



**SOUTH AFRICAN FRUIT EXPORTERS (PTY) LTD**

## **Fresh Water Report**

**Proposed new dam for**

## **Farm Bonathaba, Malmesbury**

A requirement in terms of the National Water Act (36 of 1998).  
June 2020



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## Abbreviations

|  |        |
|--|--------|
| Average Score Per Taxon                                      | ASPT   |
| Critical Biodiversity Area                                   | CBA    |
| Department of Environmental Affairs                          | DEA    |
| Department of Environmental Affairs and Development Planning | DEA&DP |
| Department of Water and Sanitation                           | DWA    |
| Ecological Importance  | EI     |
| Ecological Sensitivity                                       | ES     |
| Environmental Impact Assessment                              | EIA    |
| Government Notice  | GN     |
| Metres Above Sea Level                                       | masl   |
| National Environmental Management Act (107 of 1998)          | NEMA   |
| National Water Act (36 of 1998)                              | NWA    |
| Present Ecological State                                     | PES    |
| South Africa National Biodiversity Institute                 | SANBI  |
| South African Scoring System Version 5                       | SASS5  |
| Water Use License Application                                | WULA   |

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## 1 Introduction

South African Fruit Exporters (Pty) Ltd, SAFE in short (<https://www.safe.co.za/>), describes its core business as

*“We farm and market our own fruit”.*

SAFE is a cohesive conglomerate of at least 10 companies, including a number of farms all over South Africa, with an annual revenue of more than 11 million US dollars. One such farm is Bonathaba along the Berg River in the Western Cape, to the north of Swellendam.

During the site visit on 8 June 2020, it was abundantly evident that Bonathaba Farm is a state-of-the-art undertaking, using the very latest farming techniques and practices as implemented by most competent people who are adamant to deliver top quality farm produce to the most discerning international consumer.

Bonathaba has appointed Enviro Africa to conduct the legally required EIA for the envisaged farm dam, along with the public participation (Figure 1).

The construction of a dam will probably have an impact on the aquatic environment and will have to be addressed if approval for the dam is to be granted by the South African environmental authority, in this event DEA&DP, the Western Cape Provincial representative of the DEA.

To assess any possible impacts on the aquatic environment, Enviro Africa, in turn, has appointed Dr Dirk van Driel of WATSAN Africa.

The Bonathaba farming venture is currently classified as an “Existing Legal Water Use” by the DWS. Hence there is no need to apply for more abstraction of water from the Berg River to fill the dam. The construction of the new dam “triggers” a number of “activities” in terms of the NEMA and its regulations. For this reason a “Fresh Water Report” is required.

It was thought best to follow the same outline and profile that is required for a Fresh Water Report for WULA’s. This is a recognised and tested format, which provides the best and most answers to questions raised by the DEA. At the same time it would provide the information required by the DWS for an informed decision, should it be required.

The Bonathaba Dam is considered to be an instream dam.

## NEMA PUBLIC PARTICIPATION PROCESS

**PROPOSED DEVELOPMENT OF AN INSTREAM DAM ON PORTIONS 2 AND 3 OF FARM NO. 1100, BONATHABA, MALMESBURY, WESTERN CAPE**

Notice is hereby given of the intention to submit an application, and the public participation, process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended ("NEMA"), Environmental Impact Assessment Regulations, 2014 (as amended). The proposed development of an in-stream dam on Portion 2 and 3 of the Farm No. 1100, Bonathaba, Malmesbury, Western Cape, and includes activities listed in terms of the NEMA EIA Regulations, 2014 (as amended).

EnviroAfrica cc has been appointed by Black Orchid Farming (Pty) Ltd, to undertake the NEMA EIA Application for Environmental Authorisation process and Schoeman en Vennote was appointed to undertake the WULA for the following listed activities:

**Application for environmental authorization to undertake the following activities:**

Government Notice R327 (Listing Notice 1): Activity No. 9, 12, 19 and 27  
 Government Notice R325 (Listing Notice 2): Activity No. 16  
 Government Notice R324 (Listing Notice 3): Activity No. 14  
 Section 21 of NWA: 21(b), 21(c), and 21(i).

**Project Description & Location:**

The proposed development of an in-stream dam on Portions 2 and 3 of Farm No. 1100, Bonathaba, Malmesbury, Western Cape. The proposed in-stream dam will have a water surface area of 15.5 Ha and will have a gross storage capacity of 1 000 500m<sup>3</sup>. The dam will have a maximum wall height of 18m. The site has existing water use rights and the proposed dam will provide insurance of supply for irrigation of the existing irrigation areas. No new roads will be constructed as an existing access road will be utilised to gain access to the proposed site. The proposed site is located outside of the urban area of Malmesbury, on Farm Bonathaba, is Agriculture zoned, and the site co-ordinates are 33° 31' 13.58" S, 18° 55' 15.27" E.

**Public Participation:** Interested and Affected Parties (I&APs) are hereby notified of the application and invited to register (in writing) and/or provide initial comments and identify any issues, concerns or opportunities relating to this project to the contact details provided below. The commenting period on the EIA process will end on **17 July 2020**. However, given the current Covid-19 period, I&APs must provide their comment **within a reasonable time after 17 July 2020**. The commenting period on the WULA process will end on **14 August 2020**. In order to register or submit comment, I&APs should refer to the project name, and provide their name, address & contact details (indicating your preferred method of notification) and an indication of any direct business, financial, personal, or other interest which they have in the application. Please note that future correspondence will only be sent to registered Interested and Affected Parties.

**Please note that only Registered I&APs:**

- will be notified of the availability of reports and other written submissions made (or to be made) to the Department by the applicant, and be entitled to comment on these reports and submissions;
- will be notified of the outcome of the application, the reasons for the decision, and that an appeal may be lodged against a decision; and
- will be notified of the applicant's intention to appeal the decision of the competent authority, together with an indication of where and for what period the appeal submission will be available for inspection;

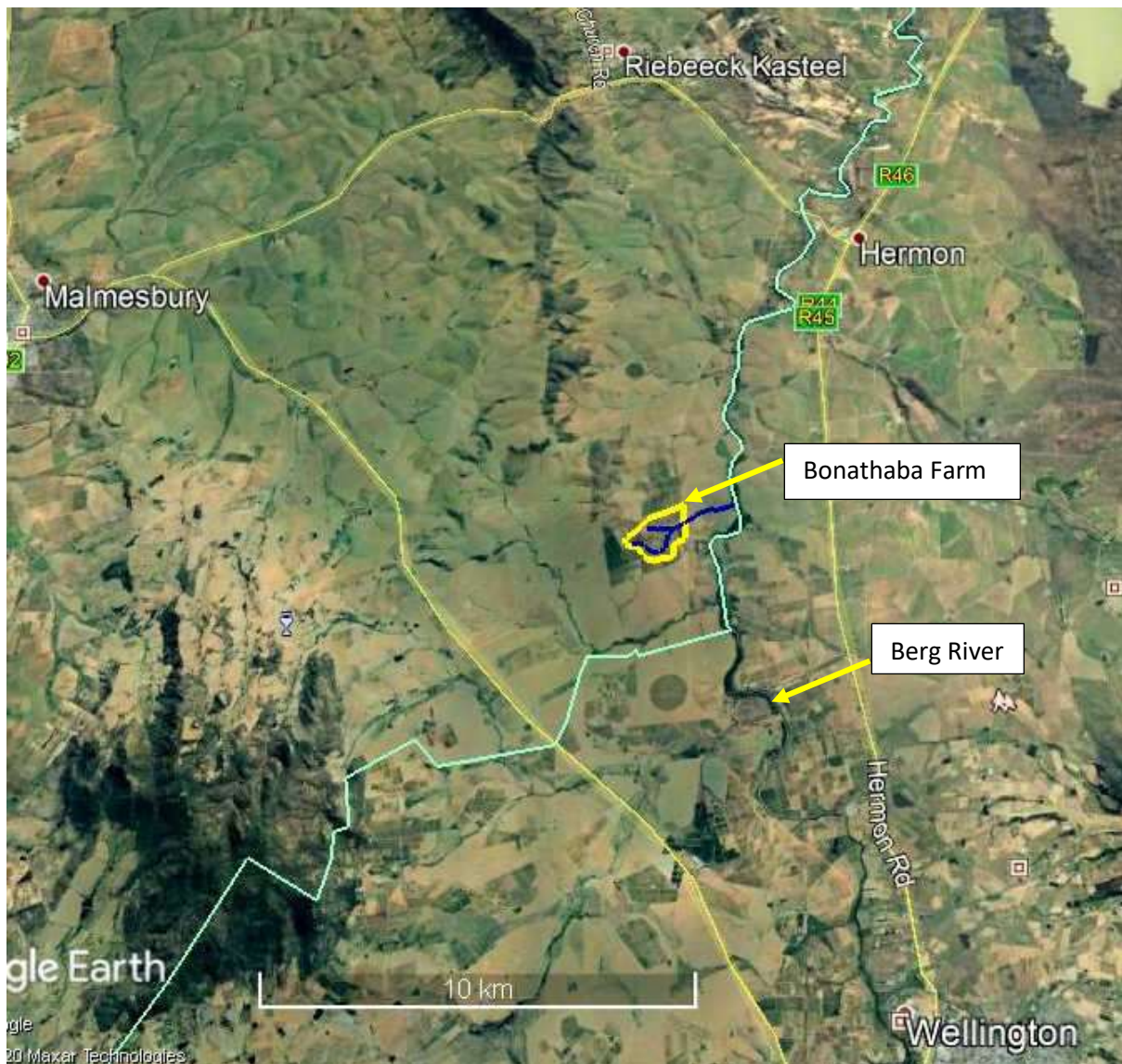
You are also requested to pass this information to any person you feel should be notified.

