KWV EFFLUENT MANAGEMENT FACILITY

Proposed upgrade of the KWV evaporation pond system at Upington

BIODIVERSITY & BOTANICAL SCAN

A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required).

March 10, 2013

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INDEPENDENCE & CONDITIONS

PB Consult is an independent consultant and has no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and PB Consult have no interest in secondary or downstream development as a result of the authorization of this proposed project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. PB Consult reserve the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

RELEVANT QUALITFICATIONS & EXPERIENCE OF THE AUTHOR

Mr. Peet Botes holds a BSc. (Hons.) degree in Plant Ecology from the University of Stellenbosch (Nature Conservation III & IV as extra subjects). Since qualifying with his degree, he had worked for more than 20 years in the environmental management field, first at the Overberg Test Range (a Division of Denel) managing the environmental department of OTB and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve). In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity en environmental legal compliance audits. During 2010 he joined EnviroAfrica in order to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes EIA applications, biodiversity assessment, botanical assessment, environmental compliance audits and environmental control work.

Yours sincerely,

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SUMMARY - MAIN CONCLUSIONS

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BIODIVERSITY ASPECT	SHORT DESCRIPTION	SIGNIFICANCE RATING
Geology & soils	Geology & soils vary only slightly in the larger study area, with deeper sandy soils found over most of the area.	No special features have been encountered (e.g. true quartz patches or broken veld) and the impact on geology and soils is expected to be very localised and low. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible. Impact = very low
Land use and cover	Natural veld utilised for stock grazing.	The property is sparsely used by the local inhabitants. The impact on land use and cover is expected to be very low and localised. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Vegetation types	Kalahari Karroid Shrubland	This vegetation type is considered "Least threatened", but the remaining natural veld shows good connectivity with the surrounding areas. According to the draft Siyanda EMF, the vegetation is of high conservation priority, but does not fall within a proposed conservation area and as such the locality is of low environmental significance. Impact low. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Conservation priority areas.	In terms of the draft Siyanda EMF	According to the EMF the site does not fall within a proposed conservation area. Impact low/localised. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Sensitivity index	In terms of the draft Siyanda EMF	According to the EMF, the proposed site falls within an area identified as of very low environmental sensitivity (1). Impact low and localised. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Protected plant species	A number of protected species (Refer to Table 3), in terms of the NCNCA was observed.	Protected species was mostly associated with the remaining natural veld to the north and south of the existing evaporation ponds. Non species protected in terms of the NFA was observed, but a number of species protected in terms of the NCNCA was observed in the above mentioned areas. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible. However, if the footprint is to be enlarged, placement must be carefully considered. Impact low to medium (depending on the footprint).
Fauna & Avi-fauna	The site is used for live-stock grazing and is in close proximity to constant human activity.	Although natural fauna and avi-fauna may still be present, it is expected that it would be limited to avi-fauna, insects and maybe some reptile's species (proximity to the urban edge and the current land-use). The activity is not expected to have a significant impact on fauna or avi-fauna. Impact low.
Rivers & wetlands	No river or wetland areas were observed within the site.	No river or wetland system is expected to be impacted directly by the proposed upgrade. The impact on rivers is thus considered **negligible**.
Invasive alien infestation	A number of *Prosopis* as well as single *Nicotiana* individuals was observed	All invasive alien species should be removed in the immediate vicinity of the existing and the new treatment works during the construction phase. If implemented the impact can be regarded as positive.

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1. INTRODUCTION

The KWV Upington Distillery is situated on Erf 5412 (Upington), right next to OWK Wines. The KWV / OWK complex in Upington comprises a brandy distillery owned by KWV and a modern wine cellar and grape juice concentrate plant owned by OWK. In the mid 1980's KWV made a capital investment and purchased a piece of land (Erf 5410) from the local authority with the aim of providing evaporation ponds for the treatment of effluent. This was required, as the local authority declined to accept their effluent into the municipal sewage system as it could be detrimental to the activated sludge process at the municipal wastewater treatment plant. All wastewater from both KWV and OWK are disposed on Erf 5410 (Upington).

Since 1981 KWV and OWK has been disposing their industrial effluent into large evaporation ponds on Erf 5410 in accordance with the conditions set out in Exemption 838 B, issued by the Department of Water Affairs in terms of section 21(4)(e) of the Water Act (Act 54 of 1956). Recently the volumes of industrial effluent that are disposed at Erf 5410 had increased to such an extent that it does not anymore conform to the conditions of Exemption 838 B. With the implementation of the new NEM:WA (Act 59 of 2008) waste act, it was determined that the facility will have to apply for a Waste Licence in terms of Category B of the "List of Waste Management activities that have, or are likely to have, a detrimental effect on the environment".

KWV / OWK had appointed BVi Engineers to investigate options for wastewater treatment with the aim of upgrading and improving the treatment system in order to ensure legal compliance and also the possibility of treating the wastewater to irrigation standards (as opposed to evaporation). EnviroAfrica was appointed to facilitate the environmental impact assessment. Since the property and its immediate surrounding areas are still covered by some areas of remaining natural veld, a Biodiversity Scan of the proposed location was commissioned in order to evaluate the environmental impact(s) of the proposed project and to establish whether further and more in depth studies would be required. Since the need for the upgrade is very apparent and urgent this biodiversity study will mainly aim to minimise the environmental impact through correct placement.

The desktop study and site visit revealed the following possible environmental issues:

- The area surrounding the existing evaporation pond system is still covered by natural veld in relative good condition and with good connectivity (Kalahari Karroid Shrubland – "Least Threatened" but poorly protected).
- No seasonal streams / drainage lines were encountered in the vicinity of the site.
- A number of protected plant species in terms of the Northern Cape Nature Conservation Act (Act 9 of 2009) or NCNCA has been observed.
- Large portions of the existing site can be described as degraded as a result of the existing treatment facility and associated activities.

1.1 TERMS OF REFERENCE

EnviroAfrica (Pty) Ltd was appointed by BVi Consulting Engineers (Upington) as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment (EIA) Process for the proposed development. PB Consult was appointed by EnviroAfrica to conduct a Biodiversity Scan of the proposed site.

PB Consult was appointed within the following terms of reference:

- Complete a Biodiversity Scan of the proposed site in order to determine whether any significant features will be impacted as a result of the proposed development.
- Make recommendations on impact minimisation should it be required
-
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

2. APPLICABLE LEGISLATION

Constitution of the Republic of South Africa (1996): of special relevance in terms of environment is section 24

Conservation of Agricultural Resources Act 43 of 1983 (CARA): supports conservation of natural agricultural resources (soil, water, plant biodiversity) by maintaining the production potential of the land and combating/preventing erosion; for example, by controlling or eradicating declared weeds and invader plants.

Hazardous Substances Act 15 of 1973: to control substances that may cause injury, ill-health, or death through their toxic, corrosive, irritant, strongly sensitizing or flammable nature, or by the generation of pressure

National Environmental Management Act 107 of 1998 (as amended): replaces the Environmental Conservation Act (ECA) and establishes principles for decision-making on matters affecting the environment, and for matters connected therewith.

- **Environmental Impact Assessment Regulations** (R543 of 2010): procedures to be followed for application to conduct a listed activity.

National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA): replaces the Atmospheric Pollution Prevention Act (No. 45 of 1965).

National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA): supports conservation of plant and animal biodiversity, including the soil and water upon which it depends.

- **National list of ecosystems that are threatened and in need of protection** (GN 1002 of 9 December 2011).

National Environmental Management: Protected Areas Act 57 of 2003 (as amended Act 31 of 2004) (NEMPAA): To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes.

National Environmental Management: Waste Act 59 of 2008 (NEMWA): To reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.

- **List of Waste Management Activities that have, or are likely to have a detrimental effect on the environment** (GN 718 of 3 July 2009): Identifies activities in respect of which a waste management license is required.

National Forests Act 84 of 1998 (as amended): supports sustainable forest management and the restructuring of the forestry sector.

- **List of protected tree species** (GN 716 of 7 September 2012)

National Heritage Resources Act 25 of 1999: supports an integrated and interactive system for the management of national heritage resources, including supports soil, water and animal and plant biodiversity.

National Veld and Forest Fire Act 101 of 1998 (NVFFA): protects soil, water and plant life through the prevention and combating of veld, forest, and mountain fires

National Water Act 36 of 1998 (NWA): promotes the protection, use, development, conservation, management, and control of water resources in a sustainable and equitable manner.

Northern Cape Nature Conservation Act 9 of 2009 (NCNCA): To provide for the sustainable utilization of wild animals, aquatic biota and plants.

2.1 NORTHERN CAPE NATURE CONSERVATION ACT 9 OF 2009

On the 12th of December 2011, the new Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect, which also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. The NCNCA is a very important Act in that it put a whole new emphasis on a number of species not previously protected in terms of legislation.

It also put a new emphasis on the importance of species, even within vegetation classified as "Least Threatened" (in accordance with GN 1002 of 9 December 20011, promulgated in terms of the National Environmental Management Biodiversity Act 10 of 2004). Thus even though a project may be located within a vegetation type or habitat previously not considered under immediate threat, special care must still be taken to ensure that listed species (fauna & flora) are managed correctly.

3. DEFINITIONS & ABBREVIATIONS

3.1 DEFINITIONS

Construction: means the period of the project during which the actual works are carried out, deemed to include site establishment, site preparation, the works, maintenance period and decommissioning.

Construction site: means the area influenced and affected by the construction activities or under the control of the Contractor often referred to as "the Site".

Contaminated water: means water contaminated by the Contractor's activities, *e.g.* concrete water and runoff from plant/ personnel wash areas.

Environment: means the surroundings within which humans exist and that are made up of:

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part of the combination of the above two bullets and the interrelationships between them;
- the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being

Environmental Aspect: any element of any construction activity, product or services that can interact with the environment.

Environmental Control Officer: a suitably qualified environmental agent responsible for overseeing the environmental aspects of the Construction phase of the EMP.

Environmental Impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from any construction activity, product or services.

