Freshwater Report

Proposed

Harmony Agriculture

On the Farm Winkelhaak 224, Koue Bokkeveld, Ceres District

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

August 2024

Executive Summary

Môrester Estate is in the Koue Bokkeveld to the north of the town of Ceres in the Western Cape. The owners lodged an application with the Department of Water and sanitation for the approval of two dams for the irrigation of permanent crops, such as apples and pears. This produce is mainly destined for the export market. The dams were finally officially approved. Construction will start in due course. One of these dams will be on the Farm Winkelhaak. This proposed dam was named the Harmony Dam.

The official approval for the development of land into orchards is the next step, now that water for irrigation has been secured. I piece of land that covers 35 hectares in proximity of the Harmony Dam was set aside. Enviro Africa of Somerset West was appointed to carry out the legally required environmental impact assessment. At the time of the writing of this report, this process was underway.

Likewise, WATSAN Africa of Knysna was appointed to produce the Freshwater Report that is required for the water use license application in terms of the National Water Act (36 of 1998). This report must be produced with a set contents according to specified methodologies and standardised assessments. One such methodology is a completed Risk Matrix.

The land that has been identified for the new orchard is in an ecological sensitive area, with endangered vegetation and with a high level of ecological significance. It is in a protected mountain catchment area. The earmarked land is traversed by mostly dry drainage lines. It is adjacent to the Houdenbek River, which swells during the rainy season into a formidable wetland.

The drainage lines are of little if any aquatic ecological, conservation value and significance. Not much would be lost if these are replaced with irrigation return flow swales. However, these swales, shallow landscaped channels, must be constructed according to strict environmental guidelines to slow down peak flows and prevent erosion.

The Houdenbek River, a mere trickle during the dry summer, morphs into a flooded wetland during the winter rainy season. The Houdenbek River, for most along its length, is heavily developed, with large-scale agriculture. Apart from abstraction, agricultural return flow that may contain agri-chemicals, mud and silt along with the runoff from the many orchards constitutes a major impact. The new orchard at Môrester adds to this impact. The impact can me ameliorated with contemporary state-of-the-art farming and irrigation methods.

It is recommended that the proposed agricultural development is approved with a General Authorisation. 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

As early as 2018 the owners of Môrester Boerdery called for quotations for specialist to guide the approval process for new dams and new orchards. The following is out of those reports (Van Driel, 2018):

"Morester Boerdery is a well-established farming operation on the Koue Bokkeveld to the west of the hamlet Dorp-op-die-Berg in the Ceres district of the Western Cape.

Harmony Trust together with Morester Boerdery (the BBBE partner) plan develop fruit trees and vegetable crops on existing agricultural land (a PALS BBBEE initiative) and require the proposed Toeka and Harmony dams for irrigation purposes.

*Morester Boerdery appointed EnviroAfrica to conduct the required Environmental Impact Assessment (*EIA*) in terms of the National Environmental Management Act (NEMA, 107 of 1998).*

EnviroAfrica, in turn, appointed WATSAN Africa to handle the Water Use License Application (WULA) on behalf of Morester Boerdery with the Department of Water and Sanitation (DWS) in terms of the National Water Act (NWA, 36 of 1998)".

Both dams were recently officially approved, with the Water Use Licenses in place. These approvals do not include the land that was set aside for the concomitant agricultural development. Consequently, Enviro Africa in Somerset West again was approached for the legally required EIA.

As in the past, Enviro Africa contracted WATSAN Africa in Knysna to produce the Freshwater Report that is mandatory for the WULA.

The Freshwater Report must include a completed Risk Matrix as published on the DWS webpage and in terms of GN509 of 2017. The completed Risk Matrix must be signed by a registered SACNASP scientist.

The Fresh Water Report must contain adequate information to allow for informed decision-making. The decision to approve the proposed development rests with DWS officials, in terms of S21 of the NWA. The Fresh Water Report must contain specified information according to a set profile, which has been developed over several years over many such reports.

The report must contain adequate information for the EIA as well, such as an impact assessment and significance assessment according to specified methodologies.

A site visit was conducted on 6 August 2024, together with a team of specialists in the various fields for which official approval was legally required.

