Raisins

South Africa

Fresh Water Report

for the proposed new vineyard on

Plot 1181, Kakamas

A requirement in terms of the National Water Act (36 of 1998).
June 2024

WATSAN Africa

EnviroAfrica
Environmental Management and Impact Assessment
Omgewingsbestuur en Impakbeoordeling

Executive Summary

Raisins SA is a service organisation to the agricultulral sector in the lower Orange River Valley of the Northern Cape. They wish to develop a fallow piece of land to the west and adjacent to Kakamas into a vineyards and a sun dry facility for the manufacture of raisins.

Enviro Africa of Somerset West was appointed to conduct the environmetal impact assessment as required by the National Environmental Management Act of 1998. This process in currently underway.

There are mostly dry drainage lines on the property. These are legitimate water resources in terms of Section 21 of the National Water Act of 1998. A Water Use License Application is required. Such an application must be accompanied and motivated by a Freshwater Report and a completed Risk Matrix. The Risk Matrix must be signed by a registered scientist.

Dr Dirk van Driel was appointed to produce this report, complete the Risk Matrix and to submit the application on the online eWULAAS facility.

The drainage line on the property is degraded. Not much would be lost to aquatic habitat and ecological functioning if the property were to be altered into a productive vineyard.

A General Authorisation is the correct level of official approval.

Index

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
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

Raisins SA, along with their corporate affilaites and co-workers, wish to develop a piece of fallow land into a productive vineyard along with a sun drying facilty for the production of raisins. This land is to the west and adjacent to the town of Kakamas along the lower Orange River in the Northern Cape.

The region is renown world-wide for the large-scale production of raisins to meet the highest international quality standards. Raisins SA is at the very forefront of this industy, with cutting-edge research, technology, logistics support and marketing.

Raisins SA appointed Enviro Africa of Somerset West to carry out the legally required EIA in terms of the NEMA. A public participation process in terms of the AIE regulatings is required. At the time of the writing of this report, this process has not yet commenced.

There are mostly dry drainage lines on the property. These only convey runoff during occasional rain in this arid area, but are nevertheles legitimate water resources in terms of the NWA. Therefore, a Water Use License is imperative, along with a Freshwater Report. This report must contain specified information as well as a set of tried and tested assessments.

GN 509 demands that a Risk Matrix be completed. The Freshwater Report must expain the numerical values that are assigned for the various aspects of the Risk Matrix. The Risk Matrix is a structured numerical mechanism to help decide about the correct level of authorisation. This can either be a General Authorisation of a License. The completed Risk Matrix must be signed by a registered SACNASP scientist.

Dr Dirk van Driel of WATSAN Africa in Knysna was appointed to draft the Freshwater Report. Above all, the report must contain adequate information for government officials to make an informed decision.

The Freshwater Report must contain adequate information for the EIA as well. Hence, several specified evaluations have been included.

According to observations during various site visits, the site is degraded, with ecological attributes compromised. Not much would be lost in ecological terms if the site were to be transformed into a vineyard.

A General Authorisation is the indicated level of authorisation. A Licence is not called for.

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 development is spanning the banks of a drainage line. The drainage line would be altered, should the development go ahead.

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

The proposed development will alter the characteristics of the banks of the drainage line.

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, the development triggers a part of the National Environmental Management Act, NEMA, 107 of 1998).

The EIA Regulations of 2014 No.1 Activity 12 states that no development may take place within 32 m of a water course without the consent of the Department of Environmental Affairs and its provincial representatives. The proposed development is in a drainage line, which fully qualifies as a water course. Consequently, this regulation is relevant to this application.

3 Location

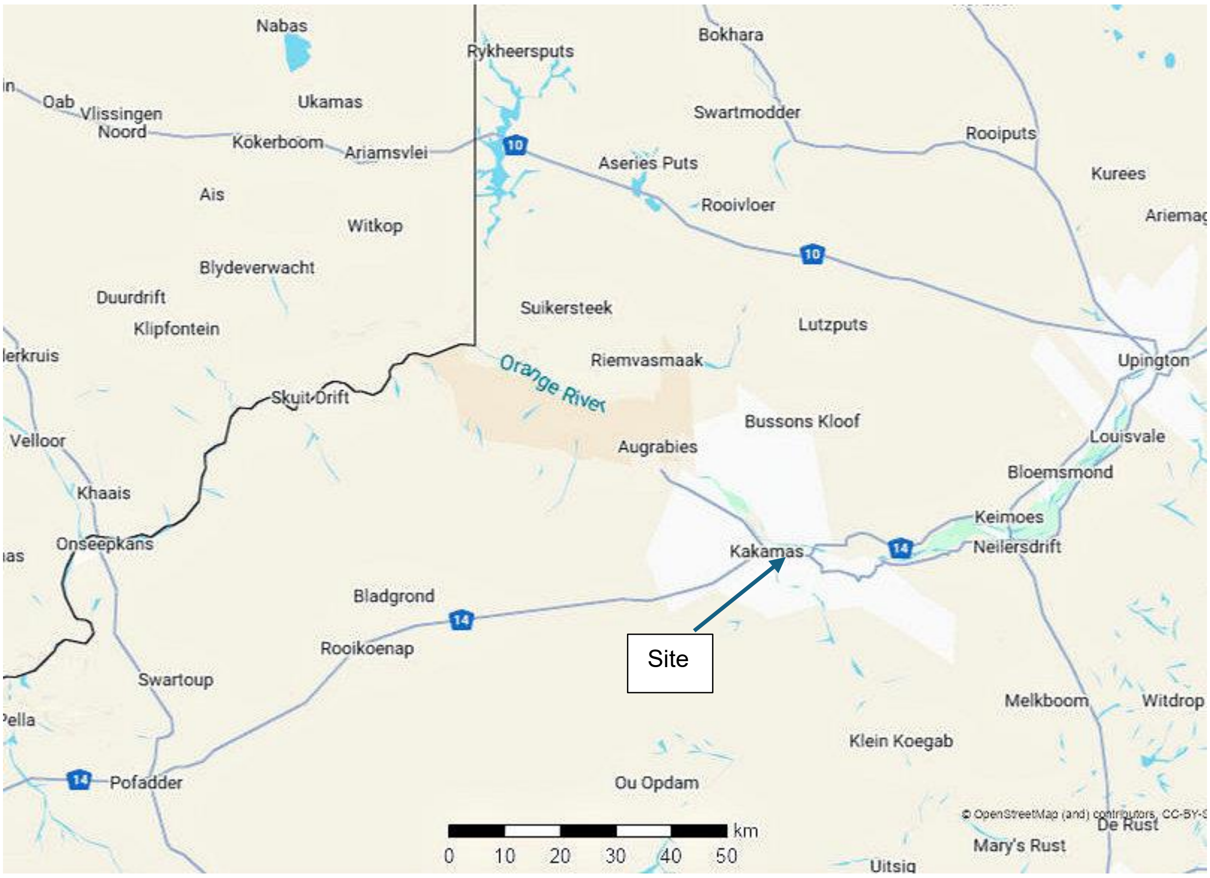


Figure 1 Location

The site is adjacent and to the west of the town of Kakamas on the N14 highway from Upington to Pofadder (Figure 1).

The coordinates are as follows:

28°46’03.85”S and 20°36’07.00”E

4 Quaternary Catchment

The envisaged development is in the D73F quaternary catchment.

5 Kakamas Climate

https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/kakamas_south-africa_993014