**EIA Consultant:** EnviroAfrica CC / P.O. Box 5367, Helderberg, 7135 / Fax: 080 512 0154 / Tel: 021 8511816 / E-mail: [amb@enviroafrica.co.za](mailto:amb@enviroafrica.co.za)  
**WULA Consultant:** Schoeman en Vennote / Call: 062 778 5180 / E-mail: [franscois@andose.co.za](mailto:franscois@andose.co.za)

**PROPOSED DEVELOPMENT OF AN INSTREAM DAM ON PORTIONS 2 AND 3 OF FARM NO. 1100, BONATHABA, MALMESBURY, WESTERN CAPE**

Figure 1 Public Participation

## 2 Locality



**Figure 2** Locality

The locality of Bonathaba Farm is indicated in Figure 1. It is located between Wellington and Hermon along the Berg River. The coordinates are as follows:

33°31'10.77"S  
18°55'26.52"E

The location of the Zwartfontein farm dam is shown in Figure 2. It is some 14km south of Riebeeckasteel and 18km south west of Malmesbury.

The dam site is shown in Figure 3.



**Figure 3** Dam site

### **3 Quaternary Catchment**

Bonathaba is in the G10D quaternary catchment

### **4 Vegetation**

According to the SANBI webpage, Bonathaba Farm is located on Swartland Schale Renosterveld, which is listed as endangered. Conservation authorities will take this in serious consideration in their decision-making processes.



## 5 The Project

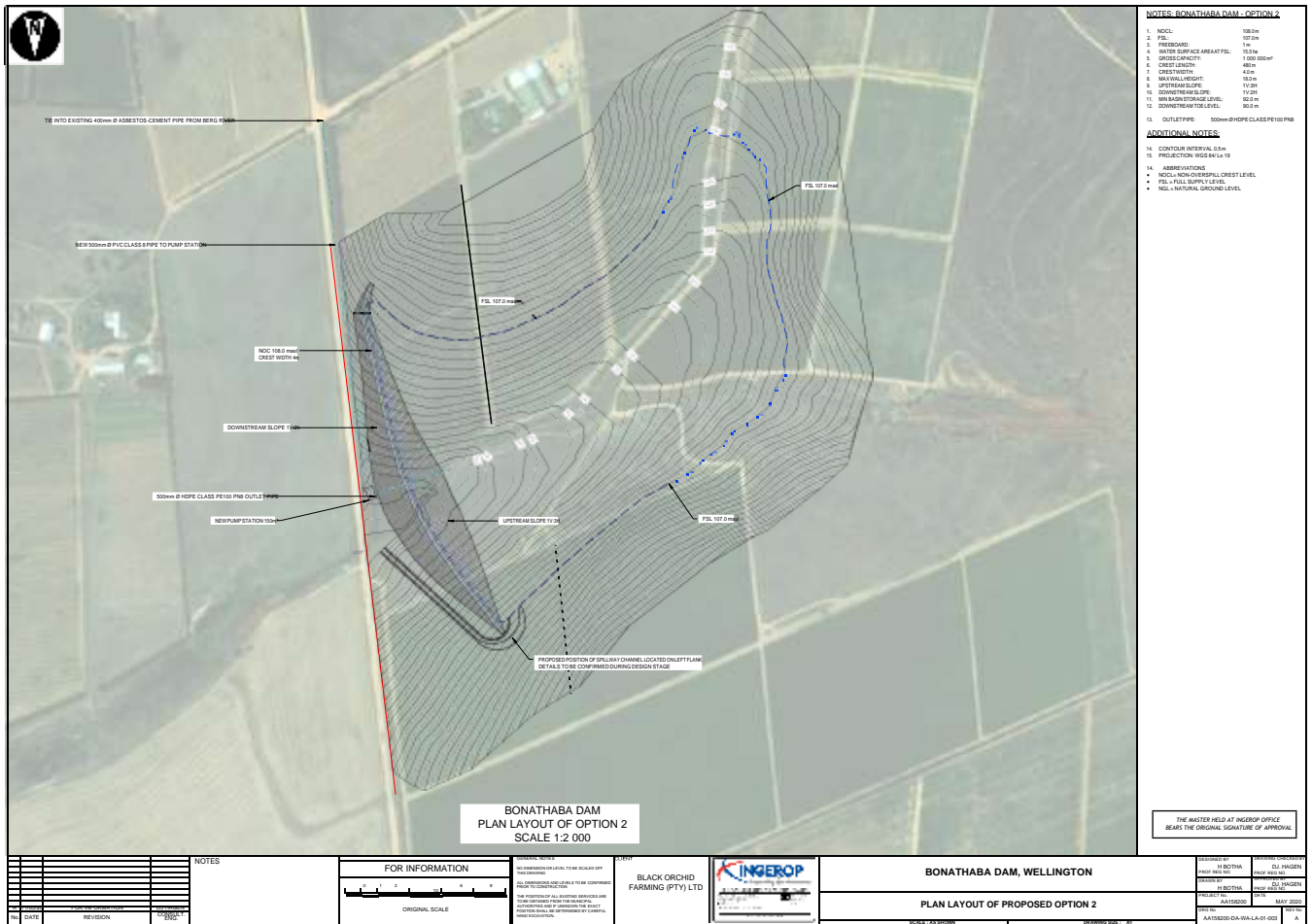


Figure 4 Site lay-out plan

The new dam of a million cubic metres is depicted in Figure 4. The dam wall will be along the dirt road right over the drainage line. The dam will cover some of the existing orchards and vineyards. According to the business unit manager, the loss of these assets, as they will be under water, does not really matter as these are over 25 years old and will have to be replaced, if they were to operated profitable.

The dam is to be filled from an existing pipeline out of the Berg River, according to an existing legal water use.

## 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 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.*

Some part of 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. A part of the development is in the river and the river bed. Consequently, this regulation is relevant to this application.

This Fresh Water Report is exclusively focussed in S21 (c) and (i) of the NWA. Should it ever become necessary to extend a WULA to the taking of water from a resource in terms of S21 (a) or the storing of water in the enlarged dam in terms of S21(b), a

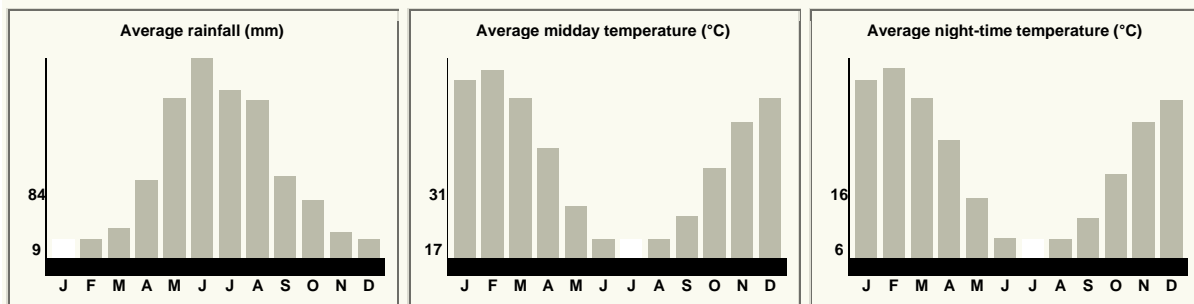
separate report is required, focussed on the specific requirements of these two sub-sections of the NWA. Under the current circumstances, this is not called for.

