HANTAM MUNICIPALITY

WATER USE LICENSE APPLICATION
FOR THE EXPERIMENTAL AQUIFER RECHARGE IN CALVINIA

FRESH WATER REPORT

A requirement in terms of the National Water Act (36 of 1998)

Executive Summary

Department of Water's hydrogeologists designed an experiment to recharge an aquifer in the arid Hantam region at Calvinia in the Western Cape. Runoff flowing down a drainage line on a mountain slope is slowed down and collected in a check dam and subsequently taken 80m and more underground through a lined borehole to replenish an aquifer. This experiment will be regarded as successful if the water table rises measurably.

If this experiment proves to add water to the aquifer that can be abstracted for human use with an equipped production borehole, Calvinia would greatly benefit. Like other Karoo towns, water is scarce as dams dry up and aquifers are depleted. Much towards water security depends on the outcome of this experiment.

Drainage lines, even though mostly dry, are regarded as legitimate water resources, in terms of the National Water Act. This experiment triggers Section 21(c) and S21 (i) of the NWA. Because of this, official approval must be applied for through established channels and with an established application procedure.

Consequently, a Water Use Application (WULA) must be lodged. This must be done on the official eWULAAS facility. A WULA must be lodged along with a completed Risk Matrix. The values or scores on the Risk Matrix must be explained, for which a Freshwater Report is required. This report must provide adequate information for informed decision-making. The report must be compiled according to a premeditated lay-out and contents.

The assessments set out in the Freshwater Report as well as the Risk Matrix indicated that a General Authorisation is the correct level of approval. A License is not called for.

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Abbreviations

Critical Biodiversity Area	CBA
Department of Fisheries, Forestry and the Environment	DFFE
Department of Water and Sanitation	DWA
Ecological Importance	EI
Ecological Importance and Sensitivity Class	EISC
Ecological Sensitivity	ES
Ecological Support Area	ESA
Environmental Impact Assessment	EIA
Environmental Management Program	EMPr
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

1 Introduction

Motivation

The town of Calvinia in the arid Hantam region of the Western Cape experience water shortages as the dams run dry. During these times the town is entirely dependent on groundwater from boreholes. As the water levels in these boreholes dropped to critical levels, more boreholes had to be sunk.

Hydrogeologists from the Department of Water and Sanitation in Pretoria investigated this threatening cycle of events (Hohne and Fourie, 2020).

Rain in Calvinia is erratic, mostly during winter, with long periods of drought, sometimes over years and with periods of more than the average rainfall. Following these generous but scarce rainfall events, the usually dry drainage lines flow again, can even come down in flood, only to dry up within weeks. Flow is fast down the steep mountain side. The contact time with the underlying soil short and penetration of rain to replenish the ground water slow.

Mr Hohne and Mr Fourie motivated for an experiment regarding the recharge of aquifers at Calvinia. The aim was to slow the running water down, to catch some runoff in shallow infiltration ponds or check dams, as they called these engineered depressions. From the check dams, runoff is diverted down boreholes far down the earth into the underlying aquifer.

This experiment would be regarded as successful if the water table level in the boreholes rises. This is an experiment with many unknowns, with little knowledge if the water table would rise at all. But it would be very much worth the effort is it does, the rising water table, from which Calvinia could benefit, as could many other communities with similar circumstances.

It is far better to store water underground than on the surface, where day-time temperatures are high and evaporation rates are high. Water can be abstracted from production boreholes, which would yield for longer because of the elevated water table.

Legal Requirements

The drainage lines against the slope of the Hantan Mountain north of Calvinia are legitimate water resources in terms of the NWA. The proposed activities, this experiment, triggers S21(c) and S21(i) of the NWA. It is therefore legally imperative to apply for a water use license (WULA), following the correct procedures, as prescribed by legislation and regulations in terms of this legislation.

Likewise, sections of the NEMA are triggered, should the experiment be officially approved.

The following entities are involved:

- The DWS in Pretoria to initiate the project, to collect the data from the boreholes and to interpret the results.
- The Hantam Municipality is the applicant, the legal entity that applies to execute this experiment.
- The civil engineering company BVi in Upington was appointed to plan and oversee the project.
- GEOSS of Stellenbosch is to provide input into the hydrogeology.
- Enviro Africa of Somerset West was appointed to conduct the EIA.
- WATSAN Africa of Knysna was appointed to conduct the WULA.

The WULA requires a Freshwater Report. The report must be compiled according to a set format and contents, with prescribed methodologies.

The Freshwater Report must be submitted along with a completed Risk Matrix.

After the completion of the Freshwater Report, the project must be registered on the online eWULAAS facility. This facility dictates the procedures and the steps that must be followed leading to the licensing of the project and its components. This report must include aspects that are required for the EIA process and its scoping report, as well as for the EMPr.

The WULA public participation process runs along with that for the EIA, on the same posters and advertisements.

A site visit was conducted on 11 October 2023.