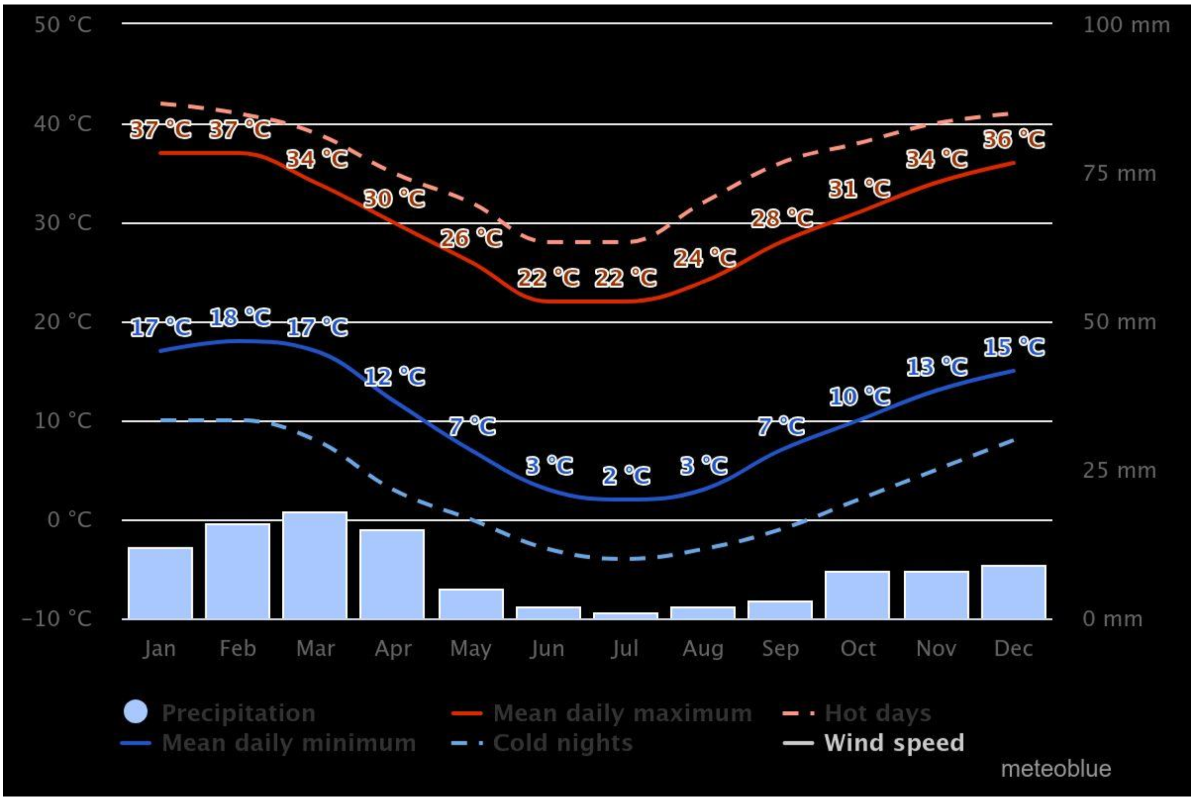


Figure 2 Climate Kakamas

Kakamas normally receives about 62mm of rain per year, with most rainfall occurring mainly during summer (Figure 2). The summers are exceedingly hot, with maximum temperatures well into the 40's. Overnight temperatures in winter can drop below zero. This is a harsh desert-like climate with extreme temperatures and very little rain.

Kakamas is arid. During 4 months of the year, it may not rain at all. Rainfall is erratic, intense with violent electric thunderstorms and sudden downpours. During these very scarce rainfall vents, drainage lines may convey water. The flow may be strong, of short duration, a day or even less, with a fierce erosion potential. The drainage lines must have been formed over millennia since historical times.

The contribution of the drainage lines to the flow in the Orange River is negligible.

The economy is entirely dependent on water abstraction from the Orange River. Successful farming depends on precise irrigation systems.

6 The Site

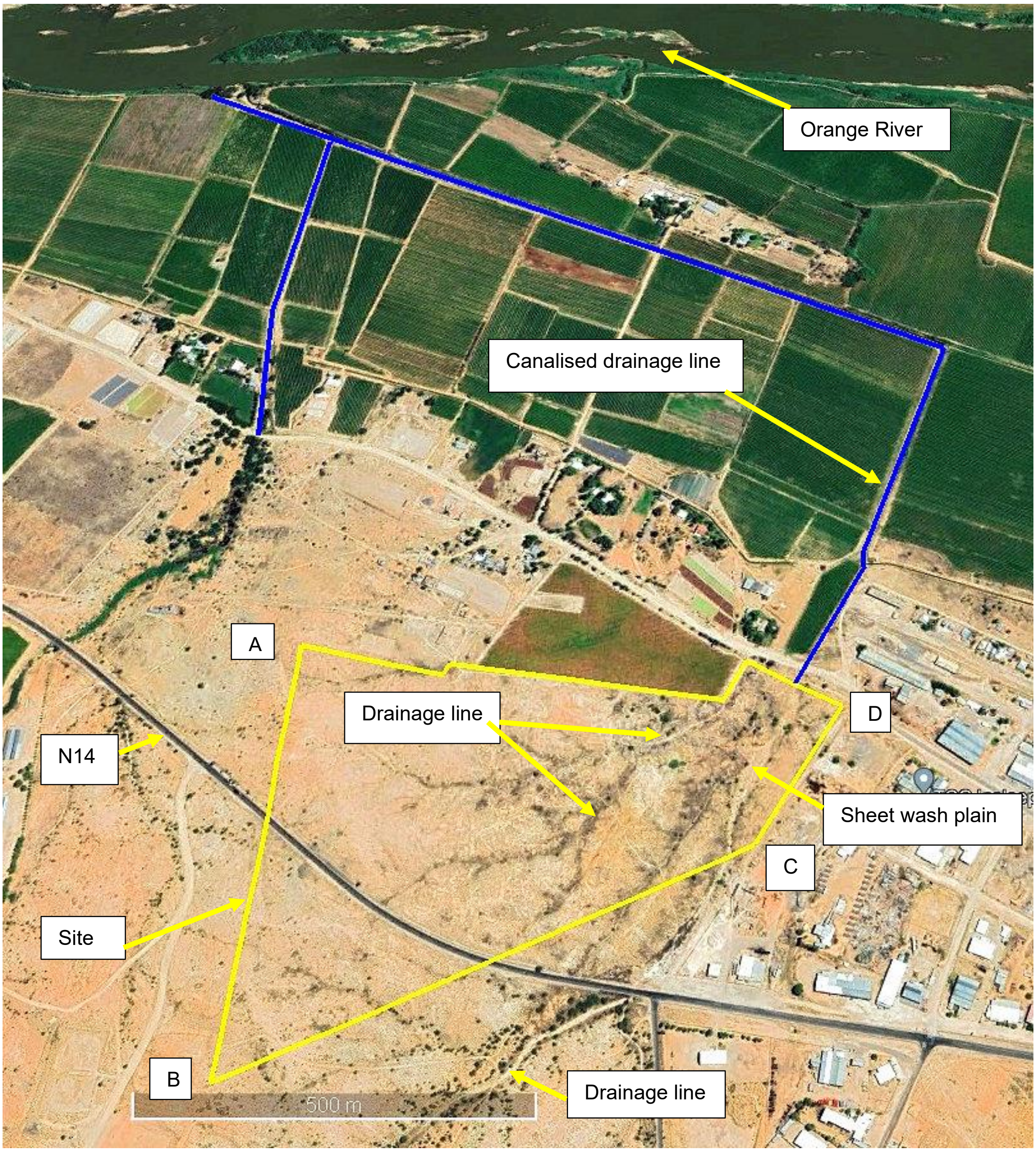


Figure 3 The site

The site is shown in Figure 3. It covers an area of 30ha of which19.9ha will be developed. It is transversed by the N14 highway. It is right up to the Kakamas urban edge. A mostly dry drainage line transverses the proposed site in the northeast corner, with small tributaries spreading over the site. The site is criss-crossed by two-track farm roads and many foot paths.

7 The Development

Figure 4 Development

The proponent supplied the above image (Figure 4) to indicate the area that stands too be developed. Only the brown area will be under new vineyard. For the time being, the blue area is not on the cards for development. This is where the drainage line crosses the property. If ever this part is to be developed, a buffer zone of either side of the drainage line must be preserved and not be developed.

The red part will be under a raisin drying facility. This is typically raised drying racks in the blazing sun (Figure 5). Importantly, the permeability of the ground underneath is not affected by these drying racks. The racks are used only following the harvest and once the grapes turned into raisins, the racks lie idle for the rest of the year.

Figure 5 Drying racks
https://raisinsa.co.za/new-drying-techniques-improve-the-quality-of-south-african-raisins

Table 1 Development Coordinates (see Figure 3)

	Elevation (m)	Coordinates	Distance (m)
A	670	28°45'50.38"S; 20°36'04.63"E	AB: 627
B	680	28°46'10.37"S; 20°36'03.47"E	BC: 756
C	660	28°45'59.63"S; 20°36'28.17"E	CD: 240
D	660	28°45'53.25"S; 20°36'33.17"E	DA: 856

8 Drainage Lines

The landscape around much of the Lower Orange River and the Sak River is dominated by a dense succession of drainage lines. They spread along the river with many smaller tributaries to cover the entire area. The iron oxides in the sands renders a red hue that is visible from space on the Google Earth images. These reds are concentrated in the drainage lines, making them even more visible (Figure 6).

The drainage lines are mostly dry, with water only during rains and perhaps shortly thereafter. During the odd thunderstorm, drainage lines can come down in flood. These floods maintain the drainage line's morphological integrity, as sediments are moved and these water ways are scoured out.

Because rainfall events are far apart, the drainage lines must have been form over millennia, even since geological times.

These drainage lines are driven by the very scant rainfall events, sudden and sometimes severe thunderstorms, spread out over millennia. Rainfall is interspersed by prolonged droughts. This gives rise to a sparse and drought resistant vegetation. The shallow ground water that migrates along these drainage lines provides just enough moist for higher vegetation to take root and to hold on under these very harsh climatic conditions. Drainage lines are ecologically important, as it provides denser and higher vegetation in an otherwise barren landscape, contributing to habitat variation, biodiversity and migration routes.