## 7 Hermon Climate

[http://www.saexplorer.co.za/south-africa/climate/hermon\\_climate.asp](http://www.saexplorer.co.za/south-africa/climate/hermon_climate.asp)

The hamlet of Hermon on the banks of the Berg River is less than 10km away from Bonathaba.

Hermon normally receives about 471mm of rain per year and because it receives most of its rainfall during winter it has a Mediterranean climate. The chart below (Figure 2, lower left) shows the average rainfall values for Hermon per month. It receives the lowest rainfall (9mm) in January and the highest (84mm) in June. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Hermon range from 17.3°C in July to 30.2°C in February. The region is the coldest during July when the mercury drops to 6°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures.

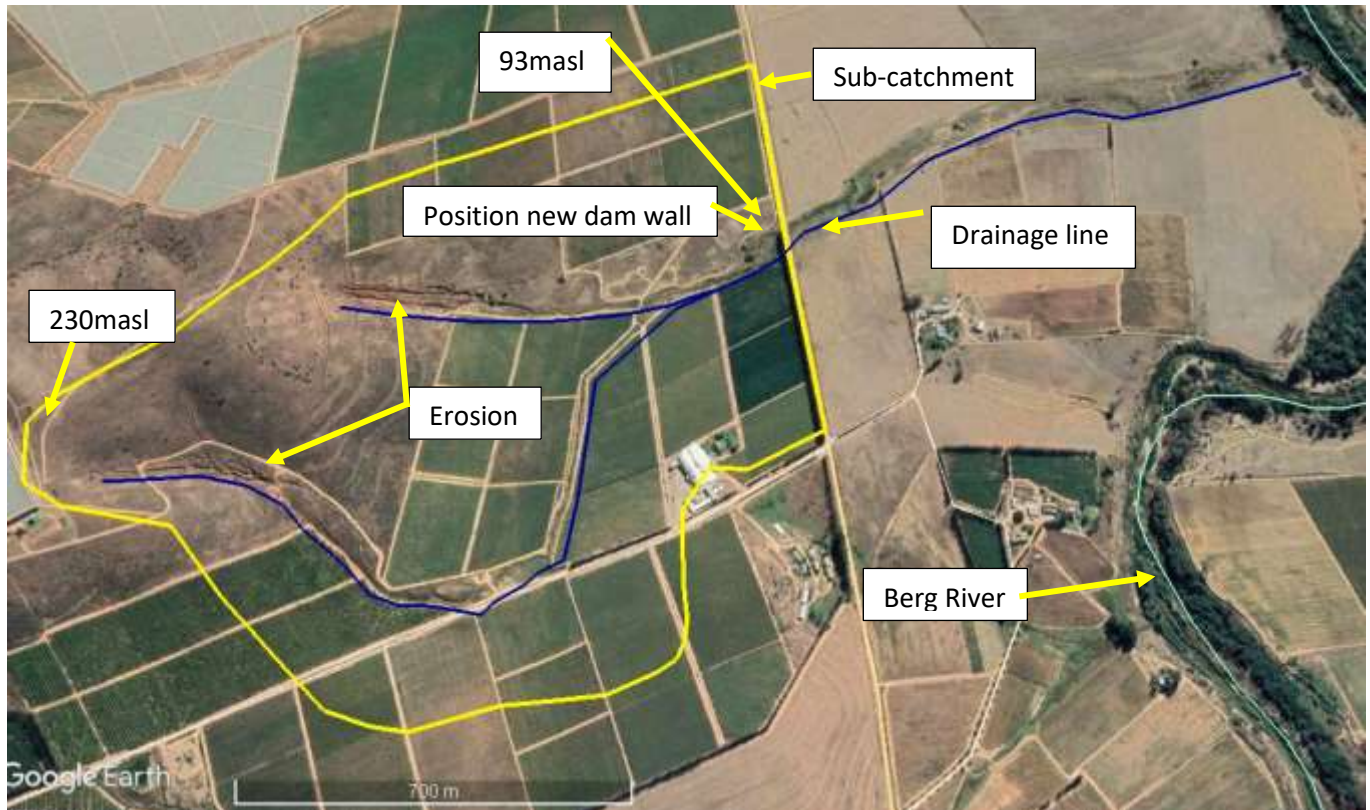


**Figure 5 Hermon Climate**

The rainfall is too little to sustain the Bonathaba fruit farming venture. The farming industry heavily depends on the Berg River's water for irrigation. Because of the absence of rain during mid-summer when water is most needed, water is taken from the river during the rainy winter months and then stored in dams for irrigation later on when it becomes really dry later on in summer.

## 8 Sub-Catchment

The sub-catchment in which the proposed dam is located is one of many along the Berg River in among the vineyards and the wheat fields (Figure 6).



**Figure 6** Sub-Catchment

The surface area of the sub-catchment upstream from the proposed new dam has been estimated by the use of the Google Earth polygon function. It is a small sub-catchment of only 140ha.

The drainage line is mostly dry, with only water during and shortly after winter rainfall events. It is 3.3km long, from where it rises in the hills above the farm, to its confluence with the Berg River. The new dam wall will be 1.4km away from the Berg River.

The highest point is at 230masl. The dam wall will be located at 93masl. This is a drop of 137m, which represents a drop of 8.9 vertical metres in every 100 horizontal metres. This is a very steep slope that can give rise to an extremely high erosion potential.

The quarzitic soil is sandy, with some clay, but not enough clay to prevent erosion. Down the slope, in the two tributaries of the drainage line, serious erosion has taken place (Figure 7 and 8). This erosion is visible on the Google Earth image (Figure 6).

Erosion can be construed as a threat to the new dam, as it will predictably be filled in over time, following a succession of large winter rain events. The filling up rate can

probably be estimated by specialists in this field, but it could be significant, with the dam losing a large part of its storing capacity within a period of 10 to 20 years.

It makes economic sense to investigate the erosion potential and to subsequently design an erosion control system. This would comprise of a combination of upstream



**Figure 7** Erosion

smaller dams, walls, canals, levies and other hard structures directed at slowing down the flow, settling out of mobilised sediments and preventing further erosion. This will have to be designed and overseen by a professional person with experience in the control of erosion.

The current effort of controlling erosion with old tyres and building rubble (Figure 9) is definitely not adequate.

Lower down the slope, in among the orchards and vineyards, the drainage line has been straightened into irrigation return flow channels. The consequent increase in flow rate and erosion, the channels deepened to some 2 to 3 metres. The channels have been overgrown with reeds (Figure 10). To prevent clogging of the channels, they are cleared with an excavator once in three or four years, according to the manager.

The creation and maintenance of these channels will contribute to an increased sedimentation or filling rate of the proposed dam.



**Figure 8** Erosion (Continued)



**Figure 9** Erosion control



**Figure 10** Irrigation return flow channel

The proposed dam wall will be constructed adjacent and just uphill from the road (Figure 11), on the other side of the row of beefwood trees. Here the drainage line passes through a pipe culvert underneath the road.

Downstream from the road, the drainage line is overgrown with *Typha* reeds (Figure 12). The growth of reeds is probably aided by the runoff from the road, apart from the water out of the drainage line. *Phragmites* reeds are growing upstream of the road.

The confluence of the drainage line with the Berg River is at an elevation of 77masl. This represents a slope of one vertical metre in every 100 horizontal metres. This is a much more even slope, with a slower flow of storm water spreading out over a wide area, which is conducive to deposition of mobilised sediments. Much of the mobilised soils from up the hill was probably deposited in this area (Figure 13).

Just before the confluence with the Berg River, a shallow channel has been scoured out in the flood plain to give rise to a channelled wetland (Figure 14).

The floodplain is overgrown with the rush *Juncus kraussii* (Figure 15).

The Berg River here is heavily overgrown with blue gum eucalyptus trees. The massive effort to remove these trees, with large piles of felled trees along the river (Figure 16). Obviously, this work is still to be completed. As there are many more of these invasive trees to be cleared out of the river.



**Figure 11 Road**



**Figure 12 Reeds**





**Figure 13** Lower drainage line flood plain



**Figure 14** Shallow channel



**Figure 15** *Juncus kraussi*



**Figure 16** Wood stacks

## 9 Biomonitoring Sampling Point



**Figure 17** Pump house



**Figure 18** Sampling point

The sampling site was chosen where the pump house (Figure 17) was located in the Berg River to abstract water for the farming operation. It was chosen because the river was accessible, with a patch on the bank not overgrown with dense vegetation (Figure 18).