2 Location

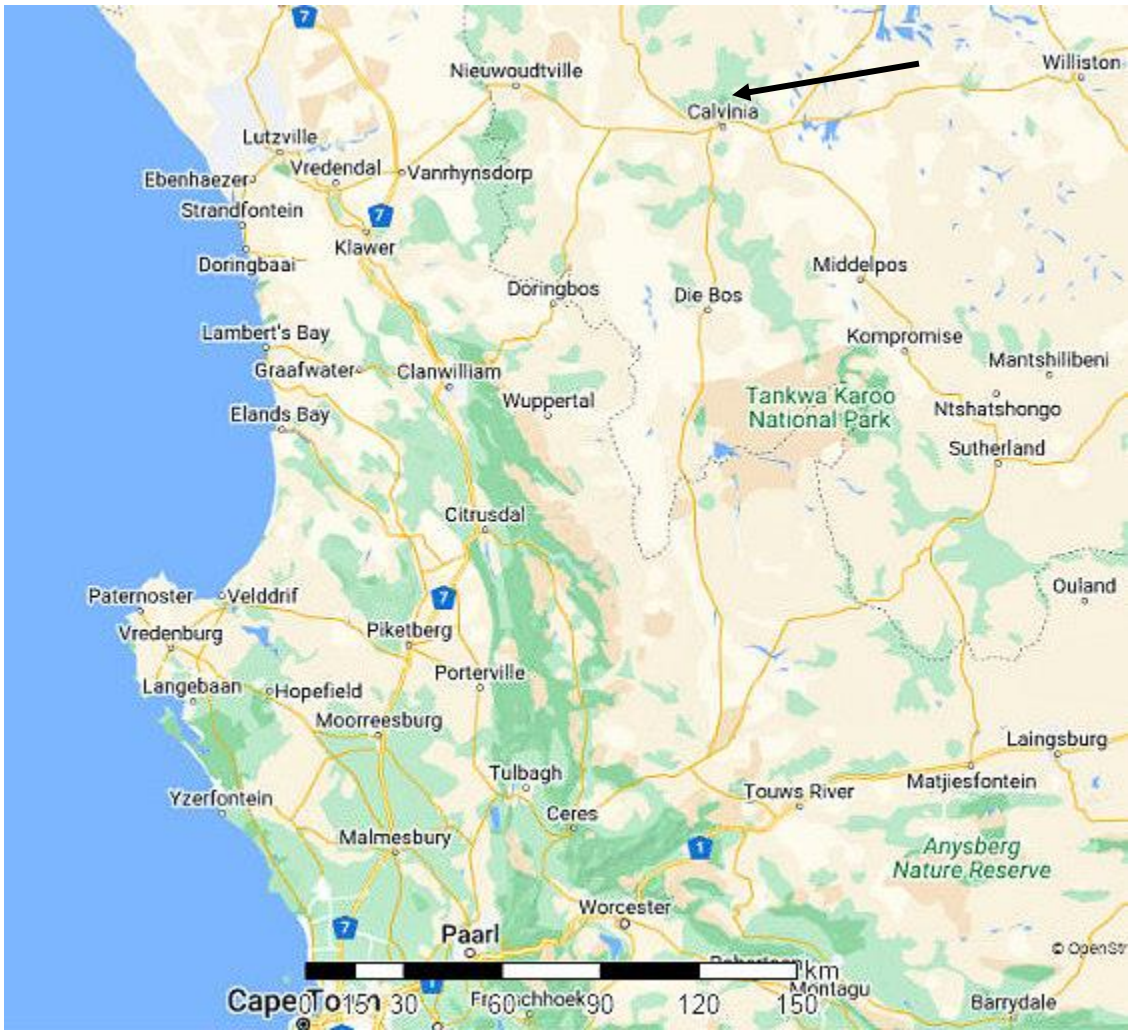

Figure 1 Map Calvinia

Calvinia (Figure 1) is in the Northern Cape Province 300km measured in a straight line to the northeast of Cape Town. Calvinia is 66km to the east of Nieuwoudtville on the R27 trunk road.

Calvinia is in the Hantam region of the Karoo, with its arid climate. It is on the northern bank of the Oorlogskloof River, which only runs during larger rainfall events. Calvinia is on the southern slope of the Hantam Mountain.

The town falls under the Hantam Local Municipality which forms part of the Namakwa District Municipality. It has a population of less than 3000 people. It is known for the brief but spectacular spring flowers that graces the otherwise semi-desert.

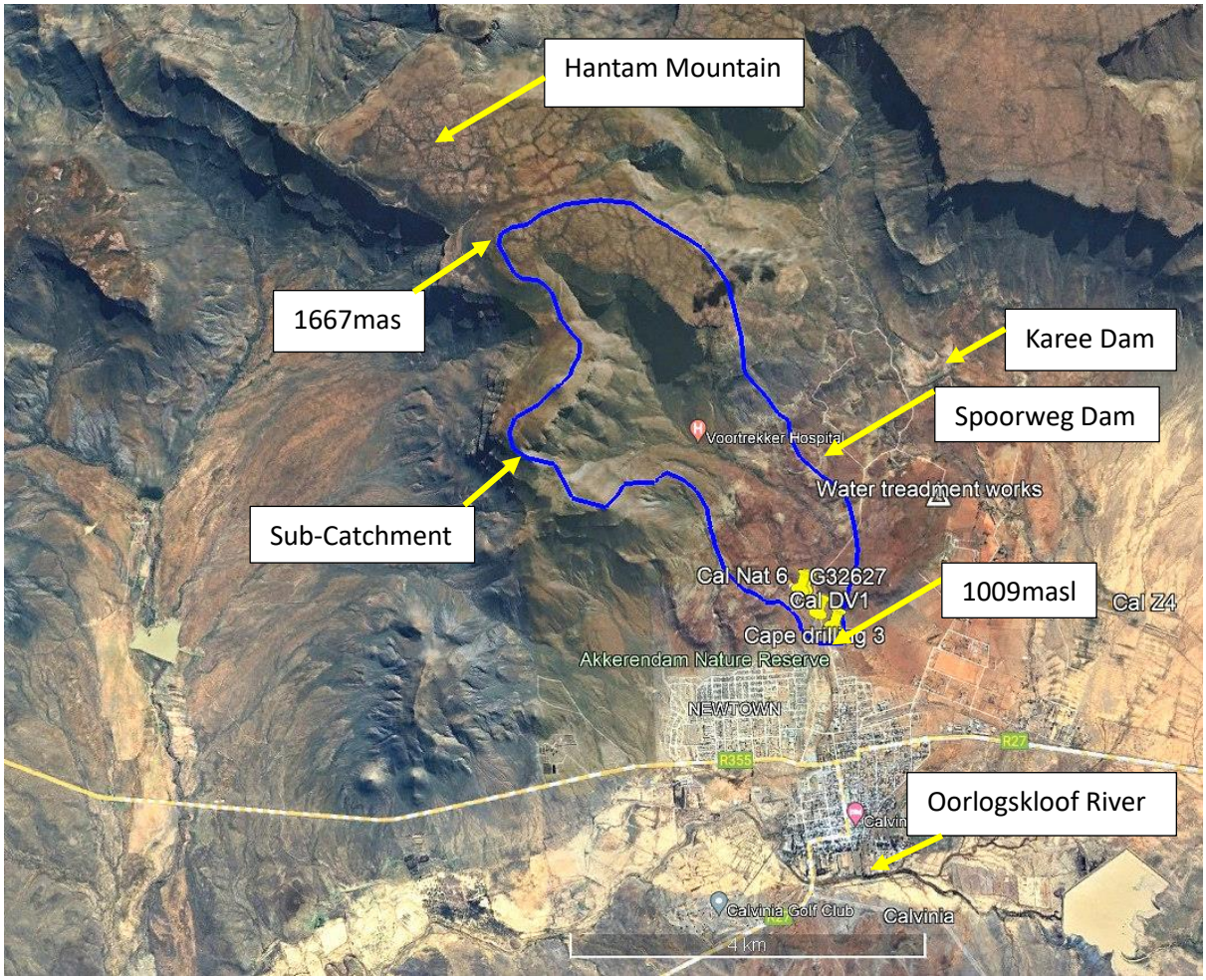

Figure 2 Mountain catchment north of Calvinia

The sub-catchment of interest is adjacent and to the north of Calvinia (Figure 2).

It rises on the ridges of the Hantam mountain. This ridge is around 1600masl. The highest point is 1667masl. The point of discharge for this project was chosen at the abstraction borehole at 1009masl. This translates into a drop of 659m over a distance of 5.93km. The average slope is 11.1 vertical meters over 100horisontal meters, which is steep against the mountain side. The part of the sub-catchment above this discharge points was measured as 970ha, using Google Earth's polygon function.

3 Quaternary Catchment

Calvinia is in the E40A quaternary catchment.

