WITZENBERG
Municipality • Munisipaliteit • U Masipala Wasa

Freshwater Report
for the replacement of the
Tierhokkloof bulk water pipeline

A requirement in terms of the National Environmental Management Act 107 of 1998
as well as the
National Water Act 36 of 1998

May 2023 Version 2.1

EnviroAfrica
Environmental Management and Impact Assessment
Omgewingsbestuur en Impakbeoordeling

WATSAN Africa

Abbreviations

Critical Biodiversity Area	CBA
Department of Fisheries, Forestry and the Environment	DFFE
Department of Water and Sanitation	DWS
Ecological Importance	EI
Ecological Importance and Sensitivity Class	EISC
Ecological Sensitivity	ES
Ecological Support Area	ESA
Existing Legal Use	ELU
Environmental Impact Assessment	EIA
Electronic Water Use License Application (on-line)	eWULAAS
Government Notice	GN
Metres Above Sea Level	masl
National Environmental Management Act (107 of 1998)	NEMA
National Freshwater Environment Priority Area	NFEPA
National Water Act (36 of 1998)	NWA
Present Ecological State	PES
Section of an Act of Parliament	S
South Africa National Biodiversity Institute	SANBI
Water Use License Application	WULA

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1 Introduction

A fibre cement pipeline for the water provision of the town of Wolseley in the Western Cape has collapsed, as these old pipes do, cannot be repaired and needs replacement. This pipeline starts up against the slope to the west of Wolseley at the foot of the Mitchel's Pass on the R46 on the way to Ceres. This is mountainous country in the upper reach of the Breede River.

According to contemporary national legislation, the new pipeline must be officially authorized. The Witzenberg Municipality appointed Enviro Africa of Somerset West to conduct the legally required EIA in accordance with the NEMA. The EIA includes a public participation process, which was under way at the time of the writing of this report, with the posters displayed at various sites, to be viewed by interested and affected parties (Figure 1).

Subsequently, Dr Dirk van Driel of WATSAN Africa in Knysna was appointed to carry out the legally required WULA. This includes one or more site visits, a Freshwater Report and the lodging of an application on the eWULAAS online facility. The aim is to have the new pipeline approved with a General Authorization issued by the DWS.

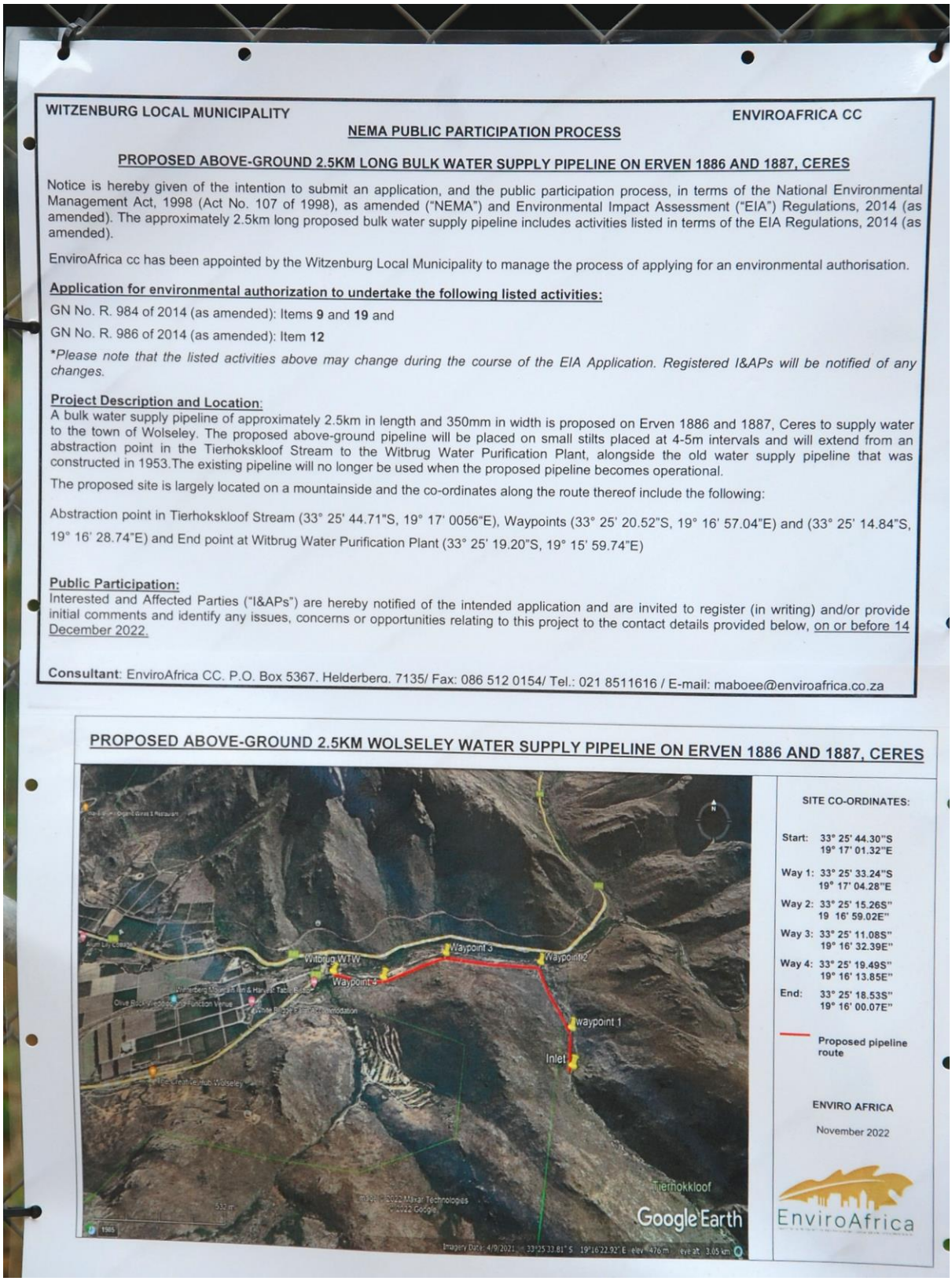
The Freshwater Report must include adequate information to allow for informed decision-making. The report has developed over literally hundreds of reports into a set format and content. The report must include a Risk Matrix that is available on the DWS webpage. This document must be completed and the signed by a SACNASP registered scientist.

The Freshwater Report is not only meant to satisfy the WULA information needs, but also that of the EIA. Hence, more aspects were added, such as the prescribed Impact Assessment.

The mountain catchment area is listed as a strategic water resource, in a proclaimed nature reserve and in the Fynbos of the Western Cape, as specialised and unique biome, with many endangered and critically endangered plants and vegetation types.

The potential impact of the new pipeline on the natural environment is of importance and requires mitigating measures.

Likewise, the abstraction of water from the Breede River and from the mountains streams has a profound impact on the aquatic environment. This impact is discussed in this report, but is listed as an ELU, which is vested in legislation. It is not for this report to propose amelioration for this impact.



WITZENBURG LOCAL MUNICIPALITY

ENVIROAFRICA CC

NEMA PUBLIC PARTICIPATION PROCESS

PROPOSED ABOVE-GROUND 2.5KM LONG BULK WATER SUPPLY PIPELINE ON ERVEN 1886 AND 1887, CERES

Notice is hereby given of the intention to submit an application, and the public participation process, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended ("NEMA") and Environmental Impact Assessment ("EIA") Regulations, 2014 (as amended). The approximately 2.5km long proposed bulk water supply pipeline includes activities listed in terms of the EIA Regulations, 2014 (as amended).

EnviroAfrica cc has been appointed by the Witzenburg Local Municipality to manage the process of applying for an environmental authorisation.

Application for environmental authorization to undertake the following listed activities:

GN No. R. 984 of 2014 (as amended): Items **9** and **19** and

GN No. R. 986 of 2014 (as amended): Item **12**

**Please note that the listed activities above may change during the course of the EIA Application. Registered I&APs will be notified of any changes.*

Project Description and Location:

A bulk water supply pipeline of approximately 2.5km in length and 350mm in width is proposed on Erven 1886 and 1887, Ceres to supply water to the town of Wolseley. The proposed above-ground pipeline will be placed on small stilts placed at 4-5m intervals and will extend from an abstraction point in the Tierhokskloof Stream to the Witbrug Water Purification Plant, alongside the old water supply pipeline that was constructed in 1953.The existing pipeline will no longer be used when the proposed pipeline becomes operational.

The proposed site is largely located on a mountainside and the co-ordinates along the route thereof include the following:

Abstraction point in Tierhokskloof Stream (33° 25' 44.71"S, 19° 17' 0056"E), Waypoints (33° 25' 20.52"S, 19° 16' 57.04"E) and (33° 25' 14.84"S, 19° 16' 28.74"E) and End point at Witbrug Water Purification Plant (33° 25' 19.20"S, 19° 15' 59.74"E)

Public Participation:

Interested and Affected Parties ("I&APs") are hereby notified of the intended application and are invited to register (in writing) and/or provide initial comments and identify any issues, concerns or opportunities relating to this project to the contact details provided below, on or before 14 December 2022.

Consultant: EnviroAfrica CC. P.O. Box 5367. Helderberg. 7135/ Fax: 086 512 0154/ Tel.: 021 8511616 / E-mail: maboee@enviroafrica.co.za

PROPOSED ABOVE-GROUND 2.5KM WOLSELEY WATER SUPPLY PIPELINE ON ERVEN 1886 AND 1887, CERES

SITE CO-ORDINATES:

Start: 33° 25' 44.30"S 19° 17' 01.32"E

Way 1: 33° 25' 33.24"S 19° 17' 04.28"E

Way 2: 33° 25' 15.26S" 19 16' 59.02E"

Way 3: 33° 25' 11.08S" 19° 16' 32.39E"

Way 4: 33° 25' 19.49S" 19° 16' 13.85E"

End: 33° 25' 18.53S" 19° 16' 00.07E"

Proposed pipeline route

ENVIRO AFRICA

November 2022

EnviroAfrica

Figure 1 Public Participation

2 Legal Framework

The proposed development "triggers" sections of the National Water Act. These are the following:

S21 (c) *Impeding or diverting the flow of a water course*

The proposed rock quarry is adjacent to natural drainage lines that are identified in the NWA and its regulations as legitimate water resources. The drainage lines could possibly be altered, should the development go ahead.

