MAINTENANCE MANAGEMENT PLAN

for the Klip and Keurbooms Rivers, Swellendam, Western Cape Province

Final Report

December 2023





DEA&DP Ref No.: 16/3/3/6/3/E3/10/1540/23

Applicant:

Swellendam Conservancy,

on behalf of the individual riparian landowners within the project area

Request for the adoption of 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.

Request submitted to: Western Cap Department of Environmental Affairs and Development Planning

		(For official use only)
File Reference Number:		16/3/3/6/3/E3/10/1540/23
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PROJECT TITLE

Maintenance Management Plan for the Klip and Keurbooms Rivers, Western Cape Province.

Report Preparation and Document Management:

	Issue 1 (Draft Report)	Final Report
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Date:	October 2023	December 2023

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EXECUTIVE SUMMARY

Brief Project Description

This Maintenance Management Plan (MMP) was prepared for the landowners along the Klip and Keurbooms Rivers with funding from the Western Cape Department of Agriculture (DoA). BlueScience (Pty) Ltd and Cornerstone Environmental Consultants (Pty) Ltd have been appointed to prepare this MMP.

The study area is fringed by agricultural land. Infrastructure associated with the agricultural activities in this area requires maintenance from time to time. The type of infrastructure determines the type of maintenance activity which is required.

The infrastructure along the Klip and Keurbooms Rivers which would potentially require maintenance activities was identified by the freshwater ecology team [BlueScience (Pty) Ltd.], photographed, and their location recorded using a hand-held Global Positioning System (GPS).

Following the initial site identification and site confirmation by the freshwater ecology team, a final register of maintenance sites was compiled. A total of 56 infrastructure items were identified along the two rivers, the bulk of which are erosion protection structures, pumps and informal low-water crossings.

What is an MMP?

An MMP is a document that describes maintenance activities that need to take place within a riverine environment which have been preapproved by the authorities. This document specifically relates to Activities 19 and 27, as listed in the NEMA EIA Regulations Listing Notice 1 of 2014 (GN R. 327), as amended. In line with this MMP, infilling or removal of more than 10m^3 material within a watercourse, and/or the clearance of 1 ha or more of indigenous vegetation are allowed, only if the works are undertaken for maintenance purposes AND forms part of this MMP when approved by the DEA&DP.

What are maintenance activities?

Maintenance activities are activities performed to keep a structure or system functioning or in service on the same location, capacity and footprint. It is therefore activities that do not change the size of structures (thus "like for like" activities).

This MMP includes all infrastructure related to the Klip and Keurbooms Rivers, downslope of the Marloth Nature Reserve, to where the Klip River flows into the Breede River. The infrastructure includes all infrastructure associated with the sustained exercising of use of the resources in the catchments of the mainstream and tributaries.

In terms of aquatic ecosystems, this MMP includes all aquatic ecosystems directly and indirectly associated with the mainstreams in so far as it could have an influence on the existing utilisation, management and protection of the resources.

The five maintenance activity categories for this MMP are:

- Activity 1a: Clearing of alien vegetation;
- Activity 1b: Clearing of nuisance indigenous *Phragmites* reeds or *Typha* bulrushes;
- Activity 2a: Minor Repairs to infrastructure;
- Activity 2b: Major repairs to- or replacement of damaged formal (FLC / FB) river crossings
- Activity 3: Sediment movement at infrastructure;
- Activity 4: Sediment removal from the channel for flood conveyance/channelisation; and
- Activity 5: Sediment movement in the channel or on the banks for repairs to berms or banks.

Stakeholder Engagement Process

The stakeholder engagement process for this MMP was designed around the specific objectives of this MMP process and involved the necessary stakeholders to enable the preparation of a comprehensive MMP that will be acceptable to the relevant stakeholders.

A **Project Steering Committee (PSC)** was established in June 2022 and included representatives from various Organs of State and relevant Organizations. The first PSC meeting was held on 23 June 2023. During this

meeting, the MMP objectives and project work plan were presented and agreed on, *inter alia*. A second PSC meeting was convened on 10 November 2022.

A first meeting was also convened with riparian **landowners** along the Klip and keurbooms Rivers on 3 November 2023. The main aim of the first meeting was to inform landowners of the MMP project, its implications for them, to invite them to comment on the project, and to obtain their various issues and activities that need to be included in the MMP. Background Information Brochures were handed to the landowners during the meeting.

A meeting was convened with riparian landowners on 13 September 2023. The contents of the Draft MMP was presented and discussed during this meeting.

The Draft MMP will be made available for stakeholder review and input. Stakeholders will be notified of the availability of the Draft MMP *via* e-mail and will be given at least 30 days to comment on the Draft MMP. Electronic copies will be distributed to stakeholders *via* a SharePoint link, or in an alternative electronic format such as Compact Disk (CD), upon request.

The comments received during the comment period on the Draft MMP will be collated into a Comments and Responses Report, which will include responses from the MMP project team where relevant.

MMP Implementation

Each individual landowner / water user will be responsible for implementing the mitigation measures as are relevant to his/her specific activities in the river. The Swellendam Conservancy will be responsible for overseeing the monitoring of the maintenance and management activities undertaken by their water users in accordance with the MMP. Records of each maintenance activity should be kept by the landowner and submitted to the Water User Association, as per the steps provided below.

Steps to be followed by landowners when implementing this MMP:

STEP 1: Identify the maintenance and management activity required.

Answer the following questions:

Will the activity be performed to keep a structure or system functioning or in service on the same location, capacity and footprint? Will the activity therefore not change the size of structures (thus “like for like” activities)?

If ‘YES’: Proceed to Step 2 below.

If ‘NO’: Activity cannot be undertaken as part of this MMP process. Environmental Authorisation may be required before the activity may be commenced with.



STEP 2: Identify relevant maintenance activity and method statement.

Identify the maintenance activity and method statement that is relevant to your proposed activity (see Section 6 above for the method statements):

Activity 1a: Clearing of alien vegetation;

Activity 1b: Clearing of nuisance indigenous Phragmites reeds or Typha bulrushes;

Activity 2a: Minor repairs to infrastructure;

Activity 2b: Major repairs to- or replacement of damaged formal (FLC / FB) river crossings

Activity 3: Sediment movement at infrastructure;

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

Activity 5: Sediment movement in the channel or on the banks for repairs to berms or banks.

STEP 3: Before commencing with activity – Complete and submit **Annexure A10** to this MMP:

- At least seven days prior to commencing with an activity, complete Sections A to C of the Klip and Keurbooms River MMP Notification and Information Form.

- The form should be submitted with photographs taken before the maintenance activity is performed, and coordinates of the photograph locations. [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].

- One form must be submitted per maintenance activity per property.

- The declaration Form (included in **Annexure A10**) must be signed and submitted with each Notification and Information Form.

- Submit the completed form and supporting information to the Swellendam Conservancy MMP contact person (see contact details below).

- **Important**:

* Where Activities 4 and/or 5 will be triggered, the Swellendam Conservancy, with advice from its MMP oversight committee [comprising *inter alia* of officials from the Breede-Olifants Catchment Management Agency (BOCMA) and the DoA] shall review the form and confirm whether this activity can be undertaken as part of the MMP. Input from an aquatic ecologist, rehabilitation specialist or botanical specialist should be sought for larger-scale projects if deemed to be required by the MMP oversight committee.

* A MMP oversight committee site clarification meeting should be undertaken before maintenance activities are undertaken at public road infrastructure. This meeting should be undertaken after submission of the "before" form.

- The contact person will then forward the forms to the BOCMA, the DoA, and other relevant project committee members, as standard practice.

STEP 4: Undertake the maintenance activity as described in the relevant method statement. Take photos of the activity being undertaken.

STEP 5: After completing the activity – Complete **Annexure A11** to this MMP:

After completion of a maintenance activity, within seven days after undertaking the activity:

- Complete Sections D to F of the information form.

- Submit photographs taken from the same position and direction as before the activity commenced, after the maintenance activity is performed.

- Any changes that were necessary to the planned activity, problems encountered or deviations from the recommended method statement must be described and motivated.

- Submit the completed form and supporting information to the Swellendam Conservancy MMP contact person (see contact details below).

- The contact person will then forward the forms to the BOCMA, the DoA, and other relevant project committee members, as standard practice.

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A2: Meeting Minutes:

- A2.1: PSC Meetings
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A3: Background Information Brochure (Afrikaans and English)

A4: E-mails issued to PSC (including Organs of State) requesting comment on the Draft MMP

A5: E-mails issued to landowners requesting comment on the Draft MMP

A6: Written comments received on the Draft MMP

A7: Comments and Responses Report

A8: Completed and signed landowner sign-up forms

A9: Signed declarations by the applicant, the EAP, and the specialist (Freshwater Ecologist)

A10: Pre-commencement form: Klip and Keurbooms Rivers MMP Notification and Information Form – Complete and submit sections A to C at least seven days before commencing with activity

A11: Post-activity form: Klip and Keurbooms Rivers MMP Notification and Information Form – Complete and submit sections D to F at least seven days after commencing with activity

Annexure B: Locality Maps, Infrastructure Lists, and Photos

B1: Catalogue of infrastructure identified along the Klip and Keurbooms Rivers, and photograph register of infrastructure maintenance sites

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Annexure C: Specialist Reports

C1: Freshwater Ecology Report: Klip and Keurbooms Rivers, by BlueScience (Pty) Ltd., August 2023

Acronyms and Abbreviations

BA	Basic Assessment
BGCMA	Breede-Gouritz Catchment Management Agency
BGIS	Biodiversity Geographic Information Systems
Bm	Berm
BOCMA	Breede-Olifants Catchment Management Agency (previously BGCMA)
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), as
CBA	Critical Biodiversity Areas
Cornerstone	Cornerstone Environmental Consultants (Pty) Ltd
CSIR	Council for Scientific and Industrial Research
cumec	Cubic meter per second
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and the Environment
Dm	Dam wall
DoA	Western Cape Department of Agriculture
DWA	Department of Water Affairs (now Department of Human Settlements, Water and
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
EC	Electrical line across river
EC	Ecological Category
EcoStatus	Ecological Status
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EISC	Ecological Importance and Sensitivity category
ELA	Environmental Law Association
EMPr	Environmental Management Programme
ES	Ecological Sensitivity
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FB	Formal Bridge
FC	Fence Crossing
FEPA	Freshwater Ecosystems Priority Areas
FLC	Formal Low-level Crossing

GA	General Authorisation, in terms of the National Water Act, 1998 (Act No. 36 of
Gb	Gabion
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IAIAsa	International Association for Impact Assessment, South Africa
IAP	Invasive Alien Plants
IAP2	International Association for Public Participation
IHI	Index of Habitat Integrity
IHI	Index of Habitat Integrity
ILC	Informal Low-level crossing
IUCN	International Union for Conservation of Nature
l/s	Litre per second
mamsl	meters above mean sea level
MAP	Mean Annual Precipitation
MAR	mean annual runoff
mcm	Million Cubic Metres
MMP	Maintenance Management Plan
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act, 1998 (Act 36 of 1998), as amended
NWM5	National Wetland Map 5
O	Other
ParP	Parallel Pipeline
PC	Pipeline Crossing the river
PES	Present Ecological State
PO	Pipe outlet
Pp	Pump
PSC	Project Steering Committee
RD	Registration Division
REC	Recommended Ecological Category
RMMP	River MMP
RQO	Resource Quality Objective
SANBI	South African National Biodiversity Institute
SASS	South African Scoring System
SWSA	Strategic Water Source Area
WC:DoA	Western Cape Department of Agriculture

WCBSP	Western Cape Biodiversity Spatial Plan
WfWet	Working for Wetlands
WMA	Water Management Area
Wr	Weir
WR2012	Water Resources 2012
WRC	Water Research Commission
WUA	Water Users Association
WUL	Water Use License

Definitions / Glossary

Abiotic	Without life, inanimate; physical environment like temperature, rainfall
Activity	**A**n 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.
Anthropogenic	Caused by human activity
Aquatic	Relating to water
Aquifer	Underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt)
Attenuation	To make something weaker or have less effect.
Baseflow	That part of stream flow contributed by groundwater and discharged gradually into the channel – remains in the channel after a stormflow has past.
Benthic	Organisms that inhabit the shallow, bottom habitat of water.
Biota	The living organisms occupying a place together, e.g. plants, animals, bacteria, etc in the aquatic biota, or terrestrial biota.
Buffer	Area adjacent to a river channel or surrounding a wetland that comprises more natural cover vegetation and provides a protection function to the adjacent aquatic ecosystem.
Bush Encroachment	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.
Catchment	The area from which any rainfall will drain into the watercourse or watercourses, through surface or subsurface flow.
Disturbance Regime	The pattern of natural variability of physical and biological processes, incorporating the return time to a stable condition from extreme conditions.
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 Health	A descriptive non-specific term for the combination of all factors, biotic and abiotic, that make up a particular environment and its organisms
Ecological Infrastructure	Naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction.
Ecoregions	Areas of similar ecological characteristics.
Ecosystem	A community of animals, plants and bacteria with its physical and chemical environment.
Environment	All of the external factors, conditions, and influences that affect the growth, development, and survival of organisms or a community. This includes climate, physical, chemical, and biological factors, nutrients, and social and cultural conditions.
Ephemeral	An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year

Flood Event	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 Regime	Recorded or historical sequence of flows used to create a hydrological profile of the water resource.
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.
Geomorphology	The branch of geology that deals with, amongst other things, the form of the earth and the changes that take place in the process of development of landforms.
Habitat	The environment or place where a plant or animal is most likely to occur naturally.
Hydraulics	Of, involving, moved by, or operated by a fluid, especially water, under pressure.
Hydrology	The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.
Hypersaline	An environment that has salinities greater than that of normal seawater
Impacts	The measurable effect of one thing on another.
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
Impoundment	To retain water artificially by means of a weir or dam.
Indigenous	Living or growing naturally in a particular area, but not naturally confined only to that area or any resource consisting of (a) any living or dead animal, plant or other organisms of an indigenous species, (b) any derivative of such animal, plant or other organisms; or (c) any genetic material of such animal, plant or other organisms.
Indigenous Species	A species that occurs, or has historically occurred, naturally in a free state, in nature within an ecologically similar area, but excludes a species that has been introduced from another area or continent as a result of human activity
Indigenous Vegetation	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.
Invertebrate	Animal without a backbone
Legislation	A law or a series of laws
Maintenance	Actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint
Maintenance Management Plan	Management plan for maintenance purposes defined or adopted by the competent authority.

Mandate	The authority to do something, given to an organisation or government, by the people who support it.
Modified	Changed, altered.
Nutrients	Elements required for life processes: nitrogen, phosphorus and potassium are probably the most important nutrients.
Point Source	A definable or precise location or source e.g., of pollution
Policy	A plan of action, statement of ideals, etc. proposed by an organisation, government, etc.
Predation	A predator is an animal that kills and eats other animals. Predation is the capturing of prey as a means of maintaining life.
Present Ecological State	The current state or condition of a resource in terms of its various components, i.e. drivers (physico-chemical, geomorphology, and hydrology) and biological response (fish, riparian vegetation and aquatic invertebrates). The prequel to recommended ecological category
Pristine	Remaining in a pure or natural state.
Quaternary Catchment	A fourth-order catchment in a hierarchical system in which the primary catchment is the major unit.
Reference Condition	The perceived natural or predevelopment state of an ecosystem.
Rehabilitation	An intervention that facilitates the return of desired ecological functioning and integrity in a degraded ecosystem
Remediation	Improving the current ecological condition of an ecosystem but not necessarily returning it to a reference state
Restoration	Reverting an ecosystem back to its perceived natural or reference state
Riparian	Of, on, or relating to the banks of a water course, including the physical structure and associated vegetation. The area of land adjacent to a stream or river that is influenced by stream-induced or related processes.
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.
Runoff	Surface water overland flow after rainfall events that enters a river or wetland
Sedimentation	The act or process of depositing sediment. Sediment comprises fragments of inorganic or organic material that are carried and deposited by water.
Species	A kind of animal, plant or other organisms that does not normally interbreed with individuals of another kind, and includes any sub-species, cultivar, variety, geographic race, strain, hybrid or geographically separate population
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.

Substrate	The surface to which a plant or animal is attached or on which it grows.
Surface Water	All water that is exposed to the atmosphere, e.g., rivers, reservoirs, ponds, the sea, etc.
Tertiary Catchment	A third-order catchment in a hierarchal classification system in which a primary catchment is a major unit.
Thalweg	The line of lowest elevation within a valley or watercourse.
Variability	The tendency to vary i.e. to change.
Water Quality	The value or usefulness of water, determined by the combined effects of its physical attributes and its chemical constituents and varying from user to user
Watercourse	(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 (d) 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.
Wetlands	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" (definition in the NWA)

1 Introduction and Project Description

The Western Cape Department of Agriculture (DoA) has initiated the development of this River Maintenance and Management Plan (MMP) for the Klip and Keurbooms Rivers at Swellendam (collectively referred to as the project area). The Klip River is a tributary of the lower Breede River at Swellendam, and the Keurbooms River is a tributary to the Klip River.

This MMP will inform the regular maintenance activities within the rivers. It has been prepared for the landowners along the above-mentioned river stretches with funding from the DoA. BlueScience (Pty) Ltd. and Cornerstone Environmental Consultants (Pty) Ltd. have been appointed to prepare this MMP. This MMP will be submitted to the Department of Environmental Affairs and Development Planning (DEA&DP) for adoption.

1.1 Overview of the project area

The Klip and Keurbooms Rivers covered by this MMP are two relatively small rivers (8.64 km and 9.49 km, respectively) that drain the Langeberg Mountains to the north of Swellendam. The rivers drain the H70B quaternary catchment, a catchment area of about 9 343 ha. The estimated natural Mean Annual Runoff for the river catchment is approx. 21.5 million cubic meters (MCM).

The upper reaches of the rivers, above the study area, lie within the Marloth Nature Reserve, on the southern slopes of the Langeberg Mountains. Nearly half of the catchment of the rivers lies within the nature reserve where the many feeder streams are fed from a mountainous catchment with an average rainfall of more than 700 mm. Downslope of the Marloth Nature Reserve the feeder stream flows through pine plantations and then agricultural areas before joining to form bigger rivers that drain past Swellendam and flow into the Breede River south of Swellendam.

The Keurbooms River is the largest tributary in the catchment and comprises about 50% of the entire Klip River Catchment. The river drains into the Klip River from the western side of the catchment, joining the river immediately to the west of the Swellendam Wastewater Treatment Works. Larger tributaries of the Keurbooms River are the Huis and Jaaglaagte Tributaries. Another larger tributary of the Klip River is the Koringland River which joins the river from the east, flowing through Swellendam before it confluences with the river a short distance downstream of where the Keurboom and Klip Rivers meet. The Koringland River lies mostly within urban and peri-urban areas and is not included in this MMP and EMPr assessment.

The study area is situated within the Swellendam Local Municipalities and the Overberg District Municipality.

Table 1: Summary of key information related to the study area.

Descriptor	Name / details	
Water Management Area	Breede Gouritz WMA	
Catchment Area	Klip	Lower Breede River System
Quaternary Catchment	H70B	
Water resource components	Riparian and instream zones and associated wetlands	
Present Ecological Status (PES)*	Klip	D = Largely modified
	Keurbooms	D = Largely modified
Ecological Importance (EI)*	Klip	L = Moderate
	Keurbooms	M = Moderate
Ecological Sensitivity (ES)*	Klip	H = High
	Keurbooms	VH = Very High
Target Ecological Category	Klip	E = Seriously modified
Latitude	33°59'28.3"S	Upstream (start) of Klip River reach
Longitude	20°25'16.5"E	
Latitude	33°59'2.8"S	Upstream (start) of Keurbooms River reach
Longitude	20°22'24.4"E	

Descriptor	Name / details	
Latitude	34° 4'2.2"S	Downstream (end) of Klip River reach
Longitude	20°24'50.5"E	

*Department of Water Affairs (2012)

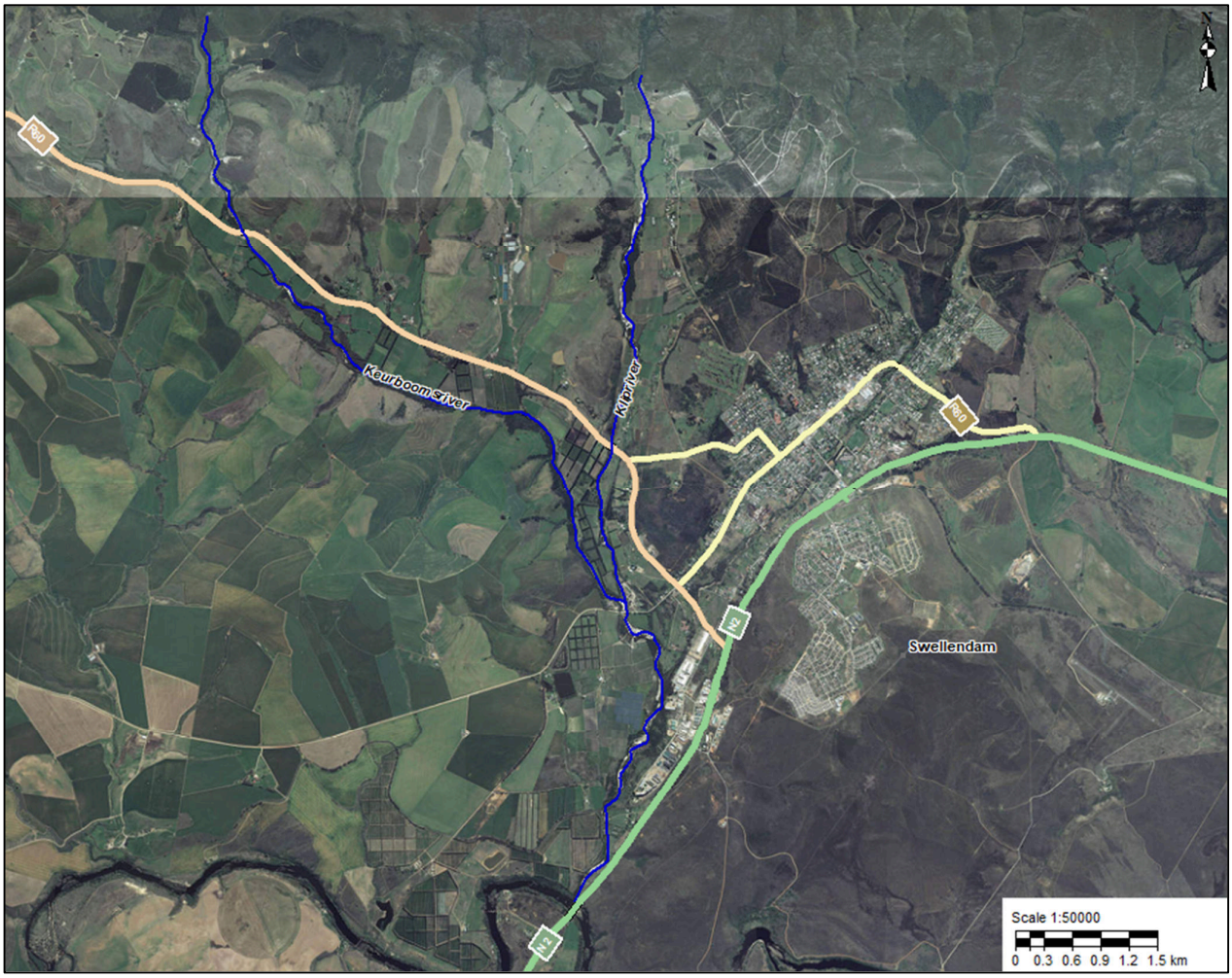


Figure 1: Orthophotograph, taken in 2016, showing the extent of rivers included in this assessment.