The banks of the river were very steep, the river deeply incised, which limited accessibility.

The location here was at

33°31'18.56"S  
18°56'00.83"E

The river here was approximately 15m wide. It was flowing slowly, at some  $0.1\text{ms}^{-1}$ , in the middle, with pool-like conditions. There was water cress that made both submerged and emerging vegetation habitat, with a little submerged *Myriophyllum*. There was some shallow water next to the bank, but most of it was deep, along the rocky shore.

The water was very clear, with perhaps 2m of underwater visibility, but dark in colour, as if this was water freshly let out of the Berg River Dam.

The oxygen concentration of only  $4.6\text{mg l}^{-1}$  was much less than is usually seen in the lower Berg River, which again left the impression that this water was water let out of the bottom of the Berg River Dam.

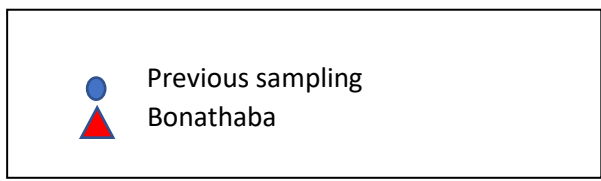
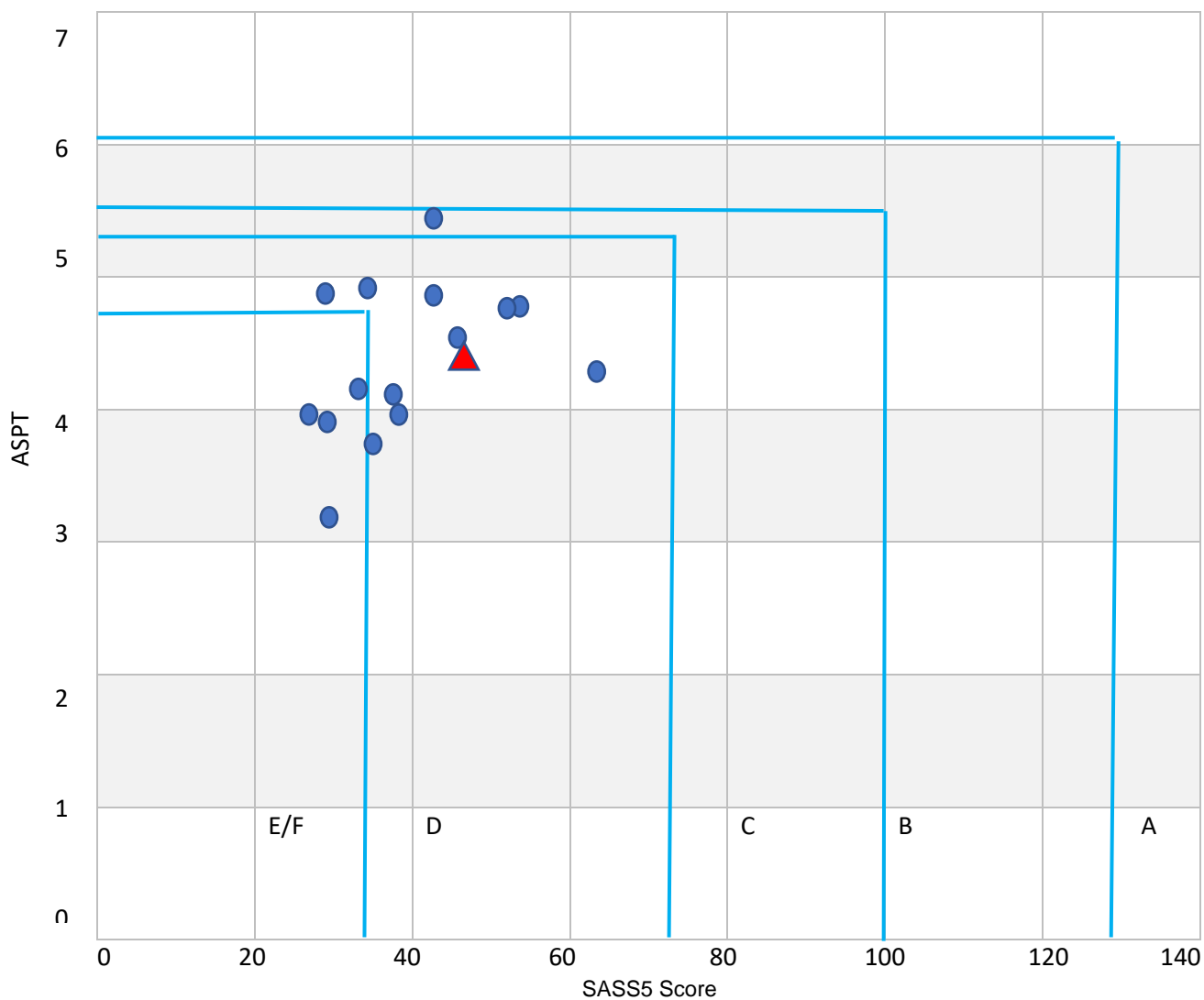
The riparian zone previously was overgrown with a stance of mature *Eucalyptus* trees, which were removed. Regrowth is threatening the gains that have been made with the control program and follow-up action is now required. A large portion of these trees remain (Figure 16).

Aquatic life was prolific on the day of sampling, with lots of macro-invertebrates. This was against expectations, as winter was in full swing, with cold water. But then the first winter floods have not started yet.

## 10 Biomonitoring Results

The SASS5 score (see SASS5 score sheet in the Appendix) at 47 was an average score for a mature river on a coastal plain, but with a high number of taxa. However, the aquatic invertebrates were of the low-scoring type, with the result that the ASPT amounted to only 4.3. The score represented a class D (Figure 19), which signifies a "Fair" state-of-the-river.

To put the classification into perspective, from 2015 to 2017 samples were taken for a previous project at the Moredou Poultry Farm near Gouda, some 23km downstream, as the crow flies. Most of these samples resulted in a class D as well (Figure 19). The SASS5 score at Bonathaba was generally higher than those at Moredou, but the ASPT



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

**Figure 19** Biomonitoring

more or less the same (Figure 1). There are more impacts downstream, such as an abattoir and a dairy farm, which could explain the lower score at Moredou, but then the entire Berg River is impacted. Upstream of Bonathaba are numerous sources of agricultural return flow, wastewater treatment works and urban storm water.

The National River Health Program classified the Berg River downstream of Hermon classified as “D” of “Fair” as well (DWAF, 2004).

Evidently the Berg River has not deteriorated or improved since 2004 and the impacts from the Bonathaba Farm seemingly does not alter the situation.

## 11 Present Ecological State (PES)

**Table 1** Habitat Integrity according to Kleynhans, 1999

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

The PES is a protocol that have been produced by Dr Neels Kleynhans (Table 1 and 2) in 1999 of the then DWAF to assess river reaches. The PES is one of the evaluations that is prescribed for S21 (c) and (i) WULA’s. The scores given are solely that of the practitioner and are based on expert opinion.

The drainage line has been classified as “E” (Table 2). This signifies that the drainage line has been significantly altered with a loss of ecological functioning.

The new dam will probably result in further deterioration. That would not be a significant loss, as there is not much to lose, to start with.

On the other hand, a dam would create a new aquatic habitat, entirely different. Irrigation dams typically have fluctuation water levels, from full to empty, in a short space of time, which renders this an aggressive habitat. If 10 or 15% of the volume could be left, it would be a more benign habitat with conditions more conducive to the survival of a variety of aquatic organisms.

The Berg River at Bonathaba was classified as a “C” (Table 3). It has lost some ecological functioning because of water quality and invasive organisms both instream and in the riparian zone. This score is better than the “D” downstream at Moredou, where the river is heavily overgrown with eucalypts.