S21 (i) *Altering the bed, bank, course of characteristics of a water course.*

The proposed pipeline may alter the characteristics of the drainage lines.

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

The Risk Matrix as published on the DWS official webpage must be completed and submitted along with the Water Use Licence Application (WULA). The outcome of this risk assessment determines if a letter of consent, a General Authorization or a License is required.

Government Notice 509 of 26 August 2016

An extensive set of regulations that apply to any development in a water course is listed in this government notice in terms of Section 24 of the NWA. No development take place within the 1:100 year-flood line without the consent of the DWS. If the 1:100-year flood line flood line is not known, no development may take place within a 100m from a water course without the consent of the DWS. Likewise, no development may take place within 500m of a wetland without the consent of the DWS.

National Environmental Management Act (107of 1998)

NEMA and regulations promulgated in terms of NEMA determines that no development without the consent and permission of the DEA and its regional agencies, in this case the DENC of the Northern Cape Provincial Government, may take place within 32m of a water course. The mostly dry drainage lines are perceived to be legitimate water courses.

3 Location

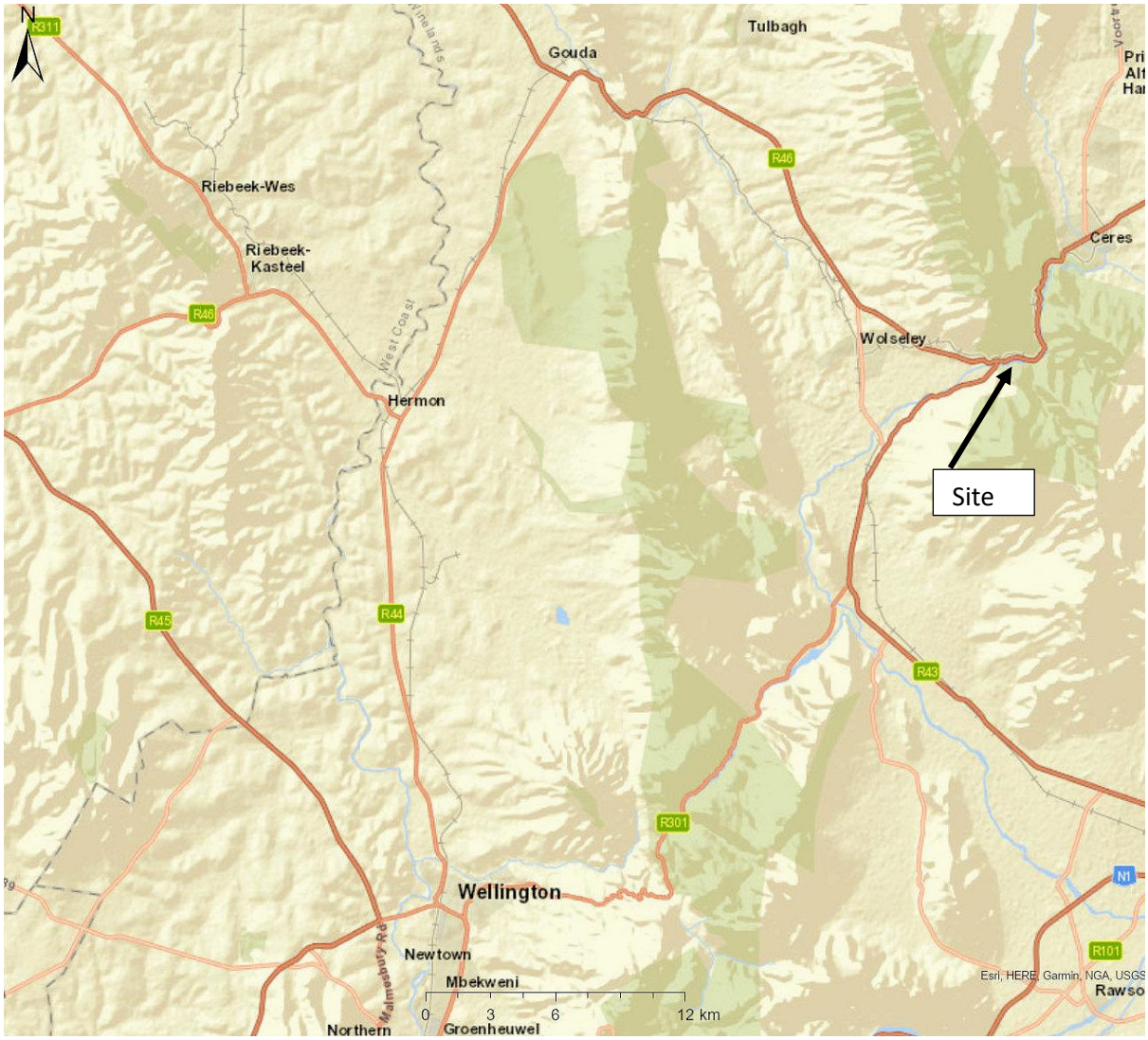


Figure 2 Location

The site is located at the junction of the R46 and the R43 (Figure 2) at the foot of the Mitchel's Pass on the way to Ceres. It is 8km to the east of Wolseley, as the crow flies.

The coordinates are as follows:

33°25'17.68"S and 19°16'56.00"E

4 Quaternary Catchment

The new pipeline is in the H10D quaternary catchment.

5 Climate Wolseley

https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/wolseley_south-africa_3359094

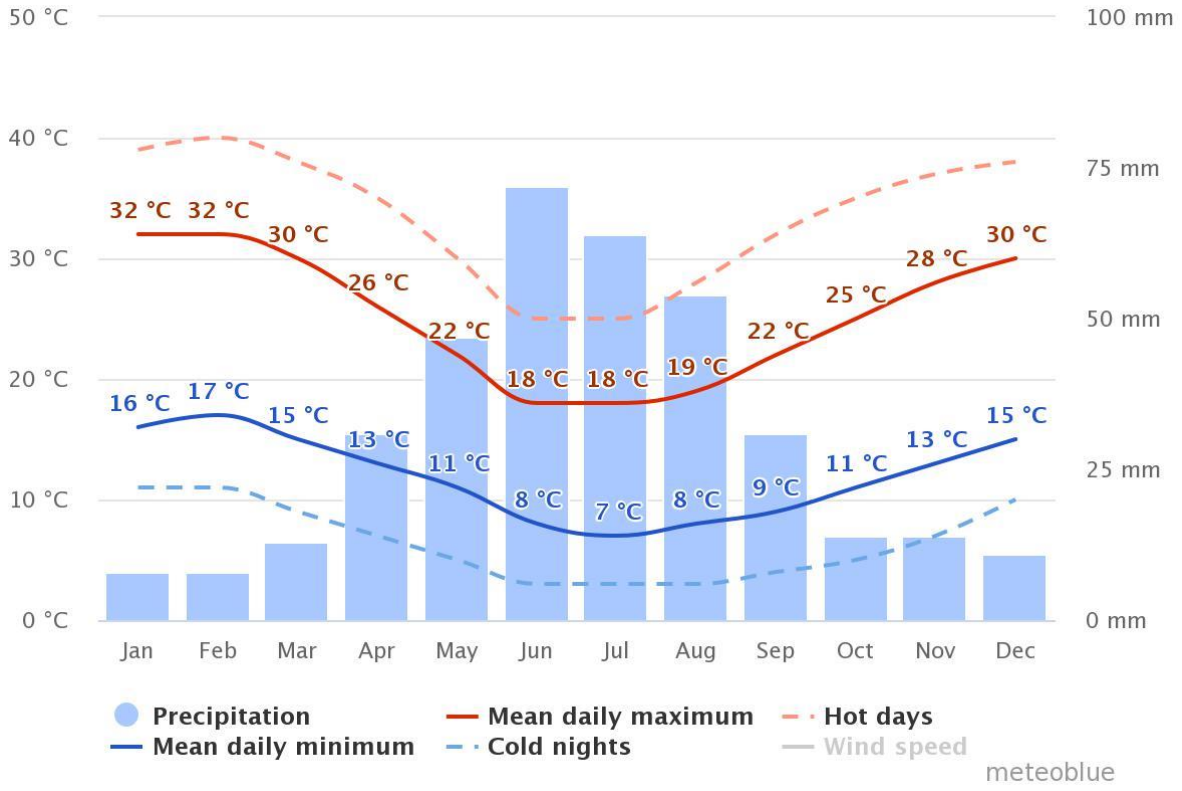


Figure 3 Climate Wolseley

Wolseley is the locality for which online climate data is available closest the site of the proposed pipeline.

Wolseley is in the winter rainfall area of the Western Cape, with dry summers. Hot desiccating winds in summer adds to the climate regime. Rainfall is mostly orographic, soft penetrating rains. The annual rainfall amounts to 706mm.

https://en.climate-data.org/africa/south-africa/western-cape/wolseley-189801/

This is higher than the average for the district and the region, but much lower than the rainfall on the high ridges and the peaks of the surrounding mountains, where it can rain up to 1800mm per year and even more. This high rainfall contributes most to the flow in the Breede River.

Water shortages for agricultural and urban use is often experienced during the summer months, which necessitates the abstraction of water from rivers during peak flows and the subsequent storage of water in large dams such as the Brandvlei Dam south of Worcester as well as in numerous smaller farm dams dotted over the landscape.

6 Conservation Status

6.1 Vegetation

The vegetation type is North Hex Sandstone Fynbos (Mucina & Rutherford, 2006).

The vegetation is listed as “Least Concern”. It is not endangered in any way.

6.2 Western Cape Biodiversity Spatial Plan

The Tierhokkloof is not listed as a CBA or as an ESA.

6.3 SANBI

The surrounds of the Breede River are listed as a wetland NFEPA. Neither the river nor the Tierhokkloof are listed as river NFEPA’s.

The Tierhokkloof and surrounding mountains are obviously important mountain catchment areas.

6.4 DFFE Screening Tool

Table 1 Screening tool results

Theme	Sensitivity
Animal species	High
Aquatic biodiversity	Very high
Plant species	Very high
Terrestrial biodiversity	Very high

Only the screening tool results pertaining to biodiversity are dealt with here, not themes such as agriculture and defence.