2 Location

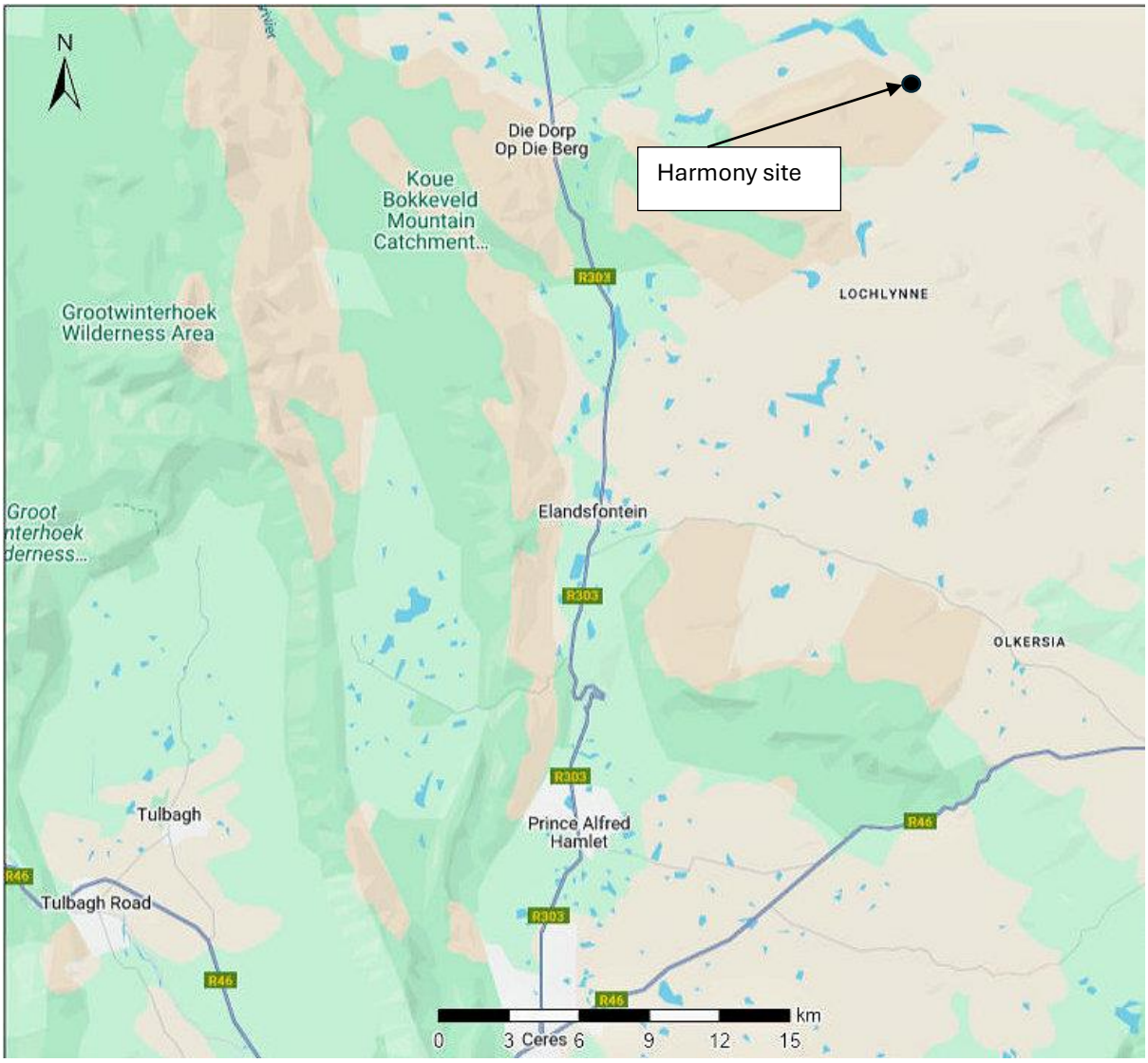

Figure 1 Location

Harmony Agriculture is 43km to the northeast of Ceres, measured in a straight line.

It coordinates are as follows:

30°00’00.39”S and 19°28’28.59”E.

Take the R303 to the north out of Ceres, through Prince Alfred Hamlet and over the Gydo Pass to Dorp of die Berg where a turnoff to the right (west) must be taken. The Morestêr Farming offices are 14.5km from the turnoff on the right-hand side of the road where one must report for entry onto the property and further directions to the site.

Figure 2 Location continued

3 Quaternary Catchment

Harmony Agriculture is in the E21C quaternary catchment area.

4 Dorp op die Berg Climate

https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/op-die-berg_south-africa_3363273

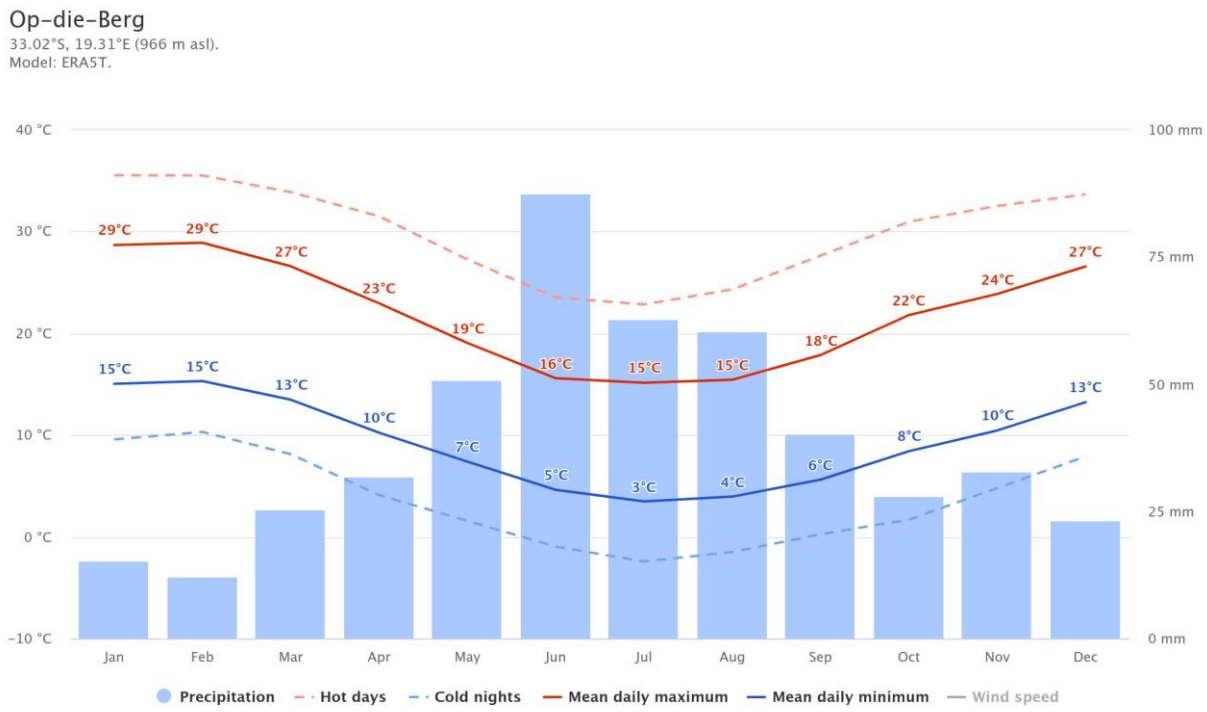

Figure 3 Dorp op die Berg Climate

The chart (Figure 3) shows that rain is spread throughout the year, but with much more rain during the winter rainy season. The annual average rainfall is not readily available online. Dorp op die Berg and surrounds is in the winter rainfall area, with long dry summers. The winters can be cold, with frost and snow on the mountains.

As rainfall is dependent on elevation, the surrounding mountains up to 1500m high, with still higher peaks, receive a lot more rain than the valleys below. Rainfall of between 1500 to 2000m per year on the high ridges and peaks is not unheard of.

Of importance to this report, the Winkelhaak farm and the proposed agricultural development does not receive enough water especially during the fruiting season for successful fruit production. Water must be abstracted from rivers when the rivers are flowing strongly during winter and stored for irrigation in late summer when permanent crops such as fruit trees need it most.

Rivers in the region stop flowing in summer and can even be dry.

Rainfall is erratic, with some very wet years and with rivers coming down in flood. Floods can be fierce, with rivers bursting their banks. On the other hand, drought flow in the Houdenbek River is often experienced, lasting several years.

5 Conservation Status

DFFE Screening Tool

The screening tool was applied to a portion of the Farm Winkelhaak 224, the part where the proposed development is planned.

Table 1 DFFE Screening Tool Results

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

Animal species theme

The following species are listed:

Circus ranivorus	Marsh harrier
Falco biarmicus	Lanner falcon
Afrotis afra	Southern black korhaan
Aquila verreauxii	Black eagle, Verreaux's eagle
Bunolagus monticularis	Riverine rabbit

The listed raptors have a very wide distribution over the region and over the country. The relatively small and localised proposed agricultural development is not about to have a noticeable impact on the survival of these organisms.

