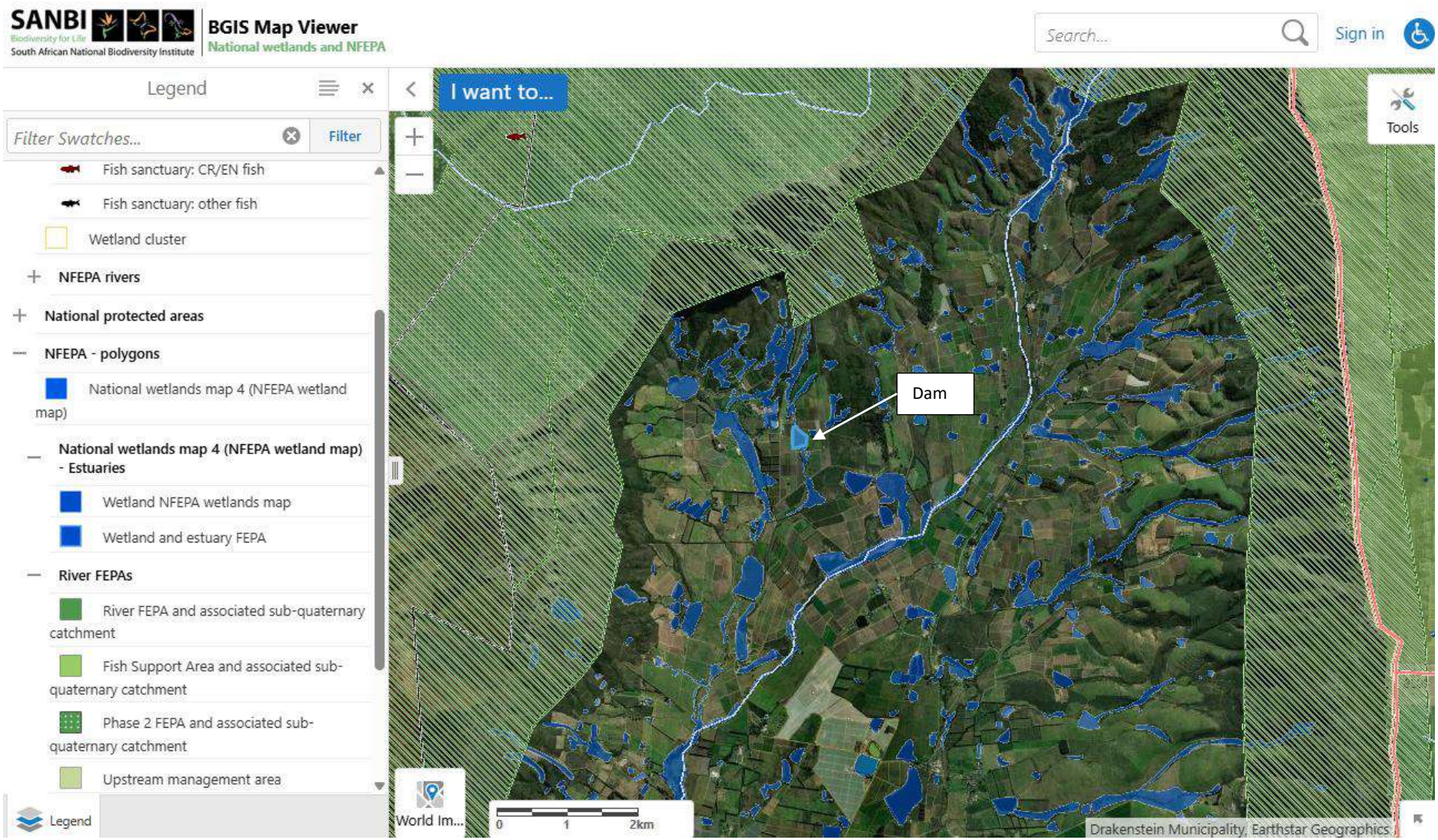


*Figure 8. National Freshwater Ecosystem Priority Areas mapping for the dam (blue polygon) and surrounding area (SANBI Biodiversity GIS, 2025)*