The aquatic biodiversity theme is obviously of importance to a Freshwater Report. It is listed as “Very High”. The sub-catchment is in the Matroosberg Mountain Catchment, which is listed as a strategic water resource.

In contrast to the SANBI and Cape Farm Mapper information, the sub-catchment in listed as a CBA, an ESA and the stream as an NFEPA. For the Freshwater Report, the screening tool results take precedence.

The sub-catchment is in the Ceres Bergfynbos Reserve, which adds weight to the conservancy status.

However, the proposed pipeline, as will be shown by the Impact Assessment later in the text, is a low-impact development and is not about to change the terrestrial or Fynbos conservation status.

The aquatic and terrestrial themes deal with the same issues. Both are addressed in this Freshwater Report. The animal and plant species require a separate and proper Site Verification Report including Specialist Reports or Compliance Statements.

The abstraction of water from the Tierhokkloof and the Breede River has a profound impact on the aquatic habitat. This impact is separate from that of the construction of the pipeline. The focus of this report is on the construction of the pipeline, even though abstraction in all its facets is cursory dealt with in this report.

7 Sub-Catchment

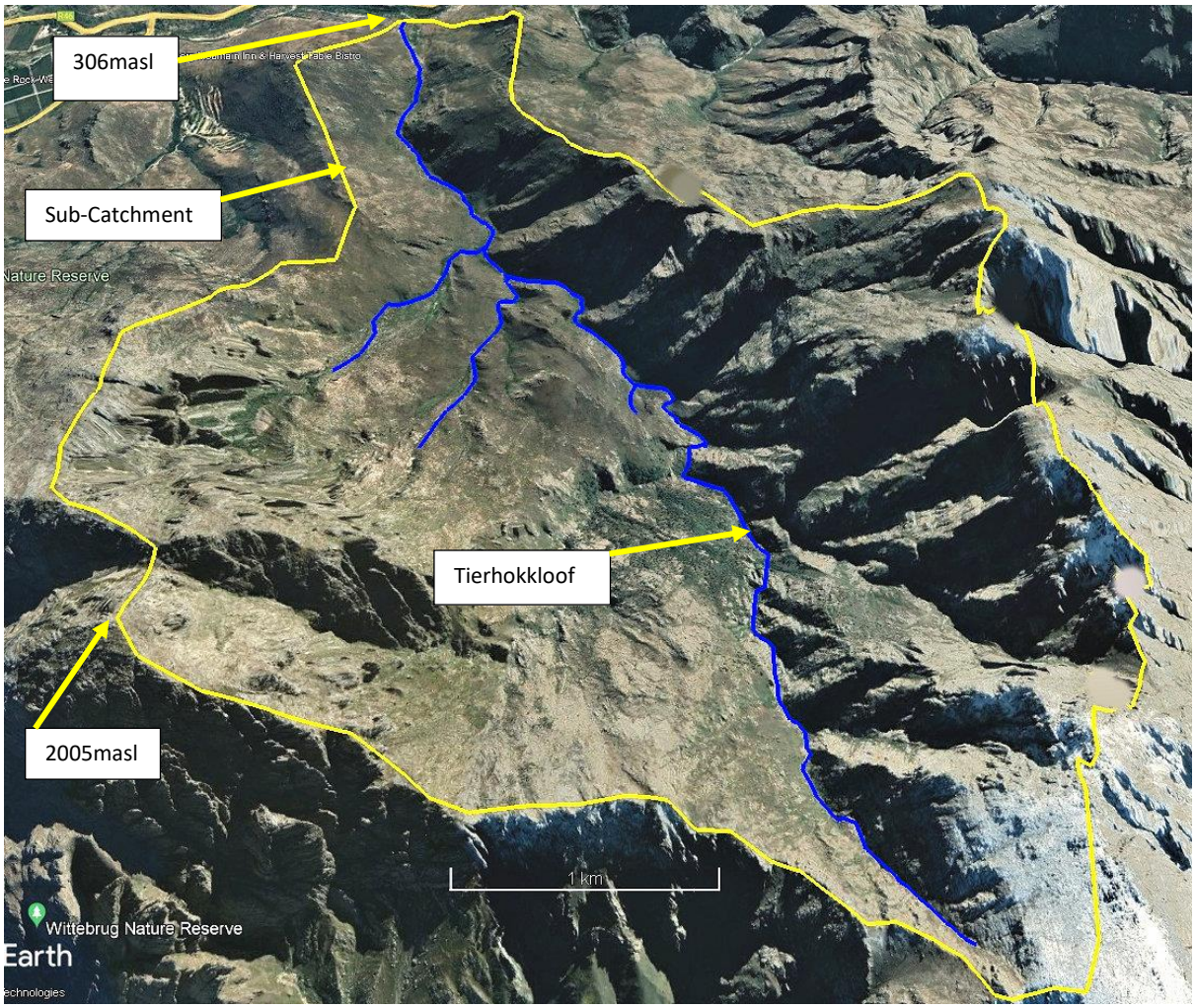


Figure 4 Sub-Catchment

The sub-catchment can be demarcated with the Google Earth polygon function by connecting the highest point around the Tierhokkloof. The watershed follows the peaks and high ridges of the Winterhoek Mountains around the Tierhokkloof Stream.

The sub-catchment is 7.0km long and 4.1km wide at its widest point.

The sub-catchment with an approximate surface area of 1900ha is in a deep valley or in a bowl on the Matroosberg Mountain Catchment Area. The highest peak is 2005masl and the lowest, at the confluence of the Tierhokkloof with the Breede River, is 306masl. Over the 5.2km from the highest point to the lowest point, the mean slope is 33 vertical meters over every 100 horizontal meters, which is an extremely steep slope and an indication of the mountainous terrain.

8 The Project

A bulk water supply pipeline of 2.5km in length and 350mm in diameter and will be constructed (Figure 5). This pipeline is meant to supply water to the town of Wolseley.

The pipeline will follow the route of the old, disused pipeline. The old pipeline is underground. After the old pipe was backfilled, it left a scar on the surface, which has not been grown over by vegetation for most of the way and which is easy to follow.

The pipeline will start at the abstraction point in the Tierhokkloof up against the incline of the mountain side. It will take an angle at the Breede River to the west and will follow the bank of the river to the Witbrug water purification plant (Figure 6).

According to the Preliminary Design Report dated 28 April 2023, a section of 700m long the proposed pipeline starting at the Witbrug water purification works will be dug in underground.

The rest of the new pipeline will be above the ground's surface. Some of it up against the incline will be on top of small concrete pedestals, placed some 5m apart. New pedestals must be constructed adjacent to the old existing pedestals.

Figure 5 Project (Bester Engineers, Ceres)

For most of the way, the new pipeline will be within the 100m buffer zone as defined in GN509, for which official approval is required.

Figure 6 Witbrug water purification plant

The upper weir in the Tierhokkloof (Figure 7), according to the Preliminary Design Report, will be upgraded. Leaks in the bottom of the weir will be plugged with fast-drying concrete. The existing pebble trap must be upgraded with a proper concrete floor and the existing gabions must be repaired and upgraded.

Figure 7 Tierhokkloof Weir (Photo Peet Botes)

Figure 8 Gabions at the Tierhokkloof weir (Photo Peet Botes)

9 Possible Impacts and Mitigating Measures

The existing underground pipeline is no longer serviceable. It has been repaired many times over and by now it cannot be repaired any longer. It is a fibre cement pipe that evidently has collapsed.

It would do more environmental damage to the Tierhokkloof and to the banks of the Breede River to dig the pipe up and to remove it altogether. It would be best to leave it where it is, underground, forever. Along the course of the pipeline, broken sections of pipe (Figure 9) and other debris were left on the ground, leftovers from previous maintenance attempts. These must be removed and disposed of properly, with the disturbed ground levelled and landscaped.

However, the 700m length of pipeline next to the Witbrug water purification works will be dug in underground. Once the trench has been backfilled, the impacted area must be levelled and landscaped, with all debris and building rubble removed.

The photographs of the Preliminary Design Report show that sections of the old pipeline are above ground up against the slope towards the upper weir. According to plan, the new pipeline will be constructed adjacent to the old one. There is no mention of the old pipeline being removed and disposed off in a proper way. It would be irresponsible of WATSAN Africa not to mention the undesirability of debris within the controlled zone of a water course. It remains for the BGCMA to have the final say and to justify the extra costs.

Pedestals must be manufactured for the placement of the new pipeline. These must preferably be manufactured off site and transported to where they are required along the length of the new pipeline. It would be environmentally unacceptable for the concrete to be mixed cast on the mountain side and up the Tierhokkloof, as this could cause considerable environmental damage. Alternatively, the engineers must provide a detailed plan as to how environmental damage is to be minimised if concrete is to be mixed up against the mountainside.

It is unimaginable to transport the pipes and pedestals over land because it would cause significant environmental damage and because the very steep terrain would not allow for such an exercise. A new road is not on the cards and an EIA for this was not scheduled. The engineering staff has not yet made it clear how the material will reach its destination. Helicopter air transport seem to be a viable option, given the environmental considerations. This aspect will become clear once the decision is made if HDPE or ductile iron pipes will be used.

The footprint along the Breede River and the Tierhokkloof must be kept as small as possible. The staging yard where materials will be assembled and from where it will be moved up the mountain must be kept as small as possible.

The pipeline must be at least 32m away from the Breede River and Tierhokkloof Stream, in accordance with the requirements of the NEMA and its regulations. The NWA and GN509 states that developments must be 100m away from any water way. This is not going to be possible. The pipeline will have to be constructed within this controlled zone, given the practicalities of having to construct against a steep mountainside. Official approval is required to place the envisaged pipeline in the controlled zone.

The pipeline must be elevated high enough above ground level that game such as rhee buck and steen buck can pass underneath. Nowhere must it be so low above ground level that it curtails the movement of smaller animals such as tortoises.

A design of the intake structure, the weir, at the top of the pipeline must be submitted for evaluation by the appointed freshwater ecologist as well as by the environmental authorities.

The visual impact could be significant, especially in a nature reserve. The pipeline and its pedestals must be of such a colour that it blends in with that of the environment.

An ECO must be appointed to oversee the project, to assure that the environmental imperatives are met.