4 The Project

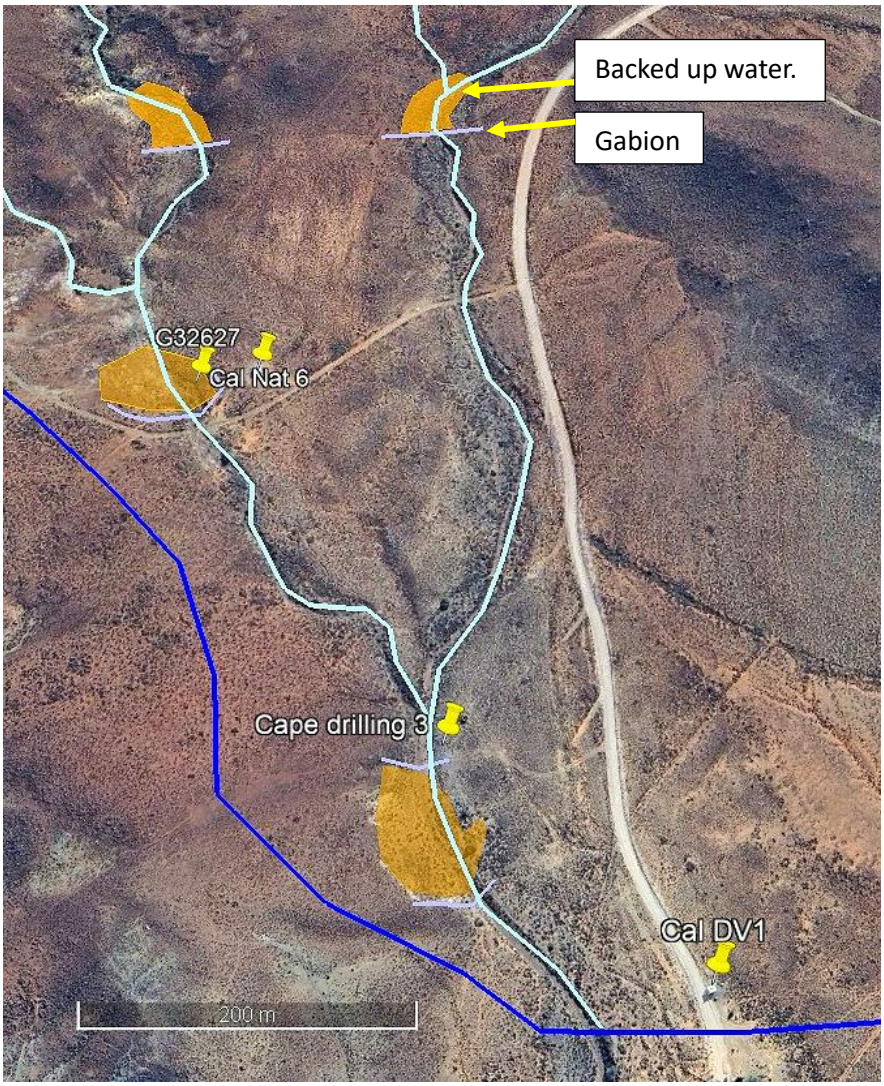

Figure 3 The Project

The aim of the project is to replenish the groundwater from the surface flow if and when there is any surface flow. Surface flow here is brief, only during and shortly after rain, perhaps for a few days, a couple of weeks, but not any longer. Flow is relatively fast down the steep incline. Naturally, there is little chance for surface water to penetrate the ground to reach the aquifer below.

The idea is to slow the surface flow down to allow for more contact time with the underlying ground for more water penetration. This can be achieved by a set of gabions (Figure 3). These are tightly packed rocks or stones in a wire basket to for a wall. A gabion is not watertight. It lets water flowing down the slope through, albeit at a much-retarded flow rate. Stormwater will back up against the gabions, as is shown

by the shaded parts on Figure 1. These small dams with the associated gabions are called check dams.

Backed-up stormwater moves down 80m deep boreholes just upstream and adjacent to the gabions into the aquifer.

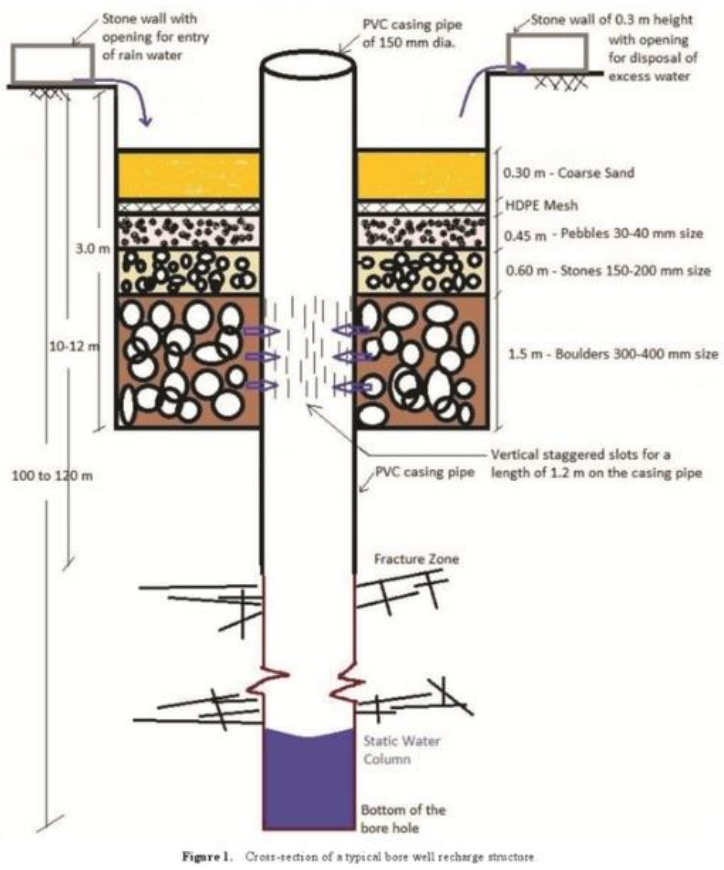

Figure 4 Intake structure

The borehole is in an intake structure (Figure 4, Hohne & Fourie, 2022) to facilitate the flow of water down the borehole. The structure is a hole in the ground filled with fine material such as sand at the top and layers of courser material deeper down that acts as a filter to keep debris out. The structure can be 10m long, 5m wide and one metre deep. The casing down the borehole is perforated to let the filtered stormwater down the borehole. The constructed depression also helps to collect stormwater around the borehole.

During the initial experimental phase of the project is important to measure the water table level down the boreholes. The water table is expected to rise as the aquifer is replenished.

This newly added groundwater for urban use can subsequently be retrieved from a borehole lower down the slope fitted for the purpose of water abstraction.

The current experimental setup consists of 4 boreholes and 5 gabions (Figure 1).

The area at Borehole Cal Nat 6 (Figure 5) is a plate of shale on the surface on which a gabion won't find any purchase. Here a concrete retention wall will be constructed anchored in the rock with steel dowels.

Figure 5 Shale

5 Legal Framework

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

S21(a) *Taking water from a water resource.*

If the production borehole contemplated in this project, it may be necessary to license that borehole through due process. The DWS may view letting water down a borehole into an aquifer as taking water from a resource as well, which may have to be licensed.

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.

6 Conservation Status

DFFE Screening Tool

Table 1 DFFE Screening Tool Results

Theme	Sensitivity
Animal species	High
Avian species	Not mentioned
Aquatic biodiversity	Very High
Plant species	Very High
Terrestrial biodiversity	Very High

Animal Species

The following birds are listed:

Circus maurus	Black harrier	Vulnerable
Neotis ludwigii	Ludwig's bustard	Endangered
Polemaetus bellicosus	Martial eagle	Endangered
Aquilla verraeuxii	Verraeux's (black) eagle	Least concern
Hydroprogne caspia	Caspian tern	Least concern
Sagittarius serpentarius	Secretary bird	Endangered
Afrotis afra	Southern black korhaan	Vulnerable

The raptors will fly over and even hunt on these grounds. Bustards and korhaans will utilise these feeding grounds. Caspian terns will settle on the water's edge if there is any water.

Bunolagus monticularis Riverine rabbit Critically endangered

There is one insect species and one unnamed, numbered species of which the name may not be published.

Here is a collection of animals that indeed are of concern. Their habitat on the southern slopes of the Hantam Mountain calls for serious conservation measures.

Aquatic biodiversity

It is not clear for what reason the drainage lines and surrounds are listed as of a very high sensitivity, probably because this is a mountain catchment area.