Groundwater seepage off the Langeberg Mountain catchment to the north maintains a natural flow in the river throughout the year, resulting in perennial flow in the river and the formation of wetlands along the rivers and on the hillslopes. Most of the watercourses are mapped as comprising valley bottom and floodplain wetlands that are mapped in the Freshwater Ecosystem Priority Area Wetlands mapping and as Aquatic Critical Biodiversity Areas in the Western Cape Biodiversity Spatial Assessment. The indigenous fish species that frequent the middle reaches of the Breede River (*Galaxia zebratus, Sandelia capensis* and *Pseudobarbus burchelli sp. nov. 'breede')* have also been recorded in the lower reaches of these rivers.

The Klip and the Keurboom Rivers are both relatively short, but fast-flowing rivers that have been significantly impacted in their lower reaches, where they are subject to agricultural and peri-urban activities. The main crops in this area are pastures, lucerne and citrus, with blackberries occurring along the lower Klip River. Due to the steepness of the catchments drained by the rivers (upper foothill rivers) and the higher rainfall in the upper catchment, erosion is the main geomorphological activity taking place within the rivers. Given the ecological importance and sensitivity of the river and its associated wetland areas, any works within this aquatic ecosystem are going to need to be strongly supported by method statements that guide works in the river corridor and rehabilitate degraded areas as far as possible.

This MMP includes all infrastructure related to the Klip and Keurbooms Rivers, downslope of the Marloth Nature Reserve, to where the Klip River flows into the Breede River. The infrastructure includes all infrastructure associated with the sustained exercising of use of the resources in the catchments of the mainstream and tributaries.

In terms of aquatic ecosystems, this MMP includes all aquatic ecosystems directly and indirectly associated with the mainstreams in so far as it could have an influence on the existing utilisation, management and protection of the resources.

1.2 Activities included in this MMP

The Klip River and its tributary the Keurbooms River within the study area occur within an area modified by agricultural land. Both the river corridors and existing infrastructure in the rivers require periodic maintenance. Different types of infrastructure require differing maintenance activities, in terms of frequency, intensity and extent. To inform this MMP, the existing infrastructure within the watercourse corridors was photographed and their location was recorded using a hand-held Global Positioning System (GPS). The various types of infrastructure were assigned codes (**Table 2**). A total of 56 infrastructure items were identified. Following the initial site identification and site confirmation, the final register of maintenance sites was compiled. This comprises a separate photograph and infrastructure asset register which forms part of the submission to DEADP for the MMP adoption. This registry is summarized in **Table 2** below.

Also refer to the following relevant Annexures:

- **Annexure** B1: Catalogue of infrastructure identified along the Klip and Keurbooms Rivers, and photograph register of infrastructure maintenance sites; and
- **Annexure** B2: Maps of the study area indicating the location of the infrastructure included in the catalogue.

Table 2: Summary of infrastructure or maintenance interventions in the Klip and Keurbooms Rivers as captured in the register.

Infrastructure or Maintenance intervention type	Klip and Keurbooms Rivers
Pumps	5
Pipelines - crossing	3
Pipelines - parallel	1
Berms	6
Weirs	3
Erosion	11
Formal bridges	4
Formal low-water crossings	4
Informal low-water crossings	5
Roads	2
Houses	3
Recreational areas	2
Other points	7
Total	**56**

The maintenance activities are typically grouped into five categories and these categories were ranked according to the potential risk of ecological degradation (1 – lowest risk; 5 – highest risk). The five categories are:

- Activity 1: Clearing of vegetation:
    - Activity 1a: Clearing of alien vegetation;
    - Activity 1b: Clearing of nuisance indigenous *Phragmites* reeds or *Typha* bulrushes;
- Activity 2: Repairs to infrastructure:
    - Activity 2a: Minor Repairs to infrastructure;

- Activity 2b: Major repairs to- or replacement of damaged formal (FLC / FB) river crossings
- Activity 3: Sediment movement at infrastructure;
- Activity 4: Sediment removal from the channel for flood conveyance/channelisation; and
- Activity 5: Sediment movement in the channel or on the banks for repairs to berms or banks.

IMPORTANT NOTE: This MMP does not legalise existing unauthorised activities [thus activities which required Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA)] and does not pronounce on the legality of existing infrastructure. Only existing activities that are authorised may be maintained as part of this MMP.

New infrastructure, for which a landowner obtained Environmental Authorisation before construction (if required), can be added to this MMP over time. In this event, the landowner/holder of the Environmental Authorisation, should forward the Environmental Authorisation to the Swellendam Conservancy MMP contact person. It is recommended that the Swellendam Conservancy then submit a list of the newly authorised activities (including what it is, e.g., a low-level crossing, its coordinates, and at least one photo of the infrastructure point) to the DEA&DP as Addenda to this MMP on a regular basis, such as annually or biannually.

1.3 Need for this MMP and how it will contribute to future sustainable practices and reducing and/or mitigating the need for maintenance

This MMP is a proactive planning tool which prevents long waiting periods associated with obtaining permission, with the associated cost, if each landowner had to apply individually to undertake maintenance activities, for example to repair flood damage after each flood event. It also saves time since, in terms of the MMP, the landowner will only need to notify the Swellendam Conservancy of his/her maintenance actions.

Ultimately, this MMP is aimed at improving the health and functioning of the Klip and Keurbooms Rivers through implementation of sustainable maintenance and management practices, therefore contributing to the long-term sustainability of the system.

1.4 Party/ies responsible for implementation of this MMP

This MMP includes all the properties within the relevant section of the Klip and Keurbooms Rivers. The MMP will be issued in the name of the Swellendam Conservancy, and each individual landowner will be responsible for implementation of the management measures as relevant to his/her activities relating to the river.

Refer to **Annexure A9** for the signed landowner sign-up forms.

1.5 Specialist Consultants and Environmental Assessment Practitioner

Blue Science (Pty) Ltd. in association with Cornerstone Environmental Consultants (Pty) Ltd. (Cornerstone) compiled this MMP on behalf of the Swellendam Conservancy. BlueScience (Pty) Ltd prepared an Ecological Report as part of this MMP (**Annexure C1**). See **Table 3** below for more information on the MMP project team.

Table 3: MMP project team, roles, qualifications and registrations/associations.

Team Member	Company	Role/ Expertise	Qualifications and Years' Experience	Registrations and Associations
Ms Toni Belcher	BlueScience (Pty) Ltd	Freshwater Ecologist	M.Sc. Environmental Management; More than 30 years relevant experience	Registered Natural Scientist - SACNASP No. 400040/10

Team Member	Company	Role/ Expertise	Qualifications and Years' Experience	Registrations and Associations
				Member of the IAIAsa[1]
Mr Dana Grobler	BlueScience (Pty) Ltd	Freshwater Ecologist	BSc (Hons); HED (1989)/. More than 30 years relevant experience	Registered Natural Scientist - SACNASP[2] No. 400058/93; Member of the SASAS[3]; Member of the WISA[4]; Member of the Botanical Society of South African
Mr Stuart Barrow	BlueScience (Pty) Ltd	Fish Biologist	MSc (Fish biology) 9 years experience	Registered Natural Scientist (SACNASP) No. 400128/16/17
Mrs Mari de Villiers	Cornerstone Environmental Consultants (Pty) Ltd	Stakeholder Engagement and Environ-mental Assessment Practitioner	Masters' Degree: Environmental Management. 19 years experience	Member of the IAIAsa[5]; Member of the IAP2[6]; Registered Environmental Assessment Practitioner (EAPASA[7] Reg. No. 2019/1160)

Portfolio of relevant evidence:

MMP projects completed by the EAP include the following:

- MMPs for the maintenance of existing infrastructure in the Baden, Kingna, Koning and Poesjesnel Rivers; and
- MMPs for the maintenance of existing infrastructure in Sub-districts 1, 2 and 3 of the Berg River (the upper ~85km of the Berg River); and
- MMPs for the maintenance of existing infrastructure in the Upper Olifants River.

1.6 Information Document used to compile this MMP

This MMP was prepared to comply with the content requirements of the "*Information Document for the Development of a Maintenance Management Plan for a Watercourse*" that was issued by the DEA&DP during March 2017, and as subsequently updated.

1.7 Relevant Legislation

The main environmental legislation that are relevant to this MMP are summarised below.

1.7.1 National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended

This MMP specifically relates to **Activities 19 and 27** as listed in the National Environmental Management Act, 1998 (Act No. 107 of 1998), (NEMA) Environmental Impact Assessment (EIA) Regulations **Listing Notice 1 of 2014**

[1] IAIAsa: International Association for Impact Assessment, South Africa
[2] SACNASP: South African Council for Natural Scientific Professions
[3] SASAS: Southern African Society for Aquatic Scientists
[4] WISA: Water Institute of Southern Africa
[5] IAIAsa: International Association for Impact Assessment, South Africa
[6] IAP2: International Association for Public Participation
[7] EAPASA: Environmental Assessment Practitioners Association of South Africa

(GN R. 327), as amended, as well as **Activity 12** as listed in the NEMA EIA Regulations **Listing Notice 3 of 2014 (GN R. 324)**, as amended.

Listing Notice 1, Listed Activity 19, relates to "*the infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from - (i) a watercourse…*".

Maintenance Activities 2 to 5, as per Section 1.2 above, often entail the removal or depositing of more than 10m^3 of material from or into the river system, hence the applicability of Listing Notice 1, Listed Activity 19. Note the definition of a "watercourse" in **Box 1**.

Box 1: Definition of "watercourse"

"Watercourse" in this document, is defined as in the National Water Act, 1998 (Act no 36 of 1998), and 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

(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse;

Furthermore, the extent of a watercourse includes, where relevant, its bed and banks of which make up the riparian habitat or the 1:100 year flood line, whichever is the greatest. Excludes the estuarine environment as delineated by the initiation of mixing zones between fresh water and sea water.

Listing Notice 1, Listed Activity 27 reads as follows:

"*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation…".*

The areas to be cleared from alien vegetation or indigenous Phragmites reeds or *Typha* bulrushes (i.e. Section 1.12, Activities 1a and 1b) may, over time, constitute more than 1 ha of indigenous vegetation in total, hence the inclusion of the Listed Activity 27 within this MMP. See **Box 2** for the definition of "indigenous vegetation".

Listing Notice 3, Listed Activity 12, relates to "*the clearance of an area of 300 square metres or more of indigenous vegetation…*

(a) 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;…"

The natural vegetation which would have occurred within the surrounding landscape under un-modified conditions is mapped as Swellendam Silcrete Fynbos and Eastern Ruens Shale Renosterveld, both Endangered vegetation types. Cape Lowland Alluvial Vegetation (Endangered) furthermore occurs along the Keurbooms River and lower reaches of the Klip River. See **Figure 2**.

Maintenance Activity 1, as per Section 1.2 above, entails the clearance of alien and/or indigenous vegetation. Listing Notice 3, Listed Activity 12 will be triggered if 300m^3 or more of indigenous vegetation will be cleared within an Endangered ecosystem, irrespective of the level of alien infestation. Note the definition of "*indigenous vegetation*" in the **Box 2**.

A Basic Assessment process should be undertaken, and Environmental Authorisation obtained before activities listed in Listing Notice 1 may be commenced with. Listing Notice 1, Activities 19 and 27, and Listing Notice 3, Activity 12 are however allowed without Environmental Authorisation, if such activities are required "*for maintenance purposes undertaken in accordance with a maintenance management plan*". **Hence the preparation of this MMP, and the submission therefor to the DEA&DP for adoption.**

Box 2: Definition of "indigenous vegetation"

"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. Consideration will be made where the indigenous plants species are considered as bush encroachment species and thus requiring active maintenance".

The NEMA EIA Regulations Listing Notice 1 of 2014, as amended, defines "maintenance" and "maintenance management plan" as follows:

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

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

A MMP is therefore designed to protect landowners from being fined or legally prosecuted for routine maintenance activities which involves the above listed activities in rivers or on riverbanks.

It is of the utmost importance that the landowners adhere to the MMP to prevent the triggering of listed activities that may need to be authorised. If in doubt, the DEA&DP should be contacted before commencement of any other activities not specified in this MMP.

It should be noted that adoption of a MMP by the DEA&DP does not absolve the Applicant or the landowners from its general "duty of care" set out in Section 28(1) of the NEMA which states that "*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*." When interpreting this "duty of care" responsibility, cognisance must be taken of the principles of sustainability as contained in Section 2 of the NEMA.

1.7.2 National Water Act, 1998 (Act No. 36 of 1998), as amended

The National Water Act, 1998 (Act No. 36 of 1998), as amended (NWA) regulates the protection, use and governance of water resources, including rivers, wetlands and groundwater.

Part 1: General Principles (Sections 21 to 26 of the NWA) sets out general principles for regulating water use. Water use, as referred to in Section 21 of the NWA, is defined broadly and includes, *inter alia*, taking and storing water, activities which reduce stream flow, altering a watercourse, and recreation. In general, a water use must be licensed unless it is listed in Schedule I, is an existing lawful use, is permissible under a general authorisation (GA) in terms of Section 39 of the NWA, or if a responsible authority waives the need for a license.

The Department of Water and Sanitation's (DWS's) risk-based assessment was used in the MMP. Typically, activities within a low-risk rating category can be authorised under the General Authorisation for Section 21 (c) and (i) of the NWA. Those with a higher risk rating need to be licensed. It should however be noted that the risk assessment undertaken as part of this MMP was not undertaken to specifically inform any water use authorisation process although the assessment would assist the DWS in its consideration of the proposed activities and their water use authorisation requirements. Many of the proposed maintenance activities are aimed at rehabilitation of the aquatic ecosystem, such as alien vegetation removal, or can be considered as an existing lawful use as they are associated with the maintenance of existing water supply scheme infrastructure. Section 4.9 below for the risk assessment.

A linear GA application will be lodged for the two river reaches forming part of this MMP process. This approach has been confirmed with the Breede-Olifants Catchment Management Agency (BOCMA) during the PSC meeting held on 18 August 2023.

1.7.3 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

Invasive species are controlled by the National Environmental Management Biodiversity Act (NEMBA) – Alien and Invasive Species (AIS) Regulations, which was Gazetted on 1 August 2014 and became law on 1 October 2014:

- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Requirement: Remove and destroy plants deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area.
  Requirement: A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift. No permits will be issued for Category 2 plants to exist in riparian zones.

- Category 3: Invasive species regulated by activity.

  Requirement: An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

See Section 5.10 below for the invasive alien plant species that were identified within the study area, as well as their relevant NEM:BA categories.

It should be noted that lists of plants provided in this MMP, as well as in the Ecological Report, both alien and indigenous, are for the purpose of describing the general and dominant habitat conditions and are not comprehensive. A comprehensive botanical survey was not conducted as part of this assessment.

1.7.4 National Heritage Resources Act, Act 25 of 1999

Activities listed under Section 38 of the National Heritage Resources Act, Act 25 of 1999 (NHRA) will not be triggered by the activities included in this MMP, since the MMP is limited to the maintenance of existing infrastructure within the same capacity and footprint, and not the construction of new infrastructure.

No structures/infrastructure that is older than 60 years may be replaced as part of this MMP without prior written approval from Heritage Western Cape (HWC). The responsibility to consult with HWC in this regard will rest with the landowner.

1.8 Maintenance Management Principles

The following overarching principles should be applied by landowners and managers when implementing this MMP (DEA&DP, 2017):

- The main objective should at all times be to prevent negative impacts and risks where possible, if prevention is not possible, impacts should be minimised, or alternatively rehabilitated (‘repaired’’), if minimisation is not possible;
- Unnecessary maintenance should be avoided and reduce;
- 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;
- 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;
- Managers and organs of state must identify, address and, where feasible, eliminate the factors that necessitate intrusive, environmentally-damaging maintenance; and
- A process of continuous management improvement be applied, namely Planning; Implementing; Checking (monitoring, auditing, determine corrective action) and Acting (management review).

2 Personal Details

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

Name of person/ authority who will under-take responsibility for the activity:	Applicant: Swellendam Conservancy, on behalf of the individual riparian landowners within the project area. Each individual landowner will be responsible for implementing the method statements that are relevant to his/her specific activities in the river (i.e., implementing this MMP). The Swellendam Conservancy will be responsible for keeping record of the maintenance activities undertaken. See Section 6.1 below for more information on the role of the Swellendam Conservancy during implementation of this MMP.		
Contact person (if other):	Swellendam Conservancy Chairperson		
Postal address:	*No postal address available*		
		Post code:	
Telephone:	-	**Cell:**	082 457 0019 / 081 019 8232
Email:	chairman@swellendamconservancy.org.za	**Fax:**	-
Name of person who prepared Maintenance Management Plan:	Mari de Villiers, Cornerstone Environmental Consultants (Pty) Ltd. and Toni Belcher from BlueScience (Pty) Ltd.		
Contact Person (if other):	Mari de Villiers		
Postal address:	PO Box 12606		
	Die Boord	**Post code:**	7613
Telephone:	021 887 9099	**Cell:**	083 235 8733
E-mail:	mari@cornerstoneenviro.co.za	**Fax:**	086 435 2174
Landowner(s) on whose behalf plan is developed:*	See **Annexure A1**: List of directly affected properties and landowners.		
Contact person(s):	See **Annexure A1**: List of directly affected properties and landowners.		
Postal address:	See **Annexure A1**: List of directly affected properties and landowners.		
	See **Annexure A1**: List of directly affected properties / landowners	**Post code:**	See **Annexure A1**: List of directly affected properties / landowners
Telephone:		**Cell:**	
E-mail:		**Fax:**	
Municipality for proposed project:	Swellendam Municipality		
Farm name(s), erf(s) etc*:	See **Annexure A1**: List of directly affected properties and landowners.		
Magisterial District or Town**:**	Overberg Magisterial District		
Name(s) of water course(s) in question:	Klip and Keurbooms Rivers. See **Figure 1** above for the extent of rivers included in this MMP. **This MMP includes all infrastructure related to the Klip and Keurbooms Rivers, downslope of the Marloth Nature Reserve, to where the Klip River flows into the Breede River. The infrastructure includes all infrastructure associated with the**		

	sustained exercising of use of the resources in the catchments of the mainstream and tributaries. **In terms of aquatic ecosystems, this MMP includes all aquatic ecosystems directly and indirectly associated with the mainstreams in so far as it could have an influence on the existing utilisation, management and protection of the resources.**
***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 Maintenance Management Plan.**	

Refer to **Annexure A9** for the signed applicant declaration.

3 Engagement Process

The stakeholder engagement process prescribed in the NEMA, as amended, only applies to applications which are subjected to Basic Assessment or Full Scoping and EIA processes. The NEMA EIA Regulations of 2014, as amended, therefore do not stipulate any stakeholder engagement process for MMP processes.

The stakeholder engagement process for this MMP was designed around the specific requirements contained in the "*Information Document for the Development of a Maintenance Management Plan for a Watercourse*", issued by the DEA&DP during March 2017, and as subsequently updated, as well as the specific objectives of this MMP process.

The **main objectives** of the stakeholder engagement process are as follow:

- To **actively engage** with the stakeholders in order for them to identify current activities and/or planned future maintenance to current activities that are being undertaken or planned to be undertaken, which may impact on the bed and/or banks of the rivers;
- To **encourage stakeholders to participate actively** by contributing local knowledge and sharing experiences regarding historical and potential future flood risks associated with the river(s), and to suggest possible interventions to address historical and potential flood damage;
- To inform stakeholders of the MMP project, and what the **implication of the project will be on them** as stakeholders;
- To **empower** the Swellendam Conservancy and riparian landowners to take ownership of the sustainable management of the river and implementation of the MMP;
- To **train and empower** at least one representation from the Swellendam Conservancy to act as MMP implementation contact person after adoption of the MMP. This person will be an important liaison between the individual landowner, the DoA and other relevant Organs of State and Organisations and should be able to assist landowners with MMP implementation related questions and processes;
- To **pro-actively obtain reasonable, objective and transparent comment** and input from stakeholders on this Draft MMP;
- To encourage stakeholders to **raise issues** of concern and opportunities for enhanced benefit; and to
- To encourage stakeholders to **take ownership** of the MMP in collaboration with the Swellendam Conservancy.

The sections below provide more information on the stakeholder engagement process that is being undertaken as part of this MMP preparation process.