**Table 2** Present Ecological State Bonathaba Drainage Line

|                                | Score | Weight | Product | Maximum |
|--------------------------------|-------|--------|---------|---------|
|                                |       |        |         | score   |
| <b>Instream</b>                |       |        |         |         |
| Water abstraction              | 24    | 14     | 336     | 350     |
| Flow modification              | 4     | 13     | 52      | 325     |
| Bed modification               | 3     | 13     | 39      | 325     |
| Channel modification           | 4     | 13     | 52      | 325     |
| Water quality                  | 9     | 14     | 126     | 350     |
| Inundation                     | 4     | 10     | 40      | 250     |
| Exotic macrophytes             | 6     | 9      | 54      | 225     |
| Exotic fauna                   | 24    | 8      | 192     | 200     |
| Solid waste disposal           | 12    | 6      | 72      | 150     |
| Total                          |       | 100    | 963     | 2500    |
| % of total                     |       |        | 38.5    |         |
| Class                          |       |        | E       |         |
| <b>Riparian</b>                |       |        |         |         |
| Water abstraction              | 24    | 13     | 65      | 325     |
| Inundation                     | 4     | 11     | 44      | 275     |
| Flow modification              | 3     | 12     | 36      | 300     |
| Water quality                  | 9     | 13     | 117     | 325     |
| Indigenous vegetation removal  | 4     | 13     | 52      | 325     |
| Exotic vegetation encroachment | 5     | 12     | 60      | 300     |
| Bank erosion                   | 4     | 14     | 56      | 350     |
| Channel modification           | 3     | 12     | 36      | 300     |
| Total                          |       |        | 466     | 2500    |
| % of total                     |       |        | 18.6    |         |
| Class                          |       |        | F       |         |

**Table 3** Present Ecological Berg River at Bonathaba

| Instream                       |       |        |         | Maximum |
|--------------------------------|-------|--------|---------|---------|
|                                | Score | Weight | Product | score   |
| Water abstraction              | 15    | 14     | 210     | 350     |
| Flow modification              | 15    | 13     | 195     | 325     |
| Bed modification               | 15    | 13     | 195     | 325     |
| Channel modification           | 20    | 13     | 260     | 325     |
| Water quality                  | 18    | 14     | 210     | 350     |
| Inundation                     | 15    | 10     | 234     | 250     |
| Exotic macrophytes             | 20    | 9      | 180     | 225     |
| Exotic fauna                   | 5     | 8      | 40      | 200     |
| Solid waste disposal           | 24    | 6      | 144     | 150     |
| Total                          |       | 100    | 1668    | 2500    |
| % of total                     |       |        | 66.7    |         |
| Class                          |       |        | C       |         |
| Riparian                       |       |        |         |         |
| Water abstraction              | 15    | 13     | 195     | 325     |
| Inundation                     | 15    | 11     | 165     | 275     |
| Flow modification              | 15    | 12     | 180     | 300     |
| Water quality                  | 20    | 13     | 260     | 325     |
| Indigenous vegetation removal  | 10    | 13     | 130     | 325     |
| Exotic vegetation encroachment | 12    | 12     | 144     | 300     |
| Bank erosion                   | 18    | 14     | 252     | 350     |
| Channel modification           | 15    | 12     | 180     | 300     |
| Total                          |       |        | 1506    | 2500    |
| % of total                     |       |        | 60.2    |         |
| Class                          |       |        | C       |         |

The better score is because of the lack of return flow at the end of the dry season, but was influenced by the water out of the Berg River Dam. The score was elevated by the invasive vegetation eradication campaign, during which eucalypts were removed. Carp dominated the instream habitat, with many large specimens visible in the clear water. These fishes often surfaced to emphasize their presence.



## 12 Ecological Importance

### 12.1 Ecological Importance of the Berg River

The Ecological Importance (EI) is based on the presence of especially fish species that are endangered on a local, regional or national level (Table 4).

Endemic fish to the region such as the Cape galaxias (*Galaxias zebratus*) and the red fin minnow (*Pseudobarbus burgeri*) can be expected in the upper reaches of the watershed rather than at Bonathabo. Perhaps white fish (*Barbus andrewi*) was present at some time ago. These have been decimated by the introduction of the exotic and predatory small mouth black bass (*Micropterus dolomieu*) and trout (*Oncorhynchus mykiss*). At Bonathabo the habitat has been taken over by carp (*Cyprinus carpio*).

Red fin minnows and white fish have both been listed by the IUCN as endangered.

With 2 species on the Red Data List, the Berg River certainly qualifies as ecologically important (Table 4). Conservation authorities therefore take a keen interest in the Berg River and as public environmental consciousness rises, the pressure for habitat rehabilitation will predictably increase.

**Table 4.** Ecological Importance according to endangered organisms (Kleynhans,1999).

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

### 12.2 Ecological Importance of the Bonathaba Drainage Line

The drainage line is devoid of permanent water, apart from irrigation return flow. There are no fish in the drainage line, or for that matter, any other plant or animal that are endangered in any way. Perhaps there were some prior to human impact. Hence the drainage line, in its current state, cannot be considered as being ecologically important.

## **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.

### **13.1 Ecological Sensitivity of the Bonathaba Drainage Line**

It seems unthinkable that the Bonathaba drainage line, as many other in the district, would ever recover, if agriculture was to cease and nature was to be left at its own devices. The current impact is of such a nature and scope that recovery seems not possible.

Looking at the surrounding renosterveld as a well-known practical example, when removed for the purpose of agriculture and then left to recover, the natural vegetation does not grow back. Cultivated areas all over the area and that have been left alone for 50 or even 100 years, have not recovered. Likewise, it can be expected that the Bonathaba drainage line would not recover. In this sense it can be considered as sensitive.

### **13.2 Ecological Sensitivity of the Lower Berg River**

The Berg River at Bonathaba has absorbed numerous and deep-cutting human impacts. Yet it 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 Berg River might have some more capacity to absorb further impact.

It was pleasing to note the recovery of the riparian zone during the site visit. It still has a very long way to go if it were to resemble anything like the original vegetation. This would probably not happen for many decades and in this respect the riparian zone can be described as sensitive.

## **14 Possible Impacts**

The Fresh Water Report is not only about the possibility of the extra water that could be taken from the Berg River because of the enlarged dam. It is accepted that the existing legal water use is already fully utilised for irrigation, has already been discounted by the DWS against the flow requirements of the Berg River and that extra storage capacity would not alter the situation.

Nevertheless, biomonitoring in the Berg River that was done for this application is a regular requirements for WULA's. It serves as background, should it in future transpire that incremental water quality and quantity impacts from Bonathabo and other locations along the river become apparent.

This report is particularly about the assessment of water courses on the Bonathabo property and the possible effects of the new dam on these water courses. With any large irrigation scheme there is always the possibility of more agricultural return flow, with its deleterious impacts.

The drainage lines have already been transformed into storm water management systems and return flow canals. The new dam would not add to these impacts, if only the farm's management endeavours to conserve the little ecological functioning that is still left in these canals.

Farm dams are often regarded as habitat for aquatic organisms. However, water levels vary widely, from full when filled during winter to empty at the end of summer. This makes for an aggressive aquatic environment with limited ecological functioning.

With such a large turn-over of water in the dam water quality problems are less of a problem.

## **15 Mitigation Measures**

The local irrigation board as well as the DWA has most likely already defined the schedule according to which water is to be taken from the Berg River. The DWS, according to its legal mandate, is already monitoring the Berg River water quality and water levels in terms of a long-standing national program. All that remains for Bonathaba is to operate within the ambit of their water use license.

The re-growth of eucalypts on the banks of the Berg River is worrisome and it would be helpful if Bonathaba could maintain contact with Working for Water and similar initiatives. The region would benefit greatly if landowners could contribute as well to this ongoing, worth-while and large-scale undertaking.

The prevention of more erosion in the upper sub-catchment has already been discussed. All that remains is to emphasise its importance.

From time to time it may become necessary to maintain and clear the drainage lines. Although already straightened and wholly de-naturalized, it is still of concern to the DWS and other conservation authorities to protect the little ecological functioning that

is still left. Maintenance should be done according to a premeditated plan, preferably in conjunction with a limnologist.

The reeds in the drainage lines serve the purpose of trapping sediments that may come out of the orchards and vineyards during high rainfall events. Therefore, the reeds should be preserved as much as possible and allowed to re-establish following maintenance.

Contemporary irrigation technology demands the measuring of soil moisture and irrigate accordingly. This would limit agricultural return flow.

The pumping of seepage and return flow back into the dam is commended and should be expanded if volumes increase.

The dam serves as a roost for water fowl. These birds should be monitored for disease and mortalities. Mortalities should be reported to relevant authorities.

There is no need for mitigation to address the eventuality of the dam overflowing when more than full. With a catchment area of only 140 hectares it is unlikely that the runoff would ever get a dam of a million cubic metres to overflow. It is unlikely that the dam would overflow because of high rainfall events.