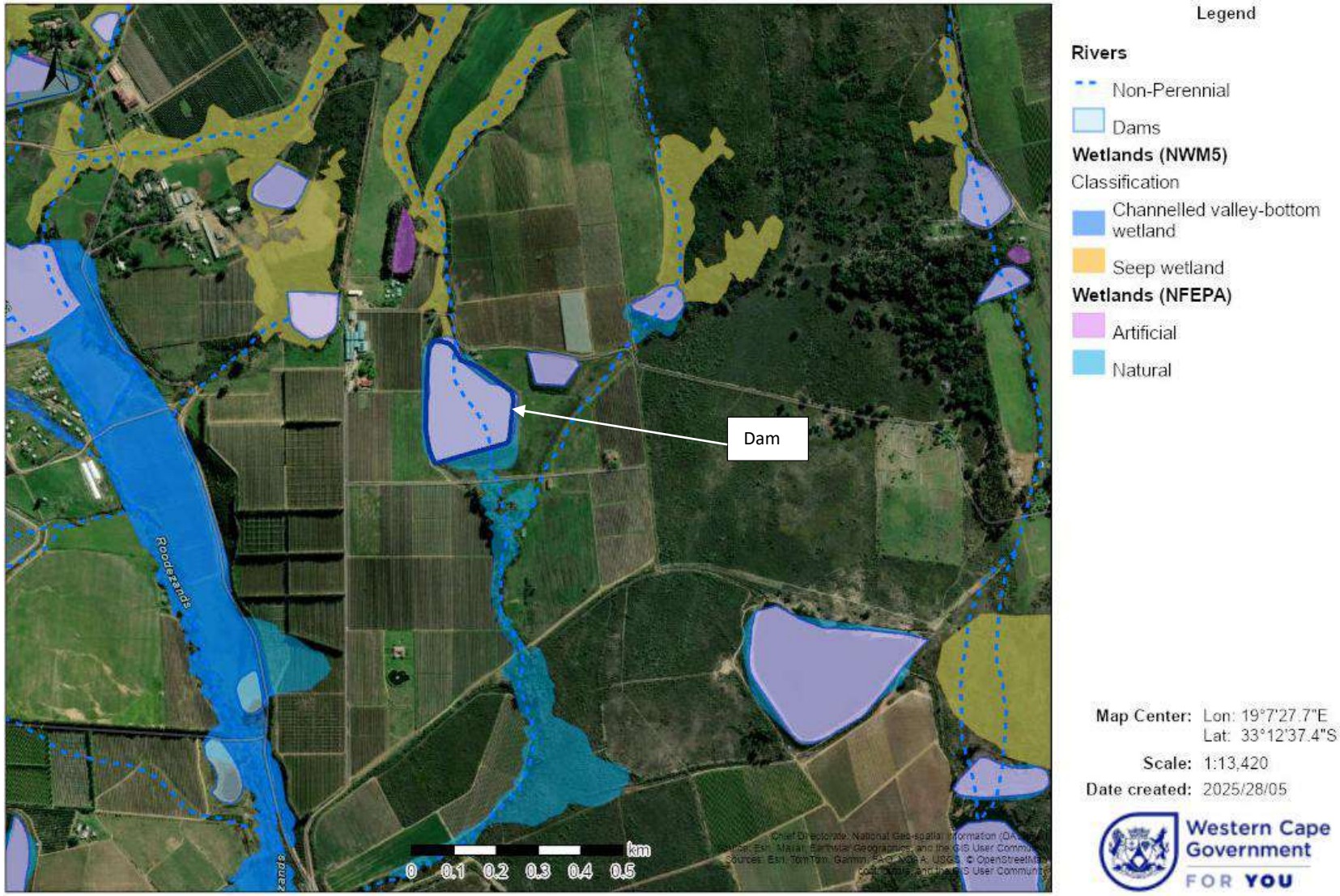


*Figure 9. FEPA Wetlands and National Wetland Map for the dam and surrounding area (CapeFarmMapper, 2025)*)