The impact of water abstraction from the Breede River and the Tierhokkloof has already been mentioned. The abstractions are existing legal water uses (ELU's) that were in place long before the promulgation of the current National Water Act in 1998. The water is dearly needed for the local communities. It seems unlikely that the ELU will ever be revoked. This ELU was allocated before the requirement of the Ecological Reserve and the minimum flow requirements for the aquatic environment.

If this was an entirely new development, it would have been mandatory, in term of current legislation and in view of the contemporary aquatic environmental requirements, that a minimum flow of water would be left in the river and in the stream. Given the current legal situation, this is not under consideration, at least not in this report.

Figure 9 Broken section of pipe

The disturbed area will be prone to alien invasive tree infestation. Follow-up action is required to control and eradicate any invasive plants.

10 The Witbrug Weir

At the T-junction of the R46 and the R43, adjacent and to the north of the Witbrug water purification plant is a weir across the Breede River (Figure 10). It blocks of the entire river to divert the flow into a set of culverts from where the entire river is relayed underground (Figure 11). No water was flowing over the weir and downstream into the Breede River. Downstream of the weir, the river was dry (Figure 1). This was on 30 November 2022.

According to standing protocol, biomonitoring must be done downstream of an impact. This was not possible at the time of the site visit, as there was no water downstream of the weir. Biomonitoring took place on a later date when there was more flow down the river.

This is an example of all the base flow, the low flow and possibly part of the high flow as well of the Breede River is taken for agriculture and other use and where the only the peak flows overtop the weir and flows down the river to contribute to river health.

This diversion structure was probably constructed long before the promulgation of the NWA in 1998 and before the Ecological Reserve became an integral part of contemporary water management. Today minimum flow requirements for rivers are legally mandatory and the total deviation of a river is no longer permissible.

Figure 10 Weir

Figure 11 Culverts

Figure 12 River downstream of the weir

Figure 13 Pool

However, according to the Wolseley Water User Association, some water may be returned to the Breede River at the end of the rainy season when the farmer's dams are all full. This release is from the very end of the irrigation canal.

Reportedly, Eskom's load shedding has a vast effect on the flow in the river. During blackouts, farmer's pumps are down as well, with no abstraction of any water. The water level in the river then rises quickly and may overtop the weir. Similar remarkable phenomena were encountered in the Upper Berg River near Klawer and the Lower Breede River downstream from Bonnievale during WATSAN investigations.

Upstream of the weir, a large pool was present (Figure 13). The water was clear and fast flowing, perhaps a meter a second in places.

There was a high stand of riparian vegetation both upstream and downstream of the weir. These were mostly trees. Along the banks were emerging vegetation (Figure 13).

Mr Schalk Albertyn of the Wolseley Water User Association informed that most of the water taken from the river at the weir goes for several farming concerns, as it is distributed by substantial water infrastructure. Water is relayed to the Artois Canal into the Boontjieskraal River downstream to the town of Tulbach. Some of this water is used for irrigation as well. None of this water flows further downstream into the Dwars River and then into the Klein Brak River, as all of it gets used for irrigating mainly fruit orchard, the main produce of the district. Water is hard to come by and the farming community won't let a drop pass without being used. Some of water taken at the weir is piped to Wolseley for household use. The weir and the taking of water are important and integral parts of the local economy.

Mr Albertyn said that an official investigation is underway to establish if there is still water left for allocation in the Upper Breede River that can be abstracted and transferred to the Berg River for storage in the Voëlvlei Dam and the use in Cape Town.

11 The Tierhokkloof

Mr Peet Botes of PB Consult in Bredasdorp, the botanist associated with Enviro Africa, visited the site on 20 February 2023, when there was a strong flow of water down the Tierhokkloof. The water was clear and running fast down the mountainside (Figure 14).

The riparian vegetation was markedly higher than that on the surrounding slopes (Figure 14). The vegetation was Fynbos, proteoid.

Figure 14 Riparian vegetation of the Tierhokkloof

12 Biomonitoring

The biomonitoring procedure was carried out according to the description of Dickens & Graham, 2002. This is a procedure that has been developed over a long period of time for South African rivers and is widely used by the DWS and in general water resource management.

The sampling on 13 March 2023 was marked by a strongly flowing upper Breede River, with lost of water spilling over the weir at Witbrug (Figure 15). It rained the previous days and with loadshedding, the farmers could not pump that much, resulting in the strong flow.

The sample was collected upstream of the weir.

The river here can possibly be classified as a foothill cobble bed, with rapids and pools and lined with vegetation, mostly trees and shrub. It can also be described as the very upper part of a mature river with pools interspersed by riffles. The pool here was approximately 20m wide and from 0.4 to 1.5m deep.

The water was tea coloured but clear.

There was lots of submerged and emerging vegetation, mostly grasses. There was one small remnant of palmiet *Prionium serratum*.

The bottom was covered with round stones and boulders, with some sand patches in between. The stones carried very little thread-like algae.

The result of the sampling is depicted in the Appendix.

Figure 15 Weir overtopping

The water quality (Table 2) was measured with a calibrated hand-held YSI Professional probe. For the parameters measured, the water quality was good to maintain a varied population of macroinvertebrates, with adequate dissolved oxygen.

The SASS5 score together with the ASPT puts the river at the Witbrug in Class A (Figure 16). This suggest that the river is not impacted and in a pristine state, which is clearly not the case, given the large-scale abstractions and irrigation return flow. This classification was possibly the result of generous rains over the preceding days, as well as less abstraction and less irrigation return flow because of load shedding. Moreover, at such a varied and relatively large habitat availability, the score should be much higher, as can be encountered in the upper near-pristine reaches of bigger rivers.

The sample was dominated by Naucoridae, which occurred in large numbers. These are predatory, that may explain the scarcity of other insect larvae, such as dragonflies and damselflies. On the other hand, there were plenty of mayflies.

The DWS runs a regular and scheduled biomonitoring program on many sampling stations along the length of the Breede River and its tributaries. It provides a much better basis for comparison and evaluation than the only 3 samples that were taken by WATSAN Africa, two much lower down the river. This DWS data is not available for public use, at least not yet.

The score at Witbrug is higher than suggested by the State-of-the-River Report for the Breede River (DWAF, 2011).

It would have been ideal to conduct biomonitoring on the Tierhokkloof as well. This would require back up staff to help carry the equipment up the 2.5km mountain slope and to deal with emergencies, should it occur in the remoteness of the mountain. This, most unfortunately, was not to be, as staff was not forthcoming on the day of sampling.

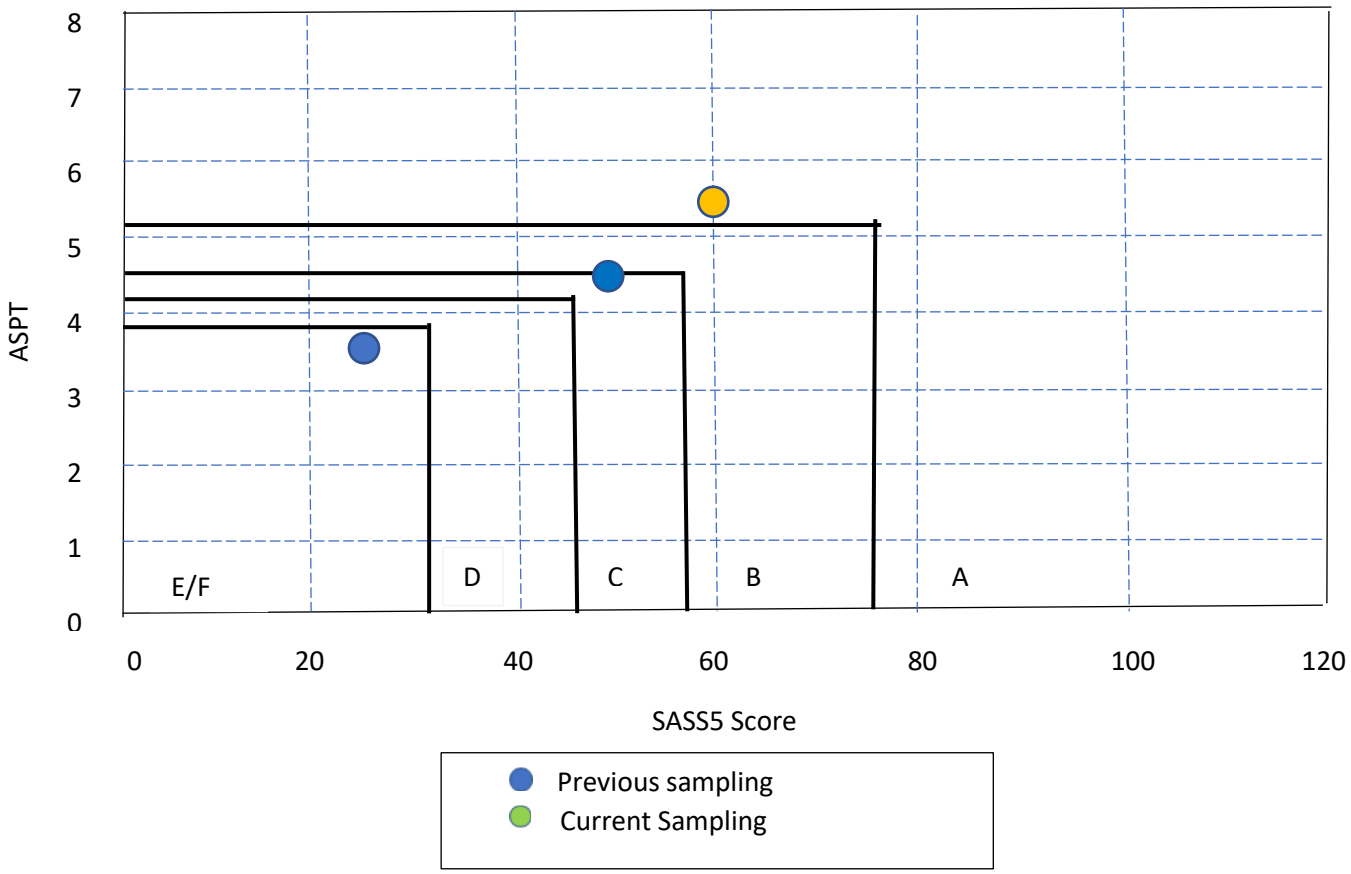
It is expected that the biomonitoring score at Witbrug will drop if more mountain tributaries are provided with water offtake points, weirs and conduits, for irrigation and general human use. The impact of the Tierhokkloof will be small, but the cumulative impact will predictably become evident as more water is taken from the river and its tributaries.