There is no need for ecological maintenance releases from the new dam. The original ecological functioning of the drainage line has been entirely altered, with little conservation value left. There are nevertheless some aquatic species that would hold out in this environment. Nevertheless, it is not necessary to release water for the benefit of these few die-hards (e.g. clicking stream frog).

## **16 Impact Assessment**

Some of the decision-making authorities 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.

This impact assessment (Table 5) is solely directed towards the possible impacts of the proposed dam on the drainage line and the aquatic environment.

**Table 5 Impact Assessment**

| <p><b>Description of impact</b></p> <p>Construction of the dam wall, removal of filling material from the empty dam, placing it onto the current dam wall, compacting the material. Mud and sediments may end up in the drainage line below.</p> <p><b>Mitigation measures</b></p> <p>Prevent fill from leaving the construction site.<br/>Keep construction foot print as small as possible.<br/>Construct during the dry season in summer</p> |                |          |          |              |             |            |               |                  |
|---|----------------|----------|----------|--------------|-------------|------------|---------------|------------------|
| Type Nature   | Spatial Extent | Severity | Duration | Significance | Probability | Confidence | Reversibility | Irreplaceability |
| Without mitigation  |                |          |          |              |             |            |               |                  |
| Negative  | Regional       | Medium   | Medium   | Low          | Probable    | Certain    | Reversible    | Replaceable      |
| With mitigation measures  |                |          |          |              |             |            |               |                  |
| Negative  | Local          | Low      | Medium   | Low          | Unlikely    | Sure       | Reversible    | Replaceable      |

| <p><b>Description of impact</b></p> <p>Operation of the dam. Filling of the dam from the Berg River and abstraction from the dam for irrigation. Increased seepage through the dam wall and down the drainage line. Increased return flow.</p> <p><b>Mitigation measures</b></p> <p>Do not over-irrigate<br/>Measure return flow<br/>Pump return flow back into the dam</p> |                |          |           |              |             |            |               |                  |
|---|----------------|----------|-----------|--------------|-------------|------------|---------------|------------------|
| Type Nature   | Spatial Extent | Severity | Duration  | Significance | Probability | Confidence | Reversibility | Irreplaceability |
| Without mitigation  |                |          |           |              |             |            |               |                  |
| Direct  | Regional       | Medium   | Long term | Medium       | Probable    | Certain    | Reversible    | Replaceable      |
| With mitigation measures  |                |          |           |              |             |            |               |                  |
| Negative  | Local          | Low      | Long term | Low          | Unlikely    | Sure       | Reversible    | Replaceable      |

| <b>Description of impact</b><br>Maintenance of drainage line  |                |          |          |              |             |            |               |                  |
|---|----------------|----------|----------|--------------|-------------|------------|---------------|------------------|
| <b>Mitigation measures</b><br>Keep as much of the reeds as possible<br>Conserve of what is left of ecological functioning<br>Maintain according to a schedule |                |          |          |              |             |            |               |                  |
| Type Nature   | Spatial Extent | Severity | Duration | Significance | Probability | Confidence | Reversibility | Irreplaceability |
| Without mitigation  |                |          |          |              |             |            |               |                  |
| Direct  | Regional       | Medium   | Medium   | Medium       | Probable    | Certain    | Reversible    | Replaceable      |
| With mitigation measures  |                |          |          |              |             |            |               |                  |
| Direct  | Local          | Low      | Medium   | Low          | Probable    | Certain    | Reversible    | Replaceable      |

The mitigation measures are readily implementable. Mud and agri-chemicals can be prevented from moving down the drainage line and eventually in the Berg River, if care is taken and best practices are implemented.

| <b>Description of impact</b><br>Construction of erosion control structures  |                |          |             |              |             |            |               |                  |
|---|----------------|----------|-------------|--------------|-------------|------------|---------------|------------------|
| <b>Mitigation measures</b><br>Keep construction footprint as small as possible<br>Construct during dry season<br>Landscape and rehabilitate construction site |                |          |             |              |             |            |               |                  |
| Type Nature   | Spatial Extent | Severity | Duration    | Significance | Probability | Confidence | Reversibility | Irreplaceability |
| Without mitigation  |                |          |             |              |             |            |               |                  |
| Direct  | Regional       | High     | Medium term | High         | Definite    | Certain    | Irreversible  | Irreplaceable    |
| With mitigation measures  |                |          |             |              |             |            |               |                  |
| Positive  | Local          | Low      | Short term  | Low          | Definite    | Sure       | Irreversible  | Irreplaceable    |

The erosion mitigating structures are not regarded as further destruction of the drainage line, as the affected reaches are already all but destroyed. The net effect is positive, as large-scale movement of sediments would be prevented.

## 17 Risk Matrix

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 6 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report.

This assessment has been designed to assist in the decision if a General Authorisation or a License is required, should the development be allowed.

The risk rating according to this assessment is generally low. This suggests that a General Authorisation should be in order.

This only applies if all of the mitigation measures are in place.

**Table 6** Risk Matrix

| No. | Activity                                      | Aspect   | Impact                                    | Significance | Risk Rating |
|-----|---|--|---|--------------|-------------|
| 1   | Construction of dam wall                      | Mobilisation of sediments                                | Sediments in drainage line and Berg River | 24           | Low         |
| 2   | Operation enlarged dam                        | Agricultural return flow in drainage line and Berg River | Eutrophication                            | 54           | Low         |
| 3   | Maintenance of drainage line                  | Remove reeds   | Habitat destruction in drainage line      | 32.5         | Low         |
| 4   | Construction of erosion mitigating structures | Mobilisation of more sediments                           | Habitat destruction                       | 54           | Low         |

**Table 6** Continued Risk Rating

| No | Flow | Water Quality | Habitat | Biota | Severity | Spatial scale | Duration | Consequence |
|----|------|---------------|---------|-------|----------|---------------|----------|-------------|
| 1  | 1    | 1             | 1       | 1     | 1        | 1             | 1        | 3           |
| 2  | 2    | 1             | 2       | 1     | 1.5      | 1             | 2        | 4.5         |
| 3  | 1    | 2             | 1       | 1     | 1.25     | 1             | 1        | 3.25        |
| 4  | 3    | 1             | 1       | 1     | 1.5      | 1             | 2        | 4.5         |

| No | Frequency of activity | Frequency of impact | Legal issues | Detection | Likelihood | Significance | Risk Rating |
|----|-----------------------|---------------------|--------------|-----------|------------|--------------|-------------|
| 1  | 1                     | 1                   | 5            | 1         | 8          | 24           | Low         |
| 2  | 2                     | 4                   | 5            | 1         | 12         | 54           | Low         |
| 3  | 2                     | 2                   | 5            | 1         | 10         | 32.5         | Low         |
| 4  | 2                     | 4                   | 5            | 1         | 12         | 54           | Low         |

For the construction of erosion prevention structures, the base-line condition was taken as the already destructed eroded reaches of the drainage line. It was construed that the structures *per se* would not cause any further deterioration.

The risks are low, given that the drainage line is already heavily impacted and that the incremental impact of the larger dam wall would not make much difference.

## 18 Resource Economics

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

The diagram (Figure 12) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 7.