The riverine rabbit occurs in dense riparian bush in dryer areas of the Karoo. The Houdenbek River at the proposed agricultural area is not ideal habitat for these rabbits,

as it is probably too wet, cold and devoid of dense vegetation. Originally the denser vegetation was probably proteoid rather than the preferred thorny Karoo bush.

Aquatic biodiversity theme

The aquatic features at the site are listed as a CBA as well as a NFEPA.

The area is listed as a strategic Groot Winterhoek Mountain catchment area.

The aquatic features are also listed as Northwest Fynbos Bioregion valley bottom wetlands. This probably applies to the Houdenbek River and not to the demarcated agricultural area higher up the slope.

Plant species theme

The screening tool lists many plant species. Some are numbered species of which the names may not be published. These plants are all framed as of medium ecological sensitivity.

Koue Bokkeveld Alluvium Fynbos is listed as endangered. This Fynbos probably occurred in the riparian zone of the Houdenbek River rather than of the proposed agricultural development. None is left at the site.

Terrestrial biodiversity theme

Under this heading, the area is listed as a terrestrial CBA as well as an ESA.

It is part of the strategic Koue Bokkeveld mountain catchment area.

It is included in the National Protected Area Expansion Strategy

6 Legal Framework

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

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

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

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

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

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

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

Government Notice 509 of 26 August 2016

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

National Environmental Management Act (107of 1998)

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

7 Agricultural Area

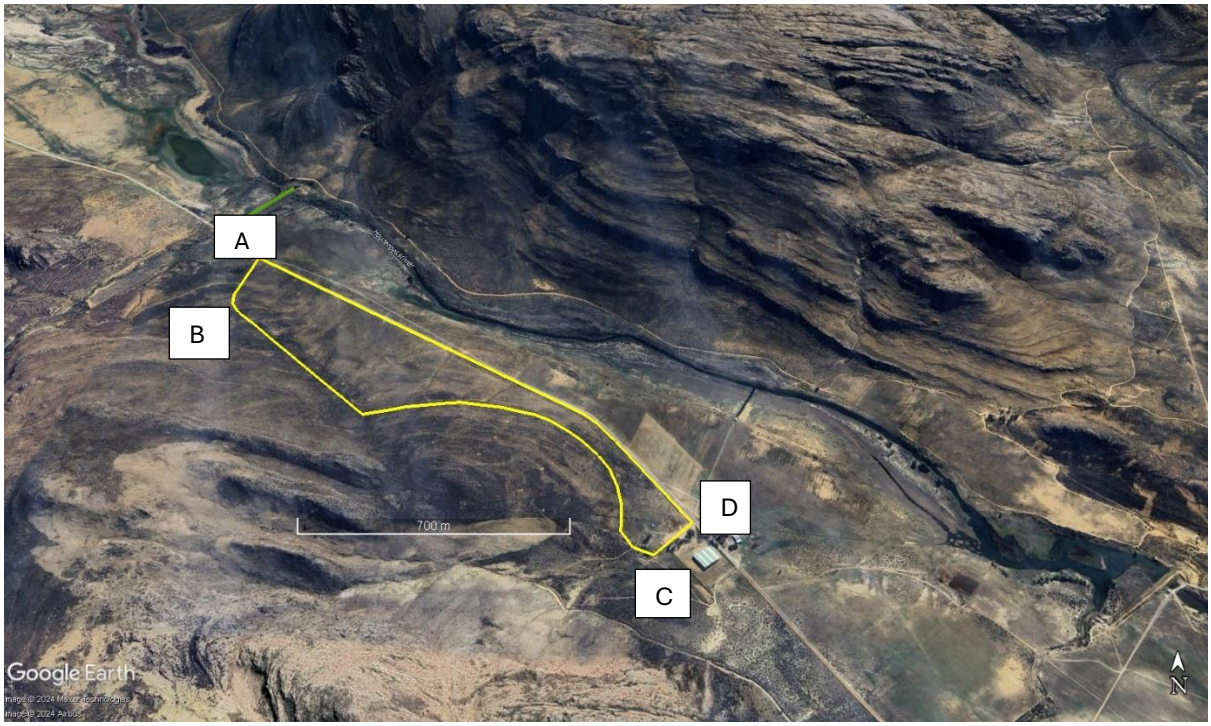

Figure 4 Agricultural Area

Figure 5 Terrain agricultural area

Table 2 Demarcated agricultural area coordinates

Point	Coordinates	Elevation masl
A	32°59'43.39"S and 19°28'07.22E	936
B	32°95'51.81"S and 19°28'06.01E	949
C	32°00'22.44"S and 19°28'57.34E	946
D	32°00'18.94"S and 19°01'07.41E	942

The agricultural area is demarcated in Figure 4. It covers an area of 35 ha. It is located on the northern slope of a mountain, with the Houdenbek River adjacent and further to the north. It is demarcated by a farm road along its northern boundary. Towards the south and southwest, the mountainous terrain is too steep and too rocky for farming, leaving only a narrow strip, 1.8km long, of relatively level arable ground between the foot of the mountain and river (Figure 4).

The entire area will be planted with permanent crops, apple trees and pear trees. The trees will be irrigated out of the planned Harmony Dam. This dam will be constructed in the valley adjacent and to the west of the agricultural area. More information on the dam is available in the technical report that was drafted for the WULA (Van Driel, 2018).

8 Sub-Catchments and Drainage Lines

There are 4 sub-catchments with drainage lines across or near the demarcated agricultural area (Figure 1).

These drainage lines, as well as the proximity to the Houdenbek river, sparked the legal requirement for a WULA, Freshwater Report and a completed Risk Matrix.

Sub-Catchment No. 1 covers an area of 101 ha, measured right up to the Houdenbek River. The drainage line is 2 km long, measured along the curve. The highest point is at 1115 masl. Its confluence with the Houdenbek River is at 931 masl. This amounts to an average slope of 9.2 vertical metres in every 100 horizontal metres, which is very steep. This slope can give rise to a fast runoff rate and a high erosion potential. This slope does not signify the mountainous terrain of which the slope can be even steeper, vertical along the high ridges and peaks. The sub-catchment is in the foothills of higher mountains to the south and southeast with ridges and peaks more that 1500masl. Its drainage line crosses the agricultural area in the eastern corner (Figure 1).

Sub-Catchment No.2 is much smaller at 14 ha, measure up to the farm road. It passes through the middle of the agricultural area. The reach from the farm road to the river is inconspicuous, hardly visible.