## 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)*

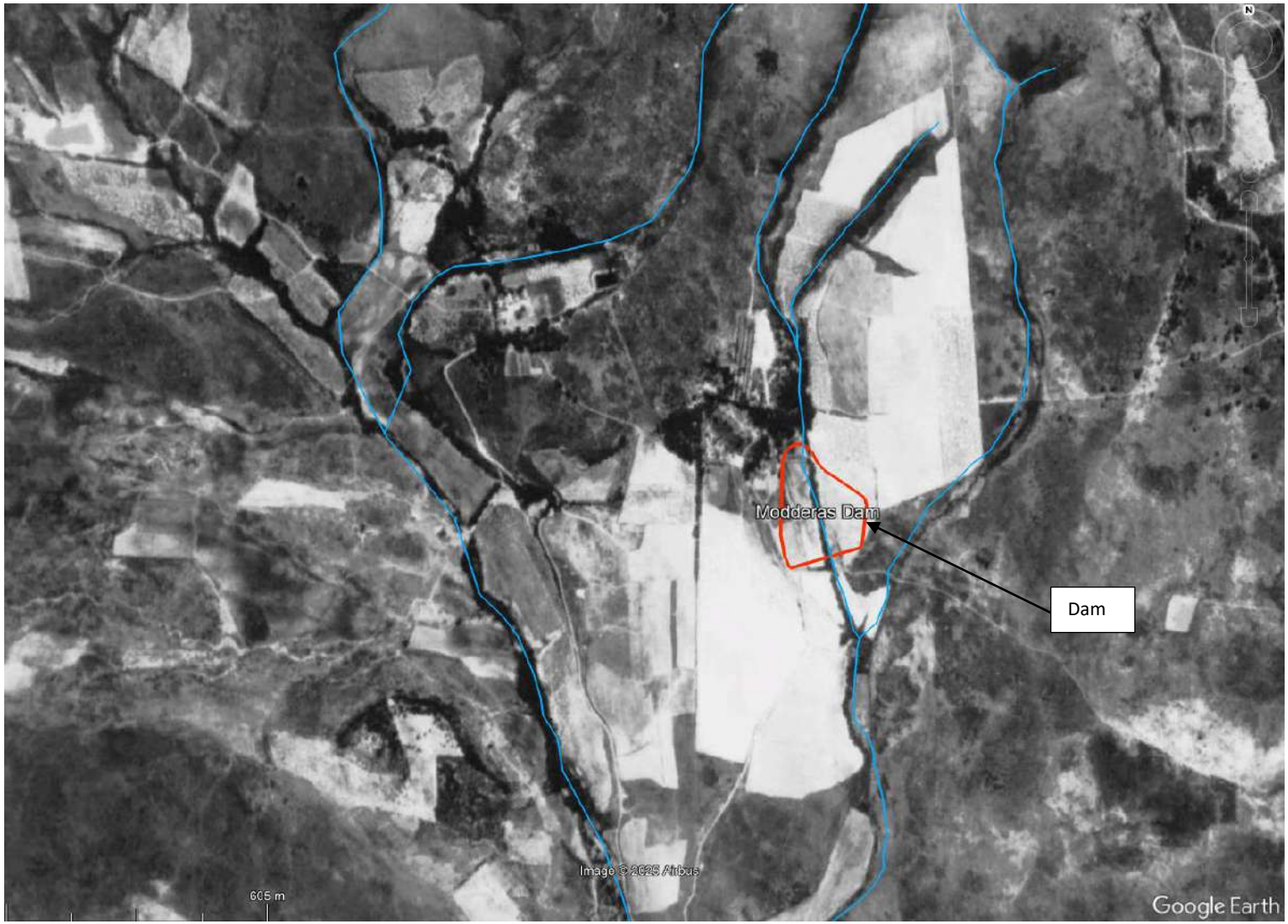


*Figure 12. Aerial image taken in 1948 and overlaid in Google Earth with the location of the dam and watercourses shown*