Table 2 Water Quality

Parameter		Value
Temperature	°C	22.0
pH		7.38
Electrical conductivity	mSm^{-1}	73.4
Dissolved Oxygen	mgl^{-1}	7

Table 3 Biomonitoring Score

Parameter	Score
SASS5	60
Number of Taxa	11
ASPT	5.5



Integrity Class	Description
A	Pristine; not impacted
B	Very Good; slightly impacted
C	Good; measurably impacted with most ecological functioning intact
D	Fair; impacted with some loss of ecological functioning
E	Poor; loss of most ecological function
F	Very Poor; loss of all ecological function

Figure 16 Biomonitoring Results

13 Present Ecological State

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 4 and 5) in 1999 of the then DWAF to assess river reaches. The scores given are solely that of the practitioner and are based on expert opinion.

The Breede River Valley was until recently heavily overgrown with invasive vegetation such as black wattle and blue gum trees. Not only was natural riparian vegetation replaced by invasives, but the loss of water due to evapotranspiration was evident. Since the start of the Working for Water program in 1995, a concerted effort was and still is maintained to remove and to control invasive vegetation. According to Mr Ryno Pienaar of the Department of Agriculture, several local and regional authorities, water user associations, conservation departments and donor organisations have been active in the valley from Ceres to Worcester. Today much of the natural riparian vegetation has been restored. The situation in lower reaches is still dire and much work still needs to be done.

Table 4 Habitat Integrity according to Kleynhans, 1999

Category	Description	% of maximum score
A	Unmodified, natural	90 – 100
B	Largely natural with few modifications. A small change in natural habitats and biota, but the ecosystem function is unchanged	80 – 89
C	Moderately modified. A loss and change of the natural habitat and biota, but the ecosystem function is predominantly unchanged	60 – 79
D	Largely modified. A significant loss of natural habitat, biota and ecosystem function.	40 – 59
E	Extensive modified with loss of habitat, biota and ecosystem function	20 – 39
F	Critically modified with almost complete loss of habitat, biota and ecosystem function. In worse cases ecosystem function has been destroyed and changes are irreversible	0 - 19

Table 5 Present Ecological State of the Breede River reach at the Witbrug Weir

Instream	Score	Weight	Product	Maximum score
Water abstraction	11	14	154	350
Flow modification	10	13	130	325
Bed modification	21	13	273	325
Channel modification	20	13	260	325
Water quality	19	14	266	350
Inundation	18	10	180	250
Exotic macrophytes	19	9	171	225
Exotic fauna	17	8	136	200
Solid waste disposal	20	6	120	150
Total		100	1690	2500
% of total			67.6	
Class			C	
Riparian				
Water abstraction	11	13	143	325
Inundation	10	11	110	275
Flow modification	9	12	108	300
Water quality	19	13	247	325
Indigenous vegetation removal	22	13	286	325
Exotic vegetation encroachment	19	12	228	300
Bank erosion	22	14	308	350
Channel modification	21	12	252	300
Total			1682	2500
% of total			67.3	
Class			C	

This corresponds to much of the classification as derived by the National River Health Programme and the State of the River Report for the Breede River (2011).

The rejuvenation of the Tierhokkloof water abstraction won't have a marked deleterious impact on the Breede River, as there are numerous other similar streams feeding the Breede River higher up in the catchment.

Table 6 Present Ecological State of the Tierhokkloof

Instream	Score	Weight	Product	Maximum score
Water abstraction	24	14	336	350
Flow modification	24	13	312	325
Bed modification	24	13	312	325
Channel modification	24	13	312	325
Water quality	24	14	336	350
Inundation	24	10	240	250
Exotic macrophytes	24	9	216	225
Exotic fauna	23	8	184	200
Solid waste disposal	22	6	132	150
Total		100	2380	2500
% of total			95.2	
Class			A	
Riparian				
Water abstraction	24	13	312	325
Inundation	24	11	264	275
Flow modification	24	12	288	300
Water quality	24	13	312	325
Indigenous vegetation removal	23	13	312	325
Exotic vegetation encroachment	19	12	228	300
Bank erosion	23	14	322	350
Channel modification	23	12	276	300
Total			2374	2500
% of total			95.0	
Class			A	

Currently no water is abstracted for the Tierhokkloof, as the pipeline collapsed. Since the collapse, the stream must have recuperated to its current near-pristine and natural state. The only impact is the weir at the start of the old pipeline.

Once the new pipeline becomes operation, the current classification of “A” for both instream and riparian, will predictably drop by at least one class, probably two. The recurrence of water abstraction would have a marked deleterious impact. This is, no doubt, already discounted by the decision-making authorities against the need for water for human use.

14 Ecological Importance

The Ecological Importance (EI) is based on the presence of especially fish species that are endangered on a local, regional or national level (Table 7).

Table 7 Ecological Importance according to endangered organisms (Kleynhans,1999).

Category	Description
1	One species or taxon are endangered on a local scale
2	More than one species or taxon are rare or endangered on a local scale
3	More than one species or taxon are rare or endangered on a provincial or regional scale
4	One or more species or taxa are rare or endangered on a national scale (Red Data)

In the near-pristine tributaries of the Breede River, up against the slopes of the high mountain catchments, indigenous fish such as *Sandelia capensis, Galaxias zebratus* are still present, but in the lower reaches these have been replaced by exotic species such as carp *Cyprinus carpio*, barbel *Clarias gariepinus,* Mozambique tilapia *Oreochromis mossambicus* and the bluegill sunfish *Lepomis macrochirus.*

The endangered Red Data *Pseudobarbus burchelli* prefers deeper pools in the mainstream. The aquatic habitat around the Witbrug weir was probably suitable *for P. burchelli* in the past, but since the introduction of alien predatory fish species, it is fair to assume that there are none left. From this perspective, the Breede River at the Witbrug and the Tierhokkloof are ecologically not important.

No fish was observed in the pool above the weir during the biomonitoring site visit.

15 Ecological Sensitivity

Ecological Sensitivity (ES) is often described as the ability of aquatic habitat to assimilate impacts. It is not sensitive if it remains the same despite of the onslaught of impacts. Put differently, sensitive habitat changes substantially, even under the pressure of slight impacts.

The Ecological Sensitivity also refers to the potential of aquatic habitat to bounce back to an ecological condition closer to the situation prior to human impact. If it recovers, it is not regarded as sensitive.

If all traces of human habitation and large-scale agriculture were to, by some unlikely incidence vanish, the aquatic habitat in the Breede River system will bounce back, but only if exotic fish species disappear as well. This is not going to happen and certainly is not a realistic expectation. The system is not about to ever bounce back.

From this perspective, the Breede River is most sensitive.

The Tierhokkloof, being up the steep mountainside, apart from water abstraction, was not subject to this onslaught. It recovered when abstraction ceased. It will deteriorate when abstraction is resumed but will come around again once it stops. There are no plants on the table for abstraction to stop and because of the Tierhokkloof is rated as ecologically sensitive as well.

16 EISC

Table 8 EISC

Determinant	Tierhokkloof	Breede River
Rare and endangered species	1	1
Populations of unique species	1	1
Species / Taxon richness	2	4
Diversity of habitat	2	4
Migration Route/ Breeding and feeding site for wetland species	3	5
Sensitivity to water quality changes	3	3
Flood storage, energy dissipation, particulate / element removal	3	5
Protection status	4	4
Ecological integrity	4	2
Average	2.3	3.3
Score	Moderate	High

Score guideline:

Very High 4, High 3, Moderate 2, Low 1, None 0

Confidence Rating

Very High 4, High 3, Moderate 2, Low 1

The EISC is an index that was devised by Dr Neels Kleynhans of the then Institute of Water Quality Studies of the Department of Water Affairs and Forestry. It is obligatory to add the value to the Risk Matrix.

Again, the values given are entirely according to the knowledge and experience of the assessor.

The Tierhokkloof EISC is set to drop in value once the abstraction starts, as the ecological integrity would deteriorate. The river will not be influenced all that much as it has many sources of water out of the surrounding mountains.

17 Impact Assessment

Some of the authorities, such as the DFFE and its provincial offices prescribe an impact assessment according to a premeditated methodology.

The main benefit of this exercise is that it allows for the evaluation of mitigation measures. Later follows a Risk Assessment. This is different from the Impact Assessment as it does not attempt to weigh the success of mitigation measures.

The methodology is set out in the Appendix.

The impact assessment follows the stages in the life cycle of a project. These stages include planning, construction, operation, decommissioning and rehabilitation.

The planning phase does not have any impact for which a Risk Matrix can be completed, as during this phase nothing is happening on the ground.

The construction of the pipeline *per se* is because of its nature a low-impact project pertaining the aquatic environment. It has more potential impact on the terrestrial environment. It is also straight forward, rather simple, not complicated, which results in a similar Impact Assessment (Table 9), limited in extent, short and simple.

The mitigating measures are readily implementable and should have positive results. The impacts assessment does not indicate any prohibition. The project should go ahead.

Table 9 Impact Assessment

Description of impact: Construction Phase

Transport of construction material such as pedestals, pipe sections and fittings up the incline
Placement of the pedestals
Placement of the pipe
Reconstruction of the gabions at the water take-off point
Removal of remnants of the old pipeline and other debris

Mitigation measures

Prevent loose soil, sediments and debris from moving down the Tierhokkloof and Breede River along with storm water.
Keep footprint as small as possible.
Do not create more access routes. Use the existing one.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	Medium	Short term	Medium	Definite	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Short term	Low	Definite	Sure	Reversible	Replaceable

Description of impact: Operational Phase

Maintenance of pipeline

Mitigation measures

Inspect the pipeline according to a schedule. Inspect pipes, fittings, valves, screen, pedestals.
Preventative maintenance, repair pipeline before any leaks occurs.
Remove any remnants and rubble after maintenance.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	Medium	Long term	Medium	Definite	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Long term	Low	Definite	Sure	Reversible	Replaceable

18 Risk Matrix

The purpose of the Risk Matrix is to determine if a General Authorisation of a License is applicable.