The upper sub-catchments of these drainage lines are mostly near-pristine, with only grazing. The lower parts are heavily impacted by agriculture and sand winning. This stark contrast is evident all over the region.

Around the Orange River, the Hartbees River and even the Sak River, large-scale agriculture has changed the drainage lines into drainage channels among the vineyards and orchards. The upper reaches away from the rivers are less impacted, even near-pristine, as intense agriculture is not possible, apart from those areas where water is piped over long distances from the Orange River.

Much of the discussion in this report is about these drainage lines.

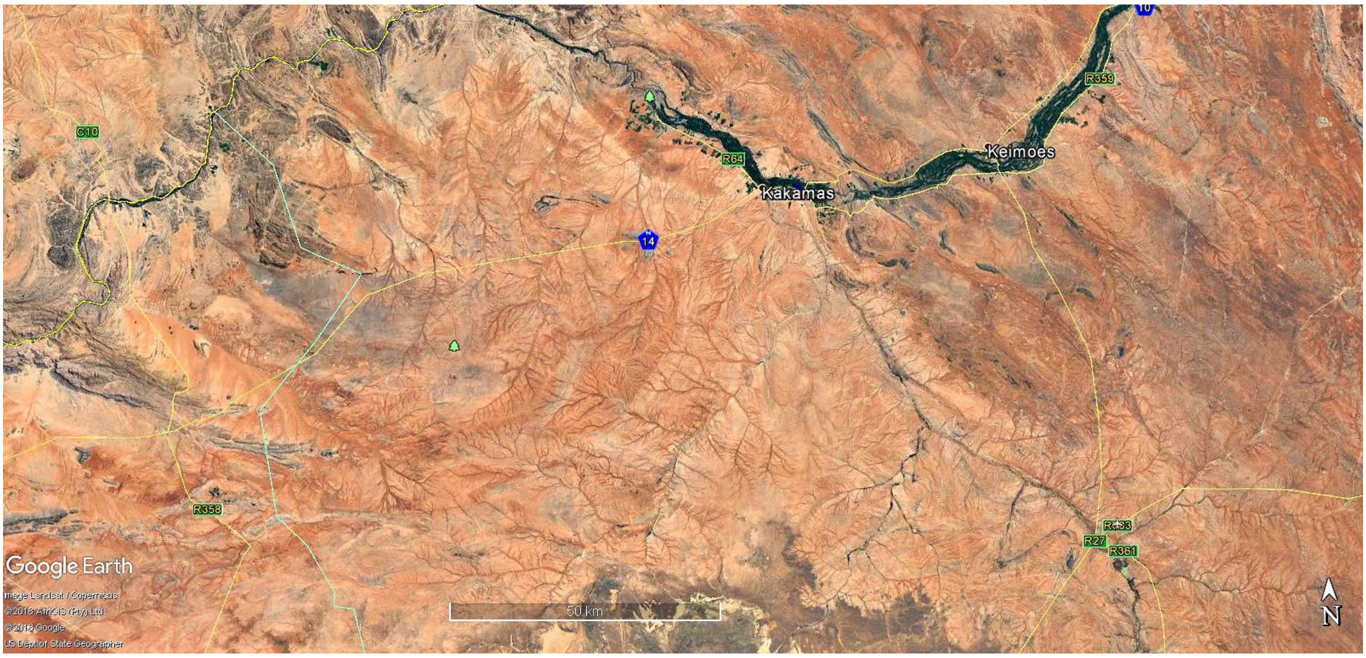


Figure 6 Drainage Lines

Smaller drainage lines all over the landscape are marked by lines of driedoring (*Rhigozum trichotonum*) rather than red iron oxide depositions. These woody and thorny bushes find more soil moisture along the drainage lines than elsewhere, hence the denser stand. These small lines are visible on Google Earth images. This landform can be described as drainage line wash fields.

These drainage lines connect to one another in a continuous fan, interconnected, with no visual demarcation between drainage lines. This is visible on Google Earth Images, as well as on the ground. During rainfall events, storm water spreads out, migrates sideways, left and right, the flow slows down, deposits its sediment load to create sandy or gravely sheet wash plains (Figure 4). Sediment transportation and deposition are clearly visible.

Where larger drainage lines fuse in this manner lower down sub-catchments, much larger sheet wash plains are evident.

11 Sub-Catchments

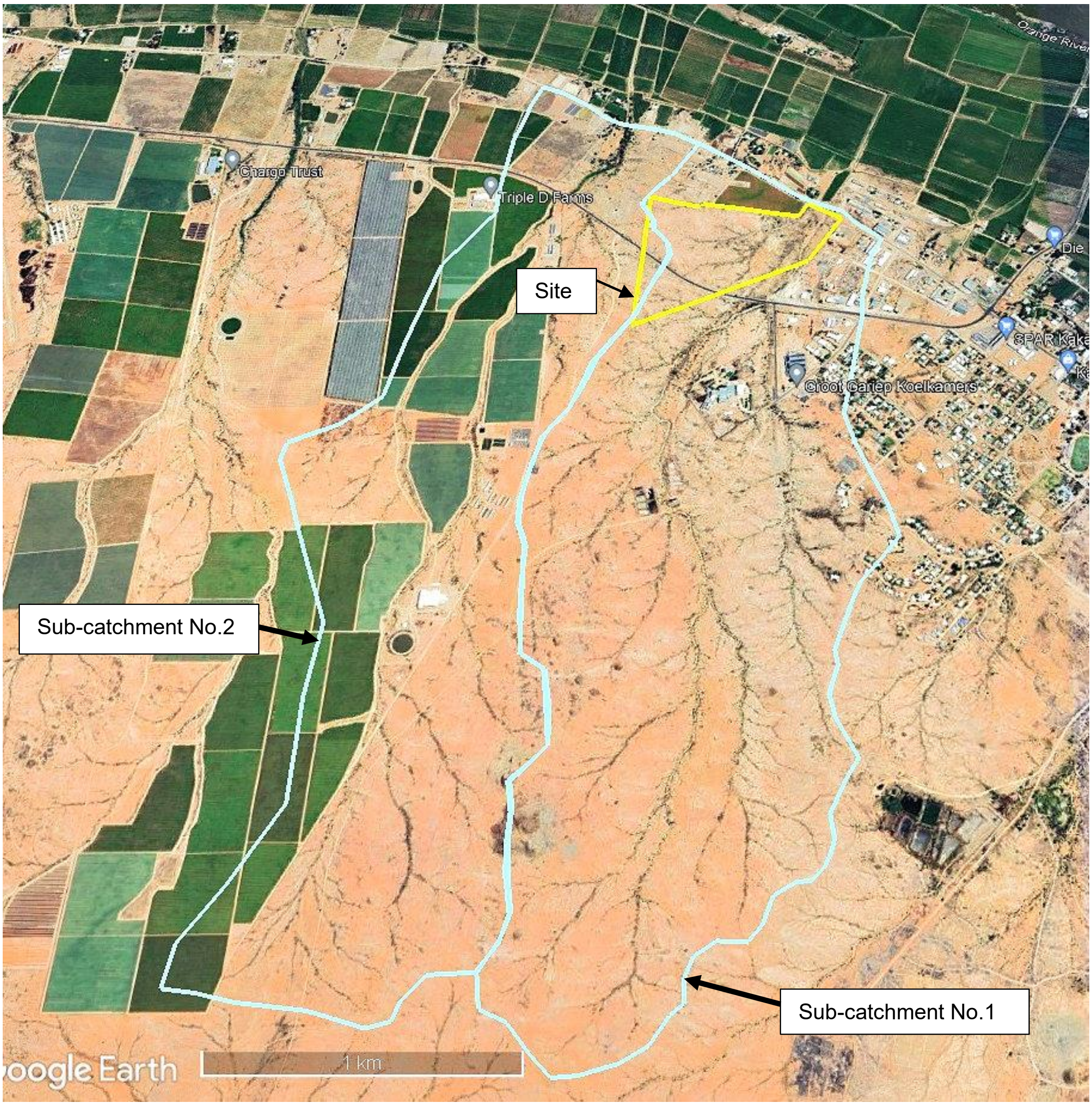


Figure 7 Sub-Catchments

For the sake of a clear explanation, the two sub-catchments, each with its mostly dry drainage line, are numbered Sub-Catchment 1 and Sub-Catchment 2 (Figure 7).

Most of the site is in Sub-Catchment No.1. A small part of the site is in Sub-Catchment No.2.

The sub-catchments can easily be demarcated by connecting the highest points around the drainage lines with Google Earth Pro. The polygon function gives the surface area.

Sub-Catchment No.1

Sub-Catchment No.1 is one of the smaller sub-catchments along the Orange River. It covers an area of 392ha, is 3.5 km long and 1.2 km wide at its widest point and has a circumference of 9.6 km. The upper sub-catchment is on an elevation of 706masl and at the N14 it is 659masl. The slope is very gentle at only 0.7m vertical in every 100m horizontal.