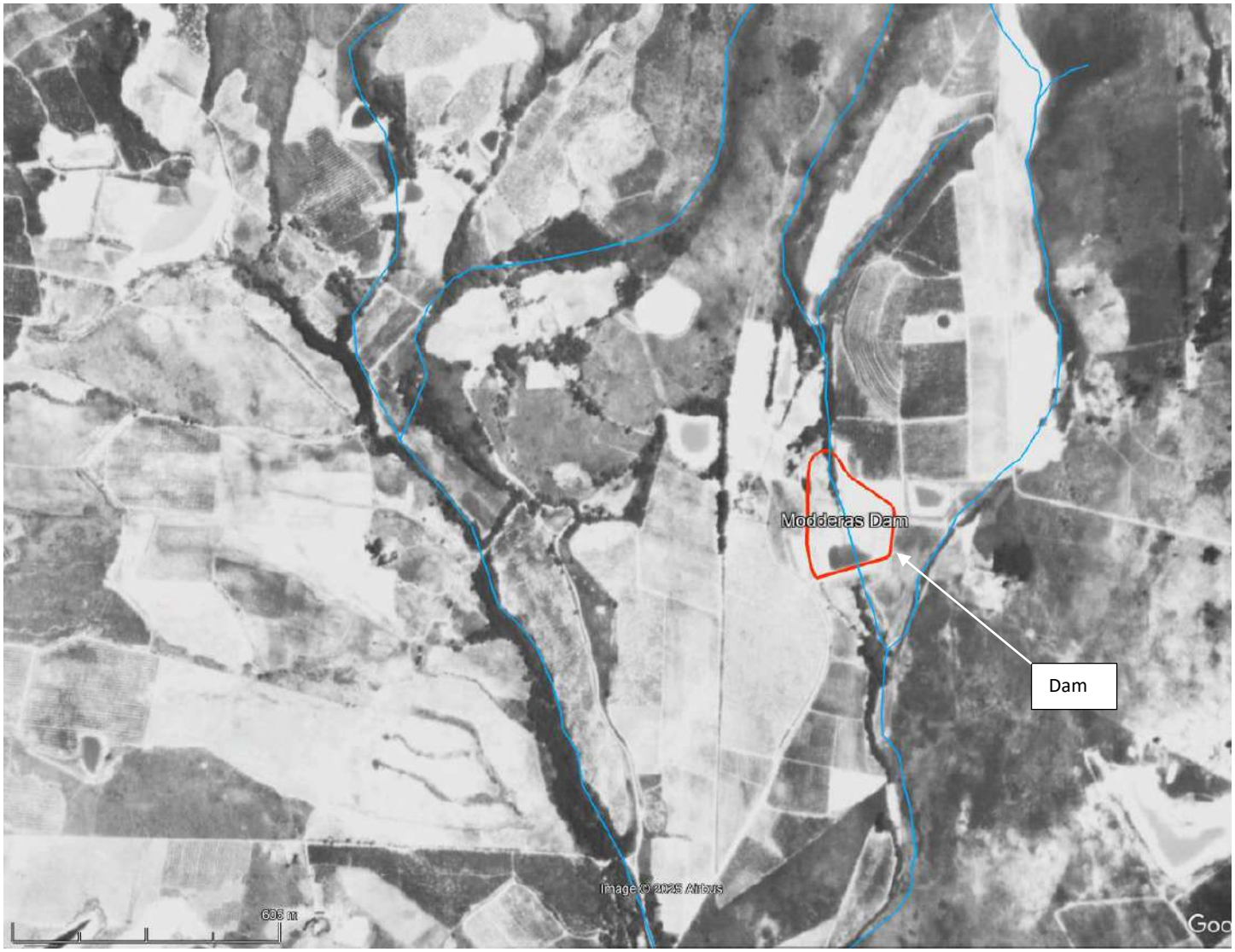


*Figure 13. Aerial image taken in 1972 and overlaid in Google Earth with the location of the dam and watercourses shown*