Sub-catchment No.3 is only 11 ha, with a short drainage line. In the past, there were more drainage lines that have since deteriorated. Only short remnants are left, not connected to the main drainage line in this sub-catchment.

The land between Sub-Catchment No. 2 and No.3 adjacent to the river does not show any distinctive drainage lines and is directly connected to the river. This land can be branded as the fourth sub-catchment. It is of no concern as there are no drainage lines that must be assessed.

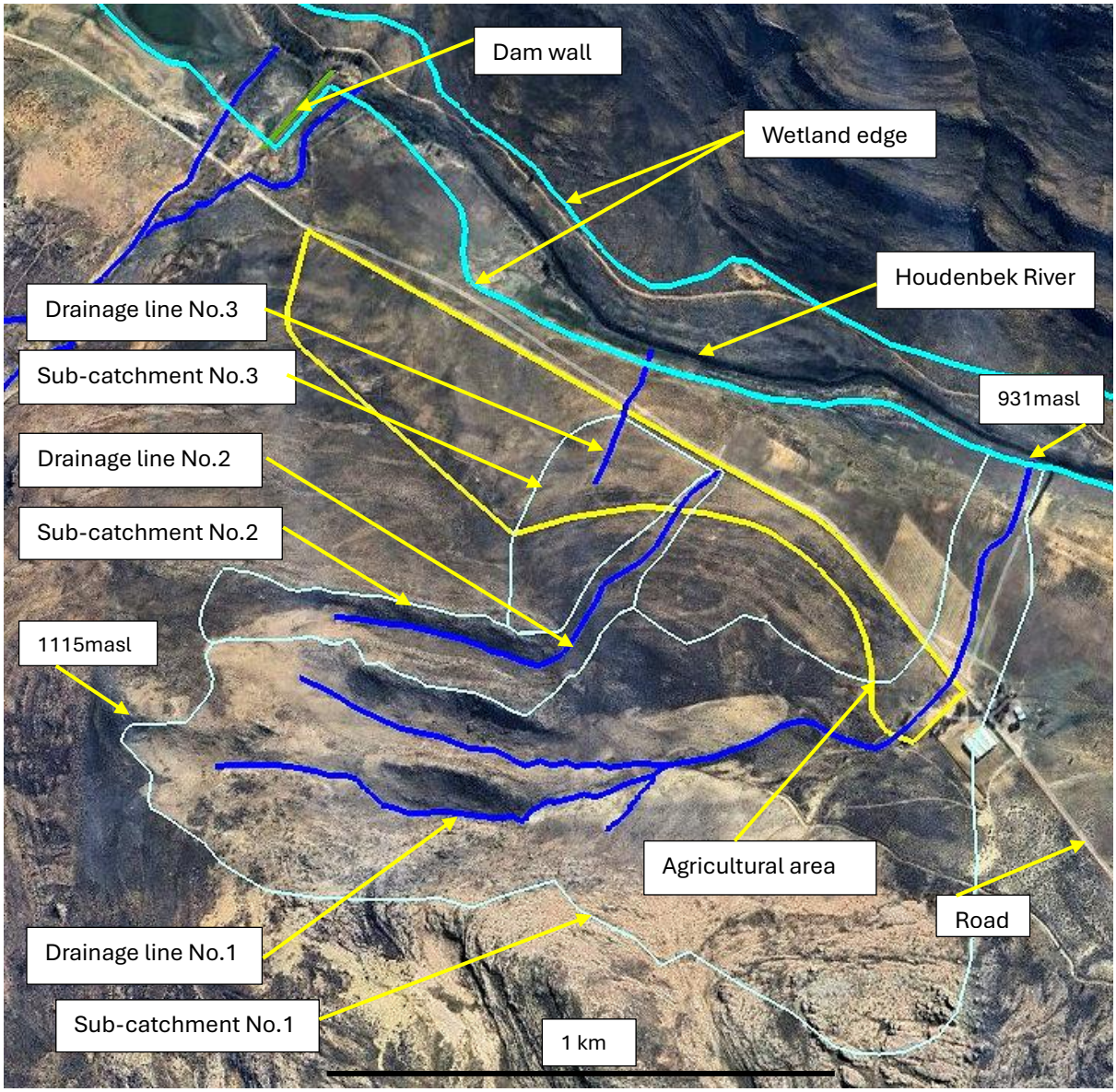

Figure 6 Harmony Drainage lines

There is a prominent drainage line to the far northwest at the dam wall (Figure 1). This drainage line is just outside of the 100m controlled zone and will therefore not be assessed.

Further to the east, just outside of the area shown in Figure 1, is another dam wall. The dams were full and overflowing during the site visit, following the top of a very good rainy season. At this time, the Houdenbek River can be classified as a wetland rather than a river or stream. This is in stark contrast to the river's status during the dry season, when the river can be reduced to a trickle of water of even entirely dry, as it was during the previous site visit.

For this report and its assessments, the Houdenbek River was regarded as a wetland, with the demarcated agricultural area within the 500m regulated zone, as demanded by GN509.

9 Drainage Lines current status

The one aspect of the drainage lines that stands out is the trench and berm (Figure 7) that were constructed along the farm road. The trench prevents runoff from Drainage Line No.1 and No.2 (Figure 6), as well as any runoff from the sub-catchment above the farm road, to cross the farm road, over the land below the farm road and into the Houdenbek River. The trench and berm are designed to protect the road from washing away. It was designed to prevent flood damage to the agricultural land below the farm road. Runoff now collects in the trench and flows down the incline towards Drainage Line No. 3 at the middle of the demarcated agricultural area, where it passes underneath the farm road through a pipe culvert (Figure 8). Downstream of the culvert, the drainage line was still visible, even though it was disturbed.

During the time of the site visit, there was still standing water in the trench after the rains.

The drainage lines above the trench up the incline are visible on Google Earth images, but on the ground are hard to distinguish from the surrounding ground (Figure 9). The vegetation resembles that of the surrounds and is not noticeably higher or any different, devoid of wetland indicator species. It appears the runoff is inadequate during hot summer months to allow for riparian vegetation to take root.

Figure 7 Trench and berm along the farm road.

Figure 8 Pipe culvert

Figure 9 Drainage Line No. 3 above the trench

Figure 10 Drainage Line No. 1 pipe culvert.

Figure 11 Trench at Drainage Line No. 1.

Figure 12 Trench to the river at Drainage Line No.1.

The environmental significance of drainage lines is that higher and lusher habitat is provided. Shallow groundwater migrates downstream along mostly dry drainage lines long after surface water flowed away. This allows for riparian vegetation to take root. This habitat is utilised by a variety of organisms that would not be present on an otherwise monotonous landscape. The drainage lines along with its groundwater in this patch of land evidently are not adequate to maintain this special habitat, resembling the situation in very arid regions.