Plant species and vegetation

There is a list of plant species, with at least 7 numbered, unnamed species and one of a very high sensitivity.

The veldt type is identified as Hantam Karoo on the SANBI webpage. It is not endangered in any way.

Terrestrial biodiversity

The land is in the Akkerendam Nature Reserve, is part of the National Protected Area Expansion Strategy and in a CBA.

Clearly, this is a most important conservation area, with numerous organisms that deserve strict conservation measures. However, the proposed experiment and its associated structures are not about to change the habitat in such a way that these organisms are put in any form of additional danger. The proposed structures are small and benign, on the town's edge and quite insignificant.

7 Calvinia Climate

https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/calvinia_south-africa_3369174

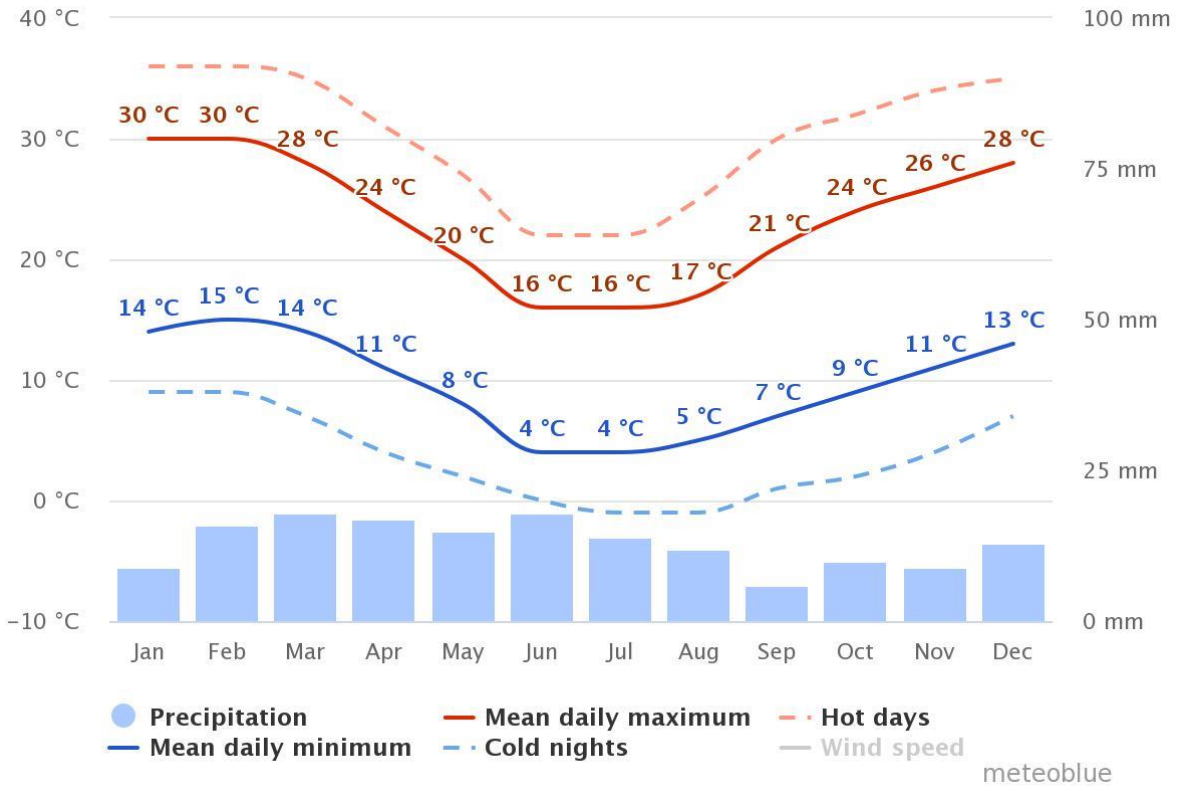

Figure 6 Calvinia Climate

Calvinia is on the verge of South Africa's winter rainfall area, where it meets the summer rainfall area. Rainfall is spread throughout the year, with mere rain in winter than in summer. The driest months are January and September (Figure 6).

Calivinia is in the Hantam, an even more arid region of the Great Karoo. Rainfall is scarce, on average 232mm per year.

https://en.climate-data.org/africa/south-africa/northern-cape/calvinia-21545/

Rainfall is erratic, with droughts lasting several years. This can be followed with years of much more than the average annual rainfall. Calvinia is dependent on both surface and ground water. When the dams dry up, only groundwater remains. There is an ongoing search for more water resources to be made available to the town of Calvinia, focussed on groundwater.

Rainfall on the mountains is substantially higher than on the plains of the Hantam. Rainfall is dependent on elevation and the mountain is high enough to attract more rain. Several tributaries rise on the Hantam Mountains. Most end up in the Olifants River to the west. One

ends up in the Vis River to the east which together with the Sak River form the Hartbees River, a tributary of the Orange River far to the north.

The summers are very hot, with temperatures often more than 40°C. The winters are cold, with nighttime temperatures dropping below freezing point.