Its lower drainage line has been transformed into a channel among the vineyards along the Orange River. This channel is straightened, with high and steep banks and with little ecological significance. It has been engineered around a right angle to follow the boundary of a large vineyard. From there it follows a straight route to the Orange River. It serves as a conduit for agricultural return flow. It is approximately 1.2km long (Figure 3). It joins the canal from Sub-Catchment 2 before its confluence with the Orange River.

Upstream from the vineyards along the Orange River, next to the N14, there is a path through the drainage line (Figure 14). In this area the drainage line is degraded by litter and building rubble. At this locality the large embankment and N14 culvert can be observed (Figure 8).

Figure 8 Path through drainage line

Figure 9 N14 Embankment and culvert

Figure 10 Infilling of bank

Figure 11 Drainage line upstream of N14 culvert

Figure 12 Erosion

Figure 13 Storm water pipes

Figure 14 Path crossing drainage line

Figure 15 Upper Sub-Catchment 2

Looking downstream the left bank along the Kakamas industrial district has been heavily impacted by infilling (Figure 10). The opposite bank is still more or less intact.

Adjacent and upstream of the vineyards and downstream of the industrial development, the drainage line probably was a sheetwash plain, but is now filled in with sediments from the upstream disturbance (Figure 3).

Two tributaries of the drainage line converge just upstream from the N14 culvert. The bed of the drainage line here is sandy (Figure 11), it is incised and the banks show signs of erosion (Figure 12), right down to bedrock level, despite the low rainfall, even slope and small catchment area.

There is yet another road crossing the drainage line further up the catchment, that allows for flow only with a set of pipes (Figure 13). Still further up the drainage line is crossed by a number of paths and tracks (Figure 14).

The upper reaches of the sub-catchment are less disturbed (Figure 15), with higher vegetation such as swarthaak (*Senegalia millefera)* in the riparian zones.

The drainage lines with their band of trees crossing the otherwise barren landscape can clearly be seen.

Sub-Catchment No.2

Sub-Catchment No.2 It is only 3.2 km long and 500m wide in its widest place. It covers an area of 299 hectares, with a circumference of 9.7km. It is partially developed, with blocks of vineyard.

Its drainage line has been formalised into a straightened canal through the vineyards to its confluence with the Orange River. This canal is 516m long. The entire catchment together with the canal is thus 3.7km long.

The drainage line directly downstream of the road culvert is shown in Figure 16.

The drainage line passes under the N14 trunk road with a culvert (Figure 17).

The northern shoulder of the road, uphill from the culvert, has been deeply incised by running storm water. There was an attempt to stabilise the trench with gabions, but the storm water found its way around this constructed obstacle (Figure 18).

A short distance further downstream the drainage line is overgrown with *Phragmitis* reeds (Figure 19). These reeds have taken root here probably because of the runoff from the road, combined with some agricultural return flow. Natural, unimpacted drainage lines in the area are devoid of any reeds.

With these arid conditions there can be no talk of any wetlands or a hydrological connectivity of drainage lines with adjacent wetlands. Many of these drainage lines have more trees and scrub than higher land up the hills and ridges because of the slightly more availability of ground water. These denser stands of vegetation can hardly be classified as riparian vegetation and still strikes the observer as arid and very much terrestrial.

Figure 16 Drainage line downstream of the N14 road

Figure 17 Culvert

Figure 18 Gabions

Figure 19 Reeds

11 Conservation Status

DFFE Screening Tool

Table 2 Screening Tool Results

Theme	Rating
Animal species	High
Aquatic biodiversity	Low
Avian	Not mentioned
Plant species.	Medium
Terrestrial biodiversity	Very High

Aquatic biodiversity theme

The Orange River is listed as an NFEPA as can be expected.

The drainage lines on and around the site are not listed. This explains the Low rating.

Vegetation

The vegetation is Bushmanland Arid Grassland. It is not endangered in any way. The site borders onto Lower Gariep Alluvial Vegetation but does not enter it. This vegetation is Endangered because of the large-scale agriculture along the lower Orange River.

Terrestrial biodiversity theme

The site is listed as a CBA and is a part of the Protected Areas Expansion Strategy. This listing is refuted by the proximity to Kakamas. The site is degraded, trampled over by farm animals and people, with lots of litter and other debris.

12 Biomonitoring the Lower Orange River

12.1 Methodology

The biomonitoring was carried out according to the description of Dickens & Graham (2002).

Biomonitoring was carried out on the Lower Orange River during site visits for successive WULAs. So far 14 samples have been analyzed at 13 localities (Table 1). The site furthest east was at Hopetown and furthest west at Augrabies, with Upington in the middle. Thirteen of these localities are located upstream of the Augrabies Falls. One sample was analyzed at Styerkraal just east of the border post of Onseepkans downstream of the Augrabies Falls.

The river is mostly braided, with many smaller streams and with islands in the middle. The river sports many rapids and riffles, but also pool-like features where the river is broad and slower flowing.

The bottom is mainly muddy, with some large rocky outcrops in the middle of the river.

12.2 Impacts on the Lower Orange River

The river is heavily utilized for agriculture, with the banks entirely modified into cultured vineyards. A multitude of large electric water pumps have been placed in the river for abstracting large volumes of water for irrigation. Abstraction significantly lowers the flow in the river.

Berms for the purpose of flood protection have been constructed on the banks of the river for most of its length. These berms have been constructed by the Department of Water Affairs and now have been a feature of the landscape for many decades. The berms keep flood water out of adjacent agricultural land and has denaturalised the riparian zone.

The single most impact on the Orange River are the two very large dams, The Gariep Dam and the Vanderkloof Dam. The river flow has been modified to a much even regime, different from the varied flown with high peak flows and low drought flows.

The Lower Orange River is lined with a dense system of mostly dry drainage lines. These drainage lines only flow during and shortly after heavy rains. Their contribution to the flow of the Orange River is insignificant. Most of the flow comes from the Lesotho Highlands and some from the Vaal River. However, many of these drainage lines have been transformed into engineered agricultural return flow furrows that carries the excess of over irrigation back to the Orange River. Agricultural return flow adds much to the nutrient load of the Orange River because runoff contains fertilizer. Nitrogen is added in large quantities. Since phosphorus readily binds to the soil, not much phosphorus is added.

Return flow can contain a heavy silt load, thereby elevating turbidity in the river.

It is suspected that pesticides in agricultural return flow have a heavy impact on biomonitoring results, significantly reducing the SASS5 score.

The banks of the Orange River in the area are densely overgrown with Spaanse Riet (*Arundo donax*). This is classified as an aggressive and exotic invasive plant, which effectively prevents access to the river. The reeds result in a homogeneous aquatic habitat. This lack of variation supresses the SASS5 score, with only a limited number of aquatic macroinvertebrate species present in this habitat.

12.3 Lower Orange River Biomonitoring Results

The biomonitoring results have been captured in Table 1 and depicted in Figure 20.

The classes from A to F in Figure 20 has been assigned for mature rivers on flood plains such as the Lower Orange River.

Only 2 of the samples were classified a good and relatively unimpacted (Class A). Five were in Class B and C, which can be regarded as acceptable under the circumstances of an impacted river reach. These classes can possible be labelled as the ideal, a compromise between agriculture and aquatic ecological functioning.

Four samples were poor (Classes E and F), an undesirable situation.

The one sample downstream of the Augrabies Falls was extremely poor.