3.1 Summary of Stakeholder Engagement activities

Table 4 below provides a summary of the stakeholder engagement activities undertaken and planned as part of preparation of this MMP.

Table 4: Summary of project/stakeholder engagement activities – Klip and Keurbooms Rivers MMP.

Event	Date	Number of attendees
DFFE meeting	26 May 2022	10
Combined PSC Meeting 1	23 June 2022	21
First training session with the relevant officials	2 November 2022, 13:00 - 15:00	13
First round of stakeholder engagement: Meeting with Klip and Keurbooms Rivers riparian landowners	3 November 2022, 10:00 - 12:00	30
Combined PSC Meeting 2	10 November 2022	18
Special meeting with the BGCMA – Water Use Authorisation requirements	1 February 2023	14
Combined PSC Meeting PSC 3	18 August 2023	17

Event	Date	Number of attendees
Second round of stakeholder engagement: Meeting with Klip and Keurbooms Rivers riparian landowners	13 September 2023, 14:00 - 16:00	18
Second training session with the relevant officials	24 October 2022, 13:00 to 16:00	12
Combined PSC Meeting PSC 4	17 November 2023	16

3.2 Combined Project Steering Committee

Nine similar MMP projects are currently being undertaken for nine rivers in the Western Cape. A combined Project Steering Committee (PSC) was therefore set up for all nine rivers/projects.

The Combined PSC includes, *inter alia*, representatives from the following Organs of State and Organisations:

- Chairperson of the Swellendam Conservancy;
- Western Cape DoA;
- Western Cape Department of Infrastructure;
- Western Cape DEA&DP;
- National Department of Forestry, Fisheries and the Environment (DFFE);
- CapeNature;
- Breede-Olifants Catchment Management Agency (previously BGCMA);
- Local and District Municipalities.

The main objectives of the Combined PSC are:

- To provide oversight and guidance to the project team for the MMP project(s), including, *inter alia*, stakeholder engagement, applicable legislation, and application process.
- To assist with providing local knowledge regarding the need for continued maintenance activities in watercourses.
- To evaluate the possibility for cooperation between, but not limited to relevant Organs of State (as represented on the PSC), Irrigation Bodies and Water User Associations (WUAs) to cooperatively or individually be responsible for
    - Managing flood threats and damage;
    - Repair and maintenance of river crossings, bridges, weirs and irrigation infrastructure (like with replacements and routine “clearing”);
    - Clearing of invasive alien plants and restoration of identified area; and
    - Sustainable eco-system protection in sensitive areas.

The following Combined PSC meetings have been convened:

- First Combined PSC meeting: Thursday, 23 June 2022 (online meeting, *via* MsTeams);
- Second Combined PSC meeting: Thursday, 10 November 2022 (Hybrid meeting – Otter’s Bend Lodge, Dassenberg Rd, Franschhoek and MS Teams);
- Third Combined PSC meeting: Friday, 18 August 2023 (Hybrid meeting – Elsenburg and MS Teams); and
- Fourth Combined PSC meeting: Friday, 17 November 2023 (Hybrid meeting – Elsenburg and MS Teams).

See **Annexure A2.1** for the Minutes of the PSC meetings.

3.3 First round of engagement: Identify and scope issues to be included in the MMP

The subsections below describe the activities that were undertaken during the first round of stakeholder engagement.

3.3.1 Stakeholder Focus Group Meetings (first round)

A focus group meeting (FGM) was convened with the Klip and Keurbooms Rivers riparian landowners on Thursday, 3 November 2022 at the Voortrekker Hall in Swellendam.

The main objectives of this first meeting were to inform riparian landowners of the MMP project, its implications on them, to invite them to comment on the project, and invite them to identify issues and activities to be included in the MMP. Large, printed maps of the study area were available at the meeting venue, and landowners were requested to identify and discuss the infrastructure, maintenance activities and flood management needs for their specific sections of the rivers.

Background Information Brochures were prepared in English and Afrikaans and were distributed to landowners at the meeting.

See **Annexure A2.2** for the Minutes of the Meetings.

3.3.2 First Round of MMP implementation training and empowerment

Representatives within the Swellendam Conservancy will be important liaisons between the individual landowners, the DoA and other relevant Organs of State and Organisations and should assist landowners with the implementation of this MMP and with related questions.

A training session was therefore convened on 2 November 2022, 13:00 - 15:00 at the Bonnievale NG Church Hall, to train and empower at least one representative of the Swellendam Conservancy, as well as DoA Extension Officers, to act as MMP implementation contract persons. This was the first of two rounds of training sessions.

3.4 Second round engagement: Obtain stakeholder comment on the Draft MMP

The Draft MMP was available for stakeholder review and input from **Monday, 19 October to Wednesday, 15 November 2023**. Stakeholders were notified of the availability of the Draft MMP *via* e-mail and were given 30 days to comment on the Draft MMP. Electronic copies were distributed to stakeholders *via* a SharePoint link, or in an alternative electronic format such as Compact Disk (CD), upon request.

Refer to **Annexure A5** for the e-mails issued to the PSC and riparian landowners requesting their comment on the documents.

3.4.1 Stakeholder Focus Group Meetings (second round)

A second FGMs was convened with the Klip and Keurbooms Rivers riparian landowners on Wednesday, 13 September 2023 at the Voortrekker Hall in Swellendam.

The main purpose of this stakeholder meeting was to present and discuss the contents of the Draft MMP, and to obtain riparian landowners' input and comment on the MMP.

3.4.2 Comment and Responses Report

The comments received on the Draft MMP and the Ecological Report (during the second round of stakeholder engagement), both in writing as well as during the relevant meetings, have been collated into a Comments and Responses Report (**Annexure A7**). The Comments and Responses Report includes responses by the project team.

4 Data Collection and Assessment

The subsections below provide detail on the data that was collected, and the assessments undertaken as part of preparation of this MMP and are set out in the same order as is required in the DEA&DP's MMP Information Document.

4.1 Map of the project area

Refer to the following relevant maps in this report:

- **Figure 1**: Orthophotograph, taken in 2016, showing the extent of rivers included in this assessment. (Source: BlueScience, 2023);
- **Figure 2**: The natural vegetation for the study area (CapeFarmMapper, 2023);
- **Figure 9**: River Freshwater Ecosystem Priority Areas relative to the study area (SANBI Biodiversity GIS, 2023);
- **Figure 10**: National Wetland Map (top) and Freshwater Ecosystem Priority Area wetlands (bottom) for the study area (CapeFarmMapper, 2023);
- **Figure 11**: Strategic Water Source Areas within the study area (CapeFarmMapper, 2023);
- **Figure 12**. The 2017 Western Cape Biodiversity Spatial Plan for the study area (CapeFarmMapper, 2023);
- **Figure 13**: Aerial images of the study area taken in 1949 overlaid in Google Earth. The thicker blue and red lines indicate the river reaches within the study area;
- **Figure 14**: Mapping in Google Earth of the watercourse extent in the study area for 1949 (dark blue areas), shown together with the present day watercourse extent (light blue areas);
- **Annexure B1**: Catalogue of infrastructure identified along the Klip and Keurbooms Rivers, and photograph register of infrastructure maintenance sites; and
- **Annexure B2**: Maps of the study area indicating the location of the infrastructure included in the catalogue.

4.2 GPS coordinates

GPS coordinates for each of the infrastructure sites are provided in **Annexure B1**: Catalogue of infrastructure identified along the Klip and Keurbooms Rivers.

4.3 Specialist Assessment

An Ecological Specialist Report was prepared by BlueScience (Pty) Ltd. See **Annexure C1**. The information that follows was sourced from the Ecological Specialist Report.

4.4 Vegetation

The natural vegetation which would have occurred within the surrounding landscape under un-modified conditions is mapped as Swellendam Silcrete Fynbos and Eastern Ruens Shale Renosterveld, both Endangered vegetation types. Cape Lowland Alluvial Vegetation (Endangered) occurs along the Keurbooms River and lower reaches of the Klip River. South Langeberg Sandstone Fynbos and some Southern Afrotemperate Forest occur on the mountain slopes within Marloth Nature Reserve, with a small band of Breede Shale Fynbos extending into the upper Keurbooms River from the west. All of these vegetation types are indicated to be of Least concern, except for Breede Shale Fynbos, which is listed as endangered in the revised 2022 list of threatened ecosystems. See **Figure 2** below.

Typically, the natural vegetation on the valley floor has been transformed by agricultural activities while the vegetation cover on the steeper hillside and mountain slopes is still largely natural. The vegetation along the watercourses is similarly impacted. More detail on the vegetation along the watercourses is discussed under each of the river descriptions in the Ecological Report (**Annexure C1**). The main invasive alien plant species within the riparian zones of the watercourses comprise *Acacia saligna, Acacia mearnsii, Acacia melanoxylon, Acacia longifolia, Pinus pinaster, Eucalyptus* spp. and *Arundo donax. Hakea sericea* occurs on the adjacent hillslopes.

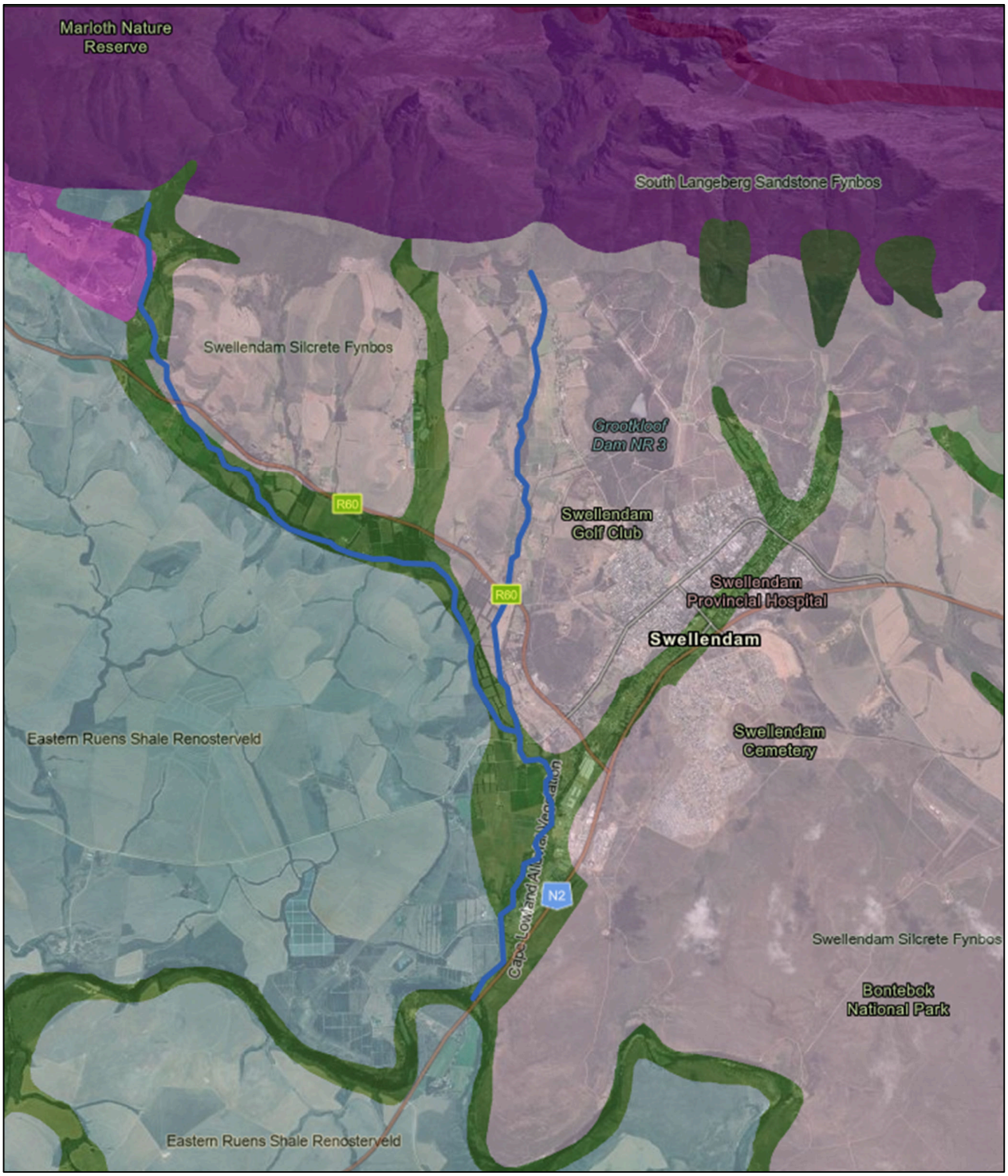


Figure 2: The natural vegetation for the study area (CapeFarmMapper, 2023).

4.5 Hydrological and geomorphological assessment of watercourse functioning

The subsections below provide more information on the climate, hydrology and floods, geomorphology, present ecological status, ecological importance and sensitivity, and target ecological category of the project area.

4.5.1 Climate, Hydrology and Floods

The study area has what is referred to as a local steppe climate, with relatively low rainfall throughout the year. The Mean Annual Precipitation for the upper reaches of the Klip and Keurbooms Rivers within the study area is 750mm with 200mm (about 25%) of this rainfall falling during May to August, within the traditional Western Cape winter rainfall period (**Figure 3**). This rainfall drops to an average of 480mm near the confluence of the river with the Breede River. The least amount of rainfall usually occurs in February (average of 27 mm) and the most in April (44 mm).

Temperatures in January average about 22 °C and about 12 °C in July, with an increase of one degree between the upper and lower reaches of the rivers. Evaporation rates are also higher in summer (approx. 160mm) and lower in winter (about 50mm), with a total annual evaporation rate of about 1260mm.

Under natural conditions, one could expect the flow in the rivers in the study area to resemble the rainfall pattern. The Department of Water and Sanitation has been recording flow in the Klip River at flow gauging weir H7H005 in the Swellendam Forest Reserve at Hermitage (approx. 6 km upstream of the confluence of the Klip and Keurbooms Rivers) since 1960 (**Figure 4**). The catchment area of the Klip River at the weir is 9 km^2, with a mean annual runoff (MAR) of 5 million cubic meters.

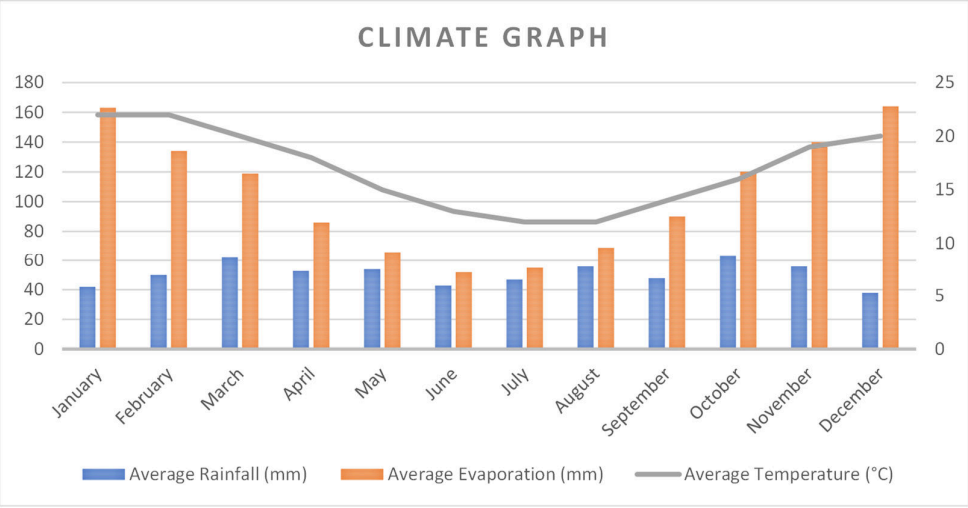


Figure 3: The rainfall, evaporation and temperature for the study area (CapeFarmMapper, 2023).

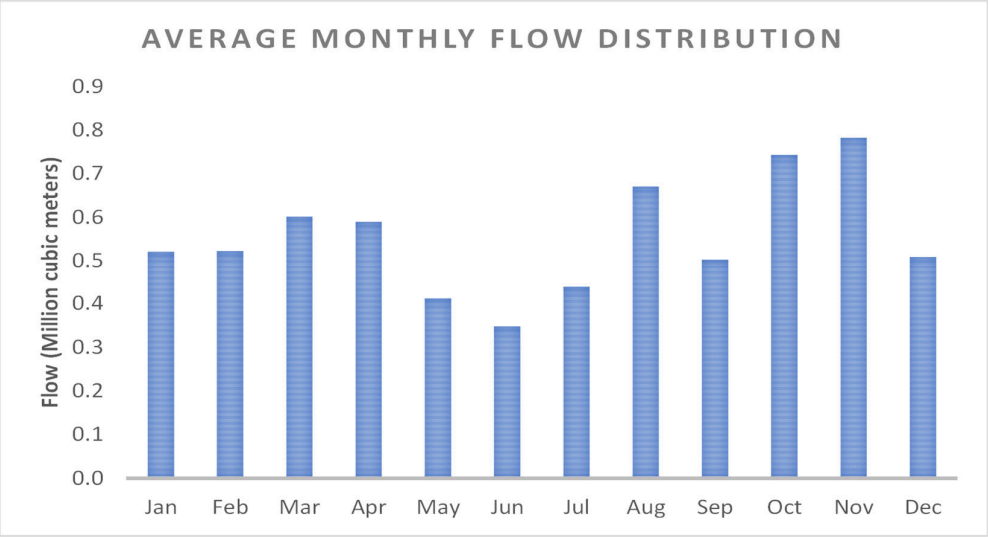


Figure 4: Monthly average flow distribution measured in the Klip River at Hermitage (H7H005) for the period 1960 to 2023.

Based on the WR2012 modelling, the MAR of the entire H70B Catchment, including the Klip and Keurbooms Rivers as well as about 16 km along the Breede River, is 35.22 million cubic meters. Of this larger quaternary catchment area, the Klip and Keurbooms Catchment is approximately 95 km^2 or 62%. The MAR of the combined Klip and Keurbooms River would thus be approximately 24 million cubic meters. There are no large instream dams within the rivers, however, there are several smaller dams and flow diversions in the rivers that have modified the natural flow patterns, reducing in particular the lower flows while the high flows are still likely to remain in the rivers. Peak flow events have been recorded in the rivers in April 1971, April 1998 and December 2004 when the flow in the river exceeded the maximum flow measurement ability of the weir (approx. 40 cubic meters per second).

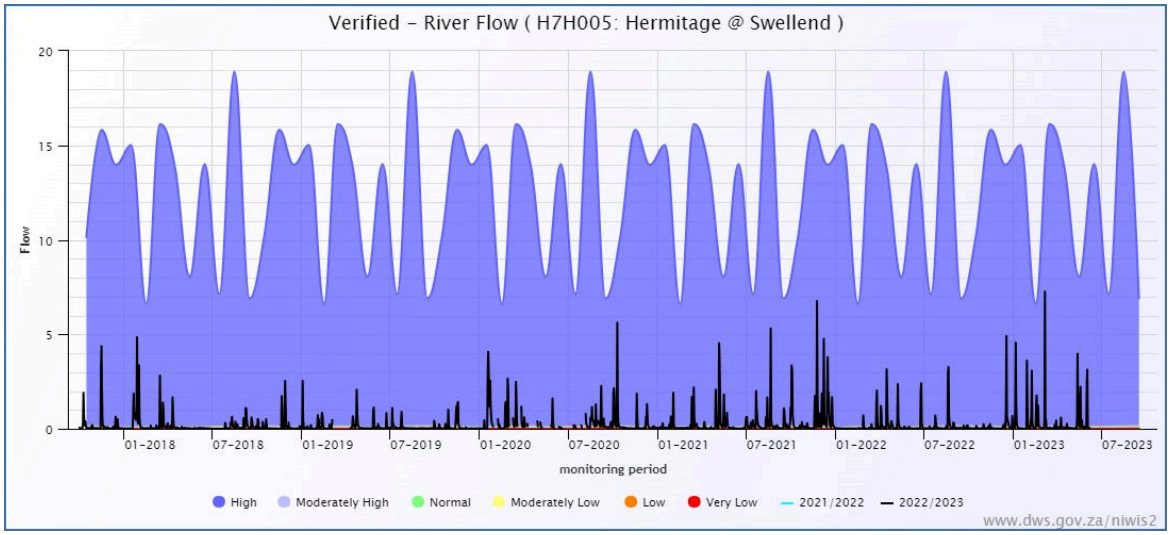


Figure 5: Verified river flow within the Klip River at Hermitage for the period (1918–1923)

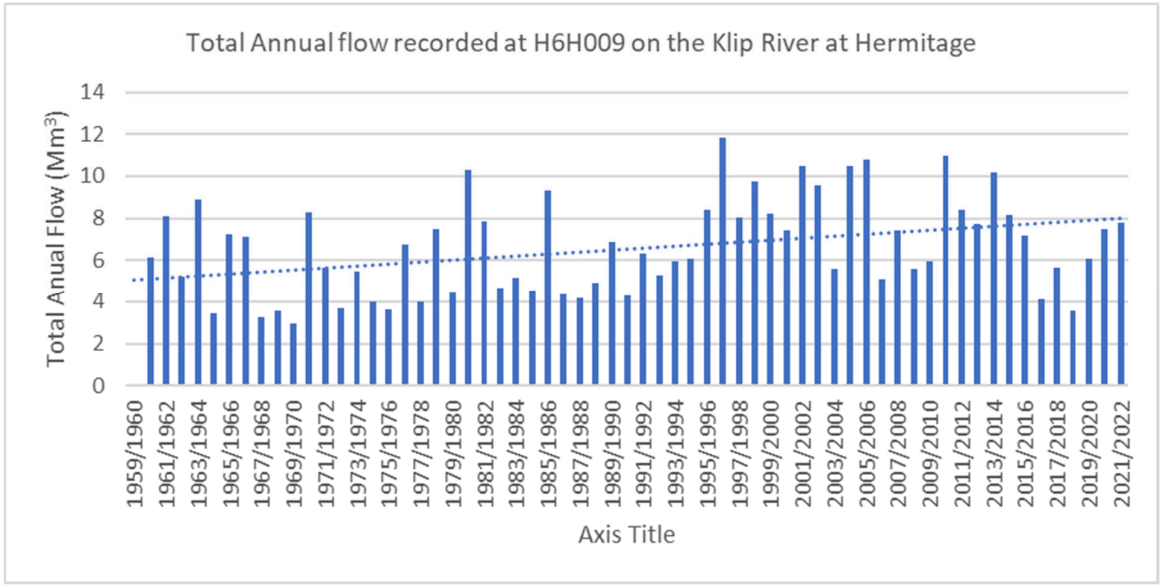


Figure 6: Average Annual Flow in the Klip River at Hermitage (1960 - 2022), where the dotted line on the graph indicates the long-term trend.