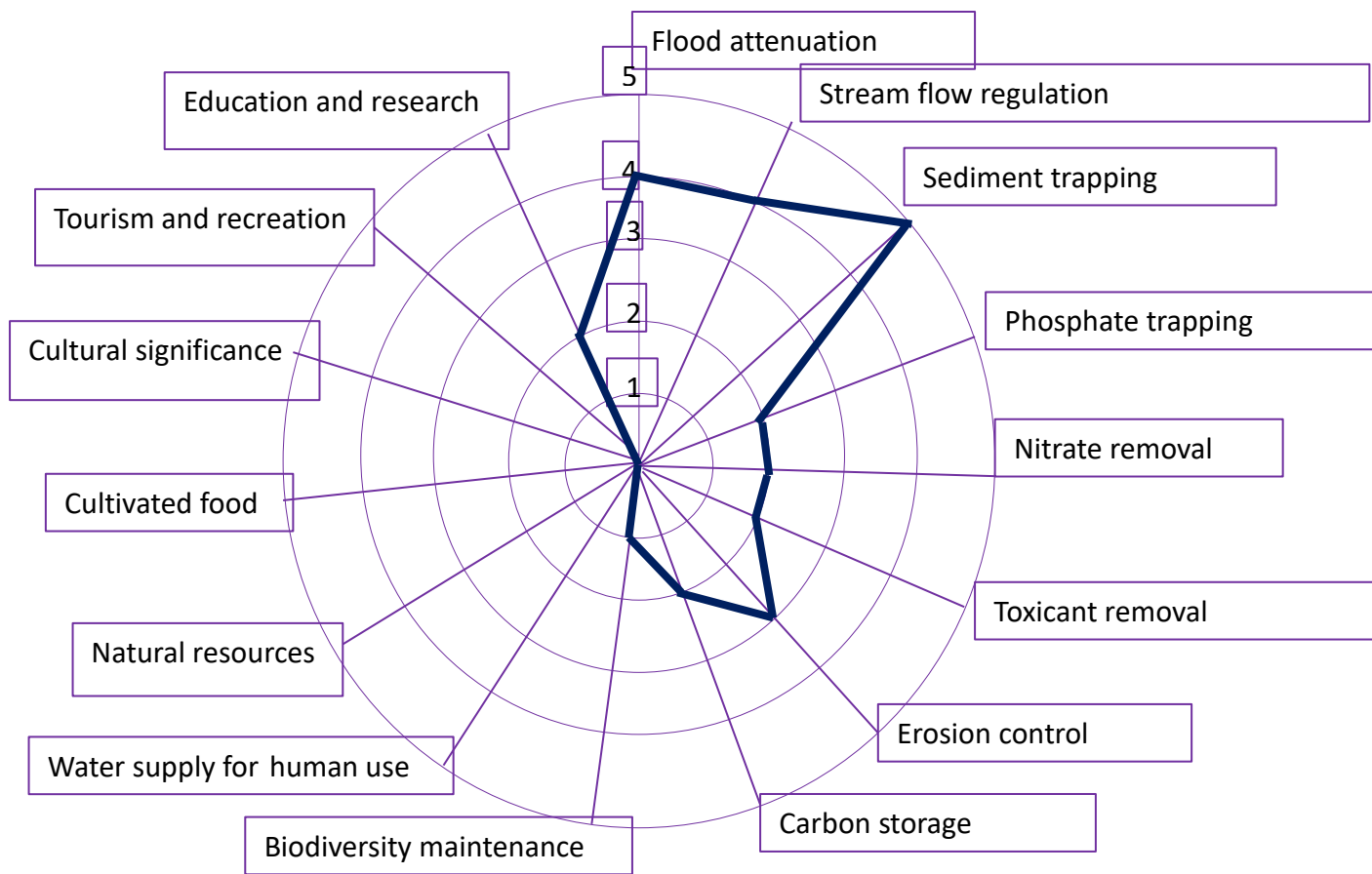
It is perhaps ironic that the environmental footprint increases as the impact rises. As the reeds in the drainage line grow more, the ability to retain floods and agricultural chemicals improves as well. Likewise, it offers a small chance to study the effect of reeds in drainage lines and its rendering of environmental services. This does not contribute anything towards the natural biodiversity.

The left-hand side of Figure 12 is deflated. The drainage line does not offer any services if it comes to water supply, food, tourism and cultural contributions. In fact, the economic resource foot print is small. The drainage line is important for sediment trapping, as it is washed off the vineyards and eroded from the drainage line during floods. Generally, the drainage line is not important in terms of rendered ecological services. The new dam is not about to change any of this.

It seems a futile exercise to plot the economic foot print of the Berg River, as the star shape would a complete circle, with a wealth of environmental services rendered.

**Table 7. Goods and Services**

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



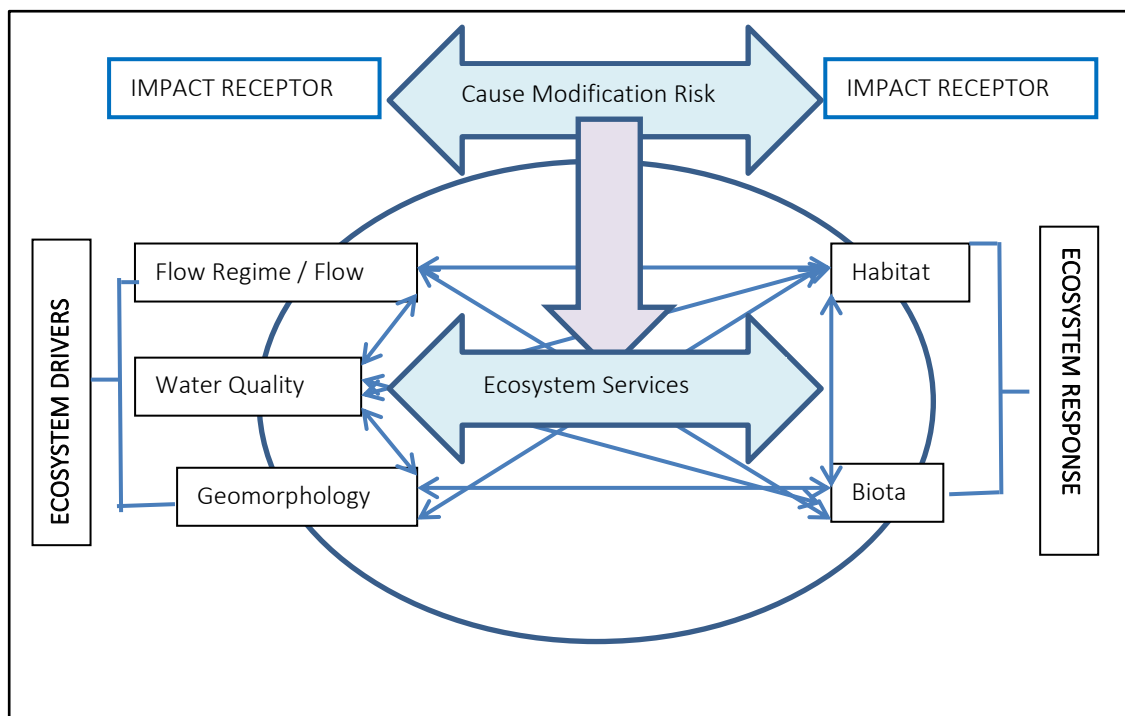
**Figure 20.** Resource Economics Footprint of the Drainage Line

## 19 Conclusions

An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on all of the other drivers and responses. This, in turn, will predictably impact on the ecosystem services (Figure 13). The WULA and the EAI must provide mitigation measured for these impacts.

Figure 13 has been adapted from one of the most recent DWS policy documents.

The driver of the Bonathaba drainage line is the seepage from the dam, that will predictably be more when the dam wall height is increased, as well as the runoff and return flow from agricultural areas. This results in a prolific growth of reeds.



**Figure 13** Minimum Requirements for a S21(c) and (i) Application

The driver of the Berg River is the flood because of the winter rains, as much as the long and very dry summer with the concomitant low flow conditions. Variability in flow is fundamental to the Berg River's ecology.

Apart from the incremental demand for water, not only from Bonathaba, but from many more similar establishments, it is not foreseen that the new dam would have any significant impacts on the Berg River. The demands on the Berg River has long been discounted against the minimum flow requirements and the Ecological Reserve.

Hence it is recommended that the construction of the new dam allowed, either by a letter of consent or a General Authorisation, should the DWS elect to do so, considering the fact that the current taking of water from the Berg River for the Bonathaba Farm is considered to be an Existing Legal Water Use.

## 20 References

Department of Water Affairs and Forestry. 2004. State-of-the-River Report, National River Health Program. Berg River. DWAF, Pretoria.

Dickens, CWS & PM Graham. 2002. *The South African Scoring System (SASS) Version 5 Rapid Bioassessment Method for Rivers*. African Journal of Aquatic Science 27: 1–10

Kleynhans, C.J. 1999. *Assessment of Ecological Importance and Sensitivity*. Department of Water Affairs and Forestry. Pretoria.

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.

Skelton, P. 1993. *A Complete Guide to the Fresh Water Fishes of Southern Africa*. Tutorial Press, Harare.