No-Go Area(s): an area of such (environmental/aesthetical) importance that no person or activity are allowed within a designated boundary surrounding this area.

Owner: the owner, or dedicated person, responsible for the management of the property on which the proposed activity will be performed.

Solid waste: means all solid waste, including construction debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Precautionary principle: means the basic principle, that when in doubt or having insufficient or unreliable information on which to base a decision, to then limit activities in order to minimise any possible environmental impact.

Watercourse: in this report the author uses a very simplified classification system to define the difference between rivers, streams or a drainage lines encountered in the Northern Cape.

- River: A river is a natural watercourse with a riverbed wider than 3m, usually freshwater, flowing toward an ocean, a lake, a sea or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water. The flow could be seasonal or permanent.
- Stream: A small river or natural watercourse with a riverbed of less than 3 m, usually freshwater, flowing toward an ocean, a lake, a sea or another river. In a few cases, a river simply flows into the

ground or dries up completely before reaching another body of water. The flow could be seasonal or permanent.

- Drainage line: A very small and poorly defined watercourse, mostly on relatively flat areas, which only flows for a short period after heavy rains, usually feeding into a stream or river or dries up completely before reaching another body of water.

3.2 ABBREVIATIONS

BGIS	Biodiversity Geographical Information System
CARA	Conservation of Agricultural Resources Act 43 of 1983
CBA	Critical Biodiversity Areas (Municipal)
DAFF	Department of Agriculture Forestry and Fisheries
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation (Northern Cape Province)
EAP	Environmental assessment practitioner
EIA	Environmental impact assessment
EMF	(Municipal) Environmental Management Framework
EMP	Environmental management plan
NCNCA	Northern Cape Nature Conservation Act 9 of 2009
NEMA	National Environmental Management Act, Act 107 of 1998
NEMAQA	National Environmental Management Air Quality Act 39 of 2004
NEMBA	National Environmental Management Biodiversity Act, Act 10 of 2004
NEMPAA	National Environmental Management Protected Areas Act 57 of 2003
NEMWA	National Environmental Management Waste Act 59 of 2008
NFA	National Forests Act 84 of 1998
NSBA	National Spatial Biodiversity Assessment
NVFFA	National Veld and Forest Fire Act 101 of 1998
NWA	National Water Act 36 of 1998
SABIF	South African Biodiversity Information Facility
SANBI	South African National Biodiversity Institute
SIBIS	SANBI's Integrated Biodiversity Information System
SKEP	Succulent Karoo Ecosystem Project
WWTW	Wastewater Treatment Works

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5. PROJECT DESCRIBTION

Consideration is been given to the upgrading of the existing effluent management system, which will also potentially change the end-use from evaporation to beneficial irrigation. The upgrading will entail the following:

- Closing and decommissioning of the current evaporation pond system.
- Construction of a suitable treatment system in order to treat the effluent from the various facilities to such an extent that it can be considered for beneficial irrigation (SA being a water scarce land).

Please note that the existing infrastructure (pipeline and pumping facilities) will be used to transfer the pre-treated wastewater from the KWV / OWK complex to the Effluent Treatment Facility (ETF).

Some 90% of the effluents that will be treated at the proposed effluent facility are generated by the Orange River Wine Cellars (OWK) and grape juice concentrate facility. Only approximately 10% of the effluent comes from the KWV distillery. OWK is a cooperative wine cellar established in Upington in 1965. Over the years the intake tonnage has increased from a meagre 5000 tons per annum to some 180 000 tons per annum. The KWV / OWK complex in Upington now comprises a brandy distillery owned by KWV and a modern wine cellar and grape juice concentrate plant owned by OWK. All wastewater from both KWV and OWK are disposed on Erf 5410 (Upington).

As is commonly known, wineries and distilleries are notorious for the quality of their effluent and at this complex it is no different. Typically, the combined effluent from the three processing plants equates to an average volume of 1 350m3 per day or some 40 000m3 per month. An analysis of the effluent has indicated that it has a chemical oxygen demand varying between 8 000mg/l to 10 000mg/l with high concentrations of Total Suspended Solids and Total Dissolved Solids. Typically the COD of winery effluent comprises some 91% of ethanol and other organic components such as acetic acid and phenols.

These constituents are notoriously difficult to treat and the analysis results indicate that the effluent is at the upper limit for aerobic process treatment and at the lower limit of anaerobic process treatment, making it extremely difficult to select a suitable process train for this effluent.

Given the above, BVi, in consultation with the client have investigated several options which are briefly described below.

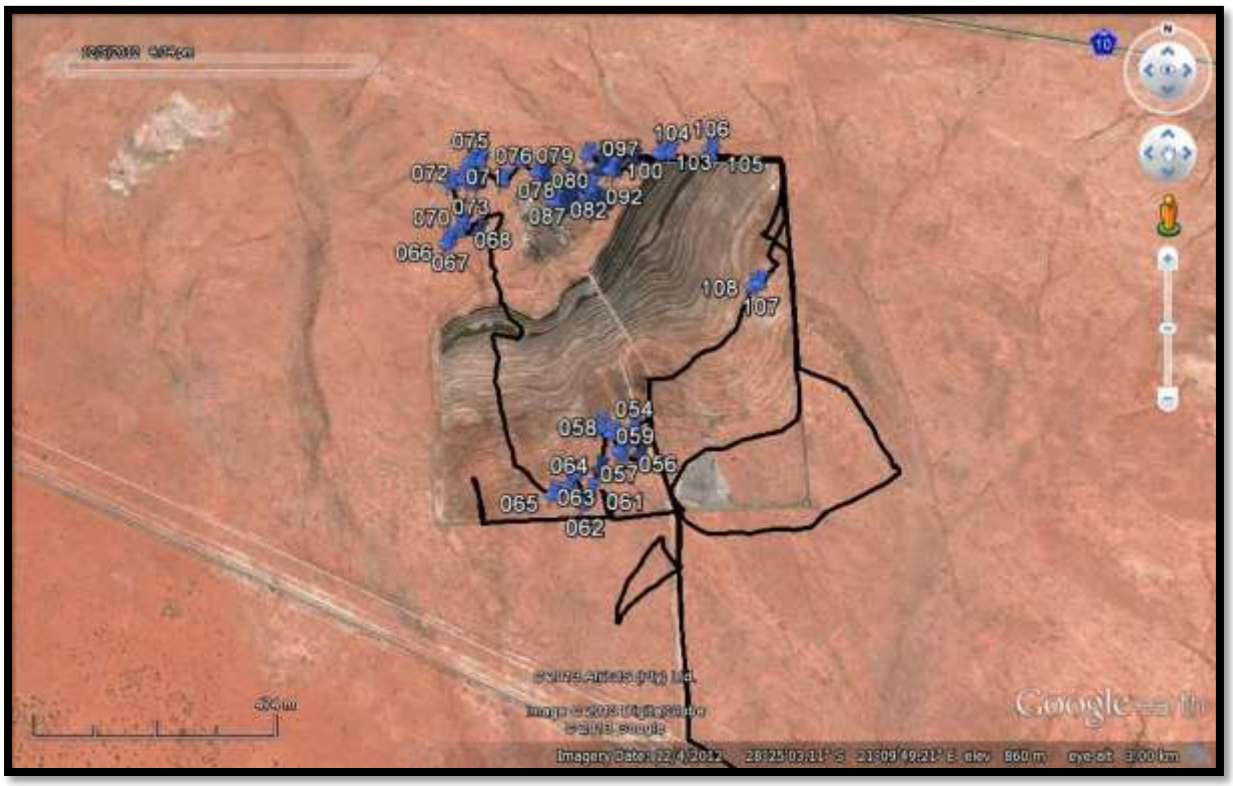
5.1 METHODS

Desktop studies were conducted, coupled by a physical site visit during September and December 2012. The timing of the site visit was reasonable in that essentially all perennial plants were identifiable and although it is likely that a few species may have been missed, the author is confident that a fairly good understanding of the biodiversity status in the area was obtained.

The survey was conducted by walking through the site and examining, marking and photographing any area of interest (Refer to Figure 1 underneath). Confidence in the findings is high. During the site visit the author endeavoured to identify and locate all significant biodiversity features, including rivers, streams or wetlands,

special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).

Figure 1: Google image indicating the route walked during the site visit as well as GPS reference points taken



A number of the protected plant species were encountered in the areas surrounding the site as well as to the south and north of the existing transformed areas within the site. The surrounding veld showed the same species distribution as encountered in the remaining natural veld (not the disturbed areas) surrounding the existing facility.

6. DESCRIPTION OF ENVIRONMENT

The aim of this description is to put the study area in perspective with regards to all probable significant biodiversity features which might be encountered within the study area. The study area has been taken as the proposed site and its immediate surroundings. During the desktop study significant biodiversity features associated with the larger surroundings was identified, and were taken into account. The desktop portion of the study also informs as to the biodiversity status as classified in the National Spatial Biodiversity Assessment (2004) as well as in the recent National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), promulgated in terms of the National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004. It also aims to take Municipal Environmental Management Frameworks (EMF's) and Municipal Critical Biodiversity Areas (CBA's) into account where applicable.

6.1 LOCATION & LAYOUT

The KWV Distillery and OWK Grape Juice Concentrate Facility are both located just off Industria Road in the industrial area of Upington (Erf 5412, Upington). The existing effluent treatment facility is located on Erf 5410 (Upington), approximately 4 km west-northwest of Erf 5412 (Refer to Figure 2-4).