8 Drainage Lines

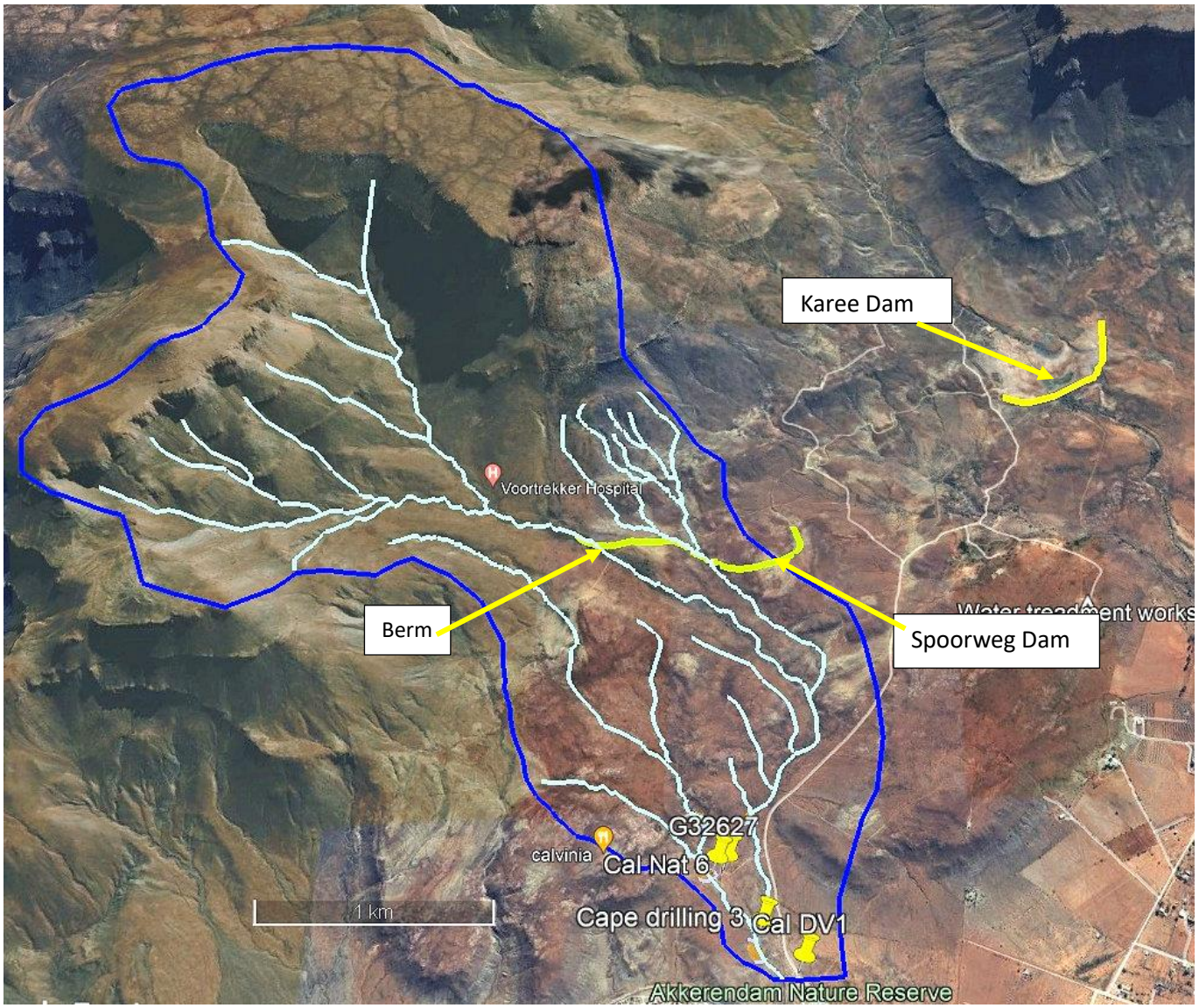

Figure 7 Drainage Lines

The major drainage lines were drafted onto the sub-catchment (Figure 7).

Approximately two thirds of the sub-catchment is drained by the easterly drainage line. The two main reaches of the drainage line are intercepted by an earthen berm (Figure 8) that channels the runoff into the Spoorweg Dam (Figure 9). This dam is a nothing more but a shallow scrape in the ground against than mountain side. It is dry most of the time, but during the site visit it contained water. Reportedly this water is used in town, when available.

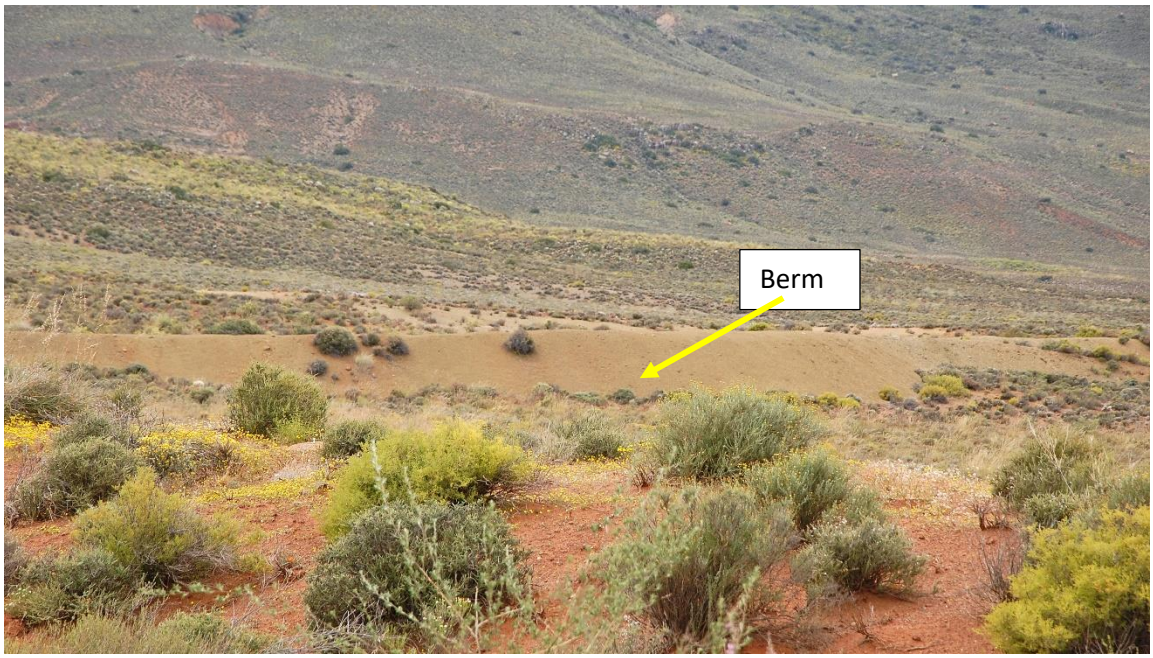

Figure 8 Berm

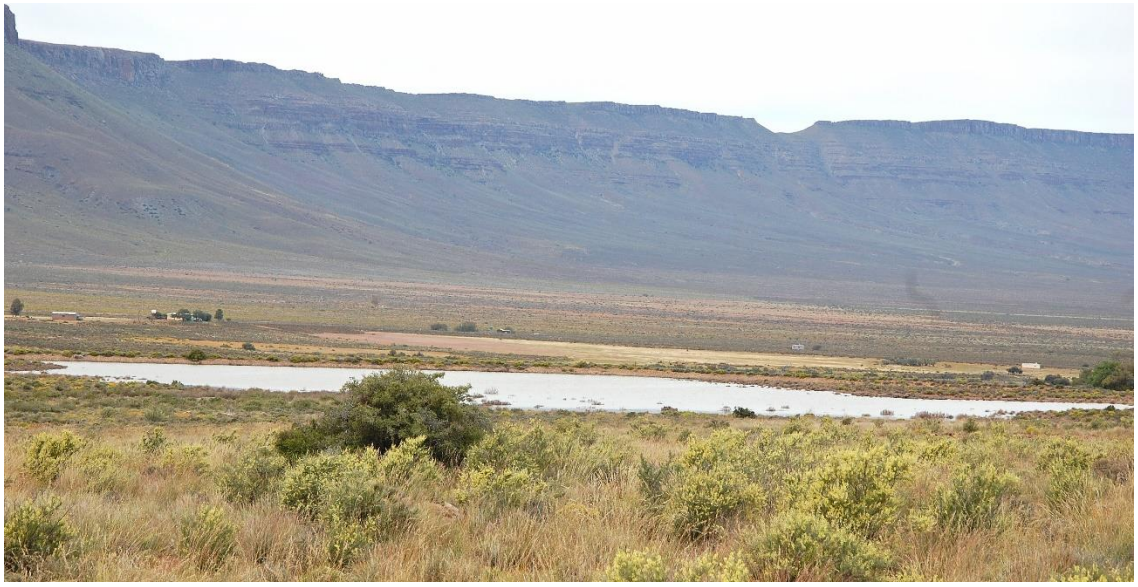

Figure 9 Spoorweg Dam

Figure 10 Flow

Figure 11 Flow lower sub-catchment

At the time of the site visit on 11 October 2023, there was a strong flow in this main drainage line of 5 to 10 ls^{-1} (Figure 10). Lower down the sub-catchment, close to the discharge point, the flow was much less, perhaps only 1 ls^{-1} (Figure 1). There was no water in the smaller reach (Figure 11) that drains the lower western one third of the sub-catchment.

9 The Sub-Catchment

The very top of the sub-catchment, where the drainage lines rise against the steep mountain side, against the vertical cliffs, over the foot of the mountain to where the ground levels out, the drainage lines are pristine (Figure 12). The only impact is farm animals grazing up the slopes.