Drainage line No.1 has a pipe culvert underneath the farm road (Figure 10). The trench starts to the east of this culvert, passes the culvert and stretches to Drainage Line No. 3 further west. The drainage line from the road to the river has been engineered into a straight channel (Figure 11). There is a concrete slab (Figure 12) over the farm road, probably to protect it from erosion and for a steady surface when it is too wet for vehicles to pass over.

The lack of a riparian zone upstream of the culvert is evident (Figure 10).

10 Houdenbek River

The proposed agricultural area is outside of the 100m controlled zone of the river during low flow conditions. That changes dramatically during the rainy season when the river turns into a wetland (Figure 13), pushing up against the dam walls and flooding the area well into the 500m controlled zone. This necessitated, among other, the WULA, Freshwater Report and completed Risk Matrix.

Figure 13 Houdenbek River flood conditions

11 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.

It is always difficult to score drainage lines of which the tops are near-pristine, while the bottom ends are hugely modified, such as the ones at the proposed agricultural area. Nevertheless, the scores given here is the best shot, given the demands of applicable legislation.

Table 3 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

The drainage lines combined are only slightly impacted, with most of the ecological functioning intact. Obviously, this would be lost if the land is transformed into apple orchards under irrigation.

The Houdenbek River is altered and impacted, with large-scale agriculture from beginning to end. Much of its water is abstracted. The storage capacity of the dam along its length is much more than its MAR. The addition of orchards *per se* would not change the current condition, other than the water that may be taken out of the aquatic system. But then this report is not about the taking of water. It solely focusses on the impact of the proposed agricultural development. The impact would rather be

the addition of agri-chemicals, silt, sand and mud from the altered land as well as any other debris that may end up in the river.

The proposed development may add to the load that comes with the runoff from agricultural land. However, given the high-intensity development all along the entire length of the Houdenbek River, the addition impact would be comparatively small if not negligible.

It is not expected that the proposed agricultural development would lower the Houdenbek River classification.

Table 4 Present Ecological State of drainage lines combined

Instream				
	Score	Weight	Product	Maximum score
Water abstraction	25	14	350	350
Flow modification	16	13	208	325
Bed modification	17	13	221	325
Channel modification	18	13	234	325
Water quality	24	14	336	350
Inundation	18	10	180	250
Exotic macrophytes	21	9	189	225
Exotic fauna	22	8	176	200
Solid waste disposal	25	6	150	150
Total		100	2044	2500
% of total			81.8	
Class			B	
Riparian				
Water abstraction	25	13	325	325
Inundation	17	11	187	275
Flow modification	15	12	180	300
Water quality	24	13	312	325
Indigenous vegetation removal	22	13	286	325
Exotic vegetation encroachment	23	12	276	300
Bank erosion	22	14	308	350
Channel modification	16	12	192	300
Total			2066	2500
% of total			82.6	
Class			B	

Table 5. Present Ecological State of the Houdenbek River at Winkelhaak Farm

Instream	Score	Weight	Product	Maximum score
Water abstraction	12	14	168	350
Flow modification	8	13	104	325
Bed modification	10	13	130	325
Channel modification	12	13	156	325
Water quality	19	14	266	350
Inundation	9	10	90	250
Exotic macrophytes	21	9	189	225
Exotic fauna	22	8	176	200
Solid waste disposal	25	6	150	150
Total		100	1429	2500
% of total			57.2	
Class			D	
Riparian				
Water abstraction	11	13	143	325
Inundation	8	11	88	275
Flow modification	7	12	84	300
Water quality	19	13	247	325
Indigenous vegetation removal	16	13	208	325
Exotic vegetation encroachment	22	12	264	300
Bank erosion	24	14	336	350
Channel modification	11	12	132	300
Total			1502	2500
% of total			60.1	
Class			C	

12 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 6).

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.

Table 6 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)

Several species of fish occur in the Olifants Doring River system:

Cape galaxias (three undescribed species)	*Galaxias zebratus*
Clanwilliam rock catfish	*Austroglanis gilli*
Spotted rock catfish	A*ustroglanis barnardi*
Clanwilliam sandfish	*Labeo seeberi*
Clanwilliam yellowfish	*Labeobarbus seeberi*
Clanwilliam sawfin	*Cheilobarbus serra*
Clanwilliam redfin	*Sedercypris calidus*
Twee River redfin	*Barbus erubescens*
Fiery redfin	*Pseudobarbus phlegethon*
Doring fiery redfin	*Pseudobarbus phlegethon*
Chubbyhead barb	*Enteromius anoplus*

There is a high degree of endemism. Some of these are endangered and critically endangered. This renders the river system and its tributaries ecologically important. Likewise, the Houdenbek River is ecologically important, despite it being seriously altered, as it remains potential habitat for some of these fishes.

Indigenous fish is seriously threatened by predation and competition by exotic invasive fish such as:

Carp	*Cyprinus carpio*
Smallmouth bass	*Micropterus dolomieu*
Rainbow trout	*Oncorhynchus mykiss*
Bluegill sunfish	*Lepomis macrochirus*

These may occur in the Houdenbek River as well. Nevertheless, it does not subtract from the river's ecological importance.

13 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 lines and its riparian zones will take many decades, if not centuries, to bounce back once obliterated by large-scale agriculture. From this point of view, the drainage lines can be viewed as ecologically highly sensitive.

The Doring River and its tributaries such as the Houdenbek River have 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 the Lower Orange River might have some more capacity to absorb further impact. Again, impacts are here to remain and will not be allowed to recover. Under these circumstances, the river is viewed as ecologically sensitive.

14 EISC

The DWS demand that the river be placed in a category according to the EISC methodology (Table 7). The EISC is one of the essential items that is required for the Risk Matrix.

Table 7 EISC

Determinant	Drainage lines combined	Houdenbek River
Rare and endangered species	0	5
Populations of unique species	0	5
Species / Taxon richness	1	4
Diversity of habitat	1	4
Migration Route/ Breeding and feeding site for wetland species	0	4
Sensitivity to water quality changes	1	3
Flood storage, energy dissipation, particulate / element removal	1	3
Protection status	3	5
Ecological integrity	4	2
Average	1.2	3.9
Score	Low	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 proposed agricultural development would lower the EISC of the drainage lines even more.

The proposed development would not change the Houdenbek River's EISC, as it is a small development with a limited potential impact.

15 Probable Impacts and Mitigating Measures

Dickens *et al* (2003) lists several possible impacts on wetlands. This provides a framework for the proposed development at the Winkelhaak Farm.