Figure 2: General location of the town within South Africa

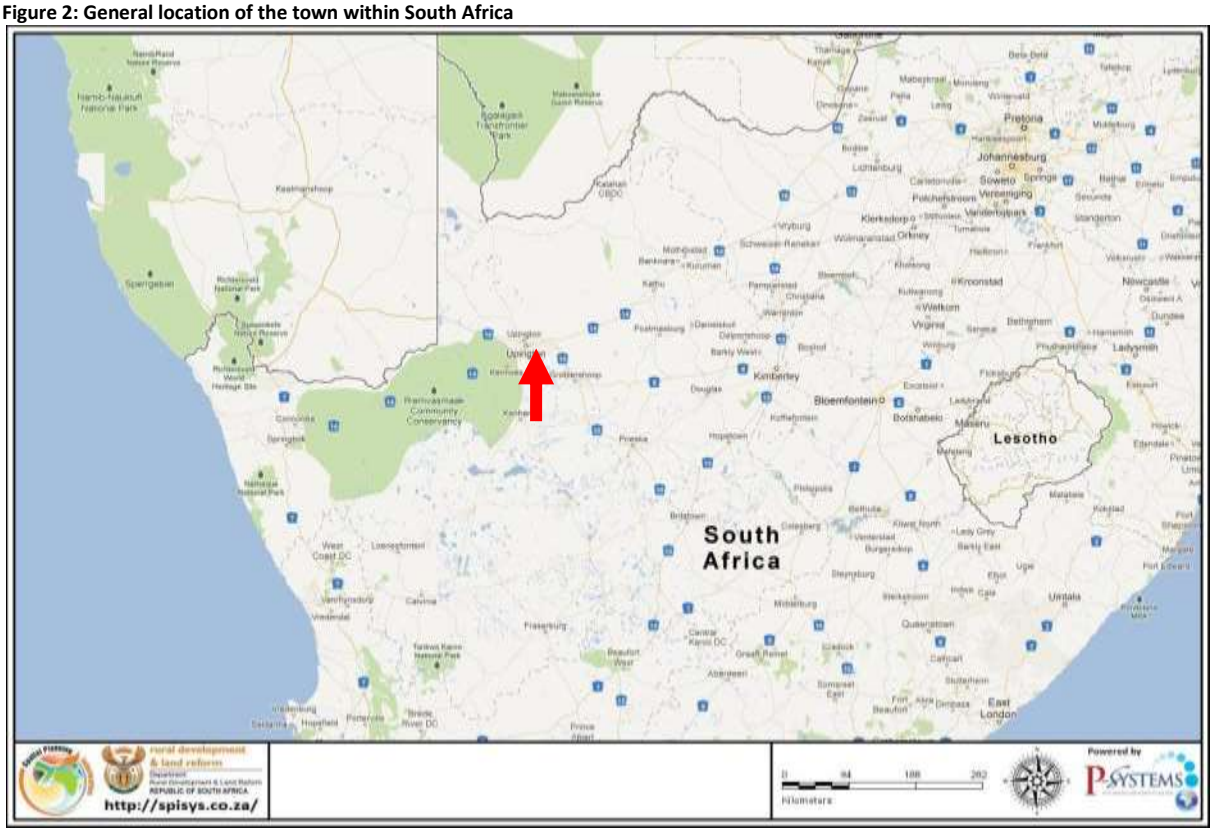


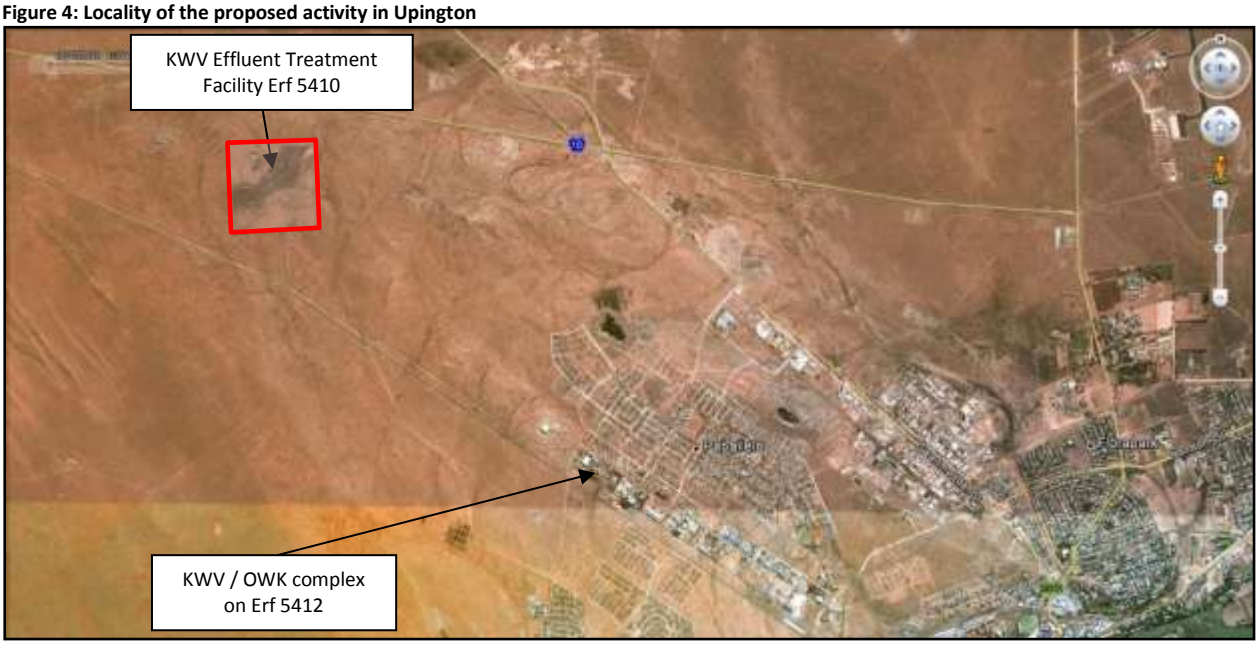
Table 1: GPS coordinates for the treatment facility

DESCRIPTION	LATITUDE AND LONGITUDE
KWV / OWK Complex (Erf 5412)	S28 26 27.7 E21 12 21.4
KWV Effluent facility (Erf 5410)	S28 25 02.6 E21 10 32.0

The N10 is located just north of the existing effluent facility (450-500m), while the Upington westward railway is located just south of the facility (300-350m).

Figure 3: Location map indicating Erf 5412 (KWV / OWK complex) and the effluent facility Erf 5410

Figure 4: Locality of the proposed activity in Upington



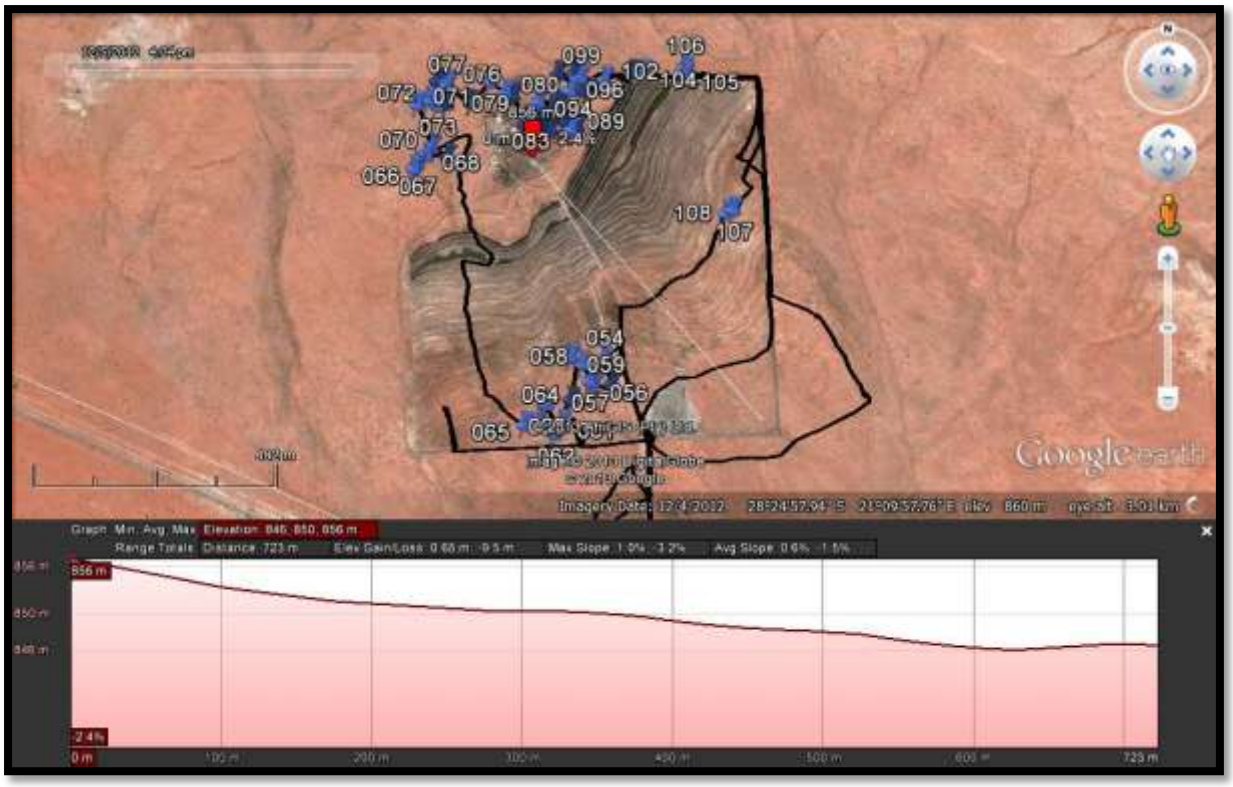
Erf 5410 is approximately 60.0197 ha in size.

6.2 TOPOGRAPHY

The existing KWV Effluent Management Facility (Evaporation pond system) is located on Erf 4512 within the Upington commonage. The topography of the site is relatively flat, but the site itself has a definite small elevation or butt towards its north western side of the Erf. From this butt the site slopes from the northwest to the southeast (towards the direction of Upington), and also from towards the west, south and north. Although no rivers or wetlands were observed on the site, small drainage lines are still located to the east and west of the existing site. These drainage lines are seasonal and did not support any permanent streams.

The average slope from the butt towards Upington is 0.5% with a fall in elevation of approximately 9 metres over a distance of more than 700 m (Refer to Figure 5).