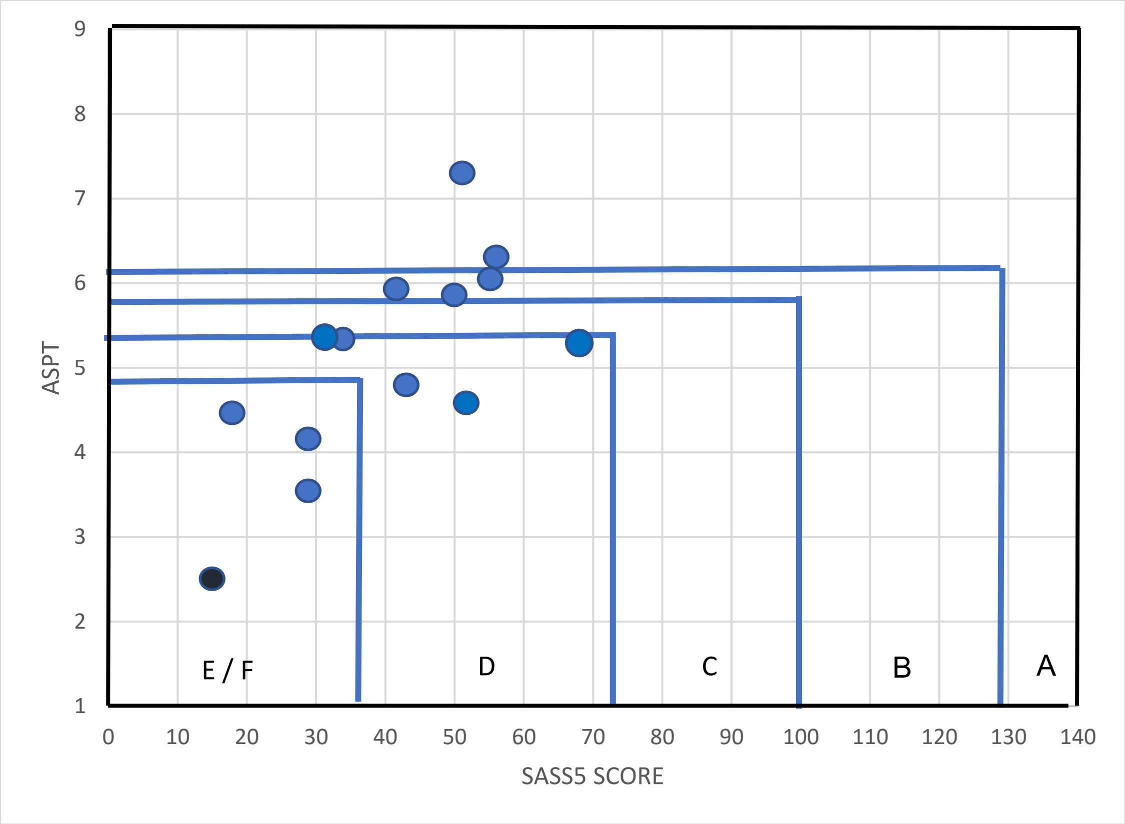
12.4 Limitations

The DWS maintains a formal and scheduled biomonitoring program throughout the country, including the Lower Orange River. This gives, no doubt, a much better indication of the state of the river than self-collected data. Because this data is not available to the consulting fraternity, self-collected data such as that of Figure 20 must suffice.

Table 3 Biomonitoring in the Lower Orange River

Locality	Coordinates	Date	SASS 5	No Taxa	ASPT
Augrabies Lair trust	28°38’41.53S 20°26’08.49E	5/09/17	18	4	4.5
Augrabies Lair Trust	28°38’41.53S 20°26’08.49E	5/10/17	43	9	4.8
Groblershoop	28°52’31.80S 21°59’13.49E	14/8/18	41	7	5.9
Kakamas Triple D	28°45’08.37S 20°35’06.16E	15/8/18	50	9	5.6
Hopetown Sewer	29°36’05.07S 24°06’05.00E	7/10/18	29	7	4.1
Hopetown Sewer	29°36’08.06S 24°21’06.16E	7/10/18	29	8	3.6
Keimoes Housing	28°42’37.12S 20°55’07.81E	8/02/19	51	7	7.3
Upington Erf 323	28°27’11.91S 21°16’14.02E	12/2/19	56	9	6.2
Upington Affinity	28°27’11.91S 21°16’14.02E	20/5/19	54	9	6
Styerkraal	28°27’25.28S 21°15’01.87E	21/5/19	15	6	2.5
Grootdrink Bridge	28°17’15.30S 21°03’50.87E	17/5/20	34	7	5.3
Turksvy Dam	28°27’09.21S 21°17’20.72E	17/5/21	69	13	5.3
Belurana Upington	28°27’49.79S 21°14’32.67E	15/12/21	51	11	4.6
Bakenrant	28°38’35.84S 20°26’07.96E	30/9/22	33	6	5.5

The lower Orange River in the Kakamas area is generally in Class C, measurably impacted, but with most of the ecological functioning still intact. More sampling is required to come to a trustworthy conclusion.



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

Figure 20 Lower Orange River Biomonitoring results

13 Present Ecological State

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 3, 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.

13.1 Present Ecological State Orange River

Much has been published on the ecological state of South African rivers and the Orange River is no exception. In fact, it seems somewhat arrogant to assess the Lower Orange River, even at the sampling point, with a team of one and with the financial backing of a single WULA. This is a large undertaking that is to be contemplated by a team of experts. Nevertheless, this is what the WULA requires.

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 Orange River downstream of Kakamas

Instream				
	Score	Weight	Product	Maximum score
Water abstraction	12	15	180	350
Flow modification	12	15	180	325
Bed modification	20	13	260	325
Channel modification	22	13	286	325
Water quality	15	14	210	350
Inundation	15	10	150	250
Exotic macrophytes	10	9	90	225
Exotic fauna	15	8	120	200
Solid waste disposal	18	6	108	150
Total		100	1584	2500
% of total			63.3	
Class			C	
Riparian				
Water abstraction	12	13	156	325
Inundation	12	11	132	275
Flow modification	20	12	240	300
Water quality	22	13	286	325
Indigenous vegetation removal	15	13	195	325
Exotic vegetation encroachment	5	12	60	300
Bank erosion	18	14	252	350
Channel modification	8	12	96	300
Total			1417	2500
% of total			56.7	
Class			D	

The river at Kakamas, as elsewhere, has been impacted by major dams, large-scale water abstractions, an influx of agricultural chemicals, encroachment of reeds and exotic macrophytes, translocated and exotic fish, levees, bridges and many other infarctions. Hence the river was scored a C (Table 5), which signifies that it has been impacted, but despite these impacts still exhibits appreciable ecological functioning.

The riparian zone scores a D (Table 5), which signifies that ecological functioning has been lost.

There is a good chance that other practitioners would score the river very much the same.

13.2 Present Ecological State of the Sub-Catchment 1 Drainage Line

Table 6 Present Ecological of Sub-Catchment 1 Drainage Line

Instream	Score	Weight	Product	Maximum score
Water abstraction	20	14	280	350
Flow modification	12	15	180	325
Bed modification	20	15	300	325
Channel modification	18	15	270	325
Water quality	15	14	210	350
Inundation	15	12	180	250
Exotic macrophytes	24	11	264	225
Exotic fauna	15	8	120	200
Solid waste disposal	12	6	72	150
Total		100	1876	2500
% of total			75.0	
Class			C	
Riparian				
Water abstraction	20	13	260	325
Inundation	15	15	225	275
Flow modification	12	15	180	300
Water quality	15	13	195	325
Indigenous vegetation removal	18	16	288	325
Exotic vegetation encroachment	20	15	300	300
Bank erosion	16	15	240	350
Channel modification	10	15	150	300
Total			1838	2500
% of total			73.5	
Class			C	

The score for Sub-Catchment 1 drainage line is somewhat higher than that of Sub-Catchment 2, mainly because of the absence of vineyards in the upper catchment, even though a part of the sub-catchment has been transformed into urban area (Table 6).

13.3 Present Ecological State of the Sub-Catchment 2 Drainage Line

Much of the catchment has been transformed into vineyards. With it some of the tributaries of the drainage line have been lost. This must have had an impact on the flow pattern and inundation, even though flow is only occasionally. Some of the runoff now sinks into the ploughed over substrate of the vineyards, instead of flowing down the drainage line, which is equivalent to abstraction.

The runoff out of these vineyards must contain agricultural chemicals, hence the growth of reeds in some places in the drainage line.

The channel has been substantially modified in the vineyards, where it has been reshaped into irrigation return flow channels. Where the drainage channel crosses the N14 road, the culverts have changed the natural flow, the bed and the banks.

Table 7 Present Ecological State of Sub-Catchment 2 Drainage Line

Instream	Score	Weight	Product	Maximum score
Water abstraction	20	1	280	350
Flow modification	12	13	156	325
Bed modification	20	13	260	325
Channel modification	18	13	234	325
Water quality	15	14	210	350
Inundation	15	10	150	250
Exotic macrophytes	24	9	216	225
Exotic fauna	15	8	120	200
Solid waste disposal	12	6	72	150
Total		100	1707	2500
% of total			68.3	
Class			C	
Riparian				
Water abstraction	20	13	260	325
Inundation	15	11	165	275
Flow modification	12	12	144	300
Water quality	15	13	195	325
Indigenous vegetation removal	18	13	243	325
Exotic vegetation encroachment	20	6	120	300
Bank erosion	16	14	224	350
Channel modification	10	12	120	300
Total			1471	2500
% of total			58.8	
Class			D	

The Sub-Catchment 2 Drainage Line was classified as C (Table 7), with still some ecological functioning, but with a marked loss of potential aquatic habitat. The area that could possibly be regarded as riparian habitat has been significantly changed, because of the vineyards, with the concomitant loss of ecological functioning.

There was not much of a natural riparian zone to begin with, with no typical riverine riparian vegetation or hydromorphic soils. It scores a D (Table 7).

Table 8 Summary of classification

Water Course	Instream		Riparian	
	Score	Class	Score	Class
Orange River	63.3	C	56.7	D
Sub-Catchment 1 Drainage Line	68.3	C	58.8	D
Sub-Catchment 2 Drainage Line	75.0	C	73.5	C

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 9).

