



