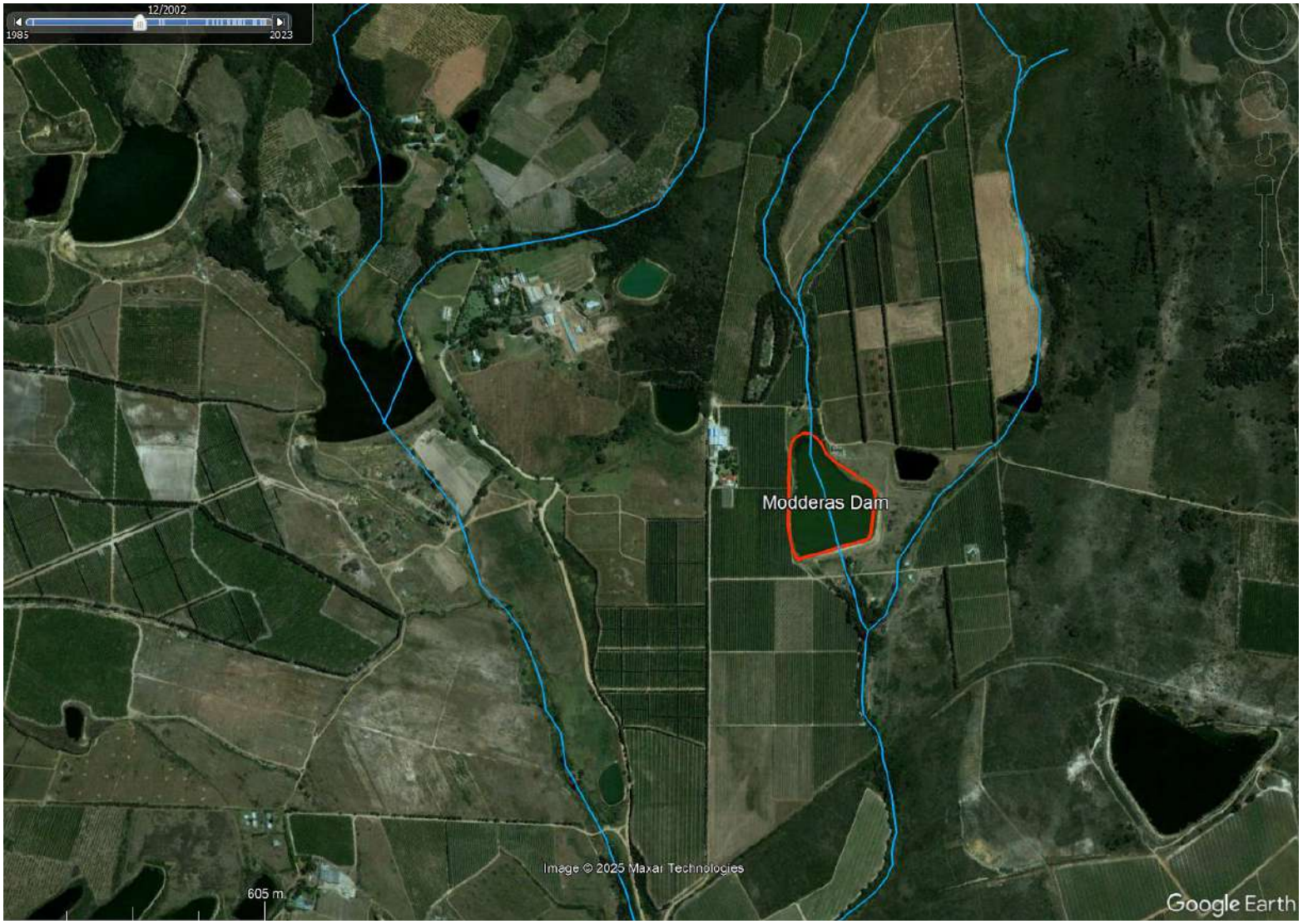


*Figure 14. Google Earth from 2002 shown with the location of the dam and watercourses shown*


*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;<br>Open Hills; Lowlands; Mountains; Moderate to High Relief;<br>**Closed Hills; Mountains; Moderate and High Relief** |
| Vegetation types | Patches Afromontane Forest;<br>Spekboom Succulent Thicket; **Little Succulent Karoo;**<br>**Grassy Fynbos; Mountain Fynbos;** South and South West Coast Renosterveld;<br>Central Mountain Renosterveld;<br>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<br>High flows | Maintenance low flows<br>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<br>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<br>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).