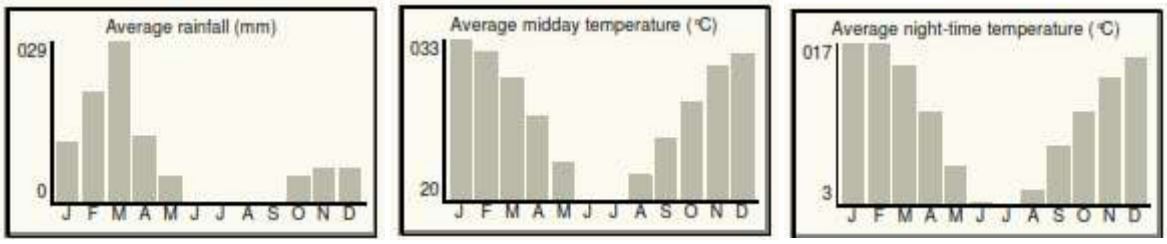
Figure 5: Google image indicating the slope of the site (northwest towards southeast)



6.3 CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Upington normally receives about 94 mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (lower left) shows the average rainfall values for Upington per month. It receives the lowest rainfall (0mm) in June and the highest (29mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Upington range from 19.8°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2.8°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures. (www.saexplorer.co.za).

Figure 6: Average rainfall, temperature and night-time temperatures for Upington (www.saexplorer.co.za)

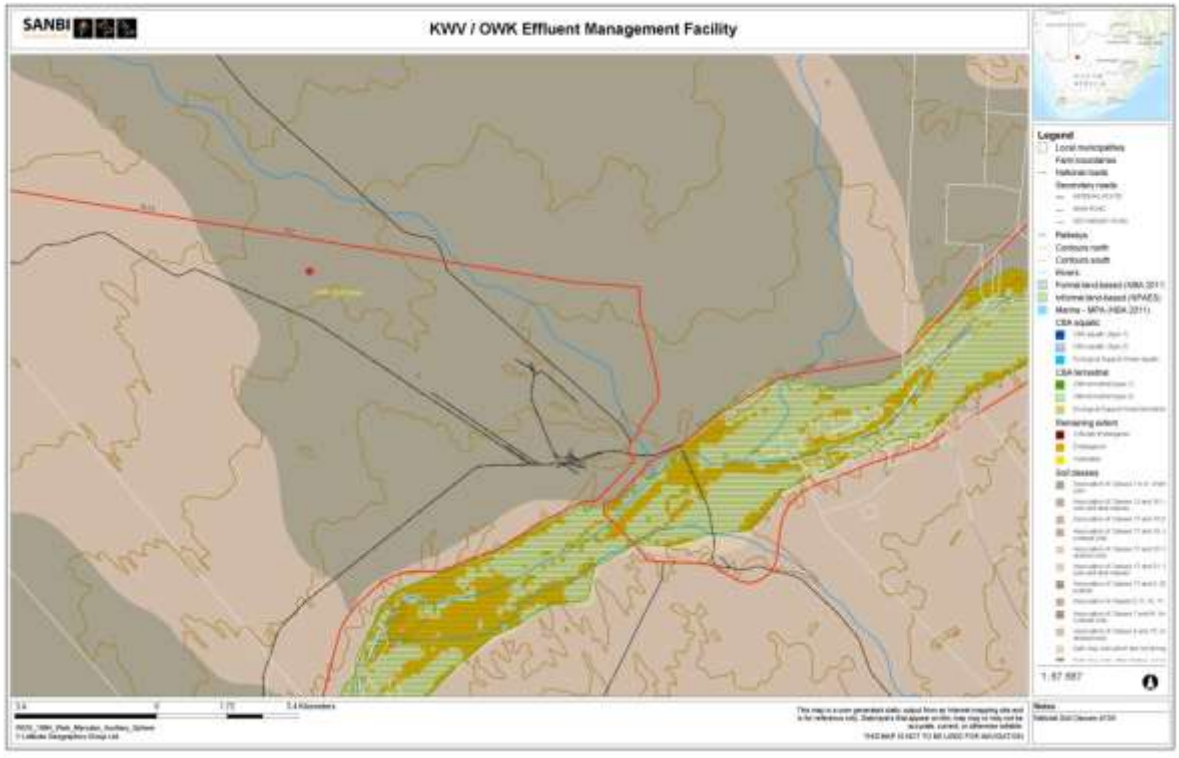


6.4 GEOLOGY & SOILS

According to Mucina and Rutherford (2006) and the SANBI Biodiversity Geographical Information System, the geology and soils for this area is described as covered by Cenozoic Kalahari Group sands and small patches also on calcrete outcrops and screes on scarps of inter-mittent rivers (mekgacha). In places Dwyka Group tillites out-crop. The soils are deep (>300 mm), red-yellow, apedal, freely drained, with a high base status, typical of Ae land type.

No special soils or geology features (e.g. quartz patches or broken veld), which could support special botanical features, were observed during the site visit (or are expected).

Figure 7: Soil class map of South Africa indicating the soils in the area on which the KWV effluent facility is located



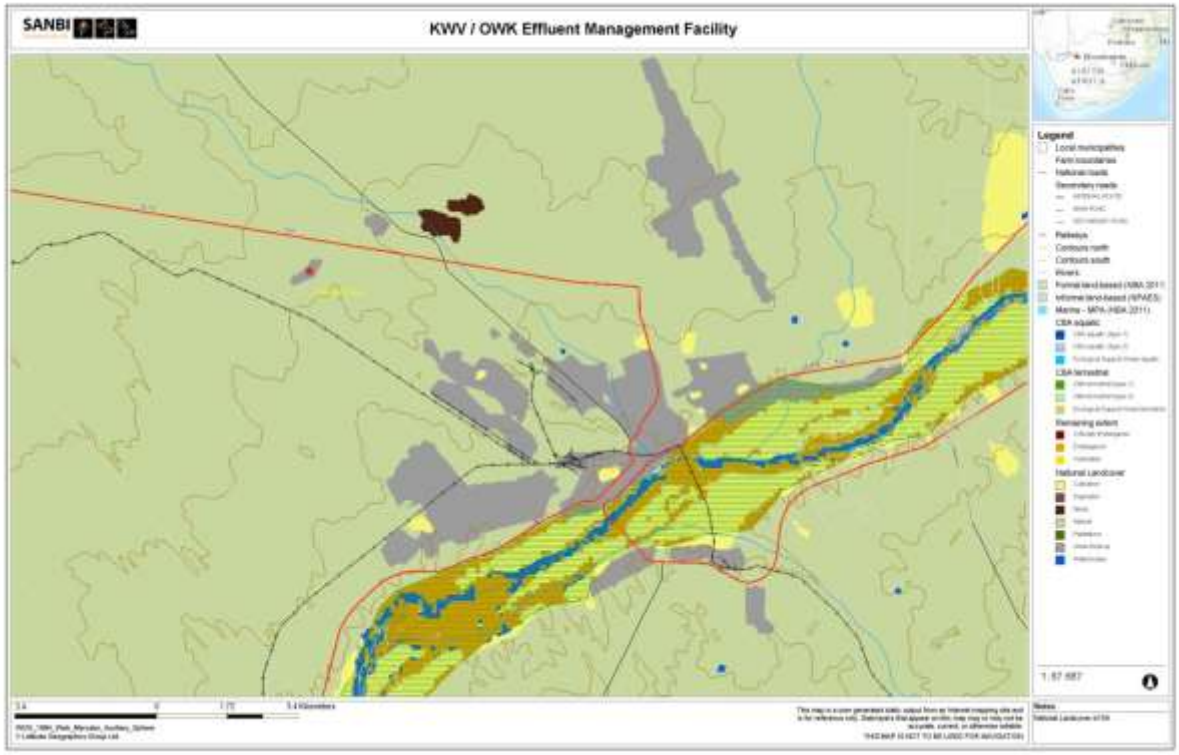
6.5 LANDUSE AND COVER

The existing WWTW and the proposed extension are surrounded by commonage land, sometimes utilised as grazing, but ritual initiation is also commonly observed on the property (Refer to Figure 8). No signs of agriculture usage had been observed, and apart from some illegal dumping observed towards the town no

other land uses were observed. The effluent facility itself is been indicated as urban build up or mostly transformed land.

Natural vegetation forms a uniform shrub layer cover over most of the surrounding area.

Figure 8: Landcover map showing the location of the KWV Effluent facility



6.6 BROAD SCALE VEGETATION TYPES EXPECTED

In accordance with the 2006 Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) only one broad vegetation types is expected on the sites, namely Kalahari Karroid Shrubland (Pink Figure 9).

According to the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011) Kalahari Karroid Shrubland are classified as "Least Threatened".