Table 9. 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)

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

No other endangered species, either plant or animal, were detected in or near the drainage line.

The Orange River is most important, according to this assessment.

According to Skelton (1993) 11 species of fish occur in the Lower Orange River. Since 2011 another one was added, as well as 3 exotic species. These are the following:

Barbus trimaculatus
B paludinosus
B. hospus
Labeobarbus kimberleyensis (Near threatened)
L aenus
Labeo umbratus
L capensis
Austroglanis sclateri (Widespread elsewhere)
Clarias gariepinus
Pseudocrenilabrus philander (Threatened locally but abundant elsewhere)
Pseudobarbus quathlabae
Mesobola brevianalis (critically endangered)
Cyprinus carpio
Tilapia sparrmanii
Oreochromus mossambicus

Those in blue are endangered to some extent. Those indicated in red are exotic or translocated fish.

The only one that causes real concern in the largemouth yellow fish *Labeobarbus kimberleyensis*. It is endemic to the Orange River system and hence is threatened not only on a local scale, but on a national scale as well. This puts the Lower Orange in category 4. This renders the Orange River as important.

According to the owners of the Kalahari River and Safari Co. along the northern bank of the Orange River on the Riemvasmaak Road, mature blue kurper *Oreochromus mossambicus* are regularly captured in increasing numbers. It now takes at least 4 man-days to capture a single yellow fish. Yellow fish are generally infected with cestode bladder worms, while darters (*Anhinga rufa*) that predate on these fish are heavily infected with tape worms. It seems as if the translocated Tilapia are not affected by these parasites.

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.

15.1 Ecological Sensitivity of the Orange River

The Orange River at Kakamas has absorbed numerous and deep-cutting human impacts. Yet is still functions as an aquatic ecosystem. In the highly improbable event of ceased human impact, the river here would probably bounce back to its previous glory. In this respect the river cannot be categorised as sensitive.

It is dreaded among conservation minded people that, according to opinions expressed by people of the water management fraternity, the Lower Orange River might have some more capacity to absorb further impact.

The inevitable truth is that anthropological impacts are permanent. The river will not return closer to its natural state. This perspective subscribes to the definition of ecological sensitivity. It underscores the notion the Orange River indeed is ecological sensitive.

15.2 Ecological Sensitivity of the Drainage Lines

If left to its own devices, the drainage lines would remain as it is now, without the need for protection measures. However, if more agricultural developments are allowed in the sub-catchments, the drainage lines would probably never recover to any resemblance of its current state. In this regard it can be considered as ecologically sensitive.

16 EISC

Table 10 EISC

	Drainage Lines	Orange River
Rare and endangered species	1	4
Populations of unique species	1	4
Species / Taxon richness	1	4
Diversity of habitat	2	4
Migration Route/ Breeding and feeding site for wetland species.	2	4
Sensitivity to water quality changes	2	3
Flood storage, energy dissipation, particulate / element removal.	1	4
Protection status	2	4
Ecological integrity	2	3
Average	1.6	3.8
Score	Moderate	Very 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 DWS demand that the aquatic habitat 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.

The EISC for the drainage lines combined is rated as Moderate, with a Medium level of confidence.

The EISC for the Orange River is Very High, with a High level of confidence.

17 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 33.4, p114, Appendix provides a system for allocation values for each of the parameters Conservation Value, Extent, Duration, Severity and Likelihood about possible impacts These values are then entered into the equation on p115 to derive at a value for Significance. The value for Significance can subsequently be evaluated according to Table 33.4.2.

Table 33.4.2 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	Drainage lines	Orange River
Conservation value	1	5
Likelihood	5	2
Duration	5	5
Extent	1	1
Severity	1	1
Average	12	45
Significance	Low	Medium / Low

The EISC for the drainage lines combined was estimated as “Low”.

The EISC for the Orange River was set at Medium / Low. The conservation value is high, the duration is long-term, but the impact in the river is going to be small and of a limited extent.

This assessment does not take the cumulative impacts of all the vineyards along the Orange River into consideration, only the insignificant impact of yet another new vineyard.

18 Possible Impacts and Mitigating Measures

Dickens *et al* (2003) lists several possible impacts on wetlands. This outline serves as a template for the discussion of the mitigating measures.

Flow modification.

The flow regulation function of the small tributaries that spread over the proposed site will no longer function once the new vineyard is planted.

Moreover, a new vineyard spells agricultural return flow. The cumulative return flow along the Orange River has a notable deleterious impact on its water quality. Any new vineyard adds to this. It is therefore most important that over-irrigation is prevented. Contemporary farming practices include the measuring of soil moisture with state-of-the-art technology. Farm managers can read on their cell phones in real time where water is needed on their vineyards and where not, employing a new brand of precision farming.

Permanent inundation

The proposed new vineyard would change the inundation regime of the drainage lines, especially that of the riparian zone, which would predictably change and lose its current ecological functioning altogether.

Only the lower part of the drainage line in Sub-Catchment No.1 will be impacted, together with the smaller tributaries. The upper sub-catchment is not going to be developed.

Water quality modification

The soil will be loosened during the construction phase with a possibility of the sediments washing into the aquatic habitat along with storm water. This must be prevented, as it will upset ecological functioning, even though only minutely. It is best to complete the construction during the dry season.

Agrichemicals in the return flow can be a problem, as it can end up in the Orange River along with the stormwater runoff during occasional high rainfall events.

Sediment load modification

Soil will be disturbed during the construction phase. It is possible that storm water can wash sand and mud into the aquatic habitat, even though limited. This must be prevented.

Canalization

Vineyards have trenches and cutoff trenches to regulate flow during sudden and fierce high rainfall events. These events are scarce in these arid parts, but if this happens it can cause damage in vineyards. It is necessary that flood calming structures are maintained in these canals and trenches. Stormwater and runoff must not be allowed to pick up a velocity that can have a large erosion potential.

The roads on the proposed site may create preferential flow paths for stormwater. Landscaped swales and holding ponds may be required to contain and calm runoff. Runoff must not be allowed to cause erosion.

Topographic alteration

The envisaged development is not about to alter the topography of the landscape in any way.

Terrestrial encroachment

Mostly dry drainage lines are terrestrial habitat. The smaller tributaries will be obliterated and replaced with vineyard. This is inevitable.

Indigenous vegetation removal

The riparian vegetation along the smaller tributaries in the lower sub-catchment would be replaced by vineyard. The lower part main drainage line in Sub-Catchment No.1 would not be affected by the current panning. However, experience learnt that drainage lines lose their ecological integrity as vineyards expand in their sub-catchments.

Prior to planting, a search-and-rescue operation is to be undertaken to remove any valuable plants. These plants should then be re-planted on a suitable site to insure their survival. The only plant of such description were two small stands of aloes, *Aloe claviflora* (Figure 21). This aloe is plentiful in the region and is not endangered in any way.

Figure 21 *Aloe claviflora*

Invasive vegetation encroachment

The main threat from invasive vegetation in these parts is Prosopis trees that rapidly take over if the soil is disturbed. In vineyards this is not much of a problem as farmers generally and actively control these invasives. One cannot have high-end grape farming with these trees in and around vineyards. Often, downstream of vineyards, shortly after new vineyards are planted and irrigation starts, downstream, drainage lines are taken over by a thick stand of *Phragmitis* reeds. This represents a vast departure of the natural ecological state. It has some advantages as well, as it somehow filters return flow, with some nutrient removal qualities. Form an ecological point of view, this is not really a commendable situation, even though minutely helpful.

Alien fauna

The Land is used for grazing sheep and cattle. With the planting of new vineyards, this would have to stop.

Over-utilization

The farm is used for grazing sheep and cattle. This would stop.

Isolation / Migration

The drainage lines now under consideration are relatively small, short, with no real function as wildlife migration route corridors.

Ground water table.

It is not foreseen that the water table would be elevated because of the irrigation of this new vineyard. The scale is too limited for anything like this to happen.

Waste

Portable toilets will be serviced by a reputable company during the construction as well as the operational phase, as is standard operating procedure on high-end raisin farms.

Litter will be collected in household wheelie bins. Waste will be disposed of on the municipal waste disposal site. These housekeeping issues will not be allowed to have any impact on the natural environment.

19 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 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. It is nevertheless worth mentioning, regarding the aquatic environment, that plans must be drafted to:

- Keep debris and sediment out of the aquatic habitat during construction.
- Keep agricultural return flow out of the aquatic habitat during operation.
- To maintain stormwater management infrastructure.

These aspects must be kept onto the budget for as long as the vineyard is in existence.

No provision is made for the closure and rehabilitation of the site because it is expected that it will prevail in the foreseeable future and beyond.