4.5.2 Geomorphology

The Keurbooms River within the study area flows from an elevation of about 200 meters above mean sea level (mamsl) where the river enters the greater Breede River Valley to 86 mamsl at the confluence of the river with the Klip River. The assessed river reach thus has an average slope of 3.4%, dropping 114 m over a distance of 8.7 km (**Figure 7**).

The Klip River within the study area flows from an elevation of about 188 mamsl where the river enters the greater Breede River Valley to 59 mamsl at the confluence of the river with the Breede River. The assessed river reach thus has an average slope of 2.4%, dropping 129 m over a distance of 9.5 km (**Figure 8**).

Both the Klip and Keurbooms Rivers within the study area can be classified as upper foothill rivers with some transitional zones. The steeper gradients in the upper reaches of the rivers result in instream habitats that comprise pool-riffle or pool-rapid sequences with runs (characteristic of upper foothill zones). The substrate is dominated by boulders and cobbles with alluvial sands occurring in the more sheltered areas of the river channel where flow decreases. The dominant fluvial geomorphological process in these reaches of the rivers is erosion and instream vegetation play a key role in protecting the watercourse banks from damage during higher flow events. Encroachment of agricultural activities, invasive alien vegetation growth in the riparian zones and reduction of the low flow in these rivers have reduced the integrity of the natural riparian and instream vegetation and its ability to mitigate high flow events.

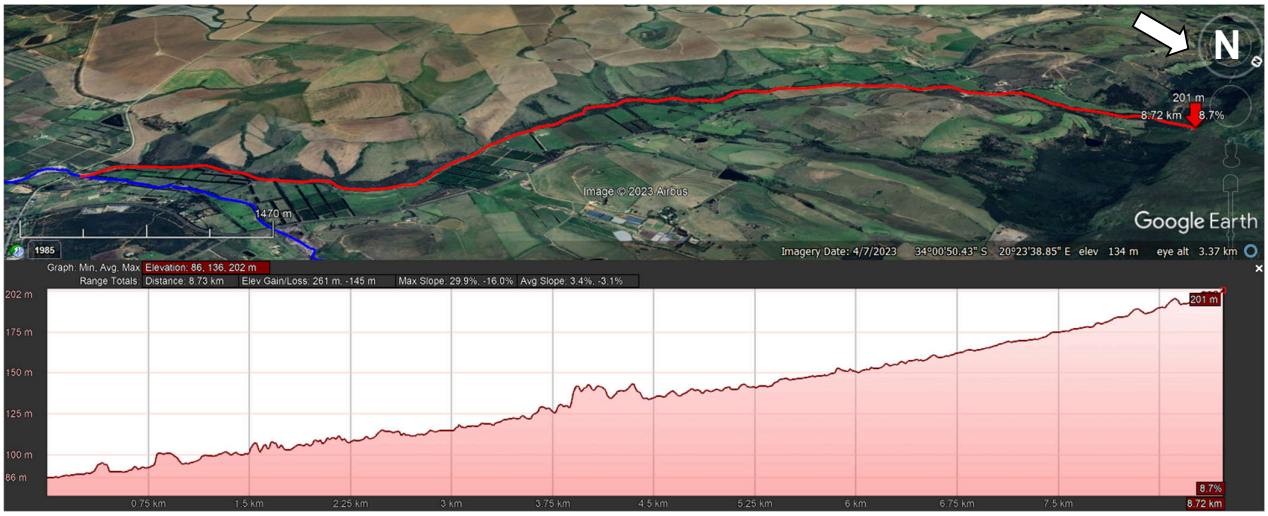


Figure 7: The elevation profile of the Keurbooms River within the study area, shown in Google Earth.

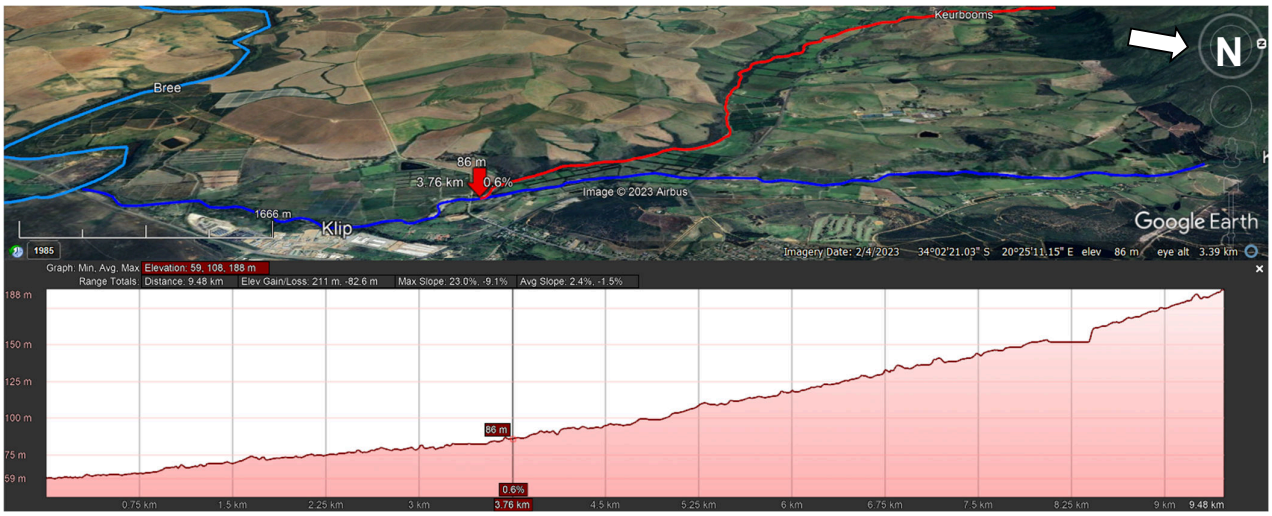


Figure 8: The elevation profile of the Klip River within the study area, shown in Google Earth. The red arrow shows the location of the confluence of the Klip and Keurbooms Rivers in the image and on the elevation profile.

4.5.3 Present Ecological Status, Ecological Importance and Sensitivity, and Target Ecological Category

The Klip and Keurboom Rivers have been the subject of several National River EcoStatus Monitoring Programme (previously National River Health Programme) assessments, regional assessments as well as *ad hoc* assessments. Present ecological state (PES) and the ecological importance (EI) and ecological sensitivity (ES) assessments of the

Klip and Keurboom Rivers have been undertaken as part of a national assessment of river segments (DWA, 2012). Below is a summary of the PES/EI&ES assessments for the applicable river reaches in the study area as well as the recommended or target ecological categories for the Breede-Gouritz Water Management Area (Government Gazette No 42063, dated 23 November 2018).

Table 5: Present Ecological Status (PES), Ecological Importance (EI), Ecological Sensitivity (ES) and Target Ecological Categories (TEC) for the Klip and Keurboom Rivers in the study area.

River	Present Ecological Status	Ecological Importance	Ecological Sensitivity	Target Ecological Category
Keurboom	D	Moderate	Very High	**E**
Klip	D	Moderate	High	**None set**

The rivers tend to be largely natural in their upper reaches where they lie within the Marloth Nature Reserve but degrade quickly once the rivers enter the valley floor, where they are impacted by agricultural activities. In general, the instream habitats of the rivers in the study area are less modified or impacted than the riparian zones.

Under natural conditions, these perennial tributaries contained Afrotemperate forests at the foot of the steep slopes followed by riparian thickets along the rivers with larger indigenous trees such as *Podocarpus latifolius, Cunonia capensis, Brabejum stellatifolium, Ilex mitis* and *Rapanea melanophloeos*. Associated with the lower sections of the rivers, in the Breede River Valley, were also wider braided valley bottom wetlands with a diversity of wetland and riparian plants such as *Prionium serratum, Psoralea pinnata, Cannomois grandis, Elegia capensis, Leucadendron salicifolium, Morella serrata, Passerina corymbosa, Searsia augustifolia, Melianthus major, Cliffortia strobilifera, Ficinia nigrescens, Pteridium aquilinum*.

The rivers have flow diversions and small dams in their upper reaches that take much of the low flow out of the rivers. This has led to the loss of riparian habitat and indigenous riparian and instream vegetation and has resulted in the invasion of alien vegetation (*Acacia mearnsii, Acacia saligna, Acacia longifolia, Acacia melanoxylon, Pinus pinaster, Lantana camara, Solanum mauritianum, Rubus* sp., *Eucalyptus* spp., etc.) in the riparian zones. The modification of habitat, flow and aquatic habitat has significantly contributed to the erosion of these streams.

Historical records exist for the presence of three indigenous fish species in this river system, namely *Pseudobarbus sp. nov. 'breede'* (Breede river redfin), *Sandelia capensis* (Cape kurper) and *Galaxias zebratus* (Cape galaxias). The Breede river redfin is listed by the International Union for the Conservation of Nature (IUCN) as being 'Vulnerable', while Cape kurper and Cape galaxias are considered 'Data Deficient'.

Amphibians occurring in the river and associated aquatic habitats are *Heleophryne orientalis* (Eastern ghost frog), *Cacosternum australis* (Southern dainty frog), *Amietia fuscigula* (Cape river frog), *Amietia vandijki* (Van Dijk's river frog), *Strongylopus grayii* (clicking stream frog) and *Sclerophrys capensis* (raucous toads). All of the above amphibians are listed on the IUCN Red List as 'Least Concern'.

4.6 Reason/cause for the maintenance activities

The Klip and Keurbooms Rivers require maintenance from time to time. The type of infrastructure, together with the geomorphological characteristics of the watercourse, determines the type of maintenance activity which is required.

The maintenance activities associated with this MMP have been grouped into the following five categories, as also mentioned before:

- Activity 1: Clearing of vegetation:
  - Activity 1a: Clearing of alien vegetation
  - Activity 1b: Clearing of indigenous vegetation
- Activity: Repairs to infrastructure:
  - Activity 2a: Minor repairs to infrastructure
  - Activity 2b: Major repairs to infrastructure

- Activity 3: Sediment removal at infrastructure
- Activity 4: Sediment removal from the channel for flood conveyance
- Activity 5: Repairs to riverbanks and associated bank stabilization infrastructure
- Activity 4. Sediment, litter and debris removal from a watercourse
- Activity 5. Repairs to riverbanks and associated bank stabilization infrastructure

4.7 MMP Objective

The overall objectives of this MMP are to assist in the ongoing improvement of the ecological integrity of the Klip and Keurbooms Rivers, and to assist landowners to function within the ambit of the NEMA.

4.8 Impact Assessment

The impacts of the proposed activities included in this MMP are assessed in light of the ecological condition and sensitivity of the Klip and Keurbooms Rivers, as discussed in the Ecological Report. The DEADP MMP Guidelines for mitigation of the potential freshwater impacts as included in Section 5.1 below would apply to these activities.

4.8.1 Activity 1a: Clearing of alien vegetation

The channel of the rivers within the study area is in places overgrown with alien vegetation such as *Acacia mearnsii, Acacia saligna, Acacia longifolia, Acacia melanoxylon, Pinus pinaster, Lantana camara, Solanum mauritianum, Rubus sp.* and *Eucalyptus spp*. The removal of invasive alien plants from the watercourse is desirable not only from an aquatic ecological perspective but also due to the fact that they reduce the ability of that watercourse to provide a number of valuable goods and services. Woody alien invasive species are noted to have caused a decline in indigenous plant numbers, changed the vegetation structure and, in many cases, reduced the biotic and habitat diversity of the riparian zones. Negative impacts of alien vegetation include reduced runoff and water availability; increased instability and erosion of banks, modified water quality; reduced biodiversity; much hotter and more destructive fires which destroy indigenous seeds in the soil and are difficult to control; form barriers to the movement of biota and have economic consequences. Key legislated invader species that should be removed from within the river corridor are:

Category 1b: *Acacia saligna* (Port Jackson willow); *Acacia longifolia* (long leaf wattle), *Eucalyptus camaldulensis* (red river gum); *Pinus pinaster* (Cluster pine), *Pennisetum clandestinum* (kikuyu grass); *Solanum mauritianum* (bugweed), *Lantana camara* (lantana), *Casuarina cunninghamiana* (beefwood) within 100m of riparian areas and untransformed land;

Category 2: *Acacia mearnsii* (black wattle); *Acacia melanoxylon* (blackwood), *Populus x canescens* (grey poplar); *Rubus fructicosus* (European blackberry) and *Ricinus communis* (castor oil);

Not listed: *Salix babylonica* (weeping willow).

Significance of impacts without mitigation: Medium to Low significance depending on methods employed and the level of intervention required to remove the alien vegetation without impacting any remaining indigenous vegetation.

Proposed mitigation: The following mitigation measures and method statements are suggested in order to enable the activity to be carried out with the lowest impact.

- Identify alien plants to be removed (See list of typical invasive alien plants in the appendices). 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 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 a period of 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.

Significance of impacts after mitigation: 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 impact on freshwater features	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	Medium to Low negative		M/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			

4.8.2 Activity 1b: Clearing of indigenous 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 completely 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 in order 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. Where proliferation of reeds is as a result of nutrient enrichment, the removal of the source of nutrients also needs to be addressed to assist with reducing the proliferation of these species.

The primary impact of clearing reeds and bulrushes is the disturbance of riparian and aquatic habitats. Clearing of nuisance reeds should mostly only take place within modified aquatic habitats such as within dams. It is recommended the reeds be cleared by hand as this would have the least impact on any birds or amphibians within

the reeds/bulrushes and would result in a very low impact where clearing should take place outside of the bird breeding season seasons (i.e. maintenance to be done during the period January to May). Secondary impacts of broad scale clearing of reeds would be the potential to facilitate erosion and increase the invasion of the area with alien plant species.

Significance of impacts without mitigation: Medium to low depending on methods employed (for example, large-scale bulldozing of a river channel) and the sensitivity of the aquatic ecosystem.

Proposed mitigation:

Methods 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 proposed 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 prior to 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;
- Clearing should be conducted during autumn 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 prior to 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 some improvement (Low positive)

Impact table:

Potential impact on freshwater features	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	Medium to Low negative	M/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		

4.8.3 Activity 2a: Minor repairs to infrastructure

The impacts of repair work on infrastructure along the rivers vary, largely depending on the type of infrastructure, the level of repairs required and the way in which 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 stormwater infrastructure, stone pitching 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.

Significance of impacts without mitigation: Low

Proposed mitigation:

- Schedule work for when flow in the stream is at its lowest;
- Prior to 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 in order 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 storm water 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 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 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 water course 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.

Significance of impacts after mitigation: Very Low

Impact table:

Potential impact on freshwater features	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		

4.8.4 Activity 2b: Major repairs to infrastructure

The impacts of major repairs to road infrastructure along the river relate largely to the level of repairs required and the manner in which the repairs are conducted. The activity however still entails the repairing of a piece of infrastructure so that it retains its original footprint and capacity, a like–for–like scenario. Any additions to infrastructure are by definition not within the scope of an MMP.

Repairs will typically involve a localised disturbance of the river channel or banks while infrastructure is repaired. During the repair work to infrastructure, undesirable pollutants can potentially enter the water course. This commonly can include lime (calcium oxide), other constituents found in cement (such as aluminium oxide), oils, diesel/petrol and sewerage. 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.

Failure to remove obstructions from infrastructure can result in undercutting of infrastructure.

Significance of impacts without mitigation: Medium to low

Proposed mitigation:

General repairs to infrastructure:

- Minimise the spatial extent of disturbance and the frequency of, or requirement for, maintenance activities. The disturbance footprint should be clearly demarcated. No activities should take place outside of this area.
- Repairs should be conducted when there is low flow in the river. Any flow in the watercourse should be diverted around the river works and the minimum base flow in the river should be maintained at all times.
- Do not impede the movement of aquatic and riparian biota.
- Manual labour is preferred to the use of mechanical equipment in order to minimise physical disturbance around the activity location.
- While the repair work is being carried out; temporary sediment trapping mechanisms should be put in place downstream of the activity to filter water from the construction site
- 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 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.
- The maintained infrastructure should not impact the structural integrity of the water course nor result in any alteration to the flow- and sediment-carrying-capacity of the river.
- Any cleared sediment, vegetation or spoil material associated with the maintenance activity should be removed from the river channel, preferably to an approved disposal site.
- After construction, any areas within the maintenance footprint that have been degraded from their condition prior to construction and as a result of the maintenance activities must be restored to their former condition. Disturbed areas should be revegetated with appropriate indigenous plant species (see suggested vegetation in this report). Clear alien plants to encourage the regrowth of indigenous species.
- All reasonable measures should be undertaken to ensure that river maintenance activities minimise future erosion of the river bed and banks.
- After maintenance activities are complete, any areas within the maintenance footprint that have been degraded from their condition prior to construction and as a result of the construction activities must be restored to their former condition (banks reshaped and vegetated).
- Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms River (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee, or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in sensitive zones of the rivers, if deemed to be required by the oversight committee.

Removal of obstructions from infrastructure:

- Drains, pipes and culverts must be inspected regularly for obstructions that, unless removed timeously, may cause major up-stream blockages, premature over- topping and 'out-flanking' of structures by high flows that damage approaches and property downstream.
- Channels upstream and downstream of the structures must be kept clear of flood debris.
- Channels upstream of the low water crossing structures should also be kept clear of *Phragmites* reeds and/or bulrushes that may serve as sediment or debris traps directly upstream of inlet structures – since this vegetation also plays useful ecological roles, clearing of the channels should be limited to no more than 5m up- or downstream of the structures.
- Banks and channels must be kept clear of alien plants that concentrate flow and contribute to erosion, sediment release and channel blockages.
- The Engineer and Environmental Control Officer must indicate the extent and depth of sediment removal, how it is to be undertaken, and where excavated material must be stockpiled. If sediment needs to be

removed from reaches beyond the road reserve, consult the Western Cape Department of Agriculture and affected landowners before finalising the method statement for sediment removal.

- Sediment stockpiles must be located further than 30 m from the channel, in already disturbed areas that are protected against erosion by water or wind so that they do not erode into the river.

Construction and decommissioning of by-passes to allow works to low water crossings:

- Bypasses, where necessary, must be located as far as possible within the immediate area of disturbance of the low water crossing.
- Fill material for bypasses can be sourced from sediment stockpiles created through the clearance of sediment from the structures, or otherwise from approved sources – they must also be of a quality that will not leach salts, pass fine sediment into the water or provide a source of invasive alien plant seed.
- Bypasses should be vented with pipes or box culverts to accommodate the base flows in the river.
- The base of by-passes must be protected against scour and erosion with sand bags or rip- rap.
- Upon decommissioning, material used for bypasses can be used for repairing damaged approaches or otherwise stockpiled outside of the river corridor. All material used in bypasses as well as all pipes and other temporary venting must be removed
- Full, previous channel width must be reinstated upon the decommissioning of bypasses.
- The disturbed footprints of by-passes should be monitored on an on-going basis for invasive alien plants, which must be removed.
- Disturbed channels must be rehabilitated, reshaped and if necessary planted with locally indigenous appropriate plant species to prevent erosion.

Significance of impacts after mitigation: Medium to Low

Impact table:

Potential impact on freshwater features	Major repairs to infrastructure			
Nature	Impaired water quality and localised disturbance of habitat		Status	-
Impact source(s)	Pollutants, disturbed silt and sediments			
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	Medium to low negative		M/L-
	With mitigation	Low negative		L-
Cumulative impact	Without mitigation	Low		
	With mitigation	Low		
Confidence	Medium/high			

4.8.5 Activity 3: Sediment removal at infrastructure

Sediment and other materials are often removed to allow access to the infrastructure or to ensure that the infrastructure can continue to operate 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 further degradation as a result of erosion and invasion by alien plants occurring in the disturbed area. 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.

Significance of impacts without mitigation: Medium to low

Proposed mitigation:

- Material may be removed within the active channel during periods of low flow;
- 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 water course 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 as suggested in this report.
- Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee, or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in sensitive zones of the rivers, if deemed to be required by the oversight committee.

Significance of impacts after mitigation: Low

Impact table:

Potential impact on freshwater features	Sediment movement at infrastructure			
Nature	Disturbance of riparian and aquatic habitat with the potential of increased turbidity downstream if the 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 the 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			

4.8.6 Activity 4: Sediment removal from the channel for flood conveyance

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. 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.

Significance of impacts without mitigation: Medium to low

Proposed mitigation:

- Material may be removed within the active channel only during periods of low flow;
- 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 water course 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.
- Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee, or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in sensitive zones of the rivers, if deemed to be required by the oversight committee.

Significance of impacts after mitigation: Low

Impact table:

Potential impact on freshwater features	Sediment removal from the channel for flood conveyance / channelisation			
Nature	Disturbance of riparian and aquatic habitat		Status	-
Impact source(s)	Direct physical disturbance of river bed and banks			
Impacted aquatic ecosystem	Aquatic habitat and biota within 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	Low negative		L-
Cumulative impact	Without mitigation	Low		
	With mitigation	Low to Very Low		
Confidence	Medium/high			

4.8.7 Activity 5: Repairs to riverbanks and associated bank stabilization infrastructure

The dynamic nature of a river results in erosion of the banks and damage to bank stabilization structures along the banks, such as gabion or retainer walls. When bank stabilisation infrastructure has been damaged, the eroding or flood-damaged banks and adjacent areas may need to be repaired. Should damage to the river banks and berms occur it is thus recommended that this be utilised as an opportunity to rehabilitate and restore some of the riparian zone functionality.