Table 2: Vegetation status according to the 2004 National Spatial Biodiversity Assessment

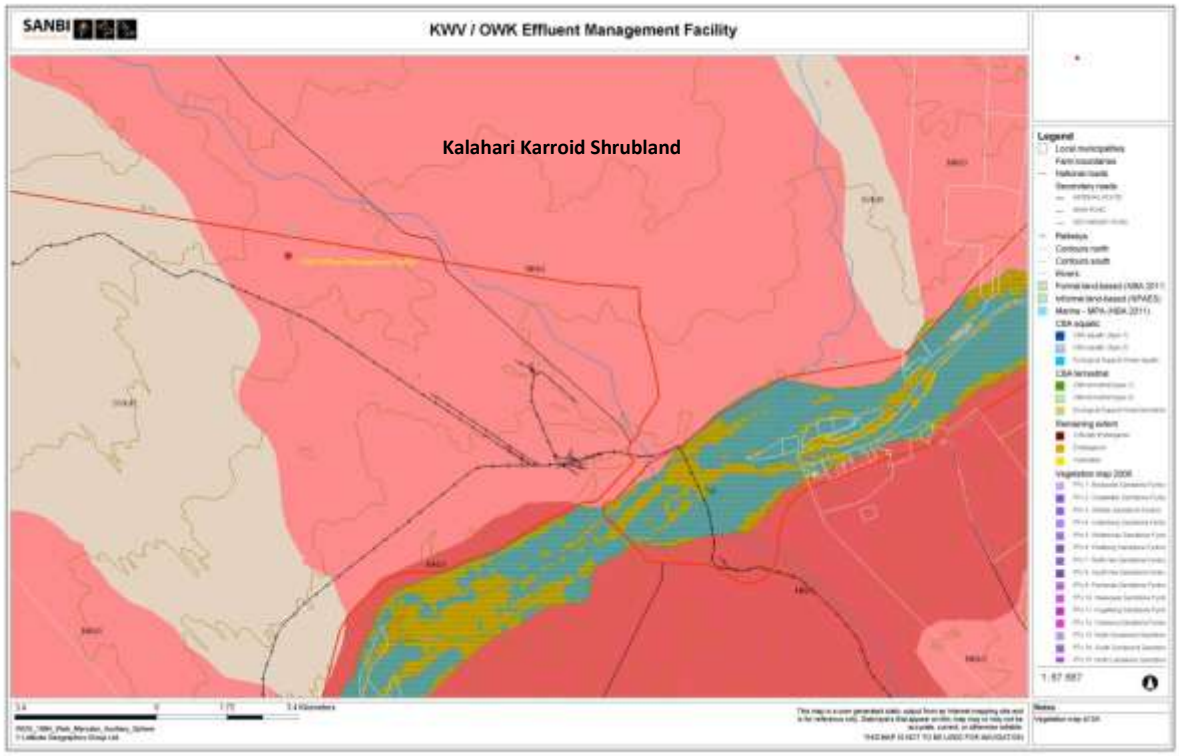
VEGETATION TYPE	NATIONAL STATUS 2011	REMAINING	CONSERVATION TARGET	FORMALLY CONSERVED
Kalahari Karroid Shrubland	Least Threatened	99.2 %	21 %	0.1 %

6.6.1 *Kalahari Karroid Shrubland*

The vegetation type is described as low Karroid shrubland on flat, gravel plains. Karoo elements meet here with northern floristic elements, indicating a transition to the Kalahari region and sandy soils.

Important taxa includes the Small Tree: *Acacia mellifera, Parkinsonia africana* and *Boscia foetida*; Tall Shrubs: *Rhigozum trichotomum*; Low Shrubs: *Hermannia spinosa*, *Limeum aethiopicum*, *Phaeoptilum spinosum, Aizoon schellenbergii, Aptosimum albomarginatum, A. lineare, A. marlothii, A spinescens, Barleria rigida, Hermannia modesta, Indigorera heterotricha, Monechma genistifolium, Tephrosia dregeana* etc.; Herbs: *Dicoma capensis, Chamaesyce inaequilatera, Amaranthus praetermissus, Barleria lichtensteiniana, Cucumis africanus, Geigeria ornativa, Hermannia abrotanoides, Monsonia umbellate, Sesamum capense* etc.; Succulent Herbs: *Giseka africana, G. pharnacioides and Trianthema parvifolia;* Graminoids: *Aristida adcensionis*, *Enneapogon desvauxii*, *Eragrostis annulata, E. homomalla, E. porosa, Schmidtia kalahariensis, Stipagrostis anomala, S. ciliata, S. uniplumis and Tragus racemosus*.

Figure 9: Vegetation map of SA, Lesotho and Swaziland (2006)



6.7 VEGETATION ENCOUNTERED

The following is a discussion of the vegetation and other significant environmental features encountered on site. The author did not attempt to identify all species but rather concentrated on identifying and marking protected plant species or any other biodiversity feature of significance. According to the vegetation map of South Africa (Figure 9), the vegetation expected should be Kalahari Karroid Shrubland. The vegetation and species composition encountered conformed to this vegetation type.

In the description of the vegetation in this document the site refer to Erf 5410, a large portion of which is mostly transformed as a result of the construction footprint of the existing evaporation ponds. The Erf which is approximately 60 ha in size have been bought by KWV to establish their wastewater treatment facility (or

evaporation ponds). Off the site approximately 65 – 70% can be described as transformed (evaporation ponds). The remaining natural veld can also be divided into two units depending on the condition of the veld. To the northwest (on the small kopje or butt) the vegetation is still relatively undisturbed and in good condition, while to the south and southeast (lower lying areas) the remaining natural veld has been impacted to a much larger degree, some of which was originally disturbed during the development of the evaporation ponds. Noteworthy is that although shallow calcrete is present almost over the whole site, the kopje shows much more signs of calcrete outcrops, while the slightly lower lying areas (as to be expected) show signs of slightly deeper sands (and the calcrete below ground level).

Figure 10: Google image demonstrating the extent of the evaporation ponds and the remaining natural veld

Also noteworthy was the number of *Boscia foetida* individuals encountered. The GPS markers in Figure 10 above all indicate the location of *Boscia foetida* plants within the site.

The vegetation on the higher lying kopje or butt represented a low dry shrubland with a fairly uniform vegetatio cover consisting mostly of low hardy shrubs including the following species (Refer to Photo 1): *Acacia mellifera, A. albomarginatum, Aptosimum spinescens, Blepharis mitrata, Boscia albitrunca, Codon royenii, Euphorbia decepta, Geigeria filifolia, Hermannia* species, *Ornithoglossum* species, *Salsola tuberculata, Sarcacaulon crassicaule, Rhigozum trigotomum* and *Zygophyllum* species. Grass species were also relatively common.

Photo 1: Overview of the relatively undisturbed vegetation encountered on top of the small kopje to the north of the site

The more disturbed vegetation along the southern parts of the site represented a sligtly more open shrubland, in places dominated by a slightly higher species composition which included: *Kleinia longiflora, Psilocaulon coriarium, Thesium liniatum* and *Salsola tuberculata*. Other species included: *Acacia mellifera, Boscia Albitrunca, Adenium oleifolium, Asparagus* cf. *africanus, Galenia africana, Geigeria filifolia, Lycium cinereum, Monechma genistifolium, Parkinsonia africana, Tribulus terestris* and *Zygophyllum* species (many of these species being actual pioneer species or indicating disturbance).

Photo 2: Overview of the more disturbed vegetation encountered along the southern portion of the site

Prosopis grandulosa, Cynodon dactylon, Salsola kali and *Nicotiana glauca* was almost totally associated with heavily disturbed areas in and around the evaporation ponds.

Table 3: List of species encountered on site (excluding grass species) and their conservation status (if applicable)

SPECIES NAME	FAMILY	STATUS
Acacia mellifera	FABACEAE	
Adenium oleifolium	**APOCYNACEAE**	**All species are protected in terms of Schedule 2 of the NCNCA**
Aptosimum albomarginatum	SCROPHULARIACEAE	
Aptosimum spinescens	SCROPHULARIACEAE	
Asparagus cf. *africanus*	ASPARAGACEAE	
Blepharis mitrata	ACANTHACEAE	
Boscia foetida	**CAPPARCEAE**	**All *Boscia* species protected in terms of Schedule 2 of the NCNCA**
Codon royenii	BORAGINACEAE	
Euphorbia decepta	**EUPHORBIACEAE**	**All *Euphorbia* species are protected in terms of Schedule 2 of the NCNCA**
Galenia africana	**AIZOACEAE**	**All species are protected in terms of the NCNCA**
Geigeria filifolia	ASTERACEAE	
Hermannia cf. *abrotanoides*	STERCULIACEAE	
Kleinia longiflora	ASTERACEAE	
Lycium cinereum	SOLANACEAE	
Monechma genistifolium	ACANTHACEAE	
Nicotiana glauca	SOLANACEAE	**Category 1 invader**
***Ornithoglossum* species**	**HYACINTHACEAE**	**All species are protected in terms of the NCNCA**
Parkinsonia africana	FABACEAE	
Prosopis grandulosa	FABACEAE	**Category 2 invader**
Psilocaulon coriarium	**AIZOACEAE**	**All Aizoaceae species are protected in terms of Schedule 2 of the NCNCA**
Rhigozum trichotomum	BIGNONIACEAE	
Salsola tuberculata	AMARANTHACEAE	
Salsola kali	AMARANTHACEAE	
Sarcocaulon crassicaule	**MESEMBRYANTHEMACEAE**	**All species are protected in terms of Schedule 2 of the NCNCA**
Thesium lineatum	SANTALACEAEA	
Tribulus terrestris	ZYGOPHYLLACEAE	
Zygophyllum cf. lichtensteinianum	ZYGOPHYLLACEAE	

6.8 SIGNIFICANT AND/OR PROTECTED PLANT SPECIES

Please note that this study never intended to be full botanical assessment. However, a scan of significant species was done during the site visit, and even though the author does not claim that all species encountered were identified, all efforts were made to do just that.

The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (GN 71 6 of 7 September 2012). Three tree species on the NFA may have a geographical distribution that may overlap the broader study area (Refer to Table 4).

- **None of these species were encountered on site.**

Table 4: NFA protected tree species with a geographical distribution that may overlap the broader study area

SPECIES NAME	COMMON NAME	TREE NO.	DISTRIBUTION
Acacia erioloba	Camel Thorn Kameeldoring	168	In dry woodlands next to water courses, in arid areas with underground water and on deep Kalahari sand
Boscia albitrunca	Shepherds-tree Witgat/Matopie	130	Occurs in semi-desert and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils.
Acacia haematoxylon	Grey Camel Thorn Vaalkameeldoring	169	In bushveld, usually on deep Kalahari sand between dunes or along dry watercourses.

In addition to the NFA the Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, which also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act.

- **A number of species listed in terms of the NCNCA were encountered on site (Refer to Table 3).**

Noteworthy is that all of the listed individual plants was encountered to the southwest and north of the existing evaporation pond footprints.

6.9 FINE-SCALE MAPPING (CBA'S)

Although a draft version of the Siyanda District Municipal, Environmental Management Framework (EMF) is available it has not been approved or published. No fine-scale mapping is as yet available for this area and as a result no critical biodiversity areas or biodiversity support areas has been promulgated for this area.