Flow modification

The flow down the drainage lines would be altered, with a possibility of added flow because of agricultural return flow. The added flow would be minimal, given

contemporary farming practices. Fruit farming in the region has become a highly technological enterprise, with perpetual in-time soil moisture measurement aimed at irrigating individual trees enough for optimum production while saving water. Irrigation is controlled remotely, even from the landowner's cell phone. It would be no different at Winkelhaak Farm.

The flow down the Houdenbek River, as in the entire Olifants Doring River system, has significantly been altered (Paxton, 2016). It is not expected that the proposed fruit farming operation would measurably add to the flow in the river. The operation is small, with a comparatively minute impact, if compared to all that already is present along the river.

Permanent inundation

The river is inundated during the wet season because of the dams. It is reduced to a trickle of water during the hot summer months. The proposed farming operation is not about to measurable change any of this.

Water quality modification

The removal of natural vegetation to be replaced with an orchard of fruit trees, along with irrigation and activity on the land, would change the characteristics of the runoff and eventually impact on the river's water quality. First with silt, mud and sediment and later, during the operational phase, with agricultural return flow. This must be minimised by contemporary farming methods, as is imperative for export quality produce.

Sediment load modification

The runoff sediment load can potentially increase during the new orchard's establishment. Contours that divert runoff into settling ponds could do much to keep excessive sediments out of the river. The landowner is expected to draft a plan and a lay-out to address runoff and sediment control.

Canalization

The drainage lines may be altered into straight, engineered drainage channels. This is the way drainage was dealt with in the past. This increased runoff velocity and erosion potential, eventually creating deeply incised channels through and alongside orchards. This practice is no longer acceptable. The velocity must be reduced by means of flow calming devices. Hydraulic drag must be increased to slow down the

flow with meanders, cobbles, weirs and vegetation. Instead of channels, landscaped and vegetated swales are the preferred option.

This would also help to flatten and spread out the river's hydrograph.

Topographic alteration

The drainage lines will be replaced with drainage channels, if the development goes ahead.

Terrestrial encroachment

The riparian vegetation will be replaced with introduced vegetation such as grasses. Cultivated land is valuable, with little room for a 32m protected zone on the banks of drainage lines. Perhaps 10m on either side of the drainage line would be more appropriate.

Indigenous vegetation removal

The Fynbos would be replaced with orchard. In time, no Fynbos will be left on the banks of the drainage lines, as has happened in other similar developments. This is the reality of commercial farming, with little scope for preserving Fynbos.

Invasive vegetation encroachment

Exotic and invasive trees and other vegetation cannot be tolerated in high-value and manicured fruit orchards. In open land between orchards a variety of grasses can be expected.

Alien fauna

As a rule, no livestock are allowed in high-value orchards. The area does not suffer from any alien fauna other than insect pests, which are controlled.

Over-utilization

No livestock will be allowed in the orchards. The land would not be utilized other than with orchards.

Isolation / Migration

The flow path of the river system is still intact, with continuous migration routes, despite of the orchards. These migration routes are limited as the drainage lines are in its natural state not important as migration routes for aquatic and semi-aquatic organisms.

Groundwater table

The groundwater table will probably not change because of the replacement of the drainage lines with swales.

Waste

Farming practices are of a high standard, as is required by a strict and discerning export market and end users demanding the very best. There is no trash or rubble lying about on the land.

16 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 drainage lines cannot be saved. They can at least be engineered into agricultural return flow channels that are designed to slow down flow, prevent erosion and that will not be allowed to develop into deeply incised straight and barren furrows or trenches that are so prominent in long-existing orchards in fruit-producing areas. These new-style channels are more like vegetated and landscaped swales that allow for a replacement aquatic ecology. For such an acceptable situation to take hold, planning is required.

Sand, mud and sediments can end up in the Houdenbek River during the construction phase, as the land is cleared from vegetation, trellis and irrigation are installed and saplings are planted. This must be prevented.

Agri-chemicals, pesticides and fertiliser can end up in the river along with return flow and the runoff during the orchard's operational phase. This is entirely undesirable and must be prevented through state-of-the-art farming methods.

The orchards will be there in perpetuaty. Decommissioning and rehabilitation are not planned for. Once the trees reach the end of their economic life, they will most likely be replanted.

Table 8 Impact Assessment

Description of impact.
Construction Phase
Drainage lines

Impact

Natural drainage lines replaced with return flow channels.
Possibility of incised furrows formed over time.
Loss of most ecological functioning.

Mitigation measures

Limit flow velocity.
Create meandering, landscaped and vegetated swales.
Retain at least some form of aquatic ecological functioning.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Site specific	High	Short term	Very High	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Direct	Site specific	High	Short term	High	Definite	Certain	Irreversible	Irreplaceable

There is no mitigating measure that can prevent the drainage lines from being converted into return flow channels. The best that can realistically be hoped for is a landscaped drainage channel that is allowed to retain some ecological functioning and that is prevented to develop into an incised trench.

Description of impact.
Construction Phase
Trellis, irrigation and planting of saplings

Impact

Mud, sand and sediment washing down the drainage lines into the river.
Erosion.
Alteration of riverine aquatic habitat.

Mitigation measures

If possible, develop the land during the dry summer season.
If possible, construct holding ponds at the lowest point to allow sediments to settle before runoff is allowed into the river.
Limit the footprint. Keep machinery out of undisturbed land.
Vegetate areas, wherever possible.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	High	Short term	Very High	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Direct	Site specific	Medium	Short term	High	Definite	Certain	Irreversible	Irreplaceable

It is hoped that proper standard operating procedures during construction will limit sediments ending up in the river.

Description of impact.
Operational Phase

Impact

Agri-chemicals and sediments ending up in the river along with runoff and return flow.

Mitigation measures

Employ contemporary farming methods to prevent over-irrigation.
Maintain return flow swales.
Prevent erosion.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	Medium	Long term	Medium	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Site specific	Low	Long term	Low	Definite	Certain	Irreversible	Irreplaceable

Proper farming methods can reduce this possible impact to a much lower and hardly noticeable level. Existing farming operation on the land subscribe to these principles and to the demands of a most discerning market.

17 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 9 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 9 (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.