The movement of material to reshape a bank or repair a berm is more often conducted by machinery as the volume of material is too much to be carried out by hand. The resulting disturbance of using machinery within and adjacent to the watercourse is usually significant and required rehabilitation measures after the work is complete.

Significance of impacts without mitigation: Medium - depends on the extent of work required

Proposed mitigation:

- Maintenance activities are best done during periods of low flow unless emergency works are 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 water course and avoid increasing channelisation or canalization of the watercourse;
- Where possible, aim to create gently sloping banks (slope of at least 1:4) 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 in order 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.
- Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee, or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in sensitive zones of the rivers, if deemed to be required by the oversight committee.

Significance of impacts after mitigation: Medium to low

Impact table:

Potential impact on freshwater features	Repairs to river banks and associated bank stabilisation infrastructure		
Nature	Disturbance of riparian and aquatic habitat	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	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		

4.9 Risk Assessment

The risk assessment is based on the assumption that the activity is conducted in accordance with the method statements of this MMP. The nature of an MMP dictates that it only relates to the maintenance of existing structures or maintenance activities. A risk assessment was carried out for the proposed activities (summaries below) to assess the potential for the proposed activities of the MMP to alter the ecological condition of the aquatic ecosystems. It should be noted that many of the proposed maintenance activities are intended to improve the ecological integrity of the aquatic ecosystem such as alien vegetation removal and shaping of the riverbanks to address erosion or can be considered as an existing lawful use such as the maintenance of existing lawful infrastructure within the watercourses.

In terms of the risks to the aquatic ecosystems, conducting any of the activities in wetland areas or the upper stretches of the rivers that are deemed of very high ecological sensitivity is deemed to pose a higher risk than conducting the activity in the lower reaches of the rivers that are already significantly modified and of lower ecological sensitivity. Separate risk assessments have been conducted for the two different river use categories.

Special care should however be taken when conducting any activities within the wetland areas or stretches of the rivers deemed of very high ecological sensitivity. For maintenance activities indicated to be of a higher than low risk, it is recommended that the activities be guided by an oversight committee comprising members of the authorising authorities (BGCMA, DEA&DP and WC: DoA). The full risk assessment matrices for the various activities can be seen in the Appendices to the Ecological Report. The risk rating categories are summarized in the table below.

Table 6. A description of the risk rating categories

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

Table 7: A summary of the risk assessment for Activity 1a – the clearing of alien vegetation, if conducted in the lower reaches of the rivers that are significantly modified and of low ecological sensitivity.

Activity	Aspect	Impact	Significance	Risk
Initial clearing of invasive alien vegetation – Cutting of stems/trunks; pulling of smaller species, removal of material from river area	Disturbance within cleared area caused by movement of people and removal of cut or pulled material	Disturbance of vegetation and soil within the river and wider riparian zone	12.75	L
Follow up clearing – Pulling of young plants or	Disturbance within cleared area within the river channel and riparian zone	Disturbance of vegetation and soil within the river and	27.5	L

spraying plants with herbicides	for pulling of plants or application of herbicide as well as removal of plant material	wider riparian zone; potential surface water quality impairment		

Table 8: A summary of the risk assessment for Activity 1a – the clearing of alien vegetation, if conducted in wetland areas or the upper reaches of the rivers deemed of very high ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Initial clearing of invasive alien vegetation – Cutting of stems/trunks; pulling of smaller species, removal of material from river area	Disturbance within cleared area caused by movement of people and removal of cut or pulled material	Disturbance of vegetation and soil within the river and wider riparian zone	17	L
Follow up clearing – Pulling of young plants or spraying plants with herbicides	Disturbance within cleared area within the river channel and riparian zone for pulling of plants or application of herbicide as well as removal of plant material	Disturbance of vegetation and soil within the river and wider riparian zone; potential surface water quality impairment	30	L

Table 9: A summary of the risk assessment for Activity 1b – the control of nuisance growth of indigenous aquatic vegetation, if conducted in the lower reaches of the rivers that are significantly modified and of low ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Physical cutting of aquatic vegetation, removal of material from river area	Disturbance around and within cleared area caused by movement of people; operation of machinery and / or fire; removal of material	Disturbance of vegetation and soil within the river and wider area	40.5	L

Table 10: A summary of the risk assessment for Activity 1b – the control of nuisance growth of indigenous aquatic vegetation, if conducted in wetland areas or the upper reaches of the rivers deemed of very high ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Physical cutting of aquatic vegetation, removal of material from river area	Disturbance around and within cleared area caused by movement of people; operation of machinery and / or fire; removal of material	Disturbance of vegetation and soil within the river and wider area	75	M

Table 11: A summary of the risk assessment for Activity 2 – repairs to infrastructure, if conducted in the lower reaches of the rivers that are significantly modified and of low ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Physically repairing an existing structure or infrastructure in the channel or riparian in a like-for-like fashion	Accessing the site, operating at the site with required machinery, rehabilitation after completion	Localised disturbance caused by movement of people and operation of machinery, potential	15.75	L

		water quality impacts caused by leaking oil etc.		

Table 12: A summary of the risk assessment for Activity 2 – repairs to infrastructure, if conducted in wetland areas or the upper reaches of the rivers deemed of very high ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Physically repairing an existing structure or infrastructure in the channel or riparian in a like-for-like fashion	Accessing the site, operating at the site with required machinery, rehabilitation after completion	Localised disturbance caused by movement of people and operation of machinery, potential water quality impacts caused by leaking oil etc.	21	L

Table 13: A summary of the risk assessment for Activity 2b – Major repairs to or replacement of damaged formal crossings, if conducted in the lower reaches of the rivers that are significantly modified and of low ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Major repairs to or replacement of a damaged formal crossing in a like-for-like fashion	Accessing the site, operating at the site with required machinery, rehabilitation after completion	Localised disturbance caused by movement of people and operation of machinery, potential water quality impacts caused by leaking oil etc.	37.5	L

Table 14: A summary of the risk assessment for Activity 2b – Major repairs to or replacement of damaged formal crossings, if conducted in wetland areas or the upper reaches of the rivers deemed of very high ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Major repairs to or replacement of a damaged formal crossing in a like-for-like fashion	Accessing the site, operating at the site with required machinery, rehabilitation after completion	Localised disturbance caused by movement of people and operation of machinery, potential water quality impacts caused by leaking oil etc.	56.25	M/L

Table 15: A summary of the risk assessment for Activity 3 – sediment movement at infrastructure, if conducted in the lower reaches of the rivers that are significantly modified and of low ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Removing sediment from the river at the site of existing of infrastructure	Accessing the site, lifting the sediment and removing it from the site, rehabilitation after completion	Localised disturbance of riparian and aquatic habitat	28.875	L

Table 16: A summary of the risk assessment for Activity 3 – sediment movement at infrastructure, if conducted in wetland areas or the upper reaches of the rivers deemed of very high ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Removing sediment from the river at the site of existing of infrastructure	Accessing the site, lifting the sediment and removing it from the site, rehabilitation after completion	Localised disturbance of riparian and aquatic habitat	57.75	M/L

Table 17: A summary of the risk assessment for Activity 4 – sediment removal from the channel for flood conveyance / channelisation, if conducted in the lower reaches of the rivers that are significantly modified and of low ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Physically removing sediment from the channel of the river	Accessing the site, lifting the sediment and removing it from the site, rehabilitation after completion	Disturbance of riparian and aquatic habitat	43.125	L

Table 18: A summary of the risk assessment for Activity 4 – sediment removal from the channel for flood conveyance / channelisation, if conducted in wetland areas or the upper reaches of the rivers deemed of very high ecological sensitivity

Activity	Aspect	Impact	Significance	Risk
Physically removing sediment from the channel of the river	Accessing the site, lifting the sediment and removing it from the site, rehabilitation after completion	Disturbance of riparian and aquatic habitat	66.125	M

Table 19: A summary of the risk assessment for Activity 5 – sediment movement in the channel or on the banks for repairs to berms or banks or adjacent flood damaged cultivated lands, if conducted in the lower reaches of the rivers that are significantly modified

Activity	Aspect	Impact	Significance	Risk
Physically moving sediment from river channel onto the banks, infilling of eroded areas within cultivated lands	Accessing the site, lifting the sediment and removing it from the site, rehabilitation after completion from the site	Disturbance of riparian and aquatic habitat	51.75	L

Table 20: A summary of the risk assessment for Activity 5 – sediment movement in the channel or on the banks for repairs to berms or banks or adjacent flood damaged cultivated lands, if conducted in wetland areas or the upper reaches of the rivers deemed of very

Activity	Aspect	Impact	Significance	Risk
Physically moving sediment from river channel onto the banks, infilling of eroded areas within cultivated lands	Accessing the site, lifting the sediment and removing it from the site, rehabilitation after completion from the site	Disturbance of riparian and aquatic habitat	80.5	M

4.10 Mapped biodiversity features

Aquatic biodiversity conservation mapping that is of relevance to the study area comprises:

- National Freshwater Ecosystem Priority Areas (NFEPA);
- National Wetland Map version 5 (NWM5);
- Strategic Water Source Areas (SWSAs); and
- Western Cape Biodiversity Spatial Plan (WCBSP) that includes Aquatic Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs).

National Freshwater Ecosystem Priority Areas

The NFEPA (2011) mapping is intended to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting the sustainable use of water resources. The maps were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries. The NFEPA River Sub-catchments and Wetlands are required to be maintained in a largely natural ecological state while fish support areas should not be allowed to degrade from their existing ecological condition. NFEPA mapping associated with the Klip and Keurbooms Rivers is shown in **Figure 9**.

In terms of River FEPAs, the catchments of the Klip and Keurbooms Rivers are mapped as Upstream Management Areas which are sub-quaternary catchments in which human activities need to be managed to prevent the degradation of downstream river FEPAs and Fish Support Areas. The entire length of the two rivers, as well as many of their tributaries within the study area, are also mapped as natural floodplain wetlands. Wetland FEPAs currently in a good ecological condition should be managed to maintain this condition. Those currently not in good condition should be rehabilitated to the best attainable ecological condition.

National Wetland Map version 5

The NWM5 (2018) provides a mapping of the location, spatial extent and ecosystem types for estuarine and inland wetlands and informs decision-makers in assessing development applications, land use and conservation planning and policy making. The spatial representation of the aquatic ecosystems is crucial for the assessment of the threat status and protection levels of wetlands, as well as the listing of threatened ecosystem types. The natural Wetland FEPAs mentioned above are also mapped in the NWM5 as either channelled valley-bottom wetlands in the upper reaches or floodplain wetlands in the middle to lower reaches (**Figure 10**).

Strategic Water Source Areas

SWSAs (2018) are defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important, or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b). They include transboundary Water Source Areas that extend into Lesotho and Swaziland. All surface water SWSAs are located in high rainfall areas where there is a strong link between groundwater and surface water. The aquifers in these areas sustain baseflow, contribute to runoff and, especially, contribute to dry season flows.

Within the study area, the Keurbooms and Klip Rivers, up to their confluence lie within the Langeberg SWSA for surface water (**Figure 11**).

Western Cape Biodiversity Spatial Plan

The WCBSP (2017) aims to guide sustainable development by providing a synthesis of biodiversity information to decision-makers to ensure appropriate land use and planning for the best possible long-term benefits and to promote integrated management of natural resources. The main map categories are Critical Biodiversity Areas (Terrestrial and Aquatic), Ecological Support Areas (Critical and Other), Other Natural Remaining Areas and No Natural Remaining Areas. The first two mentioned categories represent the biodiversity priority areas which should be maintained in a natural to near natural state. The last two mentioned categories are not considered priority areas and a loss of biodiversity within these areas may be acceptable.

Within the study area, most of the Klip and Keurbooms Rivers are mapped as Aquatic Critical Biodiversity Areas (CBAs) due to their associated wetland habitats while the wider floodplain areas are mapped as aquatic Ecological Support Areas (ESAs) that require restoration as they are degraded within agricultural areas. The upper catchment, upstream of the study area lies within the Cape Nature Marloth Nature Reserve while the area to the east of the lowest reach of the Klip River, upstream of its confluence with the Breede River forms part of the Bontebok National Park. See **Figure 12**.

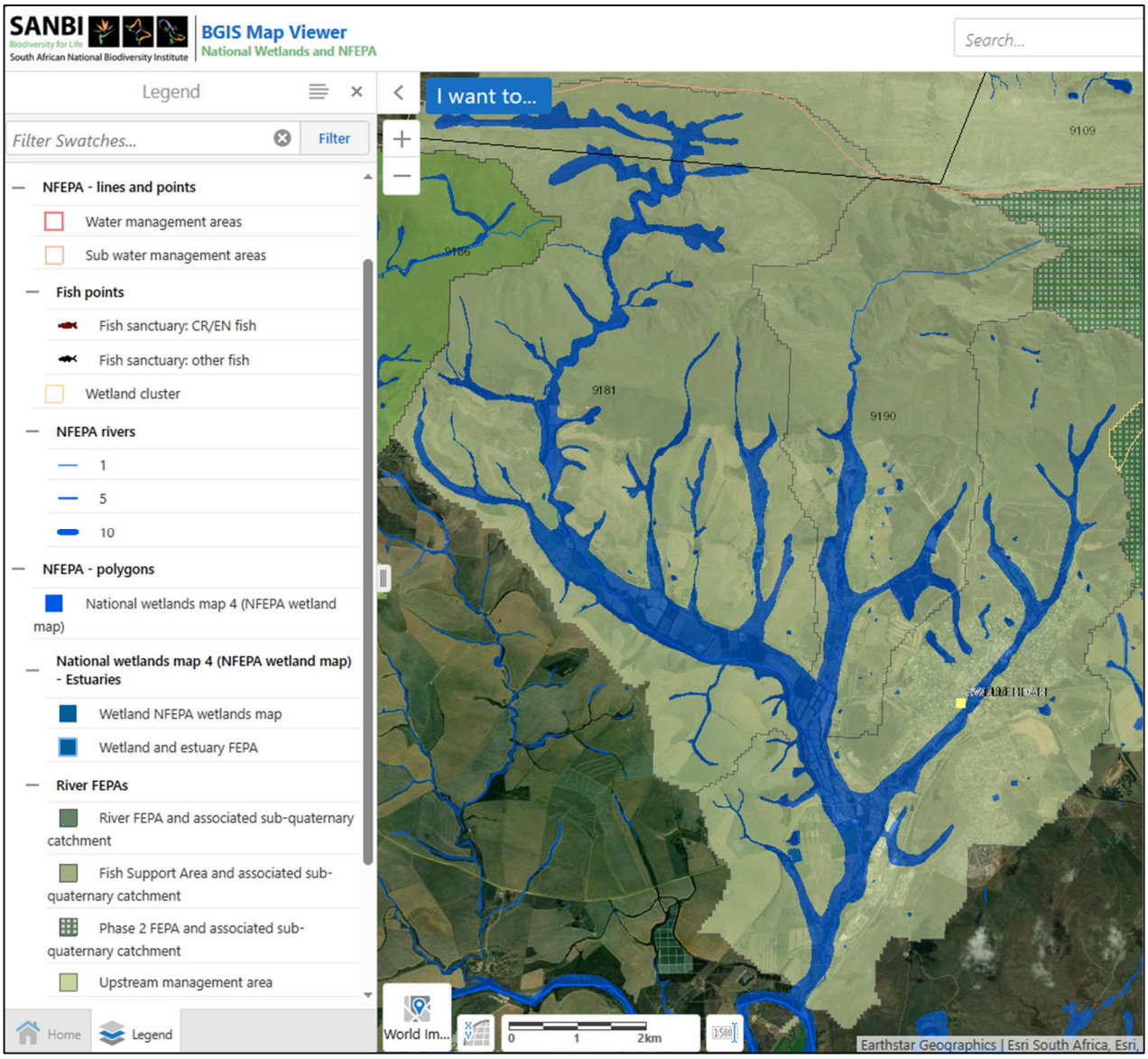


Figure 9. River Freshwater Ecosystem Priority Areas relative to the study area (SANBI Biodiversity GIS, 2023).

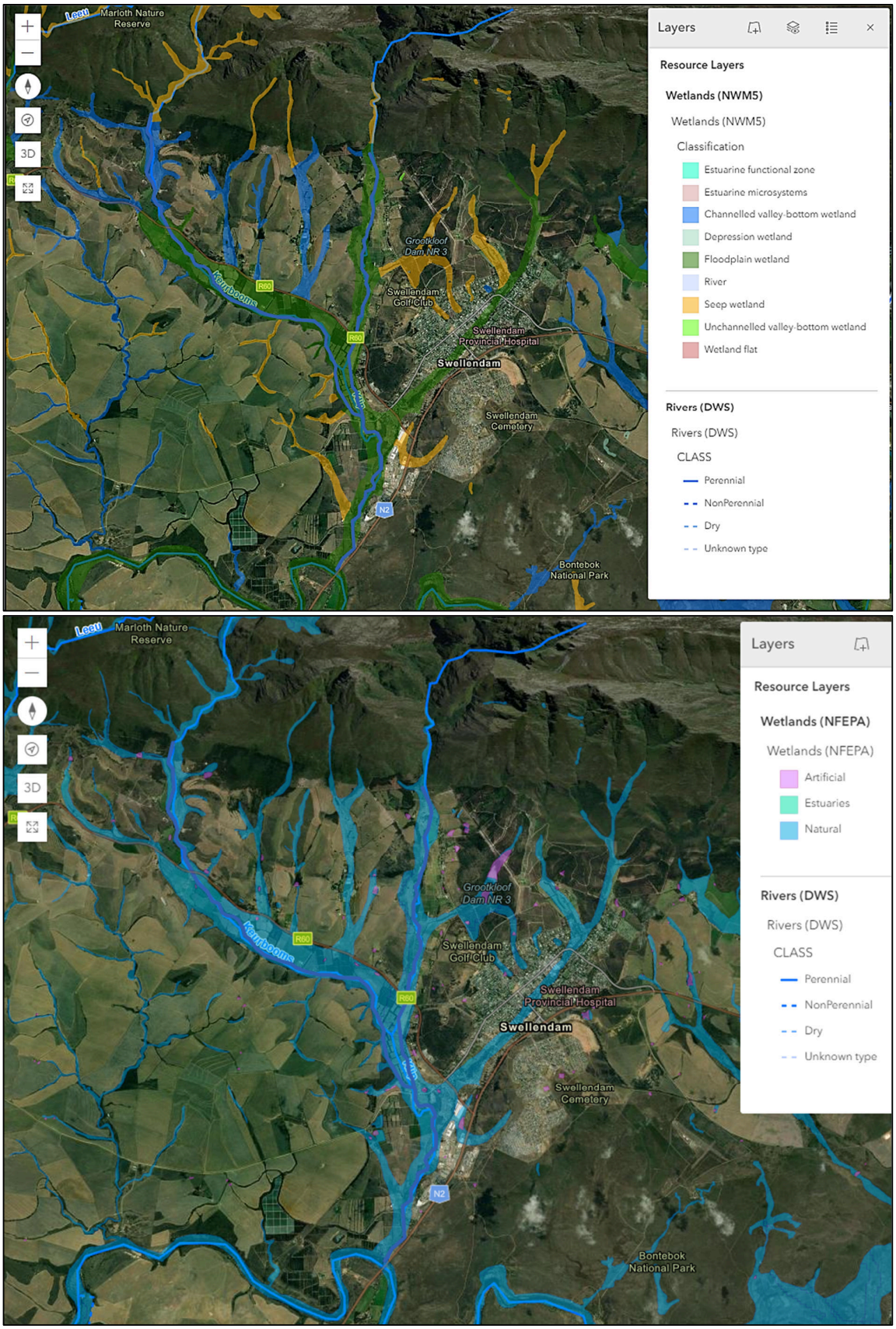


Figure 10. National Wetland Map (top) and Freshwater Ecosystem Priority Area wetlands (bottom) for the study area (CapeFarmMapper, 2023)

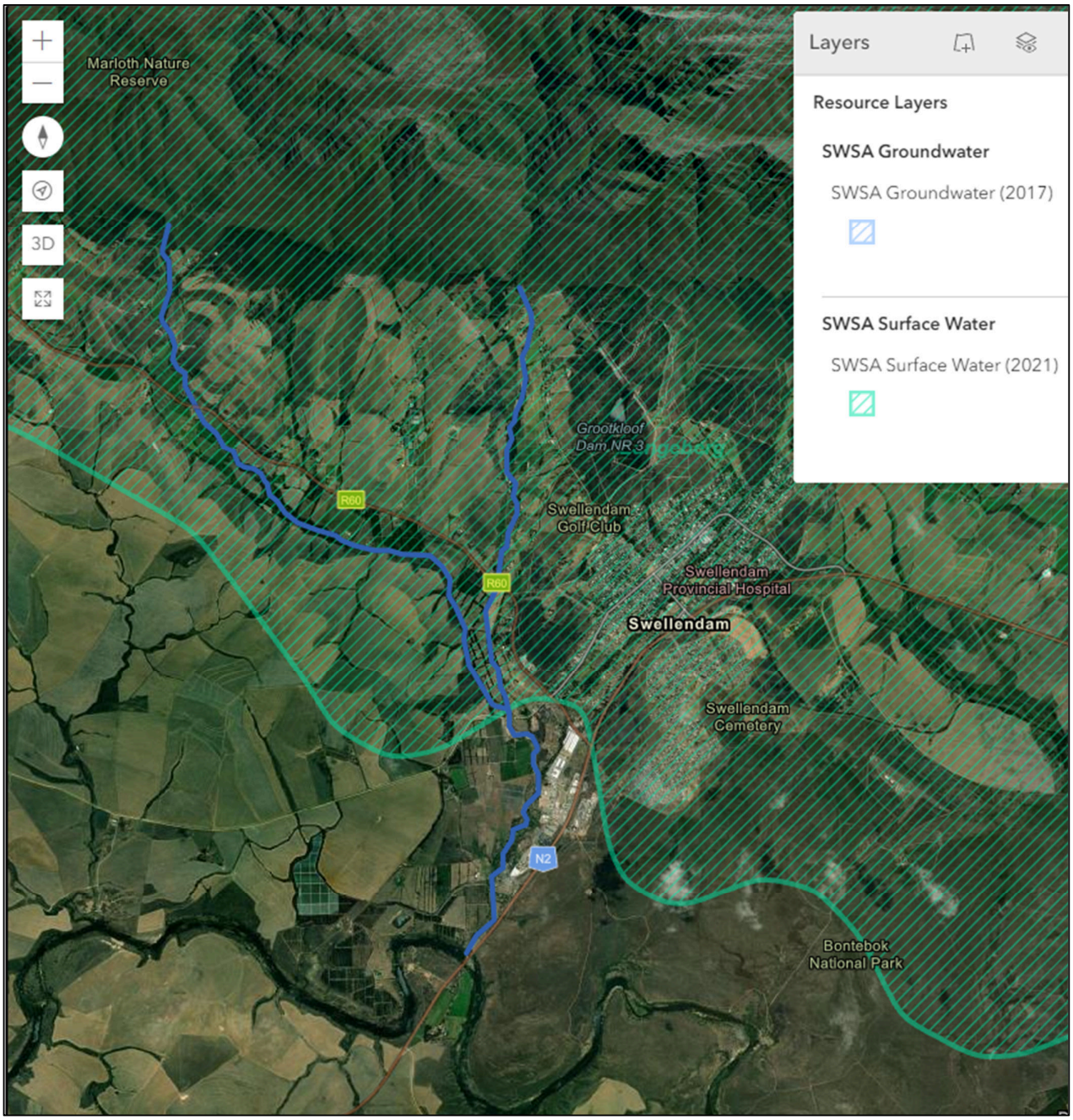


Figure 11. Strategic Water Source Areas within the study area (CapeFarmMapper, 2023)