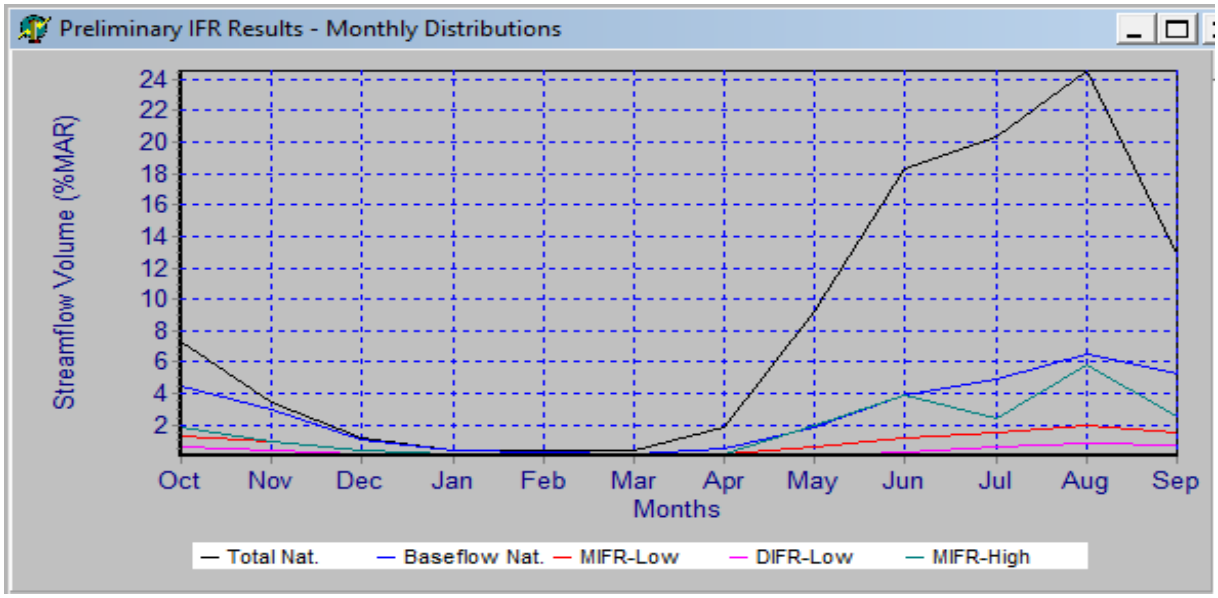


***Figure 16: Monthly Distribution curve for the area, where: black line is the natural flow distribution; the blue line is the natural baseflow (mostly groundwater contribution); MIFR – Low is the Maintenance Low Flow Environmental requirement (red line on graph); DIFR – Low is the Drought Low Flow 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.