Table 9 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1.1	**Construction** **Drainage lines**				
	Drainage lines replaced with return flow channels	Natural drainage lines replaced with return flow channels. Possibility of incised furrows formed over time.	Loss of most ecological functioning.	10	Low
1.2	Construction of trellis, irrigation infrastructure, planting of saplings	Mud, sand, sediments washing down the drainage lines into the river	Alteration of aquatic habitat	10	Low
2	Operational Phase	Agri-chemicals and sediments washing into the river along with return flow and runoff	Pollution of the river	40	Low

Table 9 Continued Risk Matrix

No	Hydrology	Water Quality	Geomorphology	Vegetation	Fauna	Overall intensity
1.1	3	2	4	4	1	8
1.2	2	2	4	4	1	8
3	1	2	1	1	1	4

No	Spatial scale	Duration	Severity	Importance	Consequence	Likelihood %	Significance	Risk Rating
1.1	1	1	10	1	10	100	10	Low
1.2	1	1	10	1	10	100	10	Low
3	1	5	10	4	40	60	24	Low

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

18 Resource Economics

The goods and services delivered by the environment, in this case the Winkelhaak aquatic habitat, is a Resource Economics concept as adapted by Kotze *et al* (2009).

The diagram (Figure 14) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 10.

Table 10. Goods and Services

Goods & Services	Drainage line combined	Houdenbek River
Flood attenuation.	2	4
Stream flow regulation	2	4
Sediment trapping	2	4
Phosphate trapping	1	3
Nitrate removal.	1	3
Toxicant removal	1	3
Erosion control	2	4
Carbon storage	1	2
Biodiversity maintenance	1	5
Water supply for human use	0	5
Natural resources	0	3
Cultivated food.	0	5
Cultural significance	0	3
Tourism and recreation	0	4
Education and research	0	4

The Houdenbek River has a large resource economics footprint. It would likely attract the attention of the official decision-makers. The river's contribution to ecological services is somewhat compromised. The river's contribution to agriculture and the local economy is substantial, as indicated by the spider diagram.

The drainage line's footprint is small, negligible. The proposed development, ironically, would swell the star shape of the spider diagram to the left, as its contribution to farming will be increased.

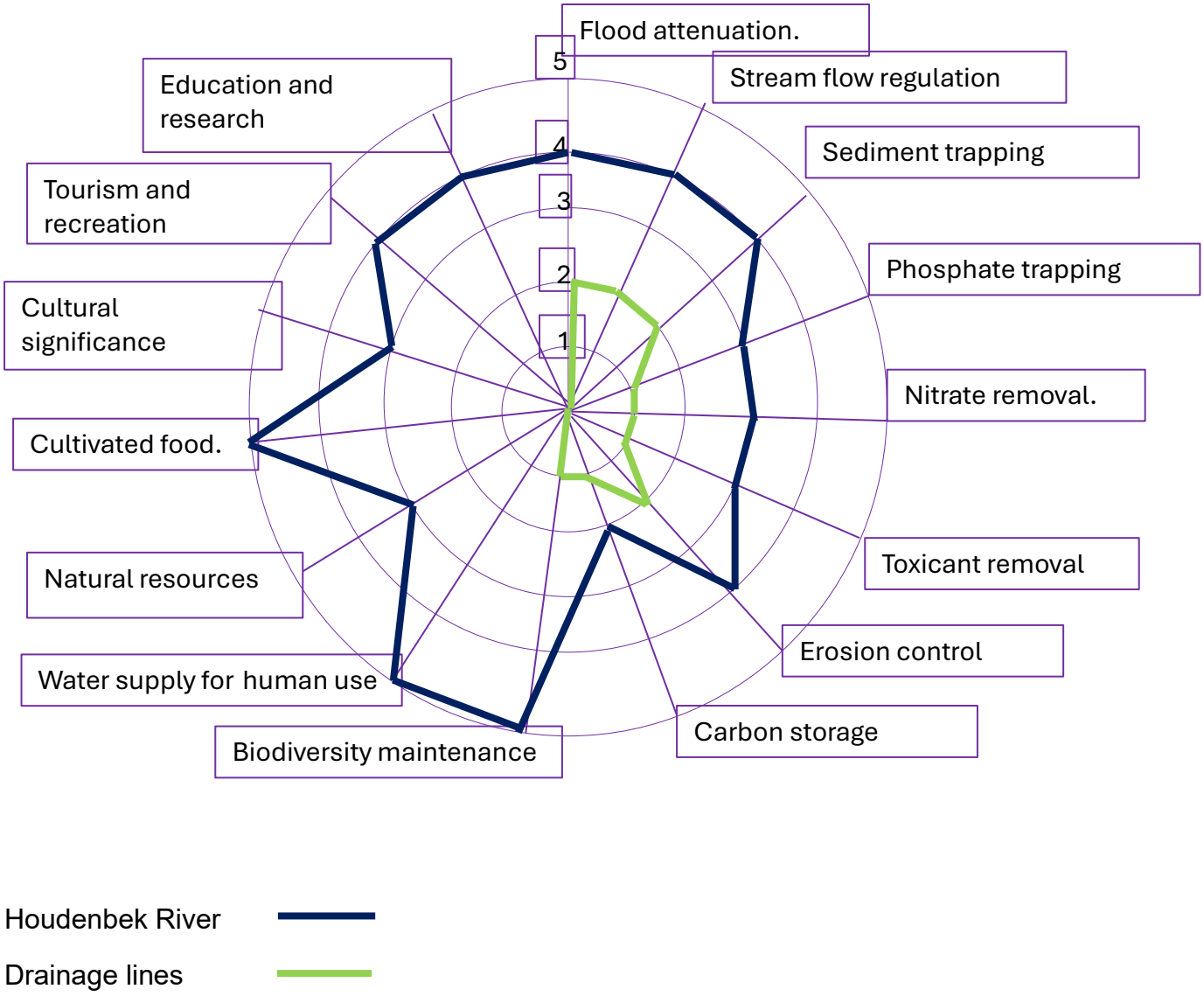

Figure 14. Resource Economics Footprint of the Houdenbek River and the Drainage Lines

19 Numerical Significance

Decision-makers often press on a numerical score for Significance, in this event the significance of the impact that the sinking of the new borehole had on the local and regional aquatic environment. This evaluation is an attempt to put a numerical value to an Impact Assessment. The score takes into consideration both the environmental value of the site and the degree of impact.

Table 25.3, p50, Appendix provides a system for allocation values for each of the parameters Conservation Value, Extent, Duration, Severity and Likelihood with regard to possible impacts on the aquatic environment. These values are then entered into the equation on p51 to derive at a value for Significance. The value for Significance can subsequently be evaluated according to Table 25.1.2.

Table 25.1.2 provides a yardstick for decision-making to allow or disallow a development with its concomitant impact on the aquatic environment.