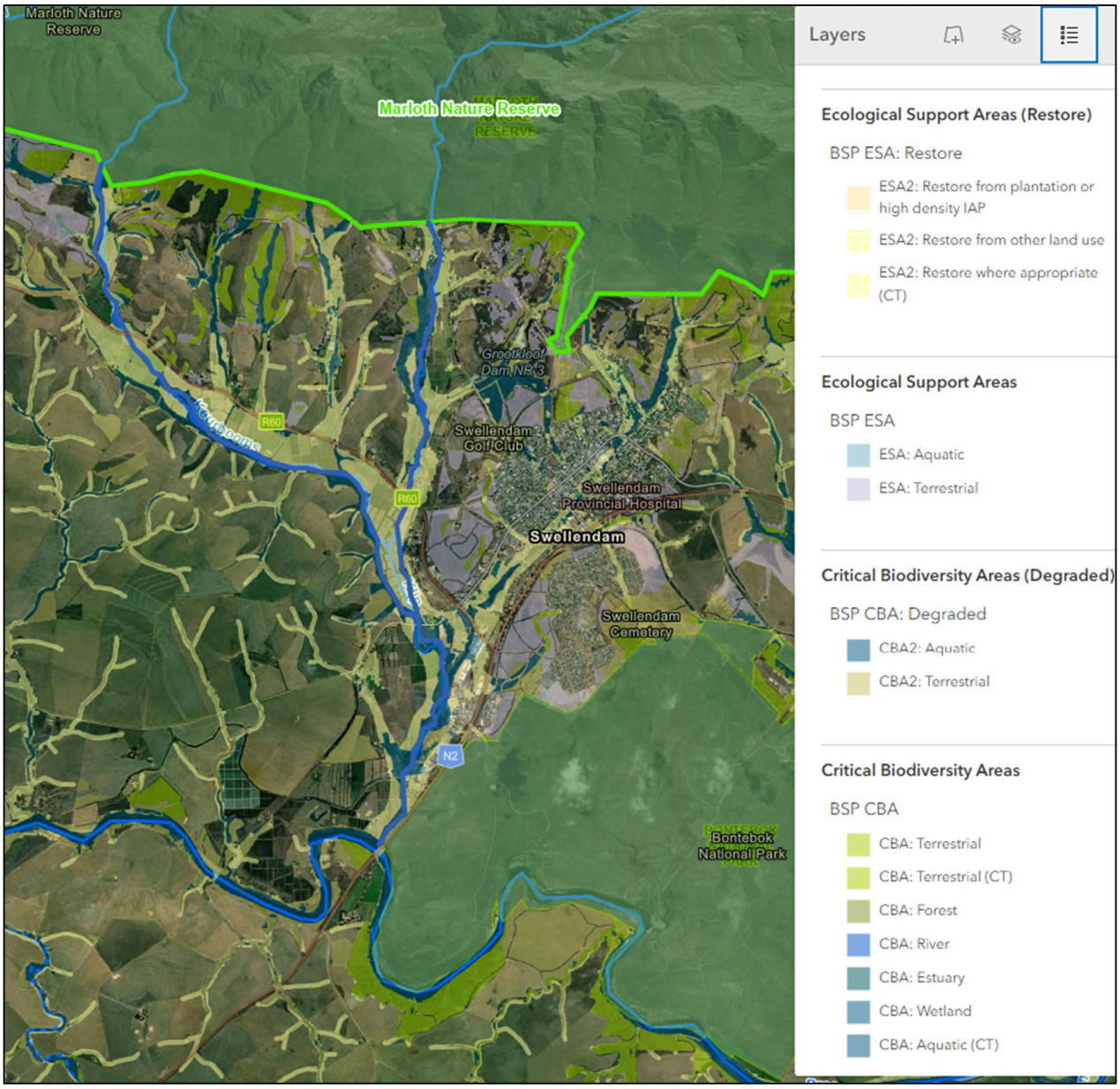


Figure 12. The 2017 Western Cape Biodiversity Spatial Plan for the study area (CapeFarmMapper, 2023)

4.11 Past River Modification, and Historical Maps

The area has a long history of development with the town of Swellendam establishing as a settlement in 1743. During its early days, the town was an important refreshment station along the coastal road and a gateway to the interior. Agricultural activities in the area and along the rivers in the study area have had a far longer history. The wider area was a known home to the Hessequa Khoi tribe. During the 1800s the town developed as an agricultural hub and trade centre in the Overberg and Western Cape. The development of the catchment in more recent years has however had a more significant impact on the ecological integrity of the river systems.

Agricultural encroachment into the riparian zones of the rivers and the physical modification of the watercourses over time has impacted the integrity of the aquatic habitat of the rivers as well as their geomorphology, flow and water quality, all of which ultimately impact the aquatic biota occurring within the river system. Past aerial imagery for the study area is available for 1949 giving some indication of the more recent change to the river corridors (**Figure 13**). By 1949 significant cultivation had already taken place along the river corridors and within the floodplain of the Klip and Keurbooms Rivers, with several smaller dams having been built in the wider catchment. The first Grootkloof Dam (81 000 m^3) intended to store diverted river water for Swellendam was constructed in 1930, followed by the Grootkloof No 2 Dam (75 000 m^3) in 1949. Grootkloof No 3 Dam was only constructed in 1983 but was much larger with a capacity of 574 000 m^3. Many of the other larger dams in the catchment were all mostly constructed in the last 30 years.

Figure 14 shows the mapped aquatic habitats from the 1949 imagery, together with that present today. Under natural conditions, the lower reaches contained much wider floodplain wetland habitats that were regularly inundated by the rivers in high-flow conditions. The river channels also had a dynamic main channel that was formed by the more recent flood events. Flooding of the adjacent floodplain is a vital occurrence as it not only serves to provide the floodplain with fertile sediments but also flushes this area of salts that have built up during the dry period. Today the associated floodplain area of the Klip and Keurbooms Rivers is about 58% of that is mapped as being present in 1949. The comparison of this area between 1949 and 2023 indicates that the areas where there has been the most significant loss are within the lower reaches and in particular near and downstream of the confluence of the two rivers.

The infilling, straightening and narrowing of the watercourses in this area, together with the encroachment of invasive alien trees, have resulted in increased energy in the flow and erosion potential of the river channels. The valley bottom and floodplain wetland areas are particularly important in attenuating flow in high-flow events and slowly releasing that water and sustaining flow in the watercourses for longer periods of time. They also assist with trapping sediment, ameliorating poor water quality, cooling surface temperatures, encouraging infiltration and providing important habitats for aquatic biota. These are all very important ecological services in minimising the impacts of climate change in the area. There is an opportunity to improve the condition of the river system through more ecologically sensitive maintenance methods due to the fact that for most of the watercourses wider river channels, wetland areas and floodplains still exist. There should also be a progressive attempt to reinstate some wetland and buffer areas along the rivers to improve the ecological functionality of the rivers. Recommendations for improvement of the ecological state of the rivers are provided in more detail in the following sections.

4.12 Photographic Record

See **Annexure B1** for a photograph register of infrastructure maintenance sites along the study area.

4.13 Risks Associated with the No-go Option

If the “no-go” option is implemented, the ecological integrity of the Klip and Keurbooms Rivers will further deteriorate.

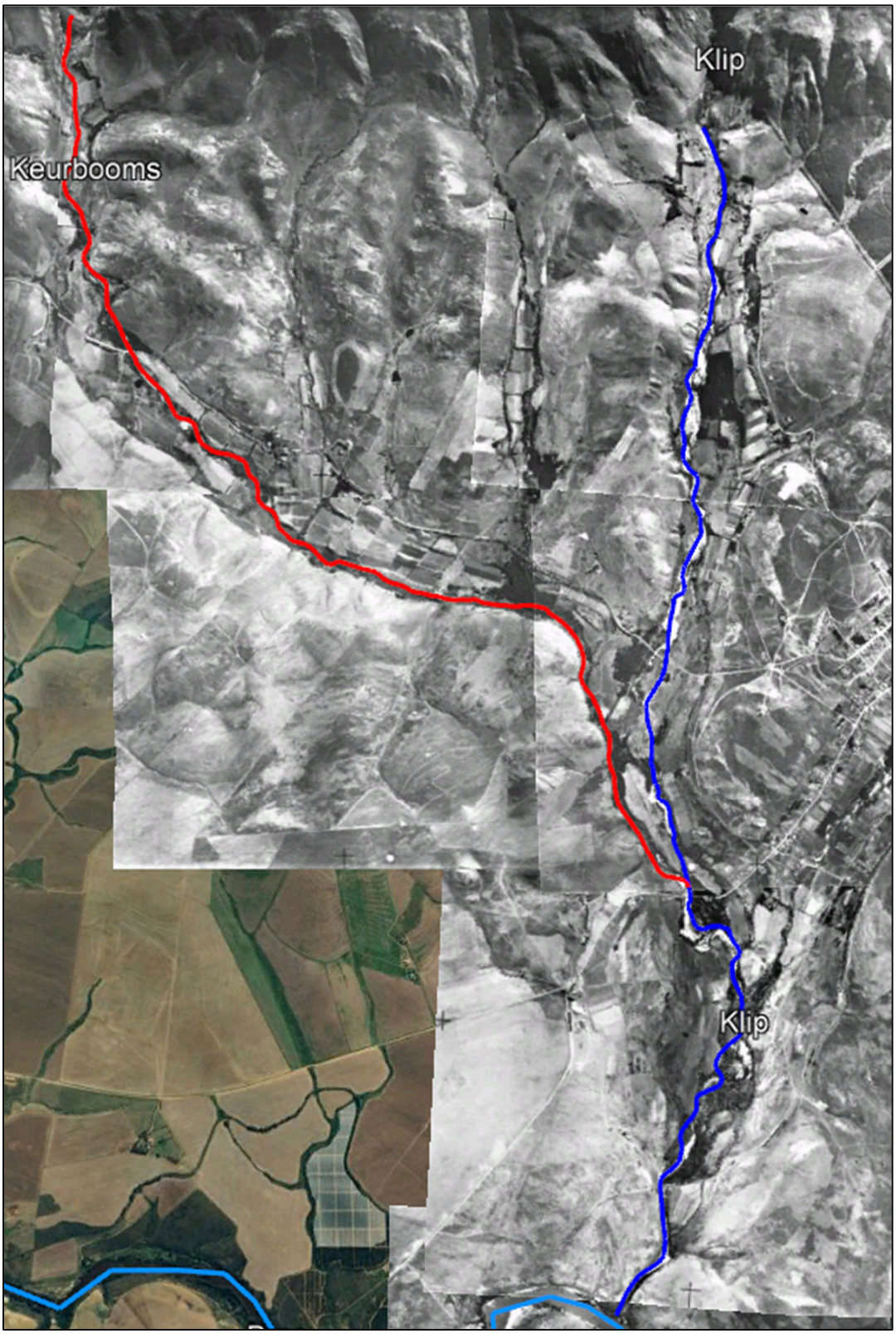


Figure 13: Aerial images of the study area taken in 1949 overlaid in Google Earth. The thicker blue and red lines indicate the river reaches within the study area.

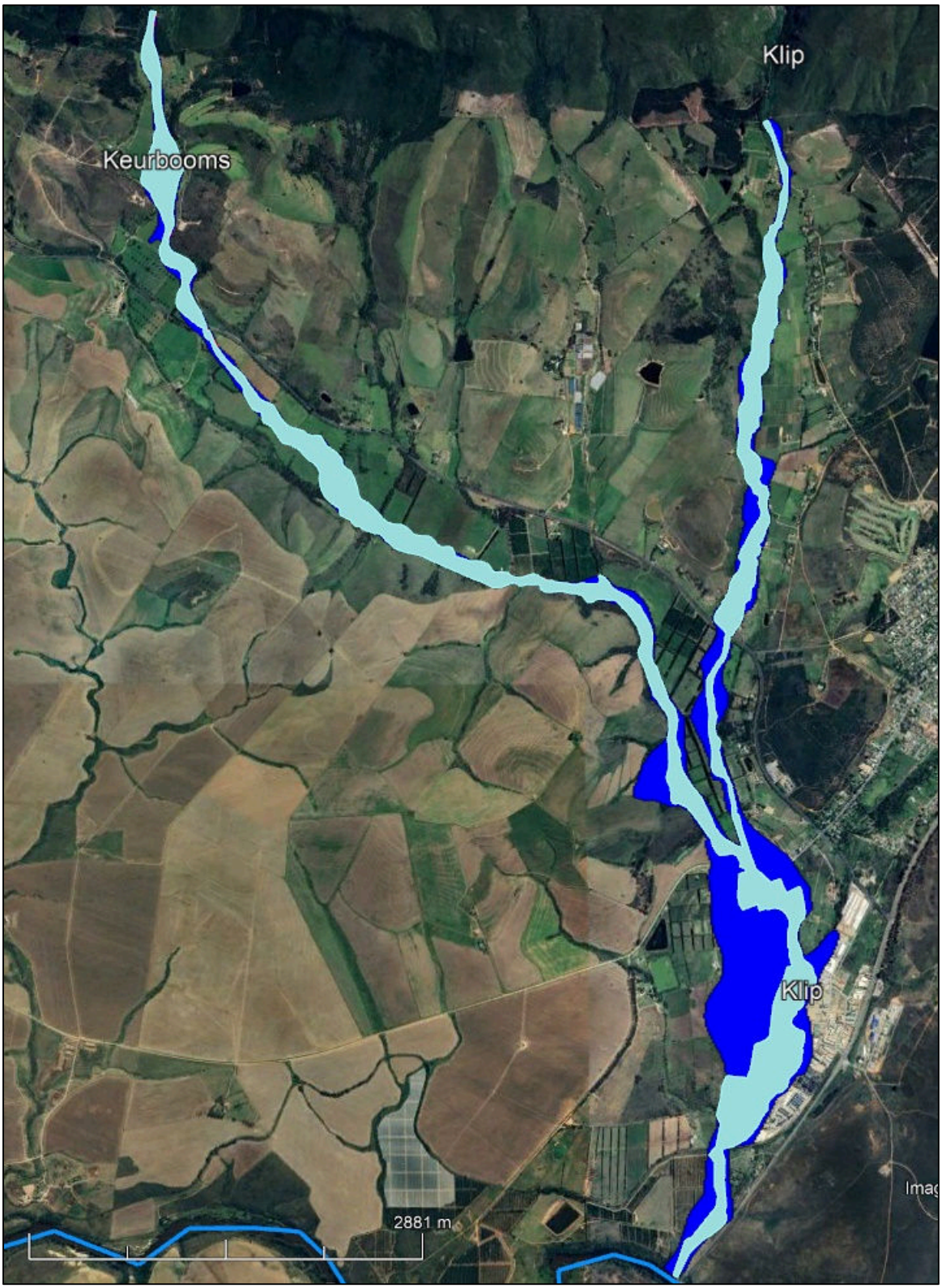


Figure 14: Mapping in Google Earth of the watercourse extent in the study area for 1949 (dark blue areas), shown together with the present day watercourse extent (light blue areas).

5 Method Statements

The subsections below provide guiding principles and guidelines, as well as the specific method statements to be implemented during MMP implementation.

5.1 DEADP MMP Principles and Guidelines

The following are overarching principles to be used by landowners and managers when considering the development and implementation of an MMP, as are set out in the DEA&DP's MMP Information Document:

1. 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;
2. Avoid and reduce unnecessary maintenance;
3. 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;
4. 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;
5. Managers and organs of state must identify, address and, where feasible, eliminate the factors that necessitate intrusive, environmentally-damaging maintenance; and
6. A process of continuous management improvement be applied, namely Planning; Implementing; Checking (monitoring, auditing, determining corrective action) and Acting (management review).

Guiding principles for maintenance work in water courses:

- Repairs and maintenance should be undertaken within the low flow season, except for emergency maintenance works.
- Where at all possible, existing access routes should be used. In cases where none exist, a route should be created through the most degraded area avoiding sensitive/indigenous vegetation areas.
- 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.
- At no time should the flow of the watercourse be blocked (temporary diversions may be allowed) nor should the movement of aquatic and riparian biota (noting breeding periods) 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 natural 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: o 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 riverbank 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.

The subsections below provide the specific method statements to be implemented during MMP implementation.

5.2 Activity 1a: Vegetation Management - Clearing of Invasive Alien Vegetation	
(a)	**Measure Description:** The removal of invasive alien plants from the watercourse is desirable not only from an aquatic ecological perspective but also because they reduce the ability of that watercourse to provide many valuable goods and services. Woody alien invasive species are noted to have caused a decline in indigenous plant numbers, changed the vegetation structure and, in many cases, reduced the biotic and habitat diversity of the riparian zones. Negative impacts of alien vegetation include reduced runoff and water availability; increased instability and erosion of banks, modified water quality; reduced biodiversity; much hotter and more destructive fires which destroy indigenous seeds in the soil and are difficult to control; form barriers to the movement of biota and have economic consequences. A list of the invasive and alien vegetation that should be removed or at least replaced over the longer term is provided in **Section 5.11** below. Suitable indigenous vegetation to plant in cleared areas is provided in **Section 5.10** below.
(b)	**Location:** This activity applies to the entire project area. Sensitive habitats exist within wetland habitats (and in particular palmiet-dominated wetlands) where additional caution measures should be applied, with the advice of the MMP oversight committee. An aquatic ecologist, rehabilitation specialist or botanical specialist should be sought for larger-scale clearing projects, if deemed to be required by the oversight committee.
(c)	**Frequency:** At least twice per year. More frequently initially during the initial clearing phase, reducing the frequency as the re-established indigenous vegetative cover becomes more established Maintenance works within the watercourse and wetland areas specifically should preferably be between January and May to avoid most amphibian and bird breeding seasons.
(d)	**Method Statement:** *Action 1 – Identify alien invasive species* A list of alien invasive plant species typically occurring within the watercourses in the are included in **Section 5.11** below. If unsure, please contact the Department of Agriculture or CapeNature for assistance. *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 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.

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.

All alien plants identified for removal 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. 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.

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.

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 often essential to ensure the dieback of an entire root system to prevent the re-growth or coppice (forming of new shoots from the stumps). Considering that the works are however near aquatic features extreme care should be taken in terms of the selection and use of herbicides. 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 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. Control of kikuyu grass should only be attempted where there is a good chance of success and must include a plan to re-establish indigenous species.

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 the 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. Biocontrol agents could be introduced to control the Australian Acacias and reduce the seedbank. Martens *et al*. 2021 (see the full refence below) can be consulted for recommended biocontrol agents.

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 access roads;

Chip the cut material and remove the chips to 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.

The control of the Spanish reed (*Arundo donax*)

Take care not to confuse the indigenous fluitjiesriet or common reeds with the Spanish reed. The key differences between common reeds and Spanish reed (eradicated) are as follows

Common reeds (*Phragmites australis*) –	Spanish reed (*Arundo donax*)
	
Indigenous aquatic plant - to be controlled where there is nuisance growth	Invasive alien plant – to be eradicated Thicker stem (10 - 80mm) and taller (2 - 7m)

	Thinner stem (10 - 35mm) and shorter (1.5 - 3m) Smaller leaf (Leaf blades are 1-5cm wide and up to 60cm long); Much-branched feathery seed heads are usually light brown and slightly curved	Bigger leaf (Leaf blades are 5-7cm wide and up to 91 cm long); Much-branched feathery seed heads are usually whitish in colour and erect

The following clearing method is proposed:

Cut the tall stems as close as possible to ground level.

Allow the rhizomes to re-sprout.

Spray the foliage of the young re-sprouting leaves in late autumn (April / May) before the leaves die back with an appropriate herbicide (Glycophosate 360). Use a low-pressure nozzle that can deliver a fine mist to improve the uptake of the herbicide by the leaves.

Where feasible, apply herbicides by the cut stem method. Take care to reduce spray drift as much as possible. Be aware of indigenous plants and aquatic habitats close to or within the stand of Spanish reed and do not spray or cut them.

Plant remains and rhizomes should be left a few months to rot until dead *in situ,* covering their cut bases.

Do not bulldoze the rhizomes out.

Action 6 – Re-vegetate with indigenous species.

