WETLAND DELINEATION

FOR THE EXPANSION OF THE

ZANDBERGFONTEIN

FARM 97/4 ROBERTSON

SAND MINING OPERATION

A requirement of Section 40 of the National Water Act (36 of 1998)

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"the goal isn't to live forever, it is to protect a planet that will"

WATSAN *Africa*

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1 Introduction

Open cast sand mining at Zandbergfontein has been going on for 20 years and more. The Viljoen family mined out some 9 hectares during this time and are now formally applying to mine another 9 hactares on the property. They appointed Greenmined (Pty) Ltd to handle the application process with the national Department of Mineral Resources (DMR). The national Department of Water and Sanitation (DWS) through their local agency the Breede-Gourits Catchment, as one of important interested and affected parties in the process, following a field visit, asked for a wetland delineation. Greenmined, in turn, appointed WATSAN Africa to produce such a wetland delineation. The presence or absence of a wetland in a potential mining area could be the determining factor to decide if a mining permit should be issued or if the application be declined.

The question is if the wetland against the lower slope of the Zandberg is indeed a valid wetland in need of protection or weather it has been artificially induced by the mining activities with little if any conservation status.

2 Regional Setting

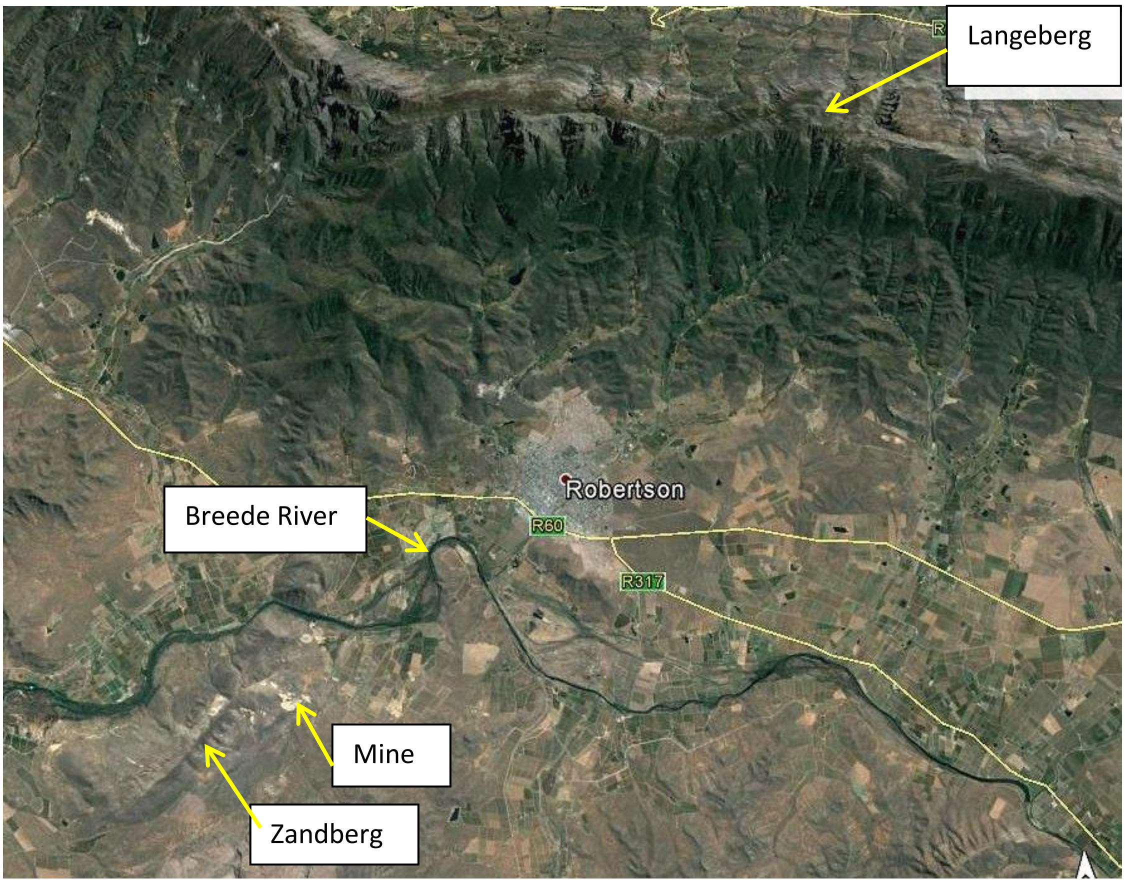

Figure 1 Regional Setting

Zandbergfontein is located approximately 8km to the south west of the town of Robertson (Figure 1). The mine's product is an essential component of the region's buiding industry.

Robertson is located on the banks of the Breede River. The river's water is driving the region's extensive wine industry. Likewise, Zandbergfontein's building sand is crucial to the agricultural and associated construction industry.

With its peaks of 1500m and higher, the Langeberg dominates the landscape. The high mountains receive 1000mm a year and more. The runoff from the mountains replenishes the Breede River. In the context of this report is is important to note that the mountain's porous Table Mountain sandstone stores rain water during the wet winters. This gound water is then migrates downwards and laterally to eventually and gradually decant into the Breede River.

Roberson is at an elevation of approximately 200m above sea level. The mine against the slope of the Zandberg is on the same elevation. Rainfall increases with elevation. Robertson is semi-arid with a much lower rainfall than on the mountains (Figure 1).

The Zandberg peaks at only 530m high and is only 5.6 km long. Nevertheless, the same priciple applies, albeit to a much smaller scale. The layer of sand and underlying sandstone of the Sandberg stores groundwater that is eventually migrates into the aquifer in the valley below.

There is a drainage line south of the Zandberg in the valley that is mostly dry and only contains water when it rains. This line connects to the Breede River.

The Fynbos of the South Western Cape is of particular botanical and conservation sinificance. The Breede Sand Fynbos of the Zandberg area is classified as vulnerable by the IUCN.

3 Quaternary Catchment

Zandbergfontein is located in the H40J quaternary catchment.

4 Mining Operation

The topsoil is removed and stockpiled (Figure 2). The aim is to return the topsoil once the area has been mined out.

The sand is simply loaded with a large front end loader (Figure 3) onto a truck and the sand is then transported to wherever it is needed.

Figure 2 Topsoil Stockpile

Figure 3 Front end loader at Zandbergfontein

5 **Climate** (http://www.saexplorer.co.za/south-africa/climate/robertson_climate.asp)

Robertson normally receives about 255mm of rain per year (Figure 4) and because it receives most of its rainfall during winter it has a Mediterranean climate. The chart below (lower left) shows the average rainfall values for Robertson per month. It receives the lowest rainfall (8mm) in January and the highest (35mm) in August. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Robertson range from 16.7°C in July to 29°C in February. The region is the coldest during July when the mercury drops to 4.2°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures.

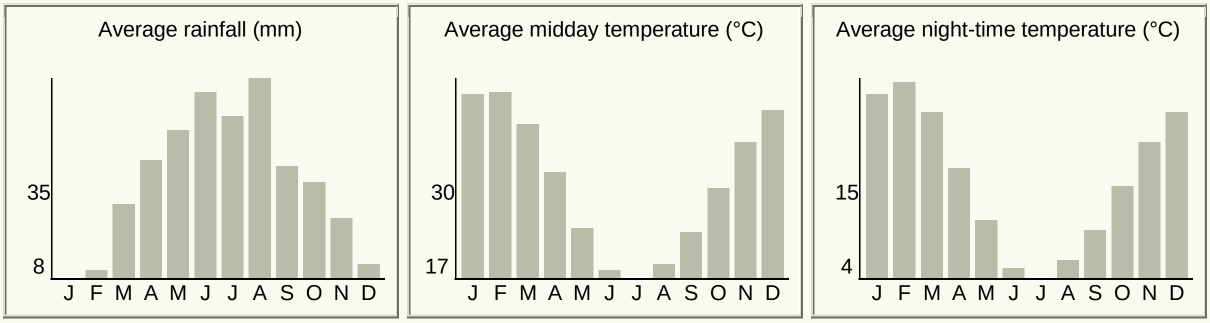

Figure 4 Climate Robertson

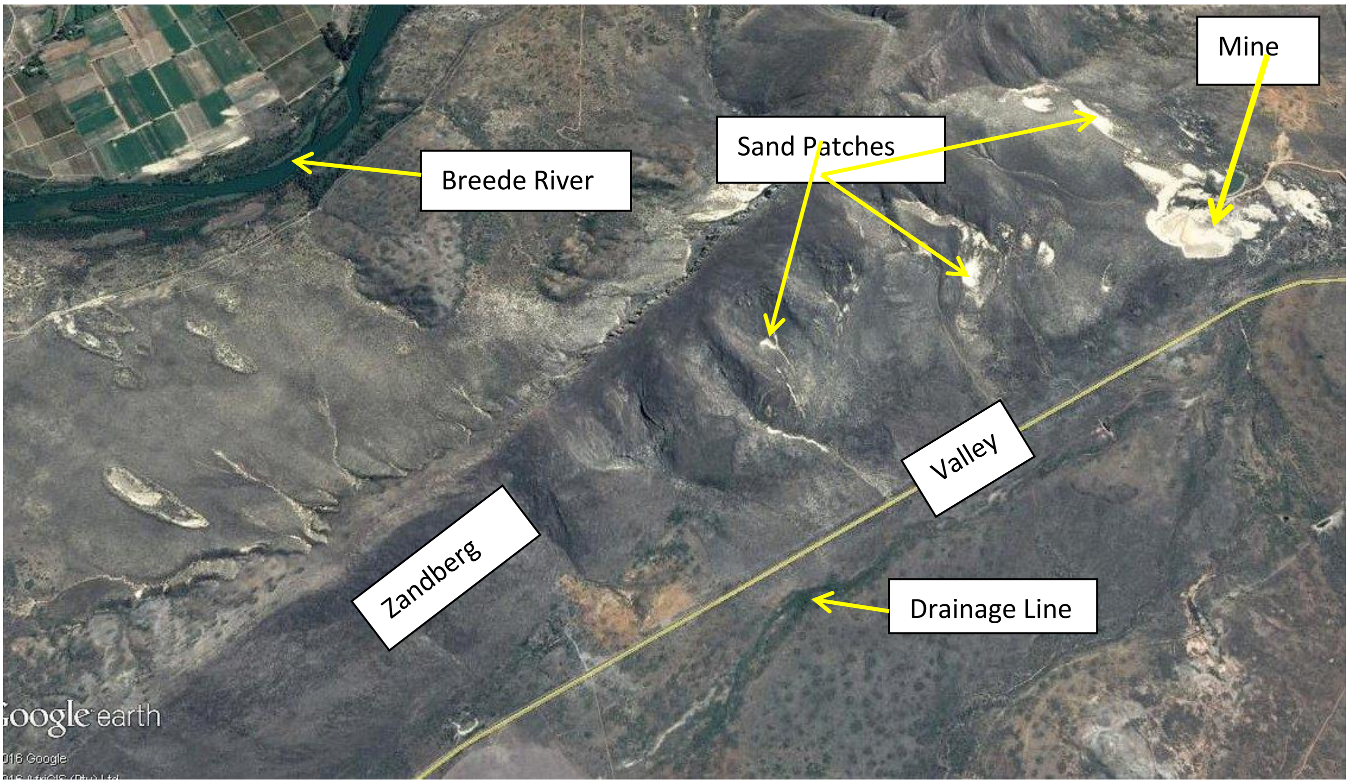

Figure 5 Zandberg and Surrounds

Figure 6 The dune at Zandbergfontein

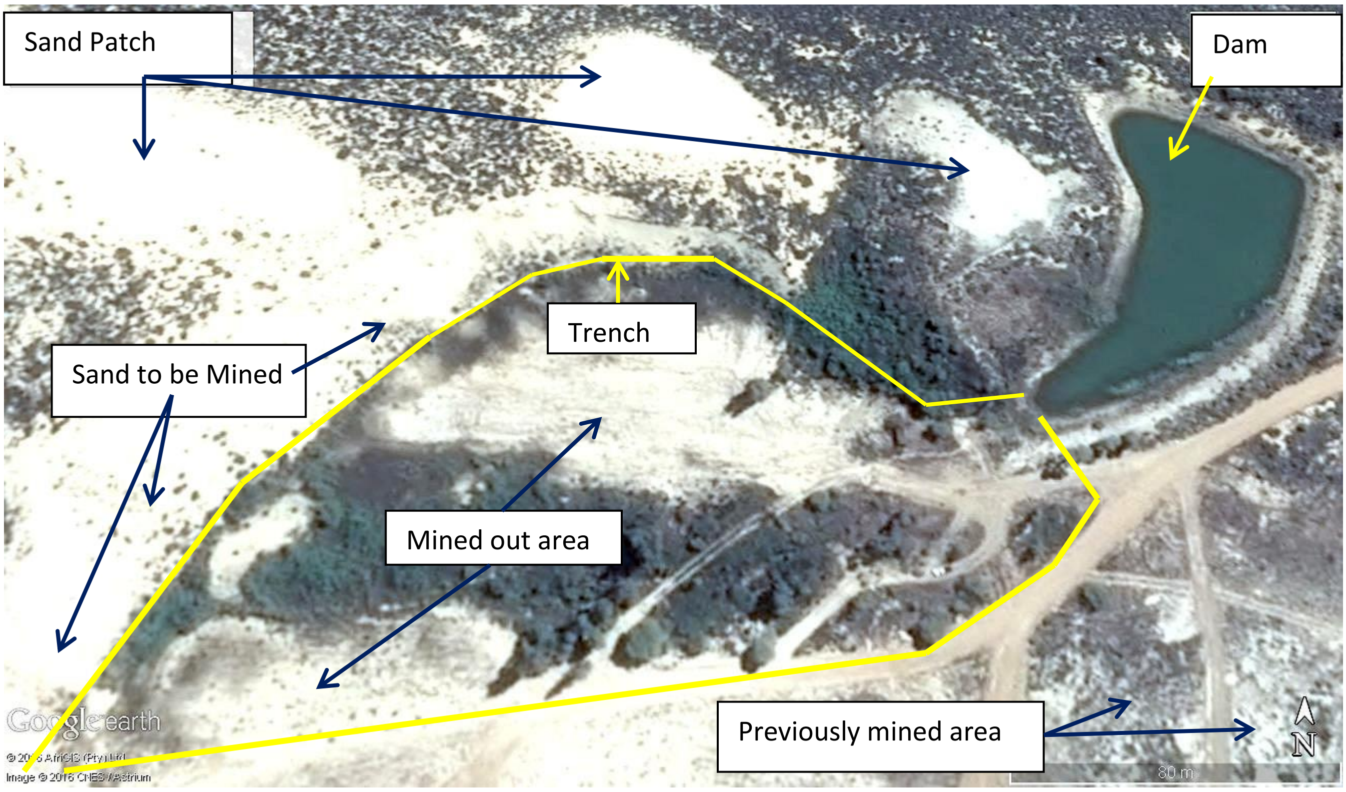

Figure 7 Wetland Demarcation.

6 Wetland Indicators

Several indicators can be applied to decide on the presence or absence of a wetland (DWAF, 2005). For this report the wetness, soil type and vegetation indicators were applied.

6.1 Wetness Indicator

The hydrogeology was described by Greeff (2010).

At the site of the mine against the southern slope of the Zandberg is a dune-like layer of sand several metres thick. The sand here is exposed, but there is probably more of it under the vegetation, as indicated by patches of sand elsewhere on the mountainside (Figure 7).

A layer of pedocrete separates the bedrock from the sand. All of these layers are porous. Water moves readily through the sand. Downward movement is somewhat slowed down by the pedocrete.

The water table in the valley below the mine is 3 meters under the surface. A borehole in the valley indicated that the ground water is artesian.

Ground water is emitted at the foot of the body of sand up against the slope of the Zandberg. The pedocrete here is exposed and the water moving through the sand is partially intercepted prior to penetrating the sandstone. Hence a fountain is formed all along the base of the sand dune, as the water surfaces at this interface.

It is uncertain if the pedocrete was exposed prior to the onset of mining and if there was a seep at the location.

Greeff (2010) eluded on a noticeable increase in groundwater yield from the temporary perched water table at the foot of the dune within 3 days of a downpour of rain. This is quite comprehensible, as the rather large sandy catchment area above the mine extends up right to the crest of the mountain (Figure 5 & 6).

It is likely that the name Zandbergfontein was derived from this feature. This is not a unique feature as productive fountains of this kind are found in many places along sand/ crete interfaces in the Western Cape.

At this very interface, at the foot of the sand dune up the slope of the mountain, a trench of a metre deep was dug in order to intercept more of the ground water, not only the part that surfaced, but also more of it that found its way lower down into the sandstone. The trench stretches all the way to the dam (Figure 8) and the large volume of water in the dam bears testimony of a strong supply of ground water, even in the drought conditions during the field visit.

Figure 8 The Dam

Ground water surfaced below the trench at various places (Figure 9) and indicates that only a portion of the ground water actually ends up in the dam. The removal of the sand layer in this part of the mined out area contributes to the decanting of ground water. The sand here is now much thinner and the remaining sand cannot hold the original volume of water. Hence it decants rather than entering the semi-saturated sandstone below. The end result is that more water evaporates and less ends up in the aquifer. This is not unique either, as a number of sand mines that WATSAN investigated in the Western Cape result in very much in the same ill effect. However, the affected area at Zandberg is small and it is surmised that the effect on the entire aquifer will hardly be noticed.

The soil adjacent and downhill from the trench was noticeably wet during the field visit. In some places water was emitted from the ground. If wetness was to be the sole indicator, this surely could be classified as a wetland. However, these wetland conditions may well be because of the recent mining, with the removal of sand and subsequent reduced water holding capacity and do not seem to be a natural or historic situation.

Figure 9 Seepage

6.2 Soil Type

The soil is much disturbed following sand mining and subsequent rehabilitation. Greeff (2010) did not find any humus-bearing topsoil known as the O layer. The area is covered with a layer of wind-blown sand that is exposed in places.

There seem to be no gleying or blotching of soils that would classify it as a wetland.

The sand that is to be mined is loose, exposed, wind-blown and without any discernible horizon.

6.3 Vegetation

The following plants were detected in the area marked with yellow lines in Figure 7:

Poaceae (grasses)
Phragmitis australis (Fluitjiesriet)

Typhaceae (Bulrushes)
Typha capensis (Bulrush)

Cyperaceae (sedges)
Ficinia radiata (stergras)
Ficinia truncata

Restionaceae (Restios)
Elegia tectorum (dekriet)

Proteaceae (Proteas)
Leucadendron xanthoconus (rooi tolbos, sickle leaf conebush)

Campanulaceae
Prismatocarpus sp.

Salicaceae
Salix mucronata (small leaved willow)

These plants are common and not listed as scarce or endangered in any sense. The little *Prismatocarpus* may be an interesting topic for further investigation.

The digging of the trench at the base of the dune resulted in the accumulation of surface water. This was quickly colonised by reeds such as *Typha* and *Phragmites* (Figure 10). Today there is a thick stand of these reeds. It is doubtful if any reeds grew in this locality prior to the digging of the trench. There are no reeds where the trench stops.

Figure 10 Reeds

The grounds water has a propensity to rather migrate downwards into the sandstone than to surface and the reason it appears above the ground is because the top layer has been removed. This clarifies the presence of sedges and restios (dekriet) in the area. Where the layer has not been removed, no sedges where detected during the field visit.

Evidently this is an anthropologically induced wetland. Perhaps it can be classified as “incidental” rather than “artificial”. It bears no special or other any conservation status.

The field type of the area is classified as Red Data Vulnerable Breede Sand Fynbos (Krige, 2015) with 2 species of plant that are vulnerable as well. To the contrary, the “wetland” is not of any concern.

The conebush on the site occurs on sandstone slopes and is not listed as a wetland indicator.

The (indigenous) willow trees were evidently planted there, as were the eucalyps and poplars, reportedly by previous owners. The invasive rooikrans and Port Jackson, no doubt, came in all by themselves. The eucalyps evapotranspirate large volumes of ground water and obviously don’t do the aquifer any good, especially as they stand to reproduce to huge numbers in the foreseeable future.

7 Wetland Demarcation

The listed wetland plants were detected in the area marked by the yellow lines in Figure 7. The trench follows the upper yellow line.

8 Wetland Classification

Because the landscape have been changed as a result of mining, it does not seem feasible to classify the Zandbergfontein Wetland. If it was nevertheless to be classified, it would be a foot slope seep against a lower mountain side without a discernible channel. The trench is artificial and is nothing that resembles a natural channel. The area of the mine does not have any connectivity with the drainage line in the valley below. The drainage line was dry during the field visit (Figure 11).

Figure 11 Drainage Line

9 Wetland Integrity

It is difficult if not feasible at all to rate a wetland that merely is a man-made trench using the methodology that has been designed for existing natural wetlands. Perhaps the best way to deal with this one is to assume that there was a small seep at the base of the dune prior to the digging of the trench. In whatever way the situation at the sand mine is looked at, it is a highly impacted area with little natural features left.

The flow of ground water has been changed and what was first destined to move into the aquifer now surfaces above ground. What was previously dry ground or perhaps a small seep now is inundated by a dam and a small quantity of surface water.

It is not known what the mining activities have done to the water quality. The difference in water quality between the water in the dam and in the trench if compared to that of the ground water is obviously large, as turbidity and nutrients are added.

The sand mine has altered the topography significantly, with the top layer removed. What originally possibly was a small seep now is a trench.

Some of the natural vegetation has been removed and most that grows there now is secondary vegetation, either planted or encroached, such as *Typha* and *Phragmites*.

Table 1. Wetland Habitat Integrity (After Kleynhans, 1999)

Attribute	Score
Hydrology	
Flow modification	4.5
Inundation	4.5
Water Quality	
Water quality modification	4.5
Sediment load modification	4.5
Hydrology / Geomorphology	
Canalization	5
Topographic Alteration	5
Biology	
Terrestrial encroachment	4.5
Removal of vegetation	5
Alien fauna	4.5
Over-utilisation of biological resources	5
Mean	4.6
Category	Highly Impacted

0-1.0	Pristine
0.1-2	Near-pristine
2.1-3	Moderately impacted
3.1-4	Modified
4.1-5	Critically modified

It is easy to assume that with the trench and the dam a host of fauna were at the time, quick to utilise the newly established habitat. The mountain slope Fynbos biota has been replaced with aquatic organisms.

The habitat can only be described as critically modified with little if any conservation status.

10 Resource Economics

Table 2. Wetland Goods and Services

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

0	Low
5	High

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

Again, to assess an incidental wetland with a methodology that has been designed for a natural wetland that actively render goods and services, is perhaps not feasible. Nevertheless, the trench, the dam and the small seep that was there previously have all very little value, from a resource economics point of view.

It will surely trap some of the runoff from the mountain during and after a heavy downpour of rain and will predictably direct sediments towards the dam. This holds true also for sediments from the mining operation, of which there will be a substantial quantity.

The water in the dam could be used for human use and could be used for livestock watering.

For all of the other criteria listed in Table 2 a value of zero or close to zero have been assigned, as it cannot be seen how the trench and the mining operation can possibly contribute to any of these.

The diagram (Figure 12) is an accepted manner to visually illustrate the resource economic footprint the wetland.

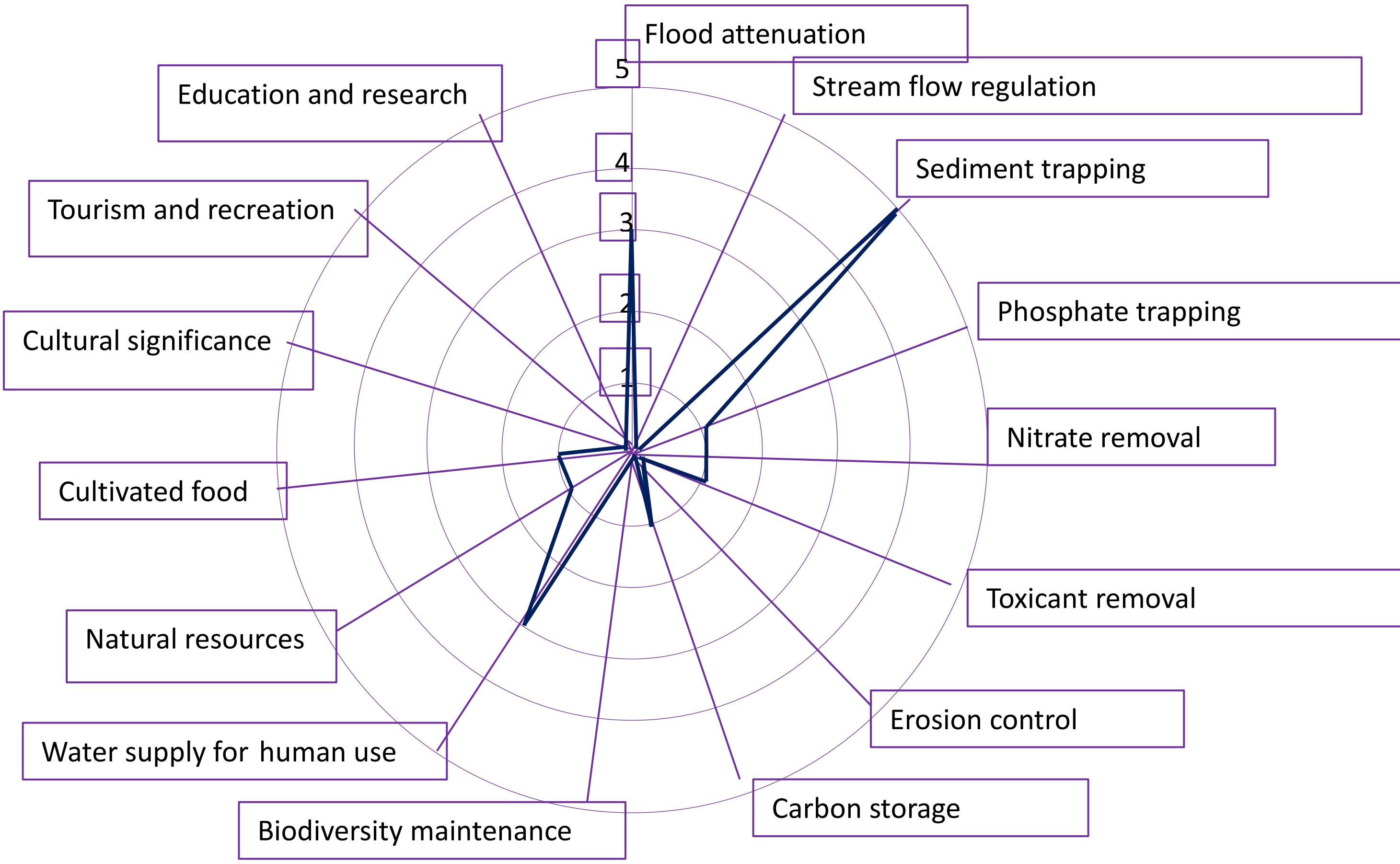

Figure 12. Resource Economics Footprint of the Zandbergfontein Wetland

The star shape in the middle of the diagram is rather small, which instantaneously and visually illustrates the insignificance of the wetland.

11 Conclusion

The trench will most likely be destroyed while mining the sand dune against the mountain slope. Once the area has been mined out the trench will probably be restored in order to assure a flow of water from the remaining seep into the dam.

The question arises if the temporary destruction of the trench is a cause of any concern. Since the trench is entirely artificial with an insignificant conservation status it is of no concern at all and is therefore recommended that the mining should go ahead.

12 Literature

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Greeff, J. 2015. *Report on the Geohydrology of the Sand Mine Site on the Remainder of Portion 4 of the Farm Zandberg Fontein No. 97 in the Robertson District.* Botanical Consultant, Robertson.

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Krige, Johlene. 2015. Botanical Impact Assessment for the Zandberg Sand Mine, Farm 97/4, Robertson. Dayimanzi Consultants, Cape Town.

Sieben EJJ.,H. Mtshali and M. Janks. 2014. *National Wetland Vegetation Database: Classification and Analysis of Wetland Vegetation Types for Conservation Planning and Monitoring.* Water Research Commission. Pretoria.

13 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

Name of the company: Watsan Africa Date: 4 April 2016

14 Resumé (much shortened)

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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 (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

WATSAN Africa **Relevant Reports 2014 - 2015**

- Fresh Water and Estuary Report Erf 77 Elands Bay
- 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
- Fresh Water Report, La Motte Development, Franschhoek