## 21 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:



19 June 2020

|   |   |
|---|---|
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|---|---|

### Experience

|   |                       |
|---|-----------------------|
| <b>WATSAN Africa</b> , Cape Town. Scientist   | <b>2011 - present</b> |
| <b>USAID/RTI, ICMA &amp; Chemonics.</b> Iraq & Afghanistan<br>Program manager.  | <b>2007 -2011</b>     |
| <b>City of Cape Town</b><br>Acting Head: Scientific Services, Manager: Hydrobiology.  | <b>1999-2007</b>      |
| <b>Department of Water &amp; Sanitation, South Africa</b><br>Senior Scientist   | <b>1989 – 1999</b>    |
| <b>Tshwane University of Technology, Pretoria</b><br>Head of Department   | <b>1979 – 1998</b>    |
| <b>University of Western Cape and Stellenbosch University 1994- 1998</b> part-time  |                       |
| <ul style="list-style-type: none"> <li>- Lectured post-graduate courses in Water Management and Environmental Management to under-graduate civil engineering students</li> <li>- Served as external dissertation and thesis examiner</li> </ul> |                       |

#### Service Positions

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

#### Membership of Professional Societies

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

## Reports

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



## 23 Appendix

### 23.1 Biomonitoring Score Sheet

| SASS5 Score Sheet |                      |                      |        |       |                      |        |       |                   |        |       |
|-------------------|----------------------|----------------------|--------|-------|----------------------|--------|-------|-------------------|--------|-------|
| Date              | 05 Jun 20            | Taxon                | Weight | Score | Taxon                | Weight | Score | Taxon             | Weight | Score |
| Locality          | Berg River           | Porifera             | 5      |       | <b>Hemiptera</b>     |        |       | <b>Diptera</b>    |        |       |
|                   | Black Orchid Farming | Coelenterata         | 1      |       | Belostomatidae       | 3      |       | Athericidae       | 10     |       |
|                   |                      | Turbellaria          | 3      |       | Corixidae            | 3      | 3     | Blepharoceridae   | 15     |       |
|                   |                      | Oligochaeta          | 1      |       | Gerridae             | 5      | 5     | Ceratopogonidae   | 5      |       |
| Coordinates       | 33°31' 18.56"        | Huridinea            | 3      |       | Hydrometridae        | 6      |       | Chironomidae      | 2      | 2     |
|                   | 18°56'00.83"         | <b>Crustacea</b>     |        |       | Naucoridae           | 7      |       | Culicidae         | 1      |       |
|                   |                      | Amphipodae           | 13     |       | Nepidae              | 3      |       | Dixidae           | 10     |       |
| DO mg/l           | 4.6                  | Potamonautidae       | 3      |       | Notonectidae         | 3      | 3     | Empididae         | 6      |       |
| Temperature °C    | 14.2                 | Atyidae              | 8      |       | Pleidae              | 4      | 4     | Ephyridae         | 3      |       |
| pH                | 7.5                  | Palaemonidae         | 10     |       | Veliidae             | 5      | 5     | Muscidae          | 1      |       |
| EC mS/m           | 20.8                 | Hydracarina          | 8      |       | <b>Megaloptera</b>   |        |       | Psychodidae       | 1      |       |
|                   |                      | <b>Plecoptera</b>    |        |       | Corydalidae          | 10     |       | Simuliidae        | 5      |       |
| SASS5 Score       | 47                   | Notonemouridae       | 14     |       | Sialidae             | 8      |       | Syrphidae         | 1      |       |
| Number of Taxa    | 11                   | Perlidae             | 12     |       | <b>Trichoptera</b>   |        |       | Tabanidae         | 5      |       |
| ASPT              | 4,3                  | <b>Ephemeroptera</b> |        |       | Dipseudopsidae       | 10     |       | Tipulidae         | 5      |       |
|                   |                      | Baetidae 1 sp        | 4      | 4     | Ecnomidae            | 8      |       | <b>Gastropoda</b> |        |       |
| Other Biota       |                      | Baetidae 2 sp        | 6      |       | Hydropsychidae 1 sp  | 4      |       | Ancylidae         | 6      |       |
|                   |                      | Baetidae >3 sp       | 12     |       | Hydropsychidae 2 sp  | 6      |       | Bulinidae         | 3      |       |
|                   |                      | Caenidae             | 6      |       | Hydropsychidae <2 sp | 12     |       | Hydrobiidae       | 3      |       |
|                   |                      | Ephemeridae          | 15     |       | Phlypotamidae        | 10     |       | Lymnaeidae        | 3      |       |
|                   |                      | Heptageniidae        | 13     |       | Polycentropodidae    | 12     |       | Physidae          | 3      |       |
|                   |                      | Leptophlebiidae      | 9      |       | Psychomyidae         | 8      |       | Planorbidae       | 3      |       |
|                   |                      | Oligoneuridae        | 15     |       | <b>Cased Caddis</b>  |        |       | Thiaridae         | 3      |       |
| Comments          |                      | Polymitarcyidae      | 10     |       | Barbarochthonidae    | 13     |       | Viviparidae       | 5      |       |
|                   |                      | Prosopistomatida     | 15     |       | Calamoceratidae      | 11     |       | <b>Pelecipoda</b> |        |       |
|                   |                      | Teloganodidae        | 12     |       | Glossostomatidae     | 11     |       | Corbiculidae      | 5      |       |
|                   |                      | Trichorythidae       | 9      |       | Hydroptilidae        | 6      |       | Sphariidae        | 3      |       |
|                   |                      | <b>Odonata</b>       |        |       | Hydrosalpingidae     | 15     |       | Unionidae         | 6      |       |
|                   |                      | Calopterygidae       | 10     |       | Leptostomatidae      | 10     |       |                   |        |       |
|                   |                      | Clorocyphidae        | 10     |       | Leptoceridae         | 6      |       |                   |        |       |
|                   |                      | Chorolestidae        | 8      |       | Petrothrincidae      | 11     |       |                   |        |       |
|                   |                      | Coenagrionidae       | 4      | 4     | Pisulidae            | 10     |       |                   |        |       |
|                   |                      | Lestidae             | 8      |       | Sericostomatidae     | 13     |       |                   |        |       |
|                   |                      | Platycnemidae        | 10     |       | <b>Coleoptera</b>    |        |       |                   |        |       |
|                   |                      | Protoneuridae        | 8      |       | Dyticidae            | 5      |       |                   |        |       |
|                   |                      | Aesthidae            | 8      | 8     | Elmidae Dryopidae    | 8      |       |                   |        |       |
|                   |                      | Corduliidae          | 8      |       | Gyrinidae            | 5      |       |                   |        |       |
|                   |                      | Gomphidae            | 6      |       | Halilidae            | 5      |       |                   |        |       |
|                   |                      | Libellulidae         | 4      | 4     | Helodidae            | 12     |       |                   |        |       |
|                   |                      | <b>Lepidoptera</b>   |        |       | Hydraenidae          | 8      |       |                   |        |       |
|                   |                      | Pyrilidae            | 12     |       | Hydrophilidae        | 5      | 5     |                   |        |       |
|                   |                      |                      |        |       | Limnichidae          | 10     |       |                   |        |       |
|                   |                      |                      |        |       | Psephenidae          | 10     |       |                   |        |       |
| Score             |                      |                      |        | 20    |                      |        | 25    |                   |        | 2     |

## 23.2 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 24.2.1** 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 23.2.2** 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/<br>Magnitude/<br>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 23.2.3** Significance Rating

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

**Table 23.2.4** 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.  |

## 23.3 Risk Matrix Methodology

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

#### Negative Rating

**TABLE 1- SEVERITY**

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

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

**Where "or wetland(s) are involved" it means**

**TABLE 2 – SPATIAL SCALE**

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

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

**TABLE 3 – DURATION**

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

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

**TABLE 4 – FREQUENCY OF THE ACTIVITY**

How often do you do the specific activity?

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

**TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT**

How often does the activity impact on the environment?

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

**TABLE 6 – LEGAL ISSUES**

How is the activity governed by legislation?

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

**Located within the regulated areas**

| <b>TABLE 7 – DETECTION</b>  |  |
|---|--|
| How quickly can the impacts/risks of the activity be observed on the environment (water resource) |  |
| Immediately   |  |
| Without much effort   |  |
| Need some effort  |  |
| Remote and difficult to observe   |  |
| Covered   |  |
|   |  |

| <b>TABLE 8: RATING CLASSES</b>  |                   |  |
|---|-------------------|--|
| <b>RATING</b>   | <b>CLASS</b>      | <b>MANAGEMENT DESCRIPTION</b>  |
| 1 – 55  | (L) Low Risk      | Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded. |
| 56 – 169  | (M) Moderate Risk | Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and  |
| 170 – 300   | (H) High Risk     | Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale                             |
| <b>A low risk class must be obtained for all activities to be considered for a GA</b> |                   |  |

| <b>TABLE 9: CALCULATIONS</b>   |
|--|
| Consequence = Severity + Spatial Scale + Duration                                  |
| Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection |
| Significance \Risk= Consequence X Likelihood                                       |