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 10 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 10 (continued) represent the same activities as in the Impact Assessment, with sub-activities added.

The methodology is tabled in the Appendix.

The environmental risks are small, even negligible, because of the low-impact nature of the project. Only the reconstruction of the gabions up in the Tierhokkloof is in the stream bed. The pipeline is outside of the water ways and outside of the riparian zone. This renders the risks negligible.

The Risk Matrix indicates that a General Authorization is the indicated level of authorization. A License is not called for.

Table 10 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Transport of construction material such as pedestals, pipe sections and fittings up the incline Placement of the pedestals Placement of the pipe Reconstruction of the gabions at the water take-off point Removal of remnants of the old pipeline and other debris	Mobilisation of soil	Soil and debris washing down the Tierhokkloof and the Breede River Destruction of aquatic habitat	24	Low
2	Maintenance of pipeline	Mobilization of soil	Soil and debris washing down the Tierhokkloof and Breede River Destruction of aquatic habitat	28	Low

Table 7 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1 2	1 1	1 1	1 1	1 1	1 1	1 1	1 2	3 4

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significance	Risk Rating
1 2	1 2	1 2	5 5	1 1	8 10	24 40	Low Low

19 Numerical Significance

Decision-makers often press on a numerical score for Significance**.** The score takes into consideration both the environmental value of the site and the degree of impact.

Table 26.4, p52, Appendix provides a system for allocation values for each of the parameters Conservation Value, Extent, Duration, Severity and Likelihood with regard to possible impacts These values are then entered into the equation on p53 to derive at a value for Significance. The value for Significance can subsequently be evaluated according to Table 26.4.2.

Table 26.4.2 provides a yardstick for decision-making to allow or disallow a development with its concomitant impact on the environment.

The scores that were given are entirely those of the specialist (Table 11), based on his or her knowledge and experience. These scores form a bases for debate and consensus, should contemporaries and decision-makers wish to add to the process.

The scores apply under the assumption that mitigation measures will be in place.

Table 11 Significance Score

Parameter	Tierhokkloof	Breede River
Conservation value	3	4
Likelihood	1	1
Duration	3	3
Extent	1	1
Severity	1	1
Significance	18	24
	Insignificant	Low

The significance rating for the Tierhokkloof came out as “Insignificant”, mainly because the conservation value is not regarded as high. The rating for the Breeder River at the Witbrug was Low.

These low to insignificant ratings indicate the project should go ahead.

20 Resource Economics

The goods and services delivered by the environment is a Resource Economics concept as adapted by Kotze *et al* (2009). The methodology was designed for the assessments of wetlands, but in the case of the river, the goods and services delivered are particularly applicable and important, hence it was decided to include it in the report.

The diagram (Figure 18) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 12.

Table 12. Goods and Services

Goods & Services	Tierhokkloof	Breede River
Flood attenuation	4	5
Stream flow regulation	4	5
Sediment trapping	4	5
Phosphate trapping	4	5
Nitrate removal	3	5
Toxicant removal	2	5
Erosion control	4	5
Carbon storage	3	5
Biodiversity maintenance	4	5
Water supply for human use	5	5
Natural resources	1	5
Cultivated food	4	5
Cultural significance	3	5
Tourism and recreation	4	5
Education and research	3	5

0	Low
5	High

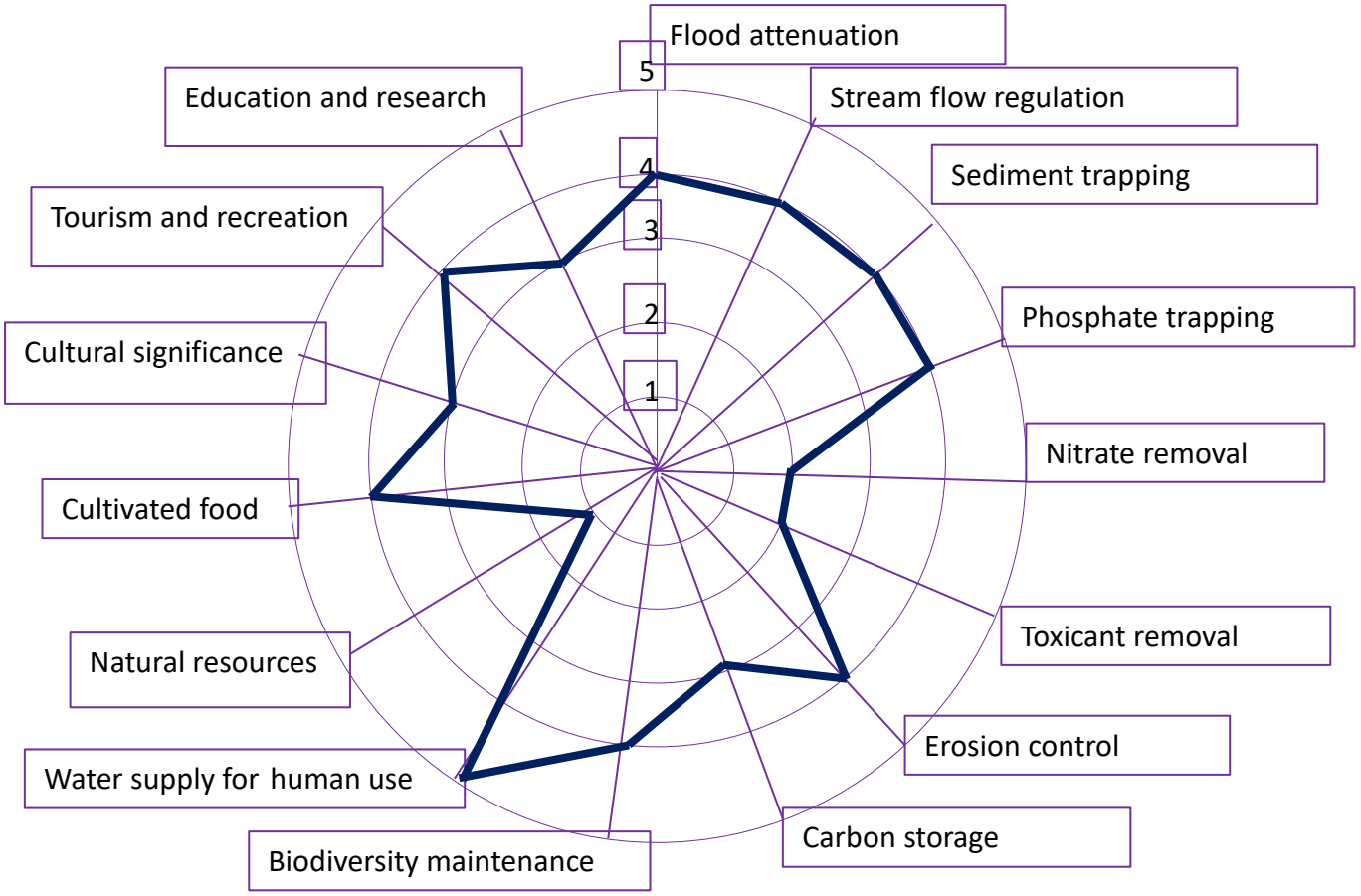


Figure 18. Resource Economics Footprint of the Tierhokkloof

A large star shape for the drainage lines combined would attract decision-maker's attention. This shape of the spider diagram large. The Tierhokkloof has a significant resource economics footprint. From this perspective, much would be lost if it is impacted. It is not expected that the new pipeline would change the resource economics footprint.

The resource economics of the Breede River is a complete circle, which is fitting for all large rivers. Again, the new pipeline is not about to change anything.

Resource Economics do not provide any reason not to go ahead with the project.

21 Summary

Table 13 Summary of evaluations

Aspect	Status
DFFE Screening Tool	High and Very High
Western Cape Biodiversity Spatial Plan	CBA and ESA
Priority Areas	NFEPA
Vegetation	Least Concern
Biomonitoring	Near-pristine
PES of the Tierhokkloof	Instream A, Riparian A
PES of the Breede River	Instream C, Riparian C
Ecological Importance Tierhokkloof	Not Important
Ecological Importance of the Breede River	Not Important (Potentially important)
Ecological Sensitivity Tierhokkloof	Sensitive
Ecological Sensitivity Breede River	Sensitive
EISC Tierhokkloof	Moderate
EISC Breede River	High
Impact assessment	Mitigation readily implementable
Risk Matrix	General Authorization
Numeric Significance	Insignificant and Low
Resource Economics	Large footprint

Table 13 gives an overall and much condensed view of the evaluations and methodologies that have been applied to the drainage line.

Like many of similar summaries it is a mixed bag ranging from not important to highly important. A CBA in a nature reserve with sensitive aquatic habitat draws attention. To the contrary, the impact is by its nature insignificant to low, as illustrated by the numerical significance.

22 Discussion and Conclusions

Figure 19 has been adapted from one of the most recent DWS policy documents.