Figure 12 Upper sub-catchment

The riparian vegetation of drainage lines in arid regions often forms a linear ecological corridor for many species of plant and animal that would not have been there, were it not for the drainage lines. This vegetation is maintained by shallow ground water that remains long after the surface water evaporated in these arid parts. Many parts of the Karoo are criss-crossed by these lines of higher vegetation, mostly soetdoring *Vachellia karoo*, a prominent feature of many karroid landscapes.

The upper parts of the main drainage lines, at the foot of the mountain, carry patches of this riparian vegetation (Figure 13).

Lower down the slope, where the ground levels out, the riparian vegetation does not differ from the surrounding karroid vegetation. The ecological benefit of higher riparian vegetation does not persist further downstream. Shallow groundwater evidently is not adequate to maintain a line of higher vegetation.

On the Hantam Mountain's western slopes, the riparian vegetation is more pronounced, in places with trees, but also not carry through lower down on the Hantam's flats (Van Driel, 2022) (Figure 14).

Figure 13 Riparian vegetation

Figure 14 Vegetation further down the slope

The state of the drainage lines changes abruptly from the earthen wall and its associated infrastructure as much of the runoff is directed into the Spoorweg Dam. Human activity along with that of farm animals was evident in the reserve at the time of the site visit. The dirt road through the reserve acts as preferential flow paths (Figure 15), with signs of erosion.

Further down the slope into town, the drainage line becomes a straightened, highly engineered stormwater channel that has departed from its original ecological functioning (Figure 16). To the south of town and into the Oorlogskloof River, most of its ecological functioning has been lost. This was fully described by Van Driel (2022). This part of the drainage line is outside of the study area. Despite not being discussed here any further, it is still included in the PES determination.

The stark contrast between the pristine upper sub-catchment and the much-impacted lower sub-catchment makes it difficult to find a realistic PES value representative of the entire sub-catchment. The WULA demands such a number. This here is the best attempt.

Figure 15 Preferential flow path

Figure 16 Channel (From Van Driel, 2022).

10 Present Ecological State

Table 2 Habitat Integrity according to Kleynhans, 1999

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

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 2 and 3) in 1999 of the then DWAF to assess river reaches. The PES is one of the evaluations that is prescribed for S21 (c) and (i) WULA's. The scores given are solely that of the practitioner and are based on expert opinion.

The groundwater recharge would take more surface water out of the system. Compared to the runoff that is diverted to the Spoorweg Dam, groundwater recharge would be small, tantamount to insignificant. It is not expected that the groundwater replenishment scheme, as planned, would change the category assignment of a "D" to the next lower class. The score would somewhat drop, but it would probably not be enough to lower the class.

The gabions and the check dams will be new features on the landscape. These are not enough to significantly lower the score and not enough to assign a lower class.

Table 3 Present Ecological State Calvinia Natuurtuin Drainage Line

Instream	Score	Weight	Product	Maximum score
Water abstraction	11	14	154	350
Flow modification	8	13	104	325
Bed modification	7	13	91	325
Channel modification	8	13	104	325
Water quality	18	14	252	350
Inundation	9	10	90	250
Exotic macrophytes	19	9	171	225
Exotic fauna	18	8	144	200
Solid waste disposal	10	6	60	150
Total		100	1170	2500
% of total			46.8	
Class			D	
Riparian				
Water abstraction	10	13	130	325
Inundation	9	11	99	275
Flow modification	8	12	86	300
Water quality	11	13	143	325
Indigenous vegetation removal	15	13	195	325
Exotic vegetation encroachment	17	12	204	300
Bank erosion	12	14	168	350
Channel modification	8	12	86	300
Total			1111	2500
% of total			44.4	
Class			D	

11 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 4).

There are no fish in the drainage lines, as there is no permanent water. According to this assessment, which is prescribed for WULA's, the drainage lines are not important.

The presence of fish cannot be the only criterion for ecological importance. The drainage lines can be of immense importance as ecological corridors and an addition to habitat variability. The Natuurtuin drainage line only has patches of higher riparian vegetation and nothing that can serve as a corridor. From this perspective the drainage line is not important.

Table 4 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)

12 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.

The drainage line and its riparian zones will take many decades, if not centuries, to bounce back once obliterated by large-scale agriculture. In these arid zones, vegetation is very slow to re-establish itself. From this point of view, the drainage line can be viewed as ecologically highly sensitive.

13 EISC

The DWS demand that the river be placed in a category according to the EISC methodology (Table 5). The EISC is one of the essential items that is required for the Risk Matrix.

Table 5 EISC for the drainage line

Determinant	Drainage lines 1 and 2
Rare and endangered species	2
Populations of unique species	2
Species / Taxon richness	2
Diversity of habitat	2
Migration Route/ Breeding and feeding site for wetland species.	1
Sensitivity to water quality changes	1
Flood storage, energy dissipation, particulate / element removal	2
Protection status	1
Ecological integrity	2
Average	1.9
Score	Low

Score guideline:
Very High 4, High 3, Moderate 2, Low 1, None 0

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

There are rare and endangered plant species that may occur in the riparian sone.

Apart from NWA protection as a water resource, the drainage line does not enjoy any protection status.

The EISC came out as “Low”.

14 Probable Impacts and Mitigating Measures

Dickens *et al* (2003) lists a number of possible impacts on wetlands. This outline can be used for the proposed high voltage line and the Diep River as well. The possible listed impacts are discussed as follows:

Flow modification

The gabions will change the flow regime, but only in a small way. It would be insignificant if compared to the runoff diversion into the Spoorweg dam.

Permanent inundation

Because the gabions are permeable, the inundation regime will not be changed. Only one wall be of concrete. This will be small and would not change the overall inundation regime.

Water quality modification

The proposed groundwater scheme is not about to cause or add to any water quality issues. This is because of the nature of the project. No pollution causing materials are to be used. Building rubble must not be allowed to enter the drainage line and must be removed as soon as possible.

Sediment load modification

There is a possibility of sand and mud washing into the river during the construction phase. Soil will be disturbed that can wash down the sub-catchment during rainfall events. This must be prevented as much as possible. Construction time must be limited as to reduce the exposure to rainfall events during construction. Following the digging of the catch pits around the boreholes, the diggings must be filled in with filter material as soon as possible. Loose and stockpiled soil must be removed as soon as possible.

Canalization

The access roads create preferential flow paths. Access roads must be demolished and rehabilitated following construction, if not used any longer. During construction, stormwater management infrastructures such as berms and trenches may be necessary to divert stormwater from the roads.

Topographic alteration

The proposed groundwater replenishment scheme will not alter any topographic features.

Terrestrial encroachment

The proposed groundwater scheme will not instigate terrestrial encroachment to any notable scale.

Indigenous vegetation removal

The lower part of the sub-catchment has been transformed into a channel and into an urban environment. The upper part is still pristine. The sub-catchment above the to town is free from exotic plants, as far as was established during the site visit.

Alien fauna

Goats, horses and cattle are regarded as alien fauna. There were not many of them during the site visit.

Over-utilization

Some farm animals were noted on the grounds during the site visit. The site is not over-utilised, as the number of animals ate kept in check by municipal officers.

Ground water table

It is the intension that the water table is elevated because of the project. If this happens, the project would be considered to be successful.

Waste

The upper sub-catchment is free of waste but lower down above town ins in the channel, waste remains a problem. The municipality has an ongoing problem to collect and remove this litter and waste.

During the construction phase portable toilets will be serviced by a reputable company and wastewater will be discharged in the municipal wastewater treatment works. Waste will be collected in with the usual municipal system and it will be disposed of on the municipal waste disposal site at standard rates.