The impact entails that the drainage lines tributaries will make way for a vineyard. The impact is therefore severe and irreversible. This is the stark reality of establishing new vineyards. The impact must be localised, only on the premise of the vineyard and not beyond. Mitigating measures should be focused on containing these impacts on the vineyard and not let them spread down the catchment into the Orange River. The significance of the impact can, because of mitigating measures, be lowered from high to medium.

Table 12 Impact Assessment

Description of impact: Construction Phase Removal of the vegetation Levelling the ground Tilling the ground Construction of infrastructure such as trellis Installation of the irrigation system Trenches for managing return flow and storm water Construction of roads Planting of the vineyards **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								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Regional	High	Permanent	High	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	High	Permanent	Medium	Definite	Sure	Irreversible	Irreplaceable

Description of impact Operation of new farming venture Irrigation of crops **Mitigation measures** Do not over-irrigate Monitor soil moisture levels and irrigate accordingly Monitor and record agricultural return flow Prevent erosion of road and agricultural areas Repair eroded areas								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Regional	Medium	Permanent	High	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Low	Permanent	Medium	Definite	Sure	Irreversible	Irreplaceable

20 Risk Matrix

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

This assessment is based on the new version of the Risk Matrix that was published in February 2024.

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 13 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 13 (continued) represent the same activities as in the Impact Assessment, with sub-activities added.

The methodology as published on the DWS webpage is duplicated in the Appendix.

The environmental risks to the drainage lines are obviously high, as the establishment of a new vineyard would destroy that part of the sub-catchment. No measure of mitigating measures can serve the drainage line.

The risk to the Orange River is low, as a relatively small volume of agricultural return flow, if compared to the overall situation, would amount to an infinitesimal added impact. The installation of contemporary irrigation control systems would limit this impact to the minimum.

Table 13 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	**Construction** Removal of the vegetation Levelling the ground Tilling the ground Construction of infrastructure such as trellis Installation of the irrigation system Trenches for managing return flow and storm water Construction of roads Planting of the vineyards Cleaning up, rehabilitation, landscaping after construction.	Mobilisation of soil	Soil washing into the drainage line, down into the Orange River, alteration of aquatic habitat.	24	Low
2	**Operation** Farming grapes, irrigation, pest control, harvesting, pruning.	Agrichemicals in the aquatic environment	Pollution of the aquatic environment	8	Low

Table 8 Continued Risk Matrix

No	Hydrology	Water Quality	Geomorphology	Vegetation	Fauna	Overall intensity
1	4	5	3	5	3	10
2	1	2	1	1	1	4

No	Spatial scale	Duration	Severity	Importance	Consequence	Likelihood %	Significance	Risk Rating
1	1	1	12	2	24	100	24	Low
2	1	1	10	4	40	20	8	Low

21 Resource Economics

The goods and services delivered by the environment, in this case the proposed new vineyard at Kakamas, is a Resource Economics concept as adapted by Kotze *et al* (2009).

The diagram (Figure 22) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 14.

Table 9. Goods and Services

Goods & Services	Drainage lines	Orange River
Flood attenuation.	3	5
Stream flow regulation	3	5
Sediment trapping	3	5
Phosphate trapping	1	5
Nitrate removal.	1	5
Toxicant removal	1	5
Erosion control	3	5
Carbon storage	1	5
Biodiversity maintenance	2	5
Water supply for human use	0	5
Natural resources	1	5
Cultivated food.	2	5
Cultural significance	1	5
Tourism and recreation	0	5
Education and research	0	5

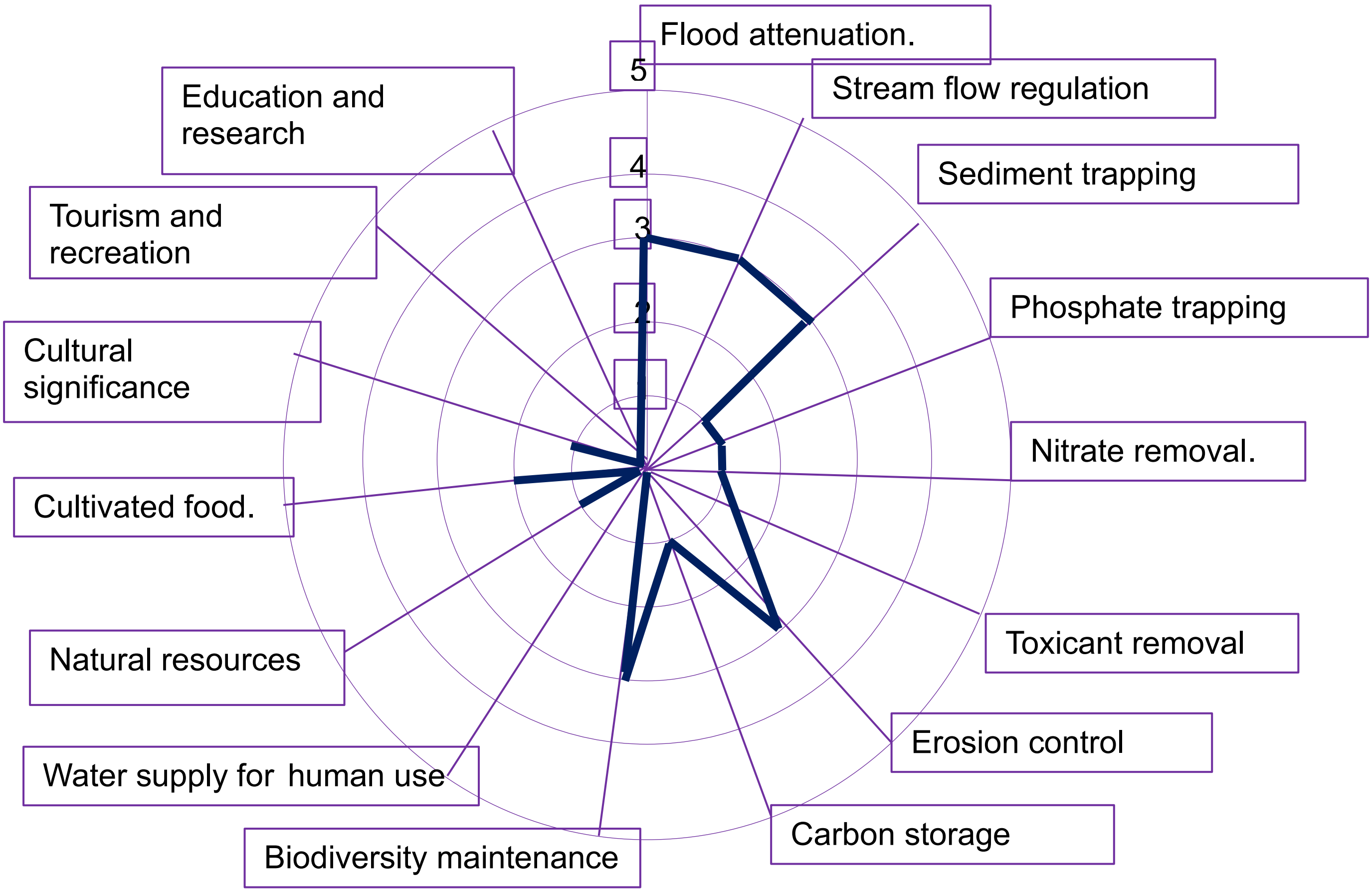


Figure 22. Resource Economics Footprint of the drainage line

The resource economic footprint of the drainage line is small (Figure 22). It would probably not attract much attention from the authorities. Not much would be lost if this drainage line suffers destruction because of the new vineyard. Ironically, the new vineyard would add to the left side of the spider diagram, increasing the drainage line's worth.

On the other hand, the resource economic footprint of the Orange River is large, a complete circle, as other large rivers are all over the globe. Another small vineyard is not going to change any aspect of the footprint.

22 Summary

Table 15 Summary of assessments

Aspect	Status
DFFE Screening Tool	Sensitivity Low, Medium, High, Very High
Protection status	CBA, Protected Areas Expansion Strategy
Drainage line	Not NFEPA
Vegetation	Least Concern
PES	D/C
Ecological Importance	Not important
Ecological Sensitivity	Sensitive
EISC	Low
Impact assessment	Impacts cannot be mitigated
Risk Matrix	General Authorization
Resource Economics	Small footprint.

Table 15 gives an overall and much condensed view of the assessments and the methodologies.

The status as a CBA may raise a red flag among decision-makers, but this is hardly warranted, as the site is next to town, trampled over and degraded. Instead of allowing it to deteriorate any further it may be beneficial to transform it into a productive vineyard.

23 Discussion and Conclusions

'An anthropogenic activity can impact on any of the ecosystem drivers or responses. 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 17). The WULA and the EAI must provide mitigation measured for these impacts.'

Figure 23 has been adapted from DWS policy documents.