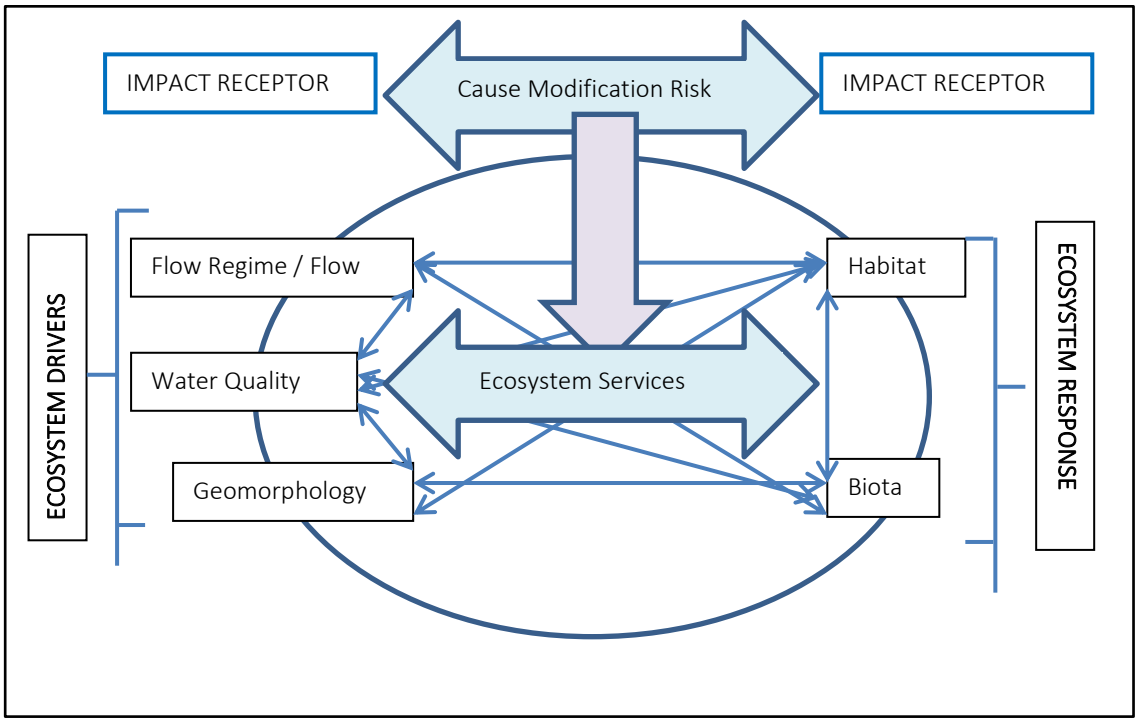


Figure 19 Minimum Requirements for a S21(c) and (i) Application.

"An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on the other drivers and responses. This, in turn, will predictably impact on the ecosystem services. The WULA and the EAI must provide mitigation measured for these impacts."

The conclusions can be structured along the outline that is provided by Figure 19.

The driver of the Breede River system is obviously the winter rains. This is high flow and peak flow time, with the occasional large flood. The dry summer months are as much of a driver, as the low flow and drought flow sets in. A trickle of water between pools may persist. The river may stop flowing, with only stagnant pools.

Rainfall is erratic, with very extended dry periods and with extreme floods.

Abstraction for agriculture has become a major driver as well. It reduces the base flow period and extends low flow and drought flow periods.

Lower down the river, large stands of mature blue gum trees evapotranspirates large volumes of water out of the river, contributing to drought flow conditions.

Along with abstraction comes agriculture return flow, with its deleterious impact om water quality.

All these conditions and impacts are evident at the Witbrug.

The construction of the new pipeline *per se* has little impact on the Tierhokkloof and on the Breede River. It would not modify any of the rendered ecosystem services.

This WULA deals with the pipeline and its construction, for which a General Authorization is the indicated level of authorization.

The revitalizing of the abstraction from the Tierhokkloof and its authorization is the domain of the DWS and its decision-makers. No doubt, this has been discounted against the availability of water and against the Ecological Reserve, according to established methodologies. This is beyond the scope of this Freshwater Report.

23 References

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24 Declaration of Independence

I, Dirk van Driel, as the appointed independent specialist hereby declare that I:

- Act/ed as the independent specialist in this application
- Regard the information contained in this report as it relates to my specialist input/study to be true and correct and;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management act;
- Have and will not have vested interest in the proposed activity;
- Have disclosed to the applicant, EAP and competent authority any material information have or may have to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the environmental Impact Assessment Regulations, 2010 and any specific environmental management act.
- Am fully aware and meet the responsibilities in terms of the NEMA, the Environmental Impacts Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R543) and any specific environmental management act and that failure to comply with these requirements may constitute and result in disqualification;
- Have ensured that information containing all relevant facts on respect of the specialist input / study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties facilitated in such a manner that all interested and affected parties were provided with reasonable opportunity to participate and to provide comments on the specialist input / study;
- Have ensured that all the comments of all the interested and affected parties on the specialist input were considered, recorded and submitted to the competent authority in respect of the application;
- Have ensured that the names of all the interested and affected parties that participated in terms of the specialist input / study were recorded in the register of interested and affected parties who participated in the public participation process;
- Have provided the competent authority with access to all information at my disposal regarding the application, weather such information is favourable or not and;
- Am aware that a false declaration is an offence in terms of regulation 71 of GN No. R543.

25 Résumé

Experience

USAID/RTI, ICMA & Chemonics. Iraq & Afghanistan **2007 -2011**
Program manager.

City of Cape Town **1999-2007**
Acting Head: Scientific Services, Manager: Hydrobiology.

Department of Water & Sanitation, South Africa **1989 – 1999**
Senior Scientist

Tshwane University of Technology, Pretoria **1979 – 1998**
Head of Department

University of Western Cape and Stellenbosch University 1994 - 1998 part-time
- Lectured post-graduate courses in Water Management and Environmental Management to under-graduate civil engineering students
- Served as external dissertation and thesis examiner

Service Positions
- Project Leader, initiator, member and participator: Water Research Commission (WRC), Pretoria.
- Director: UNESCO West Coast Biosphere, South Africa
- Director (Past Deputy Chairperson): Grotto Bay Homeowner's Association
- Past Member Dassen Island Protected Area Association (PAAC)

Membership of Professional Societies
- South African Council for Scientific Professions. Registered Scientist No. 400041/96
- Water Institute of South Africa. Member

Reports

- Process Review Kathu Wastewater Treatment Works
- Effluent Irrigation Report Tydstroom Abattoir Durbanville
- River Rehabilitation Report Slangkop Farm, Yzerfontein
- Fresh Water and Estuary Report Erf 77 Elands Bay
- Ground Water Revision, Moorreesburg Cemetery
- Fresh Water Report Delaire Graff Estate, Stellenbosch
- Fresh Water Report Quantum Foods (Pty) Ltd. Moredou Poultry Farm, Tulbagh
- Fresh Water Report Revision, De Hoop Development, Malmesbury
- Fresh Water Report, Idas Valley Development Erf 10866, Stellenbosch
- Wetland Delineation Idas Valley Development Erf 10866, Stellenbosch
- Fresh Water Report, Idas Valley Development Erf 11330, Stellenbosch
- Fresh Water Report, La Motte Development, Franschhoek
- Ground Water Peer Review, Elandsfontein Exploration & Mining
- Fresh Water Report Woodlands Sand Mine Malmesbury
- Fresh Water Report Brakke Kuyl Sand Mine, Cape Town
- Wetland Delineation, Ingwe Housing Development, Somerset West
- Fresh Water Report, Suurbraak Wastewater Treatment Works, Swellendam
- Wetland Delineation, Zandbergfontein Sand Mine, Robertson
- Storm Water Management Plan, Smalblaar Quarry, Rawsonville
- Storm Water Management Plan, Riverside Quarry
- Water Quality Irrigation Dams Report, Langebaan Country Estate
- Wetland Delineation Farm Eenzaamheid, Langebaan
- Wetland Delineation Erf 599, Betty's Bay
- Technical Report Bloodhound Land Speed Record, Hakskeenpan
- Technical Report Harkerville Sand Mine, Plettenberg Bay
- Technical Report Doring Rivier Sand Mine, Vanrhynsdorp
- Rehabilitation Plan Roodefontein Dam, Plettenberg Bay
- Technical Report Groenvlei Crusher, Worcester
- Technical Report Wiedouw Sand Mine, Vanrhynsdorp
- Technical Report Lair Trust Farm, Augrabies
- Technical Report Schouwtoneel Sand Mine, Vredenburg
- Technical Report Waboomsrivier Weir Wolseley
- Technical Report Doornkraal Sand Mine Malmesbury
- Technical Report Berg-en-Dal Sand Mine Malmesbury
- Wetland Demarcation, Osdrif Farm, Worcester
- Technical Report Driefontein Dam, Farm Agterfontein, Ceres
- Technical Report Oewerzicht Farm Dam, Greyton
- Technical Report Glen Lossie Sand Mine, Malmesbury
- Preliminary Report Stellenbosch Cemeteries
- Technical Report Toeka & Harmony Dams, Houdenbek Farm, Koue Bokkeveld
- Technical Report Kluitjieskraal Sand & Gravel Mine, Swellendam
- Fresh Water Report Urban Development Witteklip Vredenburg
- Fresh Water Report Groblershoop Resort, Northern Cape
- Fresh Water Report CA Bruwer Quarry Kakamas, Northern Cape
- Fresh Water Report, CA Bruwer Sand Mine, Kakamas, Northern Cape
- Fresh Water Report, Triple D Farms, Agri Development, Kakamas
- Fresh Water Report, Keren Energy Photovoltaic Plant Kakamas
- Fresh Water Report, Keren Energy Photovoltaic Plant Hopetown