Stormwater Management Plan

Apart from best management practices, a stormwater management plan during construction is not called for.

The erosion of the dirt road in the conservation area is obvious and requires attention. Berms must be constructed to divert stormwater away from the road's surface. The trenches eroded next to the road must be stabilized and protected so that continued erosion is checked.

15 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 prescribed form cannot be completed for the planning stage because it has a zero impact, as nothing is happening on the ground. For the protection of the aquatic environment and riparian zones, planning must take the following into consideration:

Plan to work in a designated nature area.
Plan to develop within designated footprint.
Plan to protect karroid vegetation during construction.
Plan to avoid reduce runoff from access roads and to stop the road's erosion.

This is a small project with a limited impact.
This is inherently a low-impact project.
It is a simple project, with a small number of steps.

The mitigating measures are readily implementable.
The Impact Assessment does not indicate any red flags or hindrances.
The project should go ahead, is the Impact Assessment were to be the deciding factor.

Table 6 Impact Assessment

Description of impact: Construction Phase

Removal of the vegetation
Preparing the ground
Construction of the gabions
Construction of the concrete wall
Excavating the filter box
Placement of filter material
Removal of excavated soil
Clean-up, levelling and landscaping

Impact

Soil and rubble washing down the drainage line

Mitigation measures

Preserve drainage lines as much as possible
Preserve buffer zones as much as possible
Prevent loose soil and sediments from moving down the drainage line along with storm water
Limit the footprint

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	High	Temporary	Medium	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Low	Temporary	Low	Definite	Sure	Irreversible	Irreplaceable

Description of impact: Operational Phase

Maintenace of the gabions
Maintenance of the submersible pump in the borehole
Replacement of the filter material in the catchpit, if necessary

Impact

Soil and rubble washing down the drainage line.

Mitigation measures

Prevent loose soil and sediments from moving down the drainage line along with stormwater.

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

16 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 24.2, p49, 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 p50 to derive at a value for Significance. The value for Significance can subsequently be evaluated according to Table 24.2.2.

Table 24.2.2 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 7), 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 7 Significance Score

Parameter	Drainage line Score
Conservation value	2
Likelihood	5
Duration	5
Extent	1
Severity	1
Significance	24
	Low

The score indicates that the Significance is “Low”. If the conservation value is ramped up because of the drainage line being in a conservation area, the score indicated a Medium to low rating. The impact is very localised and only a little runoff is harvested, accounting for the low rating.

17 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 8 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 8 (continued) represent the same activities as in Table 8, with sub-activities added.

The methodology is tabled in the Appendix.

The risks came out as low or even very low. This is because of the small scale of the project and the very localised scale of the impact.

The Risk Matrix indicates that a General Authorisation is the correct level of authorisation. A License is not called for.

Table 8 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	**Construction phase** Removal of the vegetation Preparing the ground Construction of the gabions Construction of the concrete wall Excavating the filter box Placement of filter material Removal of excavated soil Clean-up, levelling and landscaping	Mobilisation of soil	Soil washing down the drainage line. Destruction of drainage lines	26	Low
2	**Operational phase** Maintenance of the gabions Maintenance of the submersible pump in the borehole Replacement of the filter material in the catchpit, if necessary	Soil and rubble washing down the drainage line.	Destruction of drainage lines	31.5	Low

Table 8 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1 2	2 2	1 1	1 1	1 1	1.25 1.25	1 1	1 3	3.25 5.25

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significance	Risk Rating
1 2	1 2	1 2	5 1	1 1	8 6	26 31.5	Low Low

18 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 17) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 9.

Table 9. Goods and Services

Goods & Services	Drainage Line Score
Flood attenuation	3
Stream flow regulation	3
Sediment trapping	2
Phosphate trapping	1
Nitrate removal	1
Toxicant removal	1
Erosion control	2
Carbon storage	1
Biodiversity maintenance	2
Water supply for human use	4
Natural resources	0
Cultivated food	1
Cultural significance	2
Tourism and recreation	3
Education and research	2

0	Low
5	High

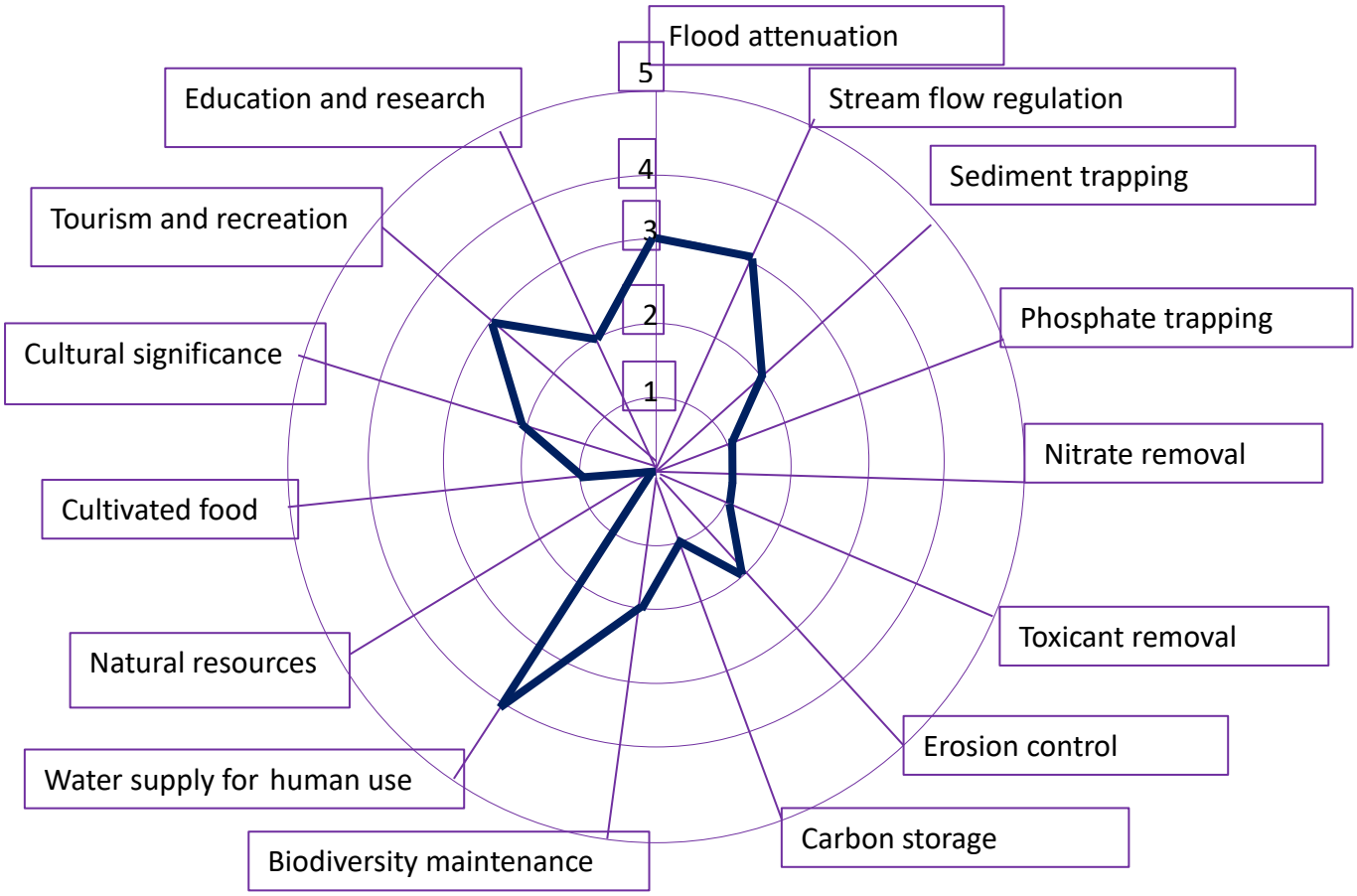

Figure 17. Resource Economics Footprint of the Drainage Line

A large star shape for the drainage line would attract decision-maker's attention. This shape of the spider diagram is small and apart from the contribution to water use, the drainage line does not have a significant resource economic footprint. From this perspective, not much would be lost if the drainage line is impacted. However, the little water that it can provide is of immense importance to the Calvinia community.

19 Summary

Table 10 Summary of evaluations

Aspect	Status
DFFE Screening Tool	Sensitivity High and Very High
Drainage line aquatic habitat	CBA, Conservation Expansion Plan
Vegetation	Least Concern
PES of the drainage line	Upper sub-catchment pristine, lower heavily impacted
Ecological Importance drainage line	Not important
Ecological Sensitivity drainage line	Sensitive
EISC drainage line	Low
Impact assessment	Mitigation readily implementable
Risk Matrix	General Authorization
Resource Economics drainage lines	Small footprint

The terrestrial nature conservation area and its organisms are listed as of a high and very high sensitivity. The drainage lines arise in a mountain catchment area.

The drainage lines are ecologically sensitive but not ecologically important and with a small resource economics footprint, according to prescribed assessments. The overall ecological status is low, as the lower catchment is heavily impacted.

This mixed bag of outcomes makes for difficult decision-making.

It must be added that the impact of the proposed development is small, insignificant.

20 Discussion and Conclusions

"An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on all the other drivers and responses. This, in turn, will predictably impact on the ecosystem services (Figure 18). The WULA and the EAI must provide mitigation measured for these impacts".

Figure 18 has been adapted from one of the most recent DWS policy documents.

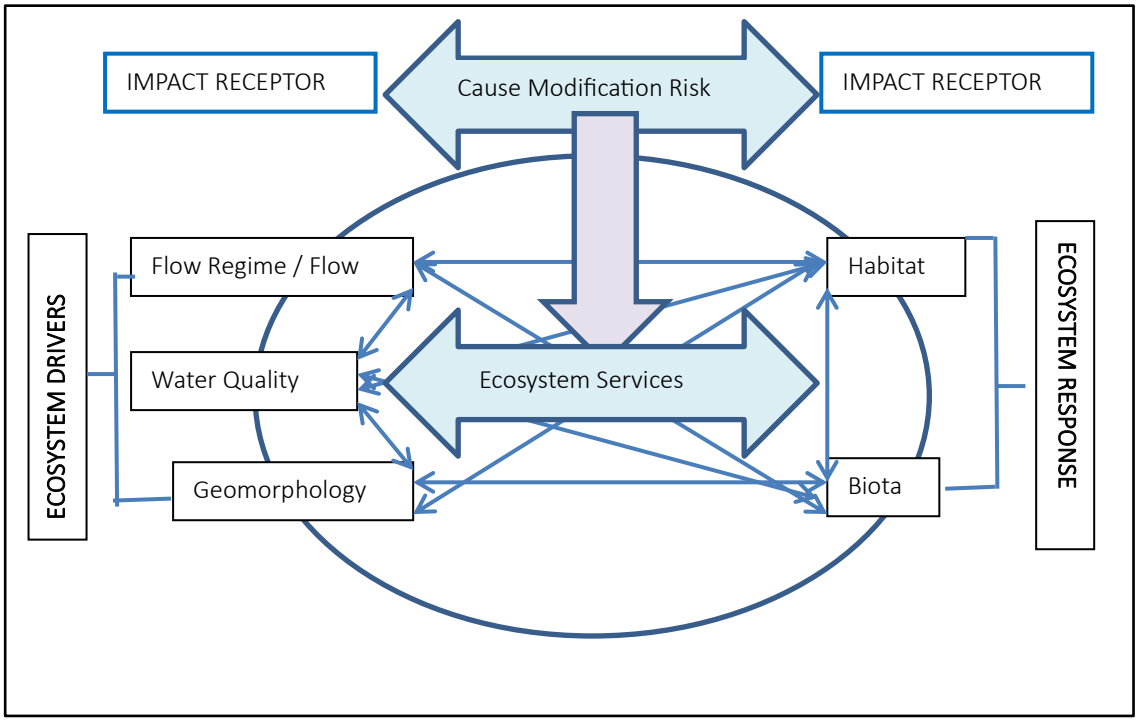

Figure 18 Minimum Requirements for a S21(c) and (i) Application

The driver of the drainage line in the nature reserve adjacent and to the north of Calvinia in the Western Cape is the winter rain on the Hantam Mountains. Runoff in the drainage line is brief, only during and shortly after heavy rain. Runoff may last a few weeks, no more. Then it dries because of the next driver, the summer heat and very high evaporation rate.

It is not the runoff that drives the system as much as the shallow groundwater that persist long after the rain stopped. This groundwater keeps the riparian vegetation alive, endure through the drought until the next downpour.

This is an arid region, with only a few patches of riparian vegetation up the mountain slopes. Elsewhere it is too dry to maintain vegetation other than the very hardy Karoo plants.

It is into this groundwater that the town of Calvinia wants to tap. The take-off point will be downstream from the ecologically active riparian vegetation. The impact therefore would be negligible.

The Risk Matrix indicated that the ecological risks are negligible. The resource economic footprint of this drainage line is small.

It is therefore recommended that the groundwater replenishment scheme at Calvinia is approved with a General Authorisation. A License is not called for.

21 References

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Rountree, M., A. L. Batchelor, J. MacKenzie and D. Hoare. 2008. Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas. Department of Water Affairs and Forestry, Pretoria.

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Van Driel, D. 2020. *Calvinia bulk water supply. Water use license application for the construction of new pipelines*. WATSAN Africa, Cape Town.

22 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.

Signature of the specialist:  30 October 2023

23 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 (Deputy Chairperson): Grotto Bay Homeowner's Association
- 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
- Freshwater Report Wolseley bulk water pipeline
- Freshwater Report Urban Settlement No.1 Pababello Upington
- Freshwater Report Urban Settlement No.2 Pababello Upington
- Freshwater Report Pringle Rock Distillery, Rooiels

- Freshwater Report De Kuilen Resort, Kamiesberg
- Wetland Delineation, Klipheuvel ZCC Solar Energy
- Freshwater Report Delville Park, George
- Freshwater Report ZCC Akkerboom electric vehicle charging station, Keimoes
- Freshwater Report ZCC Piketberg electric automobile charging station
- Freshwater Report ZCC electric truck charging station Piketberg
- Freshwater Report ZCC electric truck charging station Prince Albert Weg
- Freshwater Report Vleesbaai Wastewater Treatment Works
- Freshwater Report ZCC Brandvlei electric vehicle charging station.
- Site Sensitivity Report Desalination Plant Velddrif
- Technical Report Desalination Plant Velddrif
- Freshwater Report High Voltage Power Line Abbottsdale Malmesbury

24 Appendix

24.1 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 24.1.1 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 24.1.2 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 24.1.3 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 24.1.4 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.

Table 24.2 Numerical Significance

Table 24.2.1 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.

Table 24.2.2 Significance

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 24.2.3 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)

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