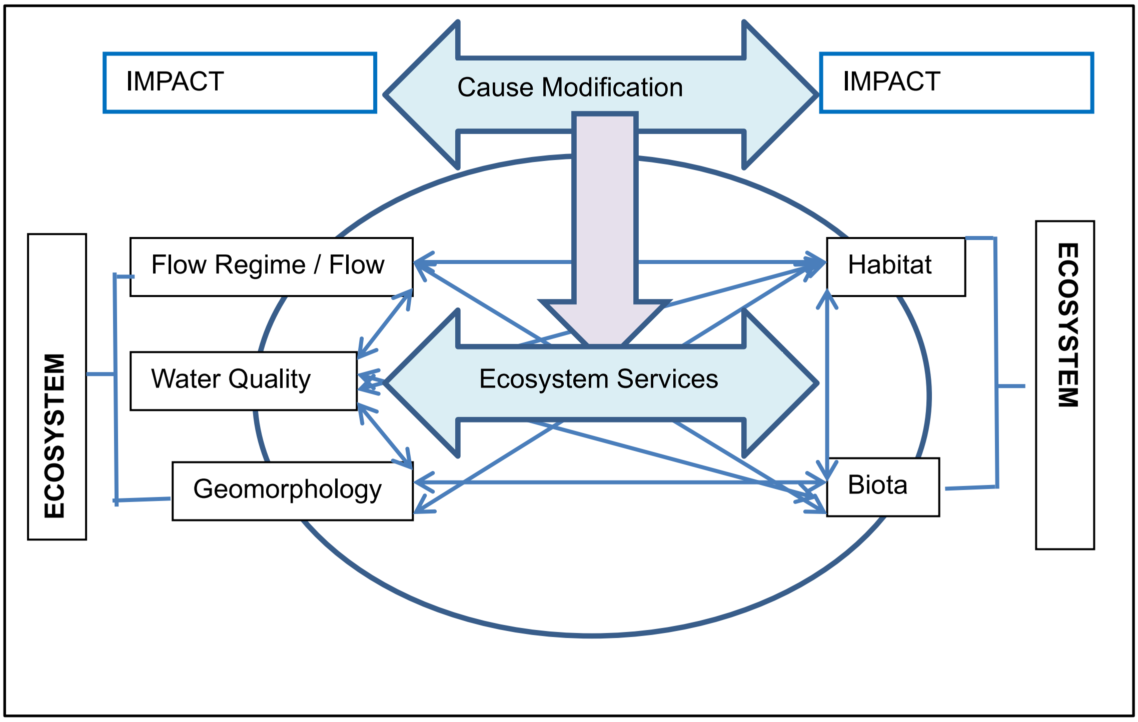


Figure23 Minimum Requirements for a S21(c) and (i) Application

The main driver of these drainage lines in the Northern Cape is obviously the summer rain that can arrive in sudden electric thunderstorms. These events are scarce, but can be fierce, with lots of runoff, but only for a couple of hours, seldom days, that scour out the drainage lines and maintain their integrity. The ecological significance is in the shallow ground water that lingers on while it migrates down the inclines towards the Orange River, while supporting riparian vegetation that adds to the habitat variability in an otherwise barren region.

Likewise, the droughts lasting for months, often for years, maintaining the semi-desert status of the region and restricting higher vegetation to the immediate surrounds of the drainage lines.

The proposed vineyard would change all this, upset the natural balance, as the smaller tributaries of the drainage line in the lower part of the sub-catchment would be taken out of existence. The lower part of the drainage line would probably change into a reed bed because of the agricultural return flow.

This drainage line is small, perhaps insignificant and right next to Kakamas. It is downtrodden, already altered and trampled over. Not much would be lost in terms of viable aquatic habitat.

There would be an added impact on the water quality of the Orange River. Compared to what there already is because of the existing large-scale agriculture, this added impact is entirely insignificant.

It is therefore suggested that the proposed vineyard should be allowed, that the project should go ahead.

A General Authorisation is the correct level of official approval. A License is not called for.

24 References

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Kotze, G., G. Marneweck, A. Batchelor, D. Lindley & Nacelle Collins. 2009. *A technique for rapidly assessing ecosystem services supplied by wetlands.* Water Research Commission, Pretoria.

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.

Mucina, L. & M.C Rutherford. 2006. *The vegetation of South Africa, Lesotho and Swaziland.* SANBI, Pretoria.

25 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: D van Driel 21 June 2024

26 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
- 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 Abbottsdale High Voltage Power Line
- Freshwater Report Darling Solar Energy Plan
- Freshwater Report Malmesbury Klipkoppie Solar Energy Plant
- River Rehabilitation Plan Louterwater, Langkloof
- River Rehabilitation Plan Kloof Please Krakeelrivier
- Freshwater Report ZZC Potchefstroom electric automobile charging station.
- Freshwater Report ZKA Information Centre Carnavon
- Freshwater Report ZCC Estcourt electric vehicle charging station
- Freshwater Report ZCC Kohler electric vehicle charging station
- Freshwater Report ZCC Harrismith electric vehicle charging station
- Freshwater Report Gustrouw residential development, Somerset West

27 Appendix

Table 27.1 Numerical Significance

Table 27.1.1 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 27.1.2 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 27.1.3 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

27.2 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 27.2.1 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 27.2.2 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 27.2.3 Significance Rating

<table>
<tr><th>Significance Rating</th><th>Description</th></tr>
<tr><td>High</td><td>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</td></tr>
<tr><td>Medium</td><td>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</td></tr>
<tr><td>Low</td><td>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</td></tr>
<tr><td>Very low</td><td>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</td></tr>
<tr><td>Neutral</td><td>Zero consequence with any combination of extent and duration</td></tr>
</table>

Table 27.2.4 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.

27.3 Risk Matrix Methodology

TABLE 1 – IMPORTANCE OF AFFECTED WATERCOURSE/S	
What is the overall importance of the watercourse/s, based on the criteria and guidelines provided below?*	
(If no formal assessment of EI / EIS / Wetland Importance has been completed, assign rating according to criterion below that results in the highest score)	
Low or Very Low EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Low rating based on presence of: - no areas identified to be of conservation importance (i.e. OESA at most); and/or - only species/habitats of Least Concern on the IUCN Red List or on a regional/national Red List (including freshwater ecosystem types of Least Concern in terms of the NBA); and/or - only species which are common and widespread and/or habitats of low conservation interest; and/or - highly degraded habitat of extremely small size	**Low / Very low** = 2
Medium EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Moderate rating based on presence of: - CESAs; and/or - species/habitats listed as VU or NT on the IUCN Red List or on a regional/national Red List (including VU/NT freshwater ecosystem types in terms of the NBA); and/or - functionality as an important ecological corridor or buffer area	**Moderate** = 3
High EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, High rating based on presence of: - CBA2; and/or - species or degraded habitats (in poor condition) listed as EN or CR on the IUCN Red List or on a regional/national Red List (including EN/CR freshwater ecosystem types in terms of the NBA)	**High** = 4
Very high EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Very high rating based on presence of: -CBA1; and/or - FEPA; and/or - species or intact habitats (in fair or good condition) listed as EN or CR on the IUCN Red List or on a regional/national Red List (including EN/CR freshwater ecosystem types in terms of the NBA); and/or - KBA or IBA or Ramsar site	**Very high** = 5
* EI=Ecological Importance; EIS=Ecological Importance & Sensitivity; OESA=Other Ecological Support Areas; IUCN=International Union for Conservation of Nature; CESA=Critical Ecological Support Area; NBA=National Biodiversity Assessment; VU=Vulnerable; NT=Near Threatened; EN=Endangered; CR=Critically Endangered; CBA=Critical Biodiversity Area; FEPA=Freshwater Ecosystem Priority Area; KBA=Key Biodiversity Area; IBA=Important Bird Area.	

TABLE 2- INTENSITY OF IMPACT	
What is the intensity of the impact on the resource quality (hydrology, water quality, geomorphology, biota)?	
Negative Impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large detrioration in PES (by one class or more)	+4
Very high / critically harmful; critrical deterioration in PES (to E/F or F class)	+5
Positive Impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5
NOTE: Positive Impacts must be given a negative Intensity Score	
***PES of affected watercourses must be considered when scoring Impact Intensity**	

TABLE 3 – SPATIAL SCALE (EXTENT) OF IMPACT	
How big is the area that the activity is impacting on, **relative to the size of the impacted watercourses**?	
Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

TABLE 4 – DURATION OF IMPACT	
How long does the activity impact on the resource quality?	
Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

TABLE 5 – LIKELIHOOD OF THE IMPACT	
What is the probability that the activity will impact on the resource quality?	
Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

TABLE 6: RISK RATING CLASSES

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	(L) Low Risk OR (+) Positive (+ +) Highly positive	Acceptable as is or or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 – 100	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

TABLE 7: CALCULATIONS AND MAXIMUM VALUES	
Intensity = Maximum Intensity Score (negative value for positive impact) X 2	MAX = 10
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 20 (MIN = -20 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 100
Significance\Risk = Consequence X (Likelihood / 100)	MAX = 100