- Fresh Water Report Hopetown Sewer
- Fresh Water Report Hoogland Farm Agricultural Development, Touws River
- Fresh Water Report Klaarstroom Wastewater Treatment Works
- Fresh Water Report Calvinia Sports Grounds Irrigation
- Fresh Water Report CA Bruwer Agricultural Development Kakamas
- Fresh Water Report Zwartfontein Farm Dam, Hermon
- Statement Delsma Farm Wetland, Hermon
- Fresh Water Report Lemoenshoek Farms Pipelines Bonnyvale
- Fresh Water Report Water Provision Pipeline Brandvlei
- Fresh Water Report Erf 19992 Upington
- Botanical Report Zwartejongensfontein Sand Mine, Stilbaai
- Fresh Water Report CA Bruwer Feldspath Mine, Kakamas
- Sediment Yield Calculation, Kenhardt Sand Mine
- Wetland Demarcation, Grabouw Traffic Center
- Fresh Water Report, Osdrift Sand Mine, Worcester
- Fresh Water Report, Muggievlak Storm Water Canal, Vredenburg
- Fresh Water Report, Marksman's Nest Rifle Range, Malmesbury
- Biodiversity Report, Muggievlak Storm Water Canal, Vredenburg
- Strategic Planning Report, Sanitation, Afghanistan Government, New Delhi, India
- Fresh Water Report, Potable Water Pipeline, Komaggas
- Fresh Water Report, Wastewater Treatment Works, Kamieskroon
- Fresh Water Report, Turksvy Farm Dam, Upington
- Fresh Water Report, Groblershoop Urban Development, IKheis Municipality
- Fresh Water Report, Boegoeberg Urban Development, IKheis Municipality
- Fresh Water Report, Opwag Urban Development, IKheis Municipality
- Fresh Water Report, Wegdraai Urban Development, IKheis Municipality
- Fresh Water Report, Topline Urban Development, IKheis Municipality
- Fresh Water Report, Grootdrink Urban Development, IKheis Municipality
- Fresh Water Report, Gariep Urban Development, IKheis Municipality
- Fresh Water Report, Bonathaba Farm Dam, Hermon
- Botanical Report, Sand Mine Greystone Trading, Vredendal
- Botanical Report Namakwa Klei Stene, Klawer
- Fresh Water Report Buffelsdrift Quarry, George
- Fresh Water Report Styerkraal Agricultural Development, Onseepkans.
- Technical Report Arabella Country Estate Wastewater Treatment Works, Kleinmond
- Fresh Water Report Calvinia Bulk Water Supply
- Fresh Water Report Swartdam Farm Dams, Riebeeck Kasteel
- Fresh Water Report Erf 46959, Gordon's Bay
- Fresh Water Report Melkboom Farm Dam, Trawal
- Stormwater Management Plan, Bot River Bricks
- Freshwater Report, Bot River Bricks
- Freshwater Report Sanddrif Farm, Joubertina
- Freshwater Report Zouterivier Cell phone tower, Atlantis
- Biodiversity Report Birdfield Sandmine, Klawer
- Freshwater Report New Wave Dam, Klawer
- Freshwater Report Harvard Solar Energy Plant, Bloemfontein
- Freshwater Report Doorn River Solar Energy Plant, Virginia
- Freshwater Report Kleingeluk Farm, De Rust
- Freshwater Report, Solar Energy Plant, Klein Brak River
- Site Verification Report Laaiplek Desalination Plant
- Freshwater Report, CA Bruwer Quarry, Kakamas
- Freshwater Report, Orren Managanese Mine, Swellendam
- Wetland Delineation, Klipheuvel ZCC Solar Energy
- Freshwater Report Delville Park, George

26 Appendix

26.1 Biomonitoring Results

SASS5 Score Sheet		Witbrug, Ceres			D van Driel SACNASP 400041/96					
Date	13-Mar-23	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**
Locality	Breede River	Porifera	5		**Hemiptera**			**Diptera**		
		Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1		Gerridae	5	5	Ceratopogonidae	5	
Coordinates	28°24' 18.04"S	Huridinea	3		Hydrometridae	6		Chironomidae	2	
	19°66'02.51"E	**Crustacea**			Naucoridae	7	7	Culicidae	1	1
		Amphipodae	13		Nepidae	3		Dixidae	10	
DO mg/l	7.0	Potamonautidae	3		Notonectidae	3	3	Empididae	6	
Temperature °C	22.0	Atyidae	8		Pleidae	4	4	Ephydridae	3	
pH	7.38	Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m	73.4	Hydracarina	8		**Megaloptera**			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	
SASS5 Score	60	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	11	Perlidae	12		**Trichoptera**			Tabanidae	5	
ASPT	5,5	**Ephemeroptera**			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		**Gastropoda**		
Other Biota		Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	3
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		**Cased Caddis**			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		**Pelecipoda**		
		Teloganodidae	12		Glossostomatidae	11		Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		**Coleoptera**					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8	8			
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				16			40			4

26.2 Methodology used in determining significance of impacts.

The methodology to be used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives is provided in the following tables:

Table 26.2.1 Nature and type of impact

Nature and type of impact	Description
Positive	An impact that is considered to represent an improvement to the baseline conditions or represents a positive change
Negative	An impact that is considered to represent an adverse change from the baseline or introduces a new negative factor
Direct	Impacts that result from the direct interaction between a planned project activity and the receiving environment / receptors
Indirect	Impacts that result from other activities that could take place as a consequence of the project (e.g. an influx of work seekers)
Cumulative	Impacts that act together with other impacts (including those from concurrent or planned future activities) to affect the same resources and / or receptors as the project

Table 26.2.2 Criteria for the assessment of impacts

Criteria	Rating	Description
Spatial extent of impact	National	Impacts that affect nationally important environmental resources or affect an area that is nationally important or have macro-economic consequences
	Regional	Impacts that affect regionally important environmental resources or are experienced on a regional scale as determined by administrative boundaries or habitat type / ecosystems
	Local	Within 2 km of the site
	Site specific	On site or within 100m of the site boundary
Consequence of impact/ Magnitude/ Severity	High	Natural and / or social functions and / or processes are severely altered
	Medium	Natural and / or social functions and / or processes are notably altered
	Low	Natural and / or social functions and / or processes are slightly altered
	Very Low	Natural and / or social functions and / or processes are negligibly altered
	Zero	Natural and / or social functions and / or processes remain unaltered
Duration of impact	Temporary	Impacts of short duration and /or occasional
	Short term	During the construction period
	Medium term	During part or all of the operational phase
	Long term	Beyond the operational phase, but not permanently

	Permanent	Mitigation will not occur in such a way or in such a time span that the impact can be considered transient (irreversible)

Table 26.2.3 Significance Rating

Significance Rating	Description
High	High consequence with a regional extent and long-term duration High consequence with either a regional extent and medium-term duration or a local extent and long-term duration Medium consequence with a regional extent and a long-term duration
Medium	High with a local extent and medium-term duration High consequence with a regional extent and short-term duration or a site-specific extent and long-term duration High consequence with either local extent and short-term duration or a site-specific extent with a medium-term duration Medium consequence with any combination of extent and duration except site-specific and short-term or regional and long term Low consequence with a regional extent and long-term duration
Low	High consequence with a site-specific extent and short-term duration Medium consequence with a site-specific extent and short-term duration Low consequence with any combination of extent and duration except site-specific and short-term Very low consequence with a regional extent and long-term duration
Very low	Low consequence with a site-specific extent and short-term duration Very low consequence with any combination of extent and duration except regional and long term

Neutral	Zero consequence with any combination of extent and duration

Table 26.2.4 Probability, confidence, reversibility and irreplaceability

Criteria	Rating	Description
Probability	Definite	>90% likelihood of the impact occurring
	Probable	70 – 90% likelihood of the impact occurring
	Possible	40 – 70% likelihood of the impact occurring
	Unlikely	<40% likelihood of the impact occurring
Confidence	Certain	Wealth of information on and sound understanding of the environmental factors potentially affecting the impact
	Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact
	Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact
Reversibility	Reversible	The impact is reversible within 2 years after the cause or stress is removed
	Irreversible	The activity will lead to an impact that is in all practical terms permanent
Irreplaceability	Replaceable	The resources lost can be replaced to a certain degree
	Irreplaceable	The activity will lead to a permanent loss of resources.

24.3 Risk Matrix Methodology

RISK ASSESSMENT KEY (Referenced from DWA RISK-BASED WATER USE AUTHORISATION APPROACH AND DELEGATION GUIDELINES)

Negative Rating

TABLE 1- SEVERITY

How severe does the aspects impact on the environment and resource quality characterisitics (flow regime, water quality, geomorfology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means	

TABLE 2 – SPATIAL SCALE

How big is the area that the aspect is impacting on?

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catch	3
National (impacting beyond seconday catchment or provinces)	4
Global (impacting beyond SA boundary)	5

TABLE 3 – DURATION

How long does the aspect impact on the environment and resource quality?

One day to one month, PES, EIS and/or REC not impacted
One month to one year, PES, EIS and/or REC impacted but no change in status
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation
Life of the activity, PES, EIS and/or REC permanently lowered
More than life of the organisation/facility, PES and EIS scores, a E or F

TABLE 4 – FREQUENCY OF THE ACTIVITY

How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT

How often does the activity impact on the environment?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

TABLE 6 – LEGAL ISSUES

How is the activity governed by legislation?

No legislation
Fully covered by legislation (wetlands are legally governed)

Located within the regulated areas

TABLE 7 – DETECTION	
How quickly can the impacts/risks of the activity be observed on the environment (water resourc	
Immediately	
Without much effort	
Need some effort	
Remote and difficult to observe	
Covered	

TABLE 8: RATING CLASSES		
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
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
A low risk class must be obtained for all activities to be considered for a GA		

TABLE 9: CALCULATIONS

Consequence = Severity + Spatial Scale + Duration
Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection
Significance \Risk= Consequence X Likelihood

Table 26.4 Numerical Significance

Table 26.4.1 Conservation Value

Conservation Value		
Refers to the intrinsic value of the area or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and fragmentation or its value in terms of the protection of habitat or species	Low 1	The area is transformed, degraded not sensitive (e.g. Least threatened), with unlikely possibility of species loss.
	Medium / Low 2	The area is in good condition but not sensitive (e.g. Least threatened), with unlikely possibility of species loss.
	Medium 3	The area is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with unlikely possibility of species loss.
	Medium / High 4	The area is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare & endangered species.
	High 5	The area is considered critically endangered or is part of a proclaimed provincial or national protected area.

Significance	Score	Description
Insignificant	4 - 22	There is no impact or the impact is insignificant in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site.
Low	23 - 36	An impact barely noticeable in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium / Low	37 - 45	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved. Impacts may have medium to short term effects on the natural environment within site boundaries.
Medium	46 - 55	Impact is real, but not substantial. Mitigation is both feasible and fairly easily possible, but may require modification of the project design or layout. These impacts will usually result in medium to long term effect on the natural environment, within site boundary.
Medium High	56 - 63	Impact is real, substantial and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. These impacts will usually result in medium to long-term effect on the natural environment, beyond site boundary within local area.
High	64 - 79	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. These impacts will usually result in long-term change to the natural environment, beyond site boundaries, regional or widespread.
Unacceptable	80 - 100	An impact of the highest order possible. There is no possible mitigation that could offset the impact. The impact will result in permanent change. Very often these impacts cannot be mitigated and usually result in very severe effects, beyond site boundaries, national or international.

Table 26.4.2 Significance

Table 26.4.3 Scoring system

Parameter	1	2	3	4	5
Conservation value Likelihood Duration Extent Severity	Low Unlikely Temporary Site specific Zero	Medium /Low Possible Short term Local Very low	Medium More possible Medium term Regional Low	Medium / High Probable Long term National Medium	High Definite Permanent International High

Significance = Conservation value (Likelihood + Duration + Extent + Severity)