The scores that were given (Table 11) are entirely those of the specialist, 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	Houdenbek River
Conservation value	1	4
Likelihood	5	3
Duration	5	5
Extent	1	1
Severity	5	1
Significance	16	40
	Low	Medium/Low

The significance of the drainage line's gross alteration is insignificant, because it has a low conservation value.

On the other hand, the significance of the impact on the Houdenbek River, however small, is rated as medium, because of its high conservation value.

20 Summary

Table 12 Summary of evaluations

Aspect	Status
DFFE Screening Tool	Sensitivity Medium, High, Very High
Conservation status	CBA, ESA, NFEPA, Strategic Mountain Catchment Area, National Protected Area Expansion Strategy
Vegetation	Endangered
PES	B, C, D
Ecological Importance drainage lines	Not important.
Ecological Importance Houdenbek River	Very important
Ecological Sensitivity drainage lines	Sensitive
Ecological Sensitivity Houdenbek River	Sensitive
EISC drainage lines	Low
EISC Houdenbek River	High
Impact assessment	Impacts can be mitigated.
Risk Matrix	General Authorization
Resource Economics	Small footprint.
Numerical Significance drainage lines	Insignificant
Numerical Significance Houdenbek River	Medium

Table 12 gives an overall and much condensed view of the assessments and the methodologies.

Words such as high ecological sensitivity, CBA, mountain catchment area, endangered vegetation and ecologically sensitive would probably alert decision-making authorities, as these words do when the environment is at stake.

Other words, such a low ecological importance and a very small resource economic footprint may set the mind at rest. Not much would be lost if the drainage lines are lost to farming and economic development.

The possible impacts on the Houdenbek River with a high EISC classification stand out. These impacts would be additional to the large-scale farming already on the ground. However, these impacts can be mitigated.

However alarming in some respects, the summary table does not provide adequate reason as not to allow the proposed development.

21 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 15). The WULA and the EIA must provide mitigation measured for these impacts.'

Figure 15 has been adapted from DWS policy documents.

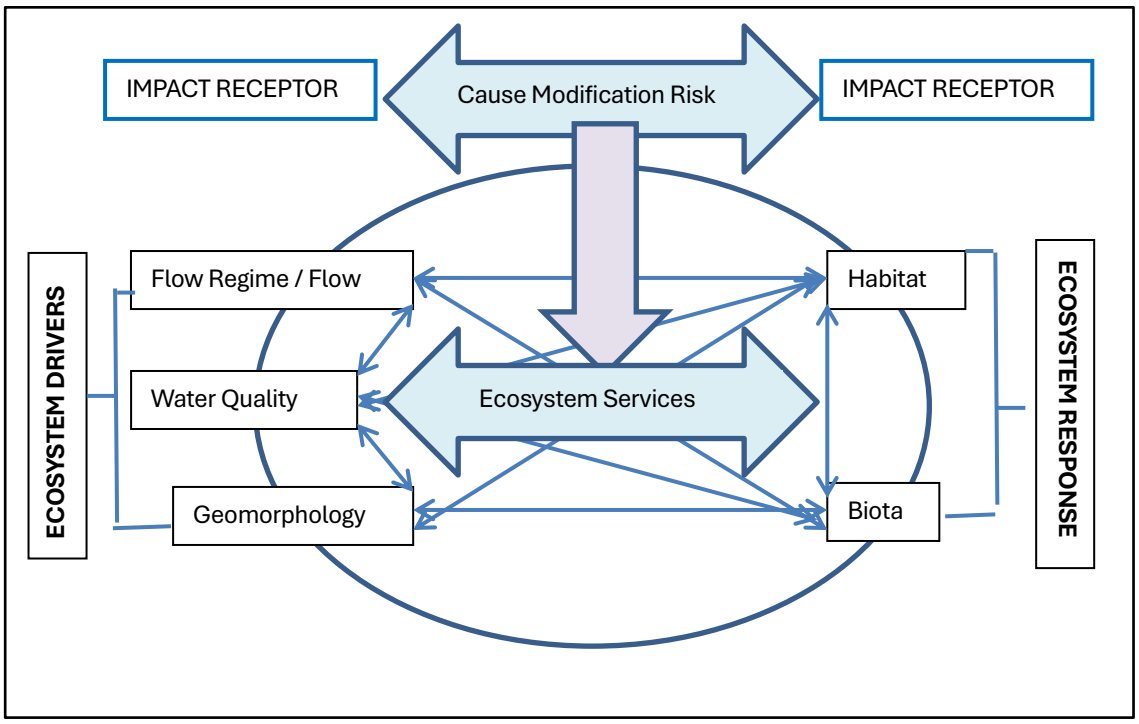

Figure 15 Minimum Requirements for a S21(c) and (i) Application.

The conclusions can be structured along the outline that is provided by Figure 15.

The ecological driver of the Doring River and its tributaries, such as the Houdenbek River, is the rain during winter. Rain is erratic, sometimes torrential, with the river coming down in a fierce and abundant flood, sometimes subdued, with the river only a shadow of what it can be. Flooding does not happen each year. Low flow conditions can last for several years.

The Houdenbek River stops flowing in summer. It can dry up altogether. In winter it can swell into a wide wetland, a spectacular and radical change. The distance between the edge of the wetland and existing orchards can be far less than the 500m controlled zone. The proposed development of Winkelhaak Farm is no exception. This called for a WULA, Freshwater Report and a completed Risk Matrix.

During summer, with the retracted river, now far away from the proposed development, but with summer heat and ripening fruit demanding irrigation, agricultural return flow can be prevented from reaching the river. Mitigating measures can be implemented that nutrients from fertilisers and sediments out of the orchards reach the river.

The drainage lines on the terrain of the proposed development are of little aquatic ecological value. If lost to development, it would not be disastrous. The drainage lines can still play a major role to calm raging flood water coming down the mountain side. It can still do much to prevent agri-chemicals and silt from reaching the river.

This report focusses on the new orchard and is possible impacts on the aquatic environment. It does not refer to additional water abstraction or on the stage of water in any new dam. These are covered in previous and other reports and in other applications for approvals.

It is recommended that the proposed orchard given the go-ahead with a General Authorisation. I License is not called for.

22 References

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23 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 2 September April 2024

24 Résumé

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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
- Wetland demarcation, Farm Gustrouw 918, Somerset West
- Freshwater Report, New vineyard, Plot 1181, Kakamas
- Freshwater Report, Farm 91, Riversdale.

25 Appendix

25.1 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 25.1.1 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 25.1.2 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 25.1.3 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 25.1.4 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.

25.2 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

Table 25.3 Numerical Significance

Table 25.3.1 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 25.3.2 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 25.3.3 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)