However, the proposed priorities for conservation in the Siyanda District is depicted on Maps 12a (Refer Figure 15) and 12b within this document, based on local occurrence, the national conservation target, the national ecosystem status and the national protection level of the vegetation types. A proposal is made for the prioritisation of vegetation types in the Siyanda District. The landcover of the Siyanda district reflects the results of the 2000 national landcover determination and is depicted on Map 13 from which it is evident that most of the area is in a natural state and the most significant spatial impact on the environment has come from mining which occupies an area of almost 7% of the total area. A sensitivity index is shown on Map 14 of the Draft EMP. The main factors that were used to compile the index include the following:

- The erosion potential of soil where soils with a high erosion potential were awarded a sensitivity of 1;
- The conservation priority of veld types for veld types with a medium conservation priority were awarded a sensitivity count of 1 those with a high conservation priority were awarded a count of 2 and those with a very high conservation priority were awarded a count of 3;

- Topographical areas with a high variance in shape and form were awarded a sensitivity count of 1;
- All watercourses, drainage lines and pans (including a 32m buffer on either side) were awarded a sensitivity count of 2; and
- All transformed areas were awarded a sensitivity count of -1.

Environmental control zones are depicted on Map 15 of the EMF. The purpose of environmental control zones is to indicate areas that require a specific type or regime of control due to unique environmental elements that occur in these areas. It may or may not be linked to the application of EIA legislation and should be dealt with at a more strategic level where it should serve as a guide for decision-making and planning.

6.9.1 Summary of findings according to the EMF

According to the Draft Siyanda Environmental Management Framework the proposed site falls within the following categories according to the various maps.

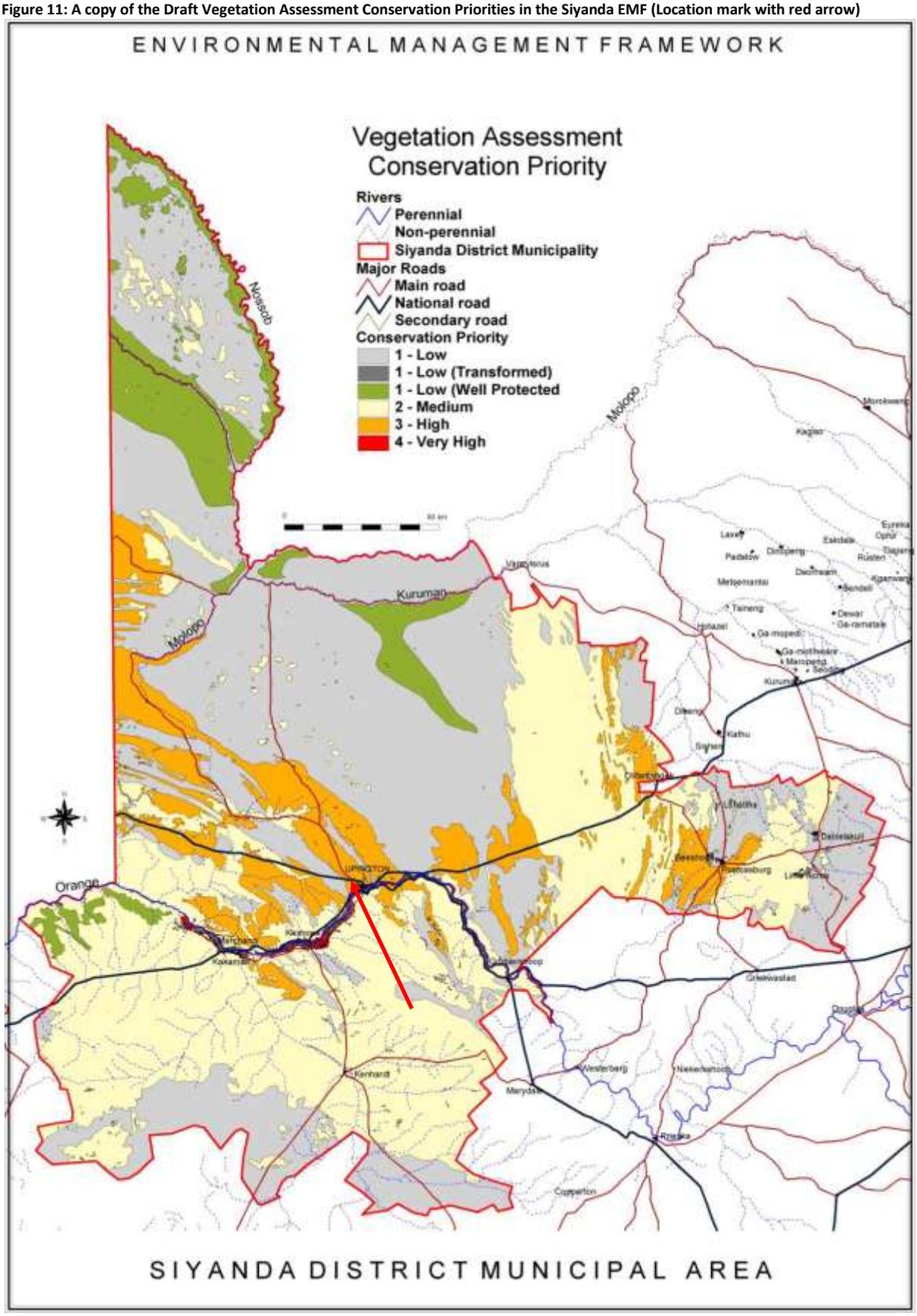
Conservation priority areas: According to Map 12a the site falls within an area (vegetation type) regarded as having a High (3) conservation priority. According to Map 12b, the site does not fall within a proposed conservation area.

Landcover: According to Map 13 of the Draft EMF, it would seem as if the proposed site falls within the area marked as shrubland.

Sensitivity Index: According to Map 14 of the Draft EMF, the proposed site falls within an area identified as of low environmental sensitivity (2) in an index which starts at Transformed and then are given values of 0-8 (8 being of high environmental sensitivity).

Control Zones: According to Map 15, the proposed site location falls within a control zone 3 area, which is regarded as areas of potential high to very high vegetation conservation areas.

Figure 11: A copy of the Draft Vegetation Assessment Conservation Priorities in the Siyanda EMF (Location mark with red arrow)



6.9.2 Key Environmental issues identified in the EMF

The following are considered to be the main environmental issues that may cause negative impacts and have to be addressed in the EMF:

- The conservation of the remaining Lower Gariep Alluvial Vegetation along the Orange River;
- the protection of vegetative groundcover across the area against overgrazing and other activities such as 4x4 and quad bike driving;
- the effect that inappropriate irrigation may have on the salination of soil in places;
- the provision of services, especially water to small populations in remote areas that may be unsustainable over the long term;
- the extensive use of firewood for cooking and heating that may be a threat to especially the protected Camel Thorn trees in places; and
- the rehabilitation of mining areas, especially along scenic routes that may have potential for further tourism development.

6.10 FAUNA AND AVI-FAUNA

Although natural fauna and avi-fauna may still be present, it is expected that it would be limited to avi-fauna, insects and maybe some reptile's species. Because of the proximity to the town of Upington and the current land-use it is not expected that game will be encountered in the vicinity of the site (none has been observed).

Mammals: The site falls within the distribution range of approximately 50 mammal species indicating moderate diversity. Human activity in the area is medium-high and it is highly unlikely that a fair representation of these mammals will be found on the property. Even though the impact will be permanent, it is highly unlikely that it will pose a significant impact on mammal species and as a result the impact is deemed negligible.

Reptiles: The site falls within the distribution range of approximately 30 reptile species, indicating low diversity. As a result of the open planes on site the reptile composition is likely to be dominated by species which inhabit open areas, such as snakes, lizards and geckos. Human activity in the area is medium-high and it is highly unlikely that large numbers of these species will be present on site. As such, the impact on reptiles should be negligible.

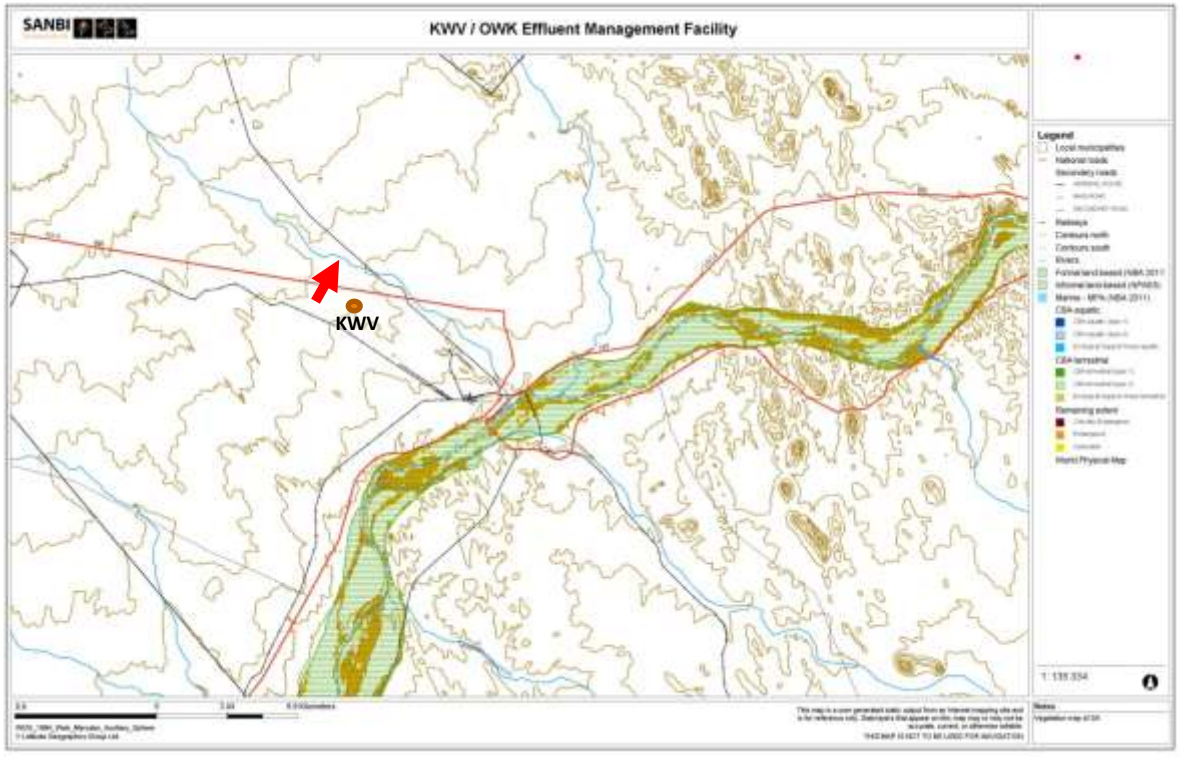
Amphibians: The site falls within the distribution range of approximately 10 amphibian species. However, no suitable breeding places were observed on the proposed site and it is highly unlikely that the proposed development will have any significant impact on amphibian species. In addition, most amphibians require perennial water and will thus not be affected at all.