Local indigenous plants recommended for the establishment within the site are included in **Section 5.10** below, where the lateral zonation in which the plants should be established is also indicated. Pockets of the aforementioned indigenous riparian plants would need to be established within cleared areas so that seeds 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.

The following useful guide can also be consulted for more information:
Martens, C., Deacon, G., Ferreira, D., Auret, W., Dorse, C., Stuart, H., Impson, F., Barnes, G. and C. Molteno. 2021. *A practical guide to managing invasive alien plants: A concise handbook for land users in the Cape Floral Region*. WWF South Africa, Cape Town, South Africa.

(e) **Material Disposal:** Cut plant material should either be chipped and used if it is free of alien plant or it should be responsibly disposed of at an approved disposal site. It should not be dumped in the watercourse channels and riparian zones or piled into heaps and burnt as the resulting hot fires kill indigenous seed in the soil.

(f) **Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.

(g) **Monitoring and Recordkeeping:** Regular monitoring and control of alien vegetation should be undertaken to ensure that the plants are removed while still young saplings 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.

Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be

	updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.
5.3	**Activity 1b: Vegetation Management - Clearing of nuisance growth of Bulrushes *(Typha capensis*)**
(a)	**Measure Description:** *Typha capensis* bulrushes are perennial indigenous wetland plants. They offer habitat for biota as well as providing essential ecological services such as mitigating nutrient enrichment, reducing erosion, causing deposition of silt, and cooling instream habitats. The fast-growing rhizomes spread quickly in more permanently inundated areas up to a depth of about 1.5m. Bulrushes in urban areas however do become hugely problematic in urban environments where it thrives on a relatively constant supply of nutrient-rich stormwater. Thus, while it is essential that where natural vegetation exists, it should be retained as far as possible. Therefore, the objective of this activity for bulrushes is to control/reduce the growth and to systematically replace them with indigenous wetland vegetation.  The primary impact of clearing bulrushes is the disturbance of riparian and aquatic habitats. The control or clearing of these plants within the site is probably only required within the more permanently inundated areas and not within the watercourse. Clearing of the nuisance rushes within the site is recommended to be done by hand, which would result in a very low impact
(b)	**Location:** Nuisance growth is likely to occur in the more permanently inundated wetland areas.
(c)	**Frequency:** Works should take place at the end of autumn, during the low flow period and outside of amphibian and bird breeding seasons (i.e. maintenance to be done during the period January to May).
(d)	**Method statement:** • The most successful method for control of *Typha* is through physically cutting the reeds in conjunction with flooding. • Identify specific plants requiring removal and/or demarcate areas requiring management. • Select access points to the watercourse that are indicated in the design as maintenance access routes to minimise disturbance of indigenous marginal and riparian vegetation. • 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 by the end of the growing season (late summer/autumn) to suppress the regrowth before the inundation. • Pulling of bulrush should be undertaken where the plants are small seedlings. • Stockpile cut material for no longer than two weeks. Temporary stockpiling areas should be located and demarcated at least 10m away from the water's edge. Where feasible stockpile heights should not exceed 2m to mitigate wind dispersion impacts and for safety considerations. • Work areas, stockpile locations and access routes (especially banks) should be monitored for erosion or growth of invasive alien vegetation. Inspections are to be undertaken at the end of the dry season and after the initial rainfall events.
(e)	**Material Disposal:** Cleared plant material should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site.

(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

5.4 Activity 1b: Vegetation Management - Clearing of nuisance growth of common reed *(Phragmites australis*)

(a) **Measure Description:**

Common *Phragmites australis* reeds 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. Therefore, the objective of this maintenance activity is to control the reeds and not to eradicate them from the river channel.



Phragmites reed 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 sediment 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 watercourses is probably only required in the lower, flatter sections where the river system. Clearing of nuisance reeds by hand would result in a very low impact, however, given the extent of reed growth, machinery is likely to be required and would have a greater impact.

The impact of clearing of reeds where there are breeding birds and amphibians is of particular concern. The clearing must thus take place outside of the bird and amphibian breeding season seasons. In addition, burning of reeds should not take place at night to avoid impacting on roosting birds. Given the above, only cutting of reeds by hand is included in the method statements.

(b)	**Location:** Nuisance growth is likely to occur in the more saline, and slower flowing watercourses and wetland areas. For large-scale removal of reed growth within the rivers, additional caution measures should be applied, with the advice of the MMP oversight committee. An aquatic ecologist, rehabilitation specialist or botanical specialist should be sought for larger-scale clearing projects, if deemed to be necessary by the oversight committee.
(c)	**Frequency:** The removal of aquatic vegetation should be undertaken during the low flow period and outside of most bird and amphibian breeding seasons (i.e., maintenance to be done during the period January to May).

(d)	**Method statement:** • Identify specific plants requiring removal and/or demarcate areas requiring management. Should large areas require clearing, not all of the area should be cleared at once, but it should rather be cleared in a phased manner, clearing in a downstream direction where sediment and litter are disturbed but the works are captured in the downstream vegetation. In the downstream section of the reed growth, silt curtains should be planned, to limit the extent of disturbed sediment deposited further downstream. • Select access points to the watercourse that are indicated in the design as maintenance access routes to minimise disturbance of indigenous marginal and riparian vegetation. • Inform residents and other stakeholders of the intended timing and duration of activities to be carried out. • 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 or deepening 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). • Stockpile cut material for no longer than two weeks. Any stockpiled litter should be removed within 2 days of completion of the cleaning operation. • If possible, clean sediment should be stockpiled separately to enable reuse thereof as fill or topsoil applications. • Work areas, stockpile locations and access routes (especially banks) should be monitored for erosion or growth of invasive alien vegetation. Inspections are to be undertaken at the end of the dry season and after the initial rainfall events.
(e)	**Material Disposal:** Cleared plant material should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site.
(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

5.5 Activity 2a. Minor repairs to infrastructure

(a)	**Measure Description:** 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 pumps, pipes, small weirs, gabion structures and minor culverts on the banks or within a 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.

(b)	**Location:** This work will need to take place where there is instream infrastructure such as culverts, weirs, and gabion walls that require repairs.
(c)	**Frequency:** Minor or emergency repairs can be undertaken immediately but must be adequately mitigated to prevent downstream impacts. Repair works that are likely to have a more significant impact on the watercourse or wetland area should be undertaken during the low flow period and outside of amphibian breeding season (i.e., maintenance to be done during the period January to May).
(d)	**Method statement:** • Before construction, plan access route and movement to and from the maintenance site – aim to use designated and existing access routes where available. • Minimise the spatial extent of disturbance and the frequency of, or requirement for, maintenance activities. The disturbance footprint should be demarcated. No activities should take place outside of this area. • 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 at a designated stockpile area that is at least 10m from the water edge, avoids disturbance of indigenous riparian or terrestrial vegetation and is easily accessible by a vehicle. • If possible, use manual labour to do the repair work, particularly within the rehabilitated areas on the site. • Mix any concrete, other materials or potential contaminants away from the rehabilitated site and transport them to a specific point of use without spilling. Concrete should be mixed/prepared on an impermeable surface with a barrier around it to prevent pollution of the surrounding environment. • 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 a silt curtain). • 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 to a suitable 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 • After construction, any areas within the maintenance footprint that have been degraded from their condition before construction and as a result of the maintenance activities must be restored to their former condition. Disturbed areas should be revegetated with appropriate indigenous plant species (See **Section 5.11** below). • All reasonable measures should be undertaken to ensure that watercourse maintenance activities minimise future erosion of the watercourse bed and banks. • Monitor disturbed areas to determine if sufficient indigenous vegetation growth has been achieved. Manage weed infestations if required. • Work areas and access routes (especially banks) should be monitored for erosion or growth of invasive alien vegetation (See **Section 5.10** below). Inspections are to be undertaken at the end of the dry season and after the initial rainfall events. • Drip trays should be placed under any machinery that may require fuel for operation, particularly when refuelling.

(e)	**Material Disposal:** Cleared plant material should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site.
(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

5.6	Activity 2b. Major repairs to infrastructure
(a)	**Measure Description:** Major repairs to infrastructure in watercourses usually relate to repairs on large bridges, erosion control structures or instream dams where there is a significant disturbance of the river channel and construction works within the watercourse channel that need to take longer than a couple of days. The impacts of major repairs to infrastructure along the river relate largely to the level of repairs required and how the repairs are conducted. The activity however still entails the repairing of a piece of infrastructure so that it retains its original footprint and capacity, a like–for–like scenario. Any additions to infrastructure are by definition not within the scope of an MMP. Repairs will typically involve a localised disturbance of the river channel or banks while infrastructure is repaired. During the repair work to infrastructure, undesirable pollutants can potentially enter the water course. This commonly can include lime (calcium oxide), other constituents found in cement (such as aluminium oxide), oils, diesel/petrol and sewerage. 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.
(b)	**Location:** This work will need to take place where there is larger instream infrastructure such as bridges, instream dams and erosion control structures that require more significant repairs. Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee. If deemed necessary by the oversight committee, or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in these sensitive zones of the rivers.
(c)	**Frequency:** Schedule work for when flow in the stream is at its lowest. Minor or emergency repairs can be undertaken immediately but must be adequately mitigated. Larger repair works that are likely to have a more significant impact on a watercourse or wetland area should be undertaken during the low flow period and outside of amphibian breeding season (i.e., maintenance to be done during the period January to April).
(d)	**Method statement:** **General repairs to infrastructure**: • Before construction, plan access route and movement to and from the maintenance site – aim to use designated and existing access routes where available. • Minimise the spatial extent of disturbance and the frequency of, or requirement for, maintenance activities. The disturbance footprint should be demarcated. No activities should take place outside of this area. • Demarcation should be conducted in consultation with the contractor or persons responsible for the work to keep the disturbance area as small as possible. • Where there is excavation work, remove topsoil and set it aside for post-construction rehabilitation. The stored topsoil should be at a designated stockpile area that is at least 10m from the water edge, avoids disturbance of indigenous riparian or terrestrial vegetation and is easily accessible by a vehicle. • Use manual labour where possible, particularly within the rehabilitated areas on the site. • Mix any concrete, other materials or potential contaminants away from the rehabilitated site

and transport them to a specific point of use without spilling. Concrete should be mixed/prepared on an impermeable surface with a barrier around it to prevent pollution of the surrounding environment.

- 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 a silt curtain).
- 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 to a suitable 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
- After construction, any areas within the maintenance footprint that have been degraded from their condition before construction and as a result of the maintenance activities must be restored to their former condition. Disturbed areas should be revegetated with appropriate indigenous plant species (**Section 5.10** below).
- All reasonable measures should be undertaken to ensure that watercourse maintenance activities minimise future erosion of the watercourse bed and banks.
- Monitor disturbed areas to determine if sufficient indigenous vegetation growth has been achieved. Manage weed infestations if required.
- Work areas and access routes (especially banks) should be monitored for erosion or growth of invasive alien vegetation (see below). Inspections are to be undertaken at the end of the dry season and after the initial rainfall events.
- Drip trays should be placed under any machinery that may require fuel for operation, particularly when refuelling.

Removal of obstructions from infrastructure:

- Drains, pipes and culverts must be inspected regularly for obstructions that, unless removed timeously, may cause major upstream blockages, premature over- topping and 'out-flanking' of structures by high flows that damage approaches and property downstream.
- Channels upstream and downstream of the structures must be kept clear of flood debris.
- Channels upstream of the low water crossing structures should also be kept clear of *Phragmites* reeds and/or bulrushes that may serve as sediment or debris traps directly upstream of inlet structures – since this vegetation also plays useful ecological roles, clearing of the channels should be limited to no more than 5m up- or downstream of the structures.
- Banks and channels must be kept clear of alien plants that concentrate flow and contribute to erosion, sediment release and channel blockages.
- The Engineer and Environmental Control Officer must indicate the extent and depth of sediment removal, how it is to be undertaken, and where excavated material must be stockpiled. If sediment needs to be removed from reaches beyond the road reserve, consult the Western Cape DoA and affected landowners before finalising the method statement for sediment removal.
- Sediment stockpiles must be located further than 30 m from the channel, in already disturbed areas that are protected against erosion by water or wind so that they do not erode into the river.

	Construction and decommissioning of by-passes to allow works to low water crossings: • Bypasses, where necessary, must be located as far as possible within the immediate area of disturbance of the low water crossing. • Fill material for bypasses can be sourced from sediment stockpiles created through the clearance of sediment from the structures, or otherwise from approved sources – they must also be of a quality that will not leach salts, pass fine sediment into the water or provide a source of invasive alien plant seed. • Bypasses should be vented with pipes or box culverts to accommodate the base flows in the river. • The base of by-passes must be protected against scour and erosion with sandbags or rip-rap. • Upon decommissioning, material used for bypasses can be used for repairing damaged approaches or otherwise stockpiled outside of the river corridor. All material used in bypasses as well as all pipes and other temporary venting must be removed. • Full, previous channel width must be reinstated upon the decommissioning of bypasses. • The disturbed footprints of by-passes should be monitored on an ongoing basis for invasive alien plants, which must be removed. • Disturbed channels must be rehabilitated, reshaped and if necessary planted with locally indigenous appropriate plant species (**Section 5.10** below) to prevent erosion.
(e)	**Material Disposal:** Cleared plant and other material or debris resulting from the works should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site.
(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning and budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

5.7	**Activity 3. Sediment removal at Infrastructure**
(a)	**Measure Description:** Watercourses naturally transport sediment particles and debris downstream, depositing the sediment and debris where energy in the watercourse decreases (typically in pools or wetland areas) and often where there is infrastructure in the channel. Sediment and other materials thus often need to be removed to ensure that infrastructure can continue to operate efficiently. The clearing of sediment at infrastructure can result in a localised disturbance within the riparian and aquatic habitats of the river with the potential for erosion and invasion by alien plants occurring in the disturbed area.
(b)	**Location:** Sediment deposition is likely to occur in areas adjacent to infrastructure in the watercourse where the flow velocity decreases.
(c)	**Frequency:** It is likely that removal of sediment will be required after storm events and high rainfall events and should be undertaken once the flow in the watercourse has subsided, except for emergency maintenance works. Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas) or where larger volumes of sediment or debris need to be removed from the rivers. It is recommended that the works be done under the guidance of an MMP oversight committee or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in these sensitive zones of the rivers.
(d)	**Method statement:** • Manual labour should be used to remove the sediment where feasible. • The required working area should be kept to a minimum and demarcated before the

	commencement of the works. As far as possible, use existing disturbed areas to access the site. • Minimise downstream impacts if required by placing a silt curtain in the watercourse downstream of the works to limit the extent of disturbed sediment deposited further downstream. • Minimise the impact on the structural integrity of the watercourse and avoid deepening the channel or increasing channelisation or canalization of the watercourse; • Any cleared sediment, vegetation or spoil material associated with the maintenance activity should be removed from the river channel to a suitable disposal site. • Disturbed areas should be revegetated with indigenous plant species (See **Section 5.11** below). • Work areas, stockpile locations and access routes (especially banks) should be monitored for erosion or growth of invasive alien vegetation (See **Section 5.10** below). Inspections are to be undertaken at the end of the dry season and after the initial rainfall events.
(e)	**Material Disposal:** Cleared sediment and plant material should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site. The location of the deposition of the sediment which is removed must also not result in negative impacts to terrestrial or aquatic habitat and should be decided upon in consultation with the oversight authorities committee or the aquatic ecologist of botanist.
(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

5.8 Activity 4. Sediment, litter and debris removal from a watercourse	
(a)	**Measure Description:** Watercourses naturally transport sediment particles and debris downstream and particularly during higher flow events. Where the energy in the watercourse decreases (typically in pools or wetland areas), the sediment and debris are deposited. Deposited sediment within watercourses can cause a blockage and alter or impede flow. During high flow events, the blockage can cause damage to the adjacent land or infrastructure. Sediment and other materials thus often need to be removed from a watercourse channel to ensure that flooding or damage to the watercourse channel does not occur. The clearing of sediment and debris can result in a localised disturbance within the riparian and 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.
(b)	**Location:** Sediment and deposition of other material and litter are likely to occur in areas where the flow velocity in the watercourses decreases. This is usually in pools and wetland areas in the foothill streams or the lower reaches with their associated with dense reed and other instream vegetation growth.
(c)	**Frequency:** • The sediment and debris removal will likely be required after storm events when the material is washed down from the upper reaches of the catchment. Removal of the sediment should preferably wait until flow in the watercourse has significantly receded. Emergency maintenance may be undertaken immediately but must be adequately mitigated. • Removal of sediment should take place before the commencement of the rainfall and higher flow period and outside of amphibian and bird breeding season (i.e. maintenance to be done during the period January to May). • Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee or

	a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in these sensitive zones of the rivers.
(d)	**Method statement:** • Manual labour should be used to remove the sediment in the river where feasible. • As far as possible, the existing access points to the river channel should be used and indigenous vegetation along the edges of the channel should preferably remain intact as it provides cover, habitat and food for the riverine biota. • The required working area around the bank to be repaired should be kept to a minimum and demarcated before the commencement of the works. • Minimise downstream impacts if required by placing a silt curtain in the watercourse downstream of the works to limit the extent of disturbed sediment deposited further downstream. • Minimise the impact on the structural integrity of the watercourse and avoid deepening the channel or increasing channelisation or canalization of the watercourse; • Where possible, aim to create gently sloping banks (slope of at least 1:4) down to the bed of the watercourse and enhance habitat diversity. • For larger sediment removal works, 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. • Disturbed areas should be revegetated with indigenous plant species (See **Section 5.11** below). • Stockpile cleared material for no longer than two weeks. If necessary, stockpiles should be temporarily enclosed by shade cloth or similar material to mitigate wind dispersion impacts. Clean sediment could be stockpiled separately to enable reuse thereof as fill or topsoil applications. • Work areas, stockpile locations and access routes (especially banks) should be monitored for erosion or growth of invasive alien vegetation (See **Section 5.10** below). Inspections are to be undertaken at the end of the dry/low flow season and after the initial rainfall events.
(e)	**Material Disposal:** Cleared sediment, debris and plant material should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site. The location of the deposition of the sediment which is removed must also not result in negative impacts to terrestrial or aquatic habitat and should be decided upon in consultation with the oversight authorities committee, or the aquatic ecologist or botanist. Where sediment is removed from an in-stream dam, it may be placed on the outer banks of the dam, outside and away from the watercourse.
(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

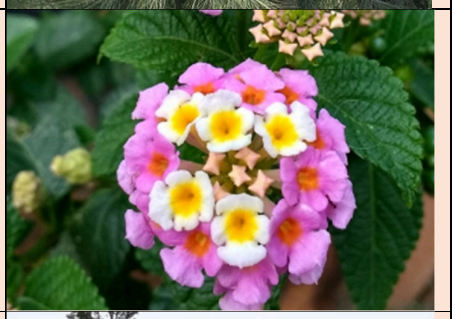
5.9 Activity 5. Repairs to riverbanks and associated bank stabilization infrastructure	
(a)	**Measure Description:** The dynamic nature of a river results in erosion of the banks and damage to bank stabilization structures along the banks, such as gabion or retainer walls. When bank stabilisation infrastructure has been damaged, the eroding or flood-damaged banks and adjacent areas may need to be repaired. Should damage to the river banks and berms occur it is thus recommended that this be utilised as an opportunity to rehabilitate and restore some of the riparian zone functionality. The movement of material to reshape a bank or repair a berm is more often conducted by machinery as the volume of material is too much to be carried out by hand. The resulting disturbance of using

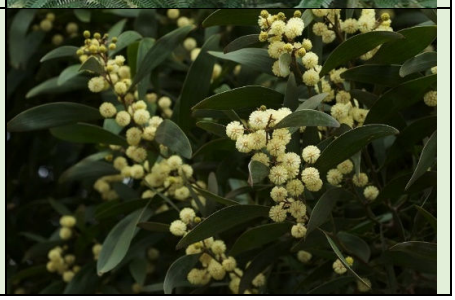
	machinery within and adjacent to the watercourse is usually significant and required rehabilitation measures after the work is complete.
(b)	**Location:** Erosion of the watercourse is likely to occur in areas where there is intense flow velocity in the watercourse. This is usually where the river channel is confined (as a result of natural topography or artificial infilling or encroachment in invasive alien vegetation, the channel has been altered (straightened and natural vegetation cover removed) or where there are higher flow speeds such as where there is a steeper gradient or on the outer bend of a river.
(c)	**Frequency:** • The repairs to flood damaged banks will likely be required after storm events. Repairs to the banks should preferably wait until flow in the watercourse has significantly receded. Maintenance activities are best done during the dry/low flow season unless emergency works are required that should be undertaken immediately. • Special care should be taken when conducting this activity within the more sensitive stretches of the Klip and Keurbooms Rivers (particularly where there are wetland areas). It is recommended that the works be done under the guidance of the MMP oversight committee or a suitably qualified aquatic ecologist or botanist should be consulted before conducting this activity in these sensitive zones of the rivers.
(d)	**Method statement:** • Manual labour is preferred to the use of mechanical equipment to minimise physical disturbance around the activity location; • Where machinery is required, the existing routes or disturbed areas to the site should be used as far as possible. • The required working area around the bank to be repaired should be kept to a minimum and demarcated before the commencement of the works. • If the flow in the river needs to be impeded or diverted to undertake the works, maintain a minimum base flow. Diversion of flow should be kept to a minimum and the channel flow reinstated as soon as the work is complete, removing all material utilised for the flow diversion/impedance. • Minimise the impact on the structural integrity of the watercourse and avoid deepening the channel or increasing channelisation or canalization of the watercourse; • Where possible, aim to create gently sloping banks (slope of at least 1:4) down to the bed of the watercourse and enhance habitat diversity. • Stockpiling of material for the repairs should be at a designated stockpile area that is at least 10m from the water edge, avoids disturbance of indigenous riparian or terrestrial vegetation and is easily accessible by a vehicle. • Sediment brought in for filling purposes should be from a local source and free of invasive alien plant seed. • Any removed material should be taken out of the channel completely and removed from the site to a suitable disposal site. • Monitor disturbed areas to determine if sufficient indigenous vegetation growth has been achieved. Manage weed infestations if required. • Disturbed areas and access routes should be monitored for erosion and growth of alien vegetation (See **Section 5.11** below). Inspections are to be undertaken before the onset of the winter rainfall period but after the initial rainfall events. • Disturbed areas should be revegetated with indigenous plant species (See **Section 5.10** below).
(e)	**Material Disposal**: Any associated material should not be dumped in the watercourse channels and riparian zones but should be removed to a suitable disposal site.
(f)	**Access:** The sites should be accessed from existing established roads or make use of existing disturbed areas. Areas comprising natural vegetation cover should be avoided.
(g)	**Monitoring and Recordkeeping:** Ongoing record keeping which documents maintenance interventions as and when they take place is necessary. See **Annexures A10** and **A11** for the before and after forms. These records are important to facilitate future planning & budgeting, capture

	environmental incidents and ensure that audits by the authorities can take place when required. The method statement may need to be updated if additional maintenance activities are identified, or amendments to the method statement are identified. Record keeping will facilitate this.