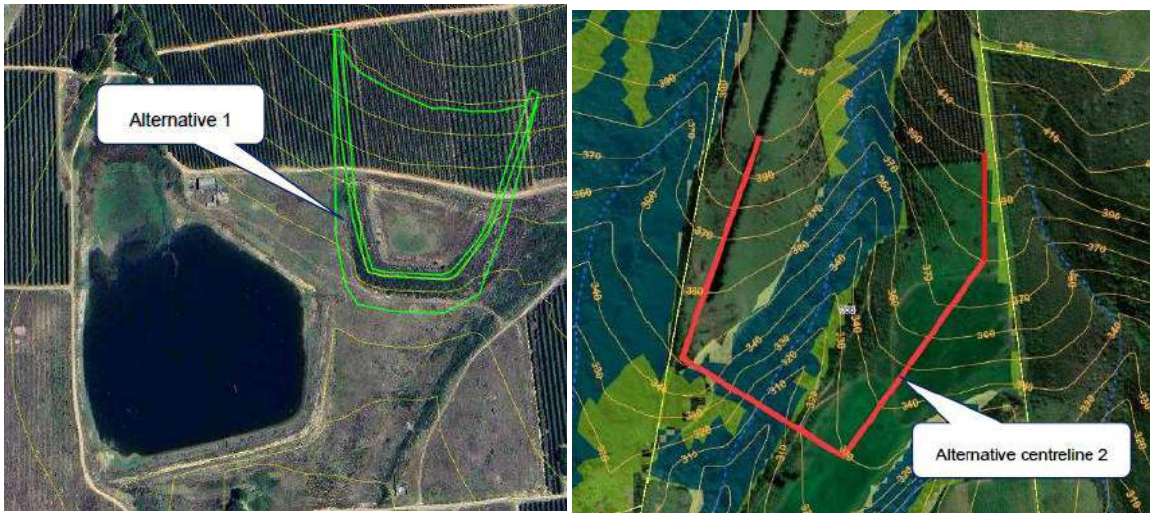


*Figure 18. Location of the two dam location alternatives considered.*

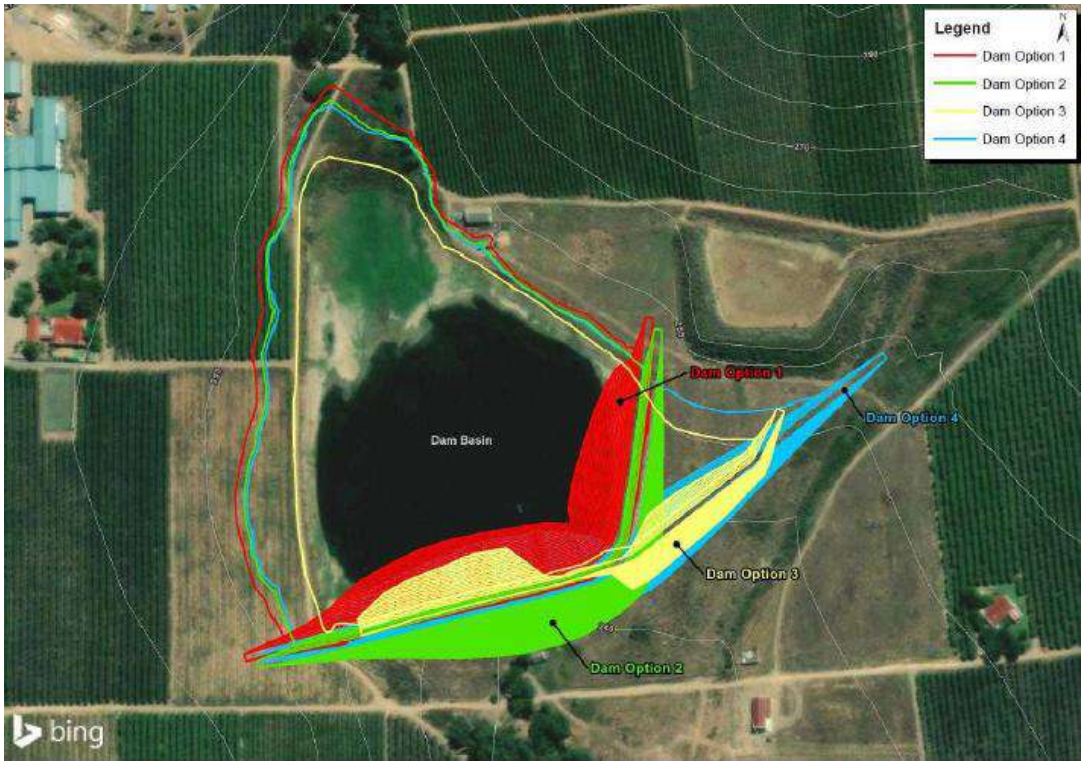


*Figure 19. The various dam layout alternatives considered.*

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 |