Avi-fauna: The site falls within the distribution range of approximately 200 bird species known from the broad area. But because of the medium-high human activity it is not expected that a fair representation of these species will be encountered on site or its immediate vicinity. Apart from the possible impact on trees the proposed activity is not expected to have a significant impact on avi-fauna. However, it remains important that all larger indigenous trees must be protected wherever possible in order to minimise the possible impact (although localised) on bird species.

6.11 RIVERS AND WETLANDS

Rivers maintain unique biotic resources and provide critical water supplies to people. South Africa's limited supplies of fresh water and irreplaceable biodiversity are very vulnerable to human mismanagement. Multiple environmental stressors, such as agricultural runoff, pollution and invasive species, threaten rivers that serve the world's population. River corridors are important channels for plant and animal species movement, because they link different valleys and mountain ranges. They are also important as a source of water for human use. Vegetation on riverbanks needs to be maintained in order for rivers themselves to remain healthy, thus the focus is not just on rivers themselves but on riverine corridors.

Figure 12: Biodiversity map indicating important river systems for the Upington area, using available BGIS data



With the exception of the Orange River all the rivers in the Siyanda District Municipal area are non-perennial rivers and the last recordings of flows in the lower reaches of the Molopo and Kuruman Rivers were in 1933 and again in the 1974/5 and 1975/6 season. The topography of this whole area is relatively flat with a slight slope from the treatment facility towards the southeast (in the direction of Upington). The Orange River itself is approximately 7 km south of the facility.

No rivers or wetland (other than those resulting from the treatment facility) were encountered on the treatment facility (Erf 4510). The east and west of the facility smaller drainage lines is present, but they will not be impacted by the proposed development. The Biodiversity Wetland information maps shows the nearest river to the effluent facility as a non-perennial tributary to the Orange River, which runs approximately 1.5 km northeast of the facility (to the north of the N10) (Refer to Figure 12).

6.12 INVASIVE ALIEN INFESTATION

Most probably because of the aridity of the area, invasive alien rates are generally very low for most of this area. Problem areas are usually associated with river systems and other wetland areas. On the proposed site a number of *Prosopis grandulosa* trees (a category 2 invader) were observed next to the wetter areas associated with the evaporation ponds. In addition single individuals of *Nicotiana glauca* (a category 1 invader) were also observed. According to regulation 15 and 16 of CARA all category 1 plants are prohibited plants no longer to be tolerated on land or on water surfaces. Their harmfulness outweighs any useful properties they may have.

Photo 3: *Nicotiana glauca* encountered on site

Photo 4: *Prosopis grandulosa* next to water

All *Prosopis* and *Nicotiana* species must be removed.

7. VELD FIRE RISK

Kalahari Karroid Shrubland is part of the Nama Karoo Biome (Mucina & Rutherford, 2006) which is not prone to veldfires. The purpose of the revised fire risk classification is to serve as a national framework for implementing the National Veld and Forest Fire Act, and to provide a basis for setting priorities for veldfire management interventions such as the promotion of and support to Fire Protection Associations. In the fire-ecology types and municipalities with High to Extreme fire risk, comprehensive risk management strategies are needed. The site is near Upington in an arid shrubland vegetation type. According the revised veldfire risk classification of March 2010 (Forsyth, 2010) in terms of the National Veld and Forest Fire Act 101 of 1998, the site is located in an area classified as a "Low Fire Risk" area. Although, the fire risk is not considered high or extreme it is still important that during construction and operation the site must adhere to all the requirements of the local Fire Protection Association (FPA) if applicable, or must adhere to responsible fire prevention and control measures.

7.1 SIGNIFICANT BIODIVERSITY FEATURES ENCOUNTERED

The table underneath gives a summary of biodiversity features encountered during the site visit and a short discussion of their possible significance in terms of regional biodiversity targets.

Table 5: Summary of biodiversity features encountered and their possible significance

BIODIVERSITY ASPECT	SHORT DESCRIPTION	SIGNIFICANCE RATING
Geology & soils	Geology & soils vary only slightly in the larger study area, with deeper sandy soils found over most of the area.	No special features have been encountered (e.g. true quartz patches or broken veld) and the impact on geology and soils is expected to be very localised and low. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible. Impact = very low
Land use and cover	Natural veld utilised for stock grazing.	The property is sparsely used by the local inhabitants. The impact on land use and cover is expected to be very low and localised. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Vegetation types	Kalahari Karroid Shrubland	This vegetation type is considered "Least threatened", but the remaining natural veld shows good connectivity with the surrounding areas. According to the draft Siyanda EMF, the vegetation is of high conservation priority, but does not fall within a proposed conservation area and as such the locality is of low environmental significance. Impact low. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Conservation priority areas.	In terms of the draft Siyanda EMF	According to the EMF the site does not fall within a proposed conservation area. Impact low/localised. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Sensitivity index	In terms of the draft Siyanda EMF	According to the EMF, the proposed site falls within an area identified as of very low environmental sensitivity (1). Impact low and localised. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible.
Protected plant species	A number of protected species (Refer to Table 3), in terms of the NCNCA was observed.	Protected species was mostly associated with the remaining natural veld to the north and south of the existing evaporation ponds. Non species protected in terms of the NFA was observed, but a number of species protected in terms of the NCNCA was observed in the above mentioned areas. If the proposed treatment system could be located on the current evaporation ponds footprint, the impact would be negligible. However, if the footprint is to be enlarged, placement must be carefully considered. Impact low to medium (depending on the footprint).
Fauna & Avi-fauna	The site is used for live-stock grazing and is in close proximity to constant human activity.	Although natural fauna and avi-fauna may still be present, it is expected that it would be limited to avi-fauna, insects and maybe some reptile's species (proximity to the urban edge and the current land-use). The activity is not expected to have a significant impact on fauna or avi-fauna. Impact low.
Rivers & wetlands	No river or wetland areas were observed within the site.	No river or wetland system is expected to be impacted directly by the proposed upgrade. The impact on rivers is thus considered **negligible**.
Invasive alien infestation	A number of *Prosopis* as well as single *Nicotiana* individuals was observed	All invasive alien species should be removed in the immediate vicinity of the existing and the new treatment works during the construction phase. If implemented the impact can be regarded as positive.

8. BIODIVERSITY ASSESSMENT

Biological diversity, or biodiversity, refers to the variety of life on Earth. As defined by the United Nations Convention on Biological Diversity, it includes diversity of ecosystems, species and genes, and the ecological processes that support them. Natural diversity in ecosystems provides essential economic benefits and services to human society—such as food, clothing, shelter, fuel and medicines—as well as ecological, recreational, cultural and aesthetic values, and thus plays an important role in sustainable development. Biodiversity is under threat in many areas of the world. Concern about global biodiversity loss has emerged as a prominent and widespread public issue.

The objective of this study was to evaluate the biological diversity associated with the study area in order to identify significant environmental features which should be avoided during development activities and or to evaluate short and long term impact and possible mitigation actions in context of the proposed development.

As such the report aim to evaluate the biological diversity of the area using the Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), with emphasis on:

- Significant ecosystems
    - Threatened or protected ecosystems
    - Special habitats
    - Corridors and or conservancy networks
- Significant species
    - Threatened or endangered species
    - Protected species

8.1 NATURE OF THE IMPACT

The extension of the WWTW might include the enlargement of the existing evaporation pond footprint, which will lead to a permanent impact on the local environment. However, the impact will be localized ant could be placed within an area already disturbed. Significant impacts will be mainly associated with impacts on the natural veld (including possible impact on provincially protected plant species).

8.1.1 Parameters of the impact

Extent of the impact: Very Localised

Duration of the impact: Permanent

Probability or likelihood: The probability or likelihood that the impact will occur if the project is approved is possible, but will depend on the size and location of the new proposed treatment works.

Severity of the impact: The severity of the impact is considered to be low-medium depending on the impact minimisation actions implemented.

8.1.2 Possible issues / impacts associated with construction

The following possible environmental impacts were identified while doing the site visit and discussing the project with the engineers and land-owners:

- The possible impact on protected plant species as described in the "List of protected tree species" (GN 716 of 2012) and the "Protected Species" list (Schedule 1 & 2 of the NC Nature Conservation Act 9 of 2009).
- Rehabilitation of contaminated soils.
- Temporary storage areas.
- Waste management and control.

8.2 EVALUATION OF SIGNIFICANT IMPACTS

8.2.1 Threatened or protected ecosystems

The site visit confirmed that the vegetation conforms to Kalahari Karroid Shrubland, which is classified as "Least Threatened" in accordance with the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011). According to the Draft Siyanda Environmental Management Framework the proposed site falls within the following categories according to the various maps:

Conservation priority areas: According to Map 12a the site falls within an area (vegetation type) regarded as having a High (3) conservation priority. According to Map 12b, the site does not fall within a proposed conservation area.

Landcover: According to Map 13 of the Draft EMF, it would seem as if the proposed site falls within the area marked as shrubland.

Sensitivity Index: According to Map 14 of the Draft EMF, the proposed site falls within an area identified as of low environmental sensitivity (2) in an index which starts at Transformed and then are given values of 0-8 (8 being of high environmental sensitivity).