5.10 Alien plant species identified within the study area

Species	Legislation	Photograph
Australian stinkbean (*Paraserianthes lophantha*)	NEMBA category 1b	
Port Jackson willow *(Acacia saligna)*	NEMBA category 1b	
Long leaf wattle *(Acacia longifolia)*	NEMBA category 1b	
Cluster pine (*Pinus pinaster*)	NEMBA category 1b	
Seringa (*Melia azedarach*)	NEMBA category 1b	

Species	Legislation	Photograph
Bugweed, luisboom (*Solanum mauritianum*)	NEMBA category 1b	
Elderberry (*Sambucus nigra*)	NEMBA category 1b	
Beefwood (*Casuarina cunninghamiana*)	NEMBA category 1b (within 100m of riparian areas and untransformed land)	
Lantana (*Lantana camara*)	NEMBA category 1b	
Pampas grass (*Cortaderia selloana*)	NEMBA category 1b	

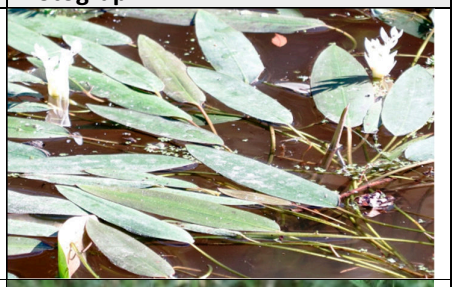
Species	Legislation	Photograph
Kikuyu grass *(Pennisetum clandestinum)*	NEMBA category 1b	
Spanish reed (*Arundo donax*),	NEMBA category 1b	
Grey poplar (*Populus x canescens*),	NEMBA category 2	
Black wattle *(Acacia mearnsii)*	NEMBA category 2	
Blackwood *(Acacia melanoxylon)*	NEMBA category 2	

Species	Legislation	Photograph
Sugar gum (*Eucalyptus cladocalyx*)	NEMBA category 2	
Castor oil plant (*Ricinus communis*)	NEMBA category 2	
European blackberry (*Rubus fruticosus*)	NEMBA category 2	
Brazilian pepper tree (*Schinus terebinthifolius*),	NEMBA category 3	

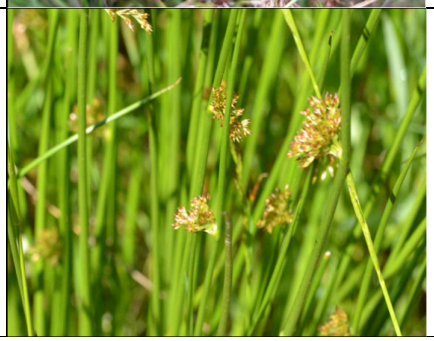
Invasive species are controlled by the National Environmental Management Biodiversity Act (NEMBA) – Alien and Invasive Species (AIS) regulations, gazetted on 1 August 2014 and became law on 1 October 2014:

- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Cat 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Cat 3 plants to exist in riparian zones.

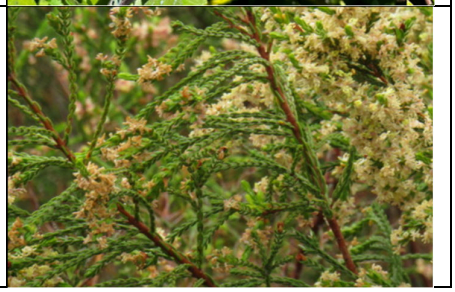
5.11 Suggested plant species for revegetating cleared areas

Species	Common name/s	Zone*	Photograph
Aponogeton distachyos	Cape pondweed	Aquatic	
Cynodon dactylon	Kweekgras	Terrestrial and back dynamic	
Ehrharta calycina	Perennial veldt grass	Terrestrial and back dynamic	
Ehrharta ramosa	Pypgrass, pohl veldtgrass	Terrestrial and back dynamic	
Eragrostis curvula	African love grass	Terrestrial and back dynamic	

Species	Common name/s	Zone*	Photograph
Pennisetum macrourum	African feather grass	Wet bank	
Cyperus textilis	Mat sedge	Wet bank/marginal zone	
Cyperus polystachyos	Manyspike flatsedge	Wet bank/marginal zone	
Cliffortia graminea	bog rice bush / vleibos	Wet bank	
Cliffortia strobilifera	bog rice bush / vleibos	Wet bank	

Species	Common name/s	Zone*	Photograph
Elegia capensis	Broom reed	Wetbank	
Isolepis prolifera	Sedge	Wet bank/marginal and aquatic zone	
Juncus lomatophyllus	Rush	Wet bank/marginal and aquatic zone	
Juncus capensis	Cape rush	Wet bank/marginal zone	
Juncus effusus	Soft rush	Wet bank/marginal and aquatic zone	

Species	Common name/s	Zone*	Photograph
Ficinia nodosa	Knotted club-rush	Wet bank/marginal zone	
Freylinia lanceolata	honeybell bush / heuningklokkiebos	Wet bank	
Gomphocarpus fruticosus	Narrow-leaf cotton bush	Seasonal wetland	
Diospyros glabra	Blueberry bush	Tree/shrub, back dynamic	
Gymnosporia buxifolia	Common spikethorn	Tree/shrub, back dynamic	

Species	Common name/s	Zone*	Photograph
Maytenus acuminata	Silky bark	Tree/shrub, back dynamic	
Halleria lucida	Tree fuchsia	Tree/shrub, lower dynamic	
Kiggelaria africana	Wild peach	Tree/shrub, back dynamic	
Erica caffra	Water heath	Upper wetback	
Osteospermum moniliferum	Bietou	Tree/shrub, Riparian and terrestrial	
Passerina corymbosa	Common gonna	Tree/shrub, Riparian and terrestrial	

Species	Common name/s	Zone*	Photograph
Salvia chamelaeagnea & *S. africana*	Blue sage	Riparian and terrestrial areas	
Zantedeschia aethiopica	Arum lily	Wet bank and wetland areas	
Psoralea pinnata	Fountainbush	Seasonal wetland	
Pteridium aquilinum	Common bracken	Wet bank	
Prionium serratum	Palmiet	Wet bank	

Species	Common name/s	Zone*	Photograph
Rapanea melanophloeos	Cape beech	Tree/shrub, back dynamic	
Brachylaena neriifolia	White water elder/ waterwitels	Riparian tree/shrub, Upper Wet bank	
Salix mucronata	Cape willow	Riparian tree, Wet bank	
Brabejum stellatifolium	Wild almond/ wilde amandel	Upper Wet bank to Lower Dynamic	
Searsia angustifolia	Willow karee / smalblaar	Tree/shrub, back dynamic	

Species	Common name/s	Zone*	Photograph
Searsia lucida	Glossy currant rhus	Tree/shrub, back dynamic	

*Referring to the figure below

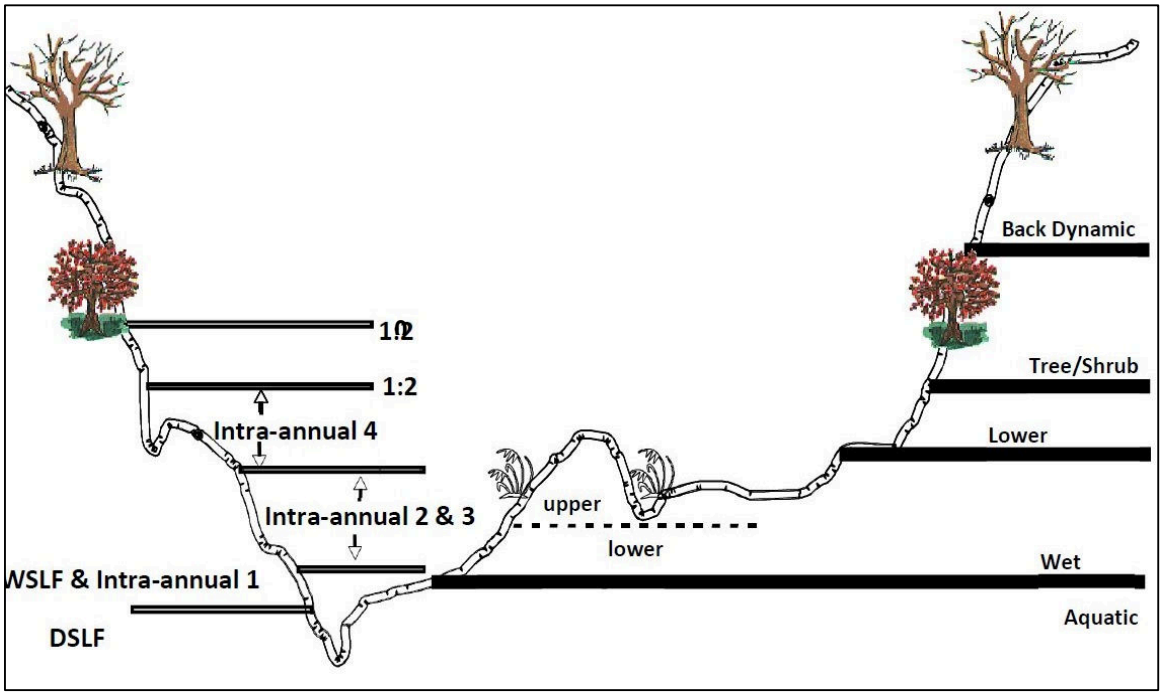


Figure 15: Schematic illustration showing generalised lateral plant community zones and their relationship to various components of the flow regime. WSLF = Wet Season Low Flow; DSLF = Dry Season Low Flow; four classes (1-4) of intra-annual flood categories, whil

6 Implementation, Monitoring and Reporting

The subsections below provide more information on the implementation, monitoring and reporting requirements associated with this MMP.

6.1 Implementation

Each individual landowner / water user will be responsible for implementing the mitigation measures as are relevant to his/her specific activities in the river. The Swellendam Conservancy will be responsible for overseeing the monitoring of the maintenance and management activities undertaken by their water users in accordance with the MMP. Records of each maintenance activity should be kept by the landowner and submitted to the Water User Association, as per the steps provided below.

The Swellendam Conservancy should set-up a MMP oversight committee which should comprise, *inter alia* of officials from the BOCMA and the DoA.

The following steps should be followed by landowners when implementing this MMP:

STEP 1: Identify the maintenance and management activity required.

Answer the following questions:

Will the activity be performed to keep a structure or system functioning or in service on the same location, capacity and footprint? Will the activity therefore not change the size of structures (thus "like for like" activities)?

If 'YES': Proceed to Step 2 below.

If 'NO': Activity cannot be undertaken as part of this MMP process. Environmental Authorisation may be required before the activity may be commenced with.



STEP 2: Identify relevant maintenance activity and method statement.

Identify the maintenance activity and method statement that is relevant to your proposed activity (see Section 6 above for the method statements):

Activity 1a: Clearing of alien vegetation;

Activity 1b: Clearing of nuisance indigenous Phragmites reeds or Typha bulrushes;

Activity 2a: Minor repairs to infrastructure;

Activity 2b: Major repairs to- or replacement of damaged formal (FLC / FB) river crossings

Activity 3: Sediment movement at infrastructure;

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

Activity 5: Sediment movement in the channel or on the banks for repairs to berms or banks.



STEP 3: Before commencing with activity – Complete and submit **Annexure A10** to this MMP:

• At least seven days prior to commencing with an activity, complete Sections A to C of the Klip and Keurbooms River MMP Notification and Information Form.

- The form should be submitted with photographs taken before the maintenance activity is performed, and coordinates of the photograph locations. [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].

- One form must be submitted per maintenance activity per property.

- The declaration Form (included in **Annexure A10**) must be signed and submitted with each Notification and Information Form.

- Submit the completed form and supporting information to the Swellendam Conservancy MMP contact person (see contact details below).
- **Important**: Where Activities 4 and/or 5 will be triggered, the Swellendam Conservancy, with advice from its MMP oversight committee [comprising *inter alia* of officials from the Breede-Olifants Catchment Management Agency (BOCMA) and the DoA] shall review the form and confirm whether this activity can be undertaken as part of the MMP. Input from an aquatic ecologist, rehabilitation specialist or botanical specialist should be sought for larger-scale projects if deemed to be required by the MMP oversight committee.
- **Important**: A MMP oversight committee site clarification meeting should be undertaken before maintenance activities are undertaken at public road infrastructure. This meeting should be undertaken after submission of the "before" form.
- The contact person will then forward the forms to the BOCMA, the DoA, and other relevant project committee members, as standard practice.

STEP 4: Undertake the maintenance activity as described in the relevant method statement. Take photos of the activity being undertaken.

STEP 5: <u>After completing the activity</u> – Complete **Annexure A11** to this MMP:

- After completion of a maintenance activity, within seven days after undertaking the activity:

- Complete Sections D to F of the information form.

- Submit photographs taken from the same position and direction as before the activity commenced, after the maintenance activity is performed.

- Any changes that were necessary to the planned activity, problems encountered or deviations from the recommended method statement must be described and motivated.

- Submit the completed form and supporting information to the Swellendam Conservancy MMP contact person (see contact details below).
- The contact person will then forward the forms to the BOCMA, the DoA, and other relevant project committee members, as standard practice.

Table 21: Swellendam Conservancy MMP implementation contact details.

Role	Telephone	E-mail
Swellendam Conservancy: Chairperson	082 457 0019 / 081 019 8232	chairman@swellendamconservancy.org.za

6.2 Monitoring and Reporting

The following monitoring of maintenance interventions (as indicated in the previous section) should take place in conjunction with the activities:

- Photographs of the site of the maintenance activity should be taken by the person undertaking the maintenance activity, before and after the activity for comparison purposes;
- Ongoing visual inspection should be undertaken by the person undertaking the maintenance activity for any sedimentation or contamination of the receiving water body in order to take corrective action as soon as possible to contain the impact with a silt screen; and
- Ongoing visual inspections should be undertaken by the farm manager/landowner for signs of erosion and growth of alien invasive species within disturbed areas to inform corrective action.

The Swellendam Conservancy will be responsible for keeping records of the maintenance activities undertaken (i.e. before and after forms submitted to them).

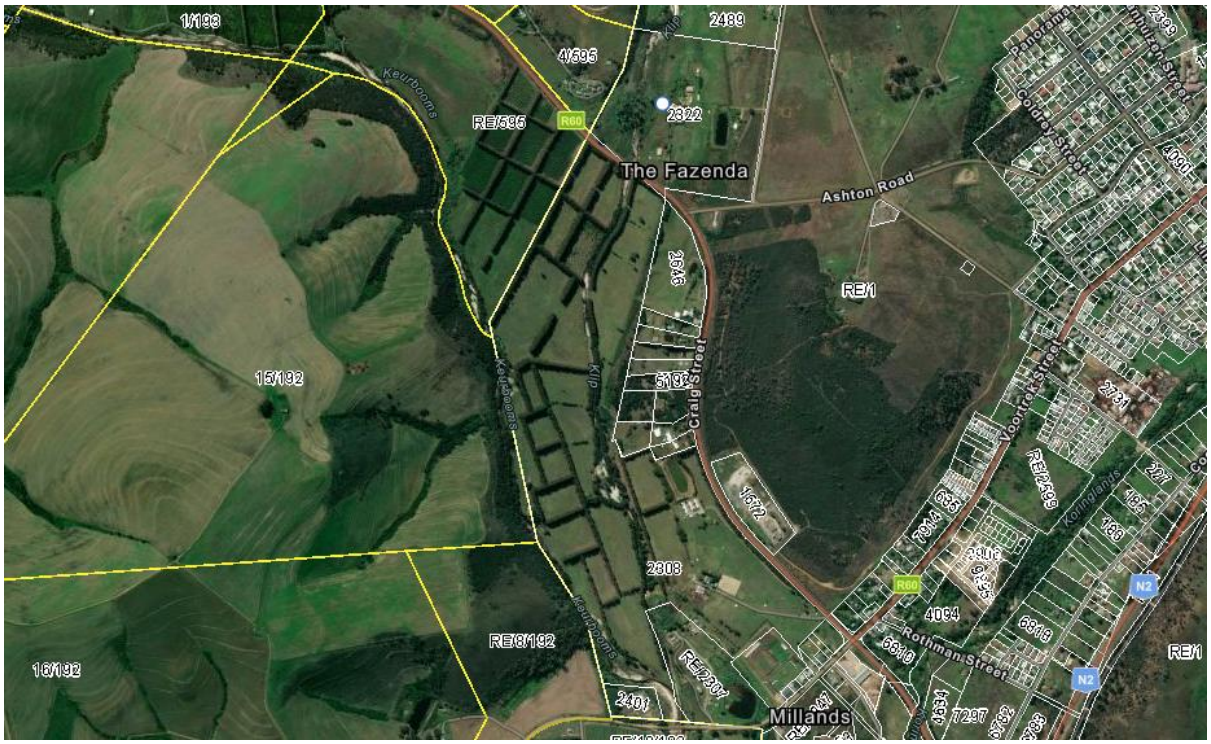
It is recommended that an audit of the maintenance and management activities, in terms of compliance with the requirements of the MMP, as well as an assessment of the ecological condition of the Klip and Keurbooms Rivers should be undertaken on a two-yearly basis. This audit should address any changes required to the method statements. This process would need to be driven by Swellendam Conservancy in conjunction with the Western Cape Department of Agriculture.

7 Refences

Belcher, T. 2023. *Landcare Environmental Management Programme for nine rivers in the Cape Winelands, Overberg and Eden Districts of the Western Cape: Ecological Report: Klip and Keurbooms Rivers MMP & EMPr*. BlueScience: Somerset West.

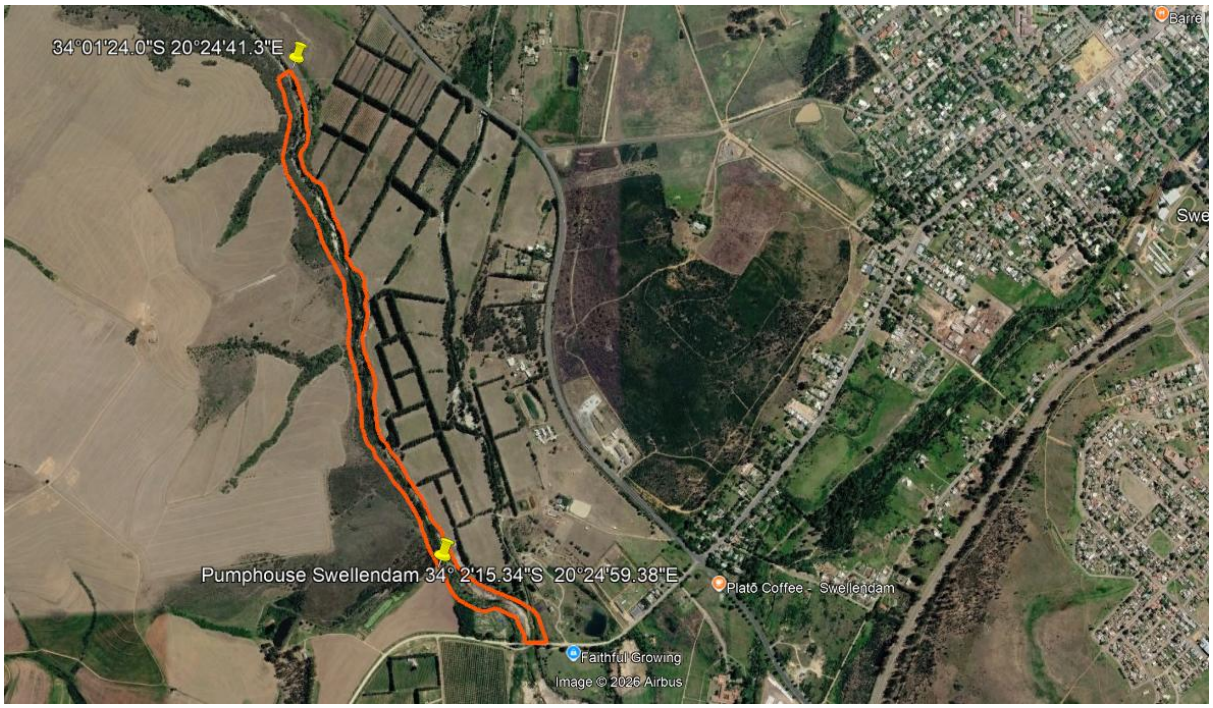
DEAD&P. 2017. *Information Document for the Development of a Maintenance Management Plan for a Watercourse*. DEA&DP: Cape Town.

MAP FARM


1/193
2489
4/595
RE/595
R60
2822
The Fazenda
Ashton Road
RE/1
15/192
Craig Street
Voortrek Street
2808
RE/8/192
16/192
2401
Millands
Rothman Street
N2
4084
RE/1

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MAP EXTENT


34°01'24.0"S 20°24'41.3"E
Pumphouse Swellendam 34° 2'15.34"S 20°24'59.38"E
Platō Coffee - Swellendam
Faithful Growing
Image © 2026 Airbus