Control Zones: According to Map 15, the proposed site location falls within a control zone 3 area, which is regarded as areas of potential high to very high vegetation conservation areas.

The impact on threatened or protected ecosystems is thus rated as low.

Mitigation:

- The proposed treatment works should utilise the existing footprint and thus the existing disturbed areas as much as possible. In doing this the impact on natural veld and protected species is minimised.
- All efforts must be made to minimise the impact on protected species encountered on site.
- Permits must be obtained for the removal of any protected species which cannot be avoided.

8.2.2 Special habitats

The vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats, were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems. Better treatment and beneficial irrigation can only improve the current pollution risk. The possible enlargement of the footprint may impact directly on small portions of remaining natural veld. However, the possible positive spinoffs (pollution prevention) should far outweigh the small impact on natural veld.

Taking the above into account the **impact is rated as very low**.

8.2.3 Corridors and or conservancy networks

Looking at the larger site and its surroundings it shows excellent connectivity with remaining natural veld in almost all directions. Corridors and natural veld networks are still relative unscathed (apart from road networks).

The localised impact of the project makes it highly unlikely that it will have a significant effect on corridors or conservancy networks. **The impact is thus rated as low**.

8.2.4 Threatened or endangered species

No threatened or endangered species were recorded during the site visit, however, this does not rule out their presence as they may be subject to seasonable rainfall and may not have been observable during the time of the site visit, since the composition of the vegetation layers will fluctuates with seasonal rainfall (Van Rooyen *et. all*, 1984, *vide* Mucina & Rutherford, 2006). However, it must be noted that the vegetation type is considered "Least Threatened" and that this classification is based on plant species diversity and turnover as well as habitat transformation. The number of species per broad geographical levels for the Nama-Karoo biome is relative low (Van Rooyen, 1988, *vide* Mucina & Rutherford, 2006). It is therefore very unlikely that any red data species will be confined to the proposed site alone.

Taking the above into account it is highly unlikely that the proposed project will have a significant or long term effect on threatened or endangered species. **The impact is thus rated as low**.

8.2.5 Protected species

No protected tree species in terms of the National Forests Act of 1998 (Act 84 of 1998) have been observed. But a number of provincially protected species in terms of the Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) have been observed (Refer to Paragraph 6.8). However, almost all of these species were recorded to the north and south of the current treatment area. The impact on protected species can this be mostly negated through correct placement of the new works, utilising the existing footprint, which is already degraded.

Taking the above into account it is possible that the proposed project will have an impact protected species, but the impact can be much reduced through correct placement. **The impact is thus rated as low-medium** (which can be reduced with mitigation).

Mitigation:

- The proposed treatment works should utilise the existing footprint and thus the existing disturbed areas as much as possible. In doing this the impact on natural veld and protected species is minimised.
- All efforts must be made to minimise the impact on protected species encountered on site.
- Permits must be obtained for the removal of any protected species which cannot be avoided.

8.2.6 Direct impacts

As the name suggest, direct impacts refers to those impacts with a direct impact on biodiversity features and in this case were considered the potentially most significant associated impacts (some of which have already been discussed above).

- Direct loss of vegetation type and associated habitat due to construction and operational activities.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities. (Refer to page 25).
- Loss of local biodiversity and threatened plant species (Refer to page 26)
- Loss of ecosystem connectivity (Refer to page 27)

The impact will be permanent, but very small scale (localised). In addition, the vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats were encountered on site. However, the possible positive spinoffs (pollution prevention) should far outweigh the small impact on natural veld.

Taking the above into account the direct impact on the environment is **rated as low-medium, which can be reduced to low** with mitigation.

Mitigation: The following is some mitigation which will minimise the impact of the solar plant location and operation.

- The proposed treatment works should utilise the existing footprint and thus the existing disturbed areas as much as possible. In doing this the impact on natural veld and protected species is minimised.
- Permits must be obtained for the removal of any protected species which cannot be avoided.
- Only existing access roads should be used for access to the terrain. Access roads must be clearly demarcated and access must be tightly controlled (deviations may not be allowed).
- Indiscriminate clearing of areas must be avoided (all remaining areas to remain as natural as possible).
- Soils contaminated as a result of the current evaporation pond treatment system must be rehabilitated and used as base material for the construction of the new treatment work (especially if constructed wetland treatment is implemented).
- Once the construction is completed all further movement must be confined to the access tracks to allow the vegetation to re-establish over the excavated areas.

8.2.7 Indirect impacts

Indirect impacts are impacts that are not a direct result of the main activity, but are impacts still associated or resulting from the main activity. The following possible indirect impacts were associated with the proposed project:

- The possible impact on protected plant species as described in the "List of protected tree species" (GN 716 of 2012) and the "Protected Species" list (Schedule 2 of the NC Nature Conservation Act 9 of 2009).
- Pollution as a result of poorly treated effluent.
- Temporary storage areas (e.g. pipe's and fittings and concrete mixing material).
- Waste management

It is very likely that the proposed project will have indirect impacts. It is considered that indirect impacts will have a similar impact as direct impacts, which will lead to a cumulative effect on the environment. However, the upgrade will also lead to improved effluent treatment and thus a lower pollution risk. In addition construction related impacts can be much reduced through good environmental control during construction. **On its own the impact is considered to be low** (better pollution management might even lead to environmental improvement).

Mitigation:

- Appoint a suitably experience ECO during the construction phase of the project.

8.2.8 Cumulative impacts

In order to comprehend the cumulative impact, one has to understand to what extent the proposed activity will contribute to the cumulative loss of ecological function and other biodiversity features on a regional basis. The vegetation is classified as "Least Threatened", No special habitats were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems. According to the Draft EMF for Siyanda the site falls within an area regarded as having a high conservation priority, but does not fall within a proposed conservation area. In addition it is rated as having a very low environmental sensitivity and is regarded as a low control zone. The possible positive spinoffs should outweigh the possible small impact on natural vegetation.

The proposed project will thus have a permanent, but localised impact. **On the whole the cumulative impact is considered to be low-medium**. With the implementation of impact minimisation actions the impact could even be reduced to **low**.

8.3 THE NO-GO OPTION

The "No-Go alternative" does not signify significant biodiversity gain or loss especially on a regional basis. However, it will ensure that none of the potential impacts above occur. The current status quo will remain and there will be no direct impact (even temporarily) on the vegetation, protected species or river corridors. However, during the last years, significant development has taken place in terms of the KWV and OWK facilities and flows in excess of the original intent are regularly experienced. There is also no proof that the evaporation ponds is lined or contained and even recent soil studies done my Dr. P Raath shows little significant soil contamination away from the evaporation ponds, the soils within the evaporation ponds had been contaminated and the possibility of polluting the lower lying areas is real. In addition, in a water scares country like South Africa, evaporation is not considered the best re-use of a water resource.

The No-Go option will mean that the current unacceptable effluent treatment practices will not be improved. As a result continual pollution issues (which will further increase over time) will remain, with possible health risks as well.

Over the long term the proposed project is likely to have a positive environmental impact, while the No-Go option will lead to environmental pollution and health risks.

9. RECOMMENDATIONS & IMPACT MINIMIZATION

The No-Go option will mean that the current unacceptable effluent treatment practices will not be improved and pollution and health risks will increase, while the proposed project is likely to have a positive environmental impact over the long term. Because of the identified need for improved treatment it is highly unlikely that the "No-Go" option will be an option.

Other locations may be looked at, but ultimately the need for an upgraded or enlarged treatment system remains. Even though the impact will be permanent, it will also be localised and is situated within a vegetation type not considered by either National Spatial Biodiversity Indicators or by local environmental planning initiatives (Siyanda Draft EMF, 2008) as a sensitive area. However, various provincially protected species in terms of NCNCA was encountered within the larger site, but by utilising the existing degraded footprint the impact on any protected species could be negated. Various impact minimisation recommendations are given in this report, which will reduce the cumulative impact of the proposed development to a very large degree. The major impact minimisation recommendation is associated with placement of any new facilities or treatment infrastructure.

Having evaluated and discussed the various biodiversity aspects associated with the project it is clear that the most significant impacts associated with the project will be:

- The possible localised loss of natural vegetation (which can be minimised through correct placement).
- The possible impact on protected plant species (which again can be minimised through correct placement).
- Prevention of pollution (and health risks) as a result of treatment within design capacity.

It is, however, considered highly unlikely that the proposed project will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity

With the available information to the author's disposal it is recommended that project be approved since it is not associated with irreversible environmental impact, provided that mitigation is adequately addresses.

9.1 IMPACT MINIMIZATION

9.1.1 General

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and the Biodiversity study recommendations as well as any other conditions which might be required by the Department of Environmental Affairs.
- An integrated waste management system must be implemented during the construction phase.
- All rubble and rubbish (if applicable) must be collected and removed from the site to a suitable registered waste disposal site.
- All alien vegetation should be removed from the larger property.

9.1.2 Other site specific mitigation recommendations

- The proposed treatment works should utilise the existing footprint and thus the existing disturbed areas as much as possible. In doing this the impact on natural veld and protected species is minimised (Refer to Figure 13 underneath).
- Permits must be obtained for the removal of any protected species which cannot be avoided.
- Only existing access roads should be used for access to the terrain. Access roads must be clearly demarcated and access must be tightly controlled (deviations may not be allowed).
- Indiscriminate clearing of areas must be avoided (all remaining areas to remain as natural as possible).
- Soils contaminated as a result of the current evaporation pond treatment system must be rehabilitated and used as base material for the construction of the new treatment work (especially if constructed wetland treatment is implemented).
- All topsoil (in areas with natural veld) must be removed and stored separately for re-use for rehabilitation purposes. The topsoil and vegetation should be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of the species removed during construction.
- Once the construction is completed all further movement must be confined to the access tracks to allow the vegetation to re-establish over the excavated areas.
- Adequate measures must be implemented to ensure against erosion.

Figure 13: Google image demonstrating the extent of the evaporation ponds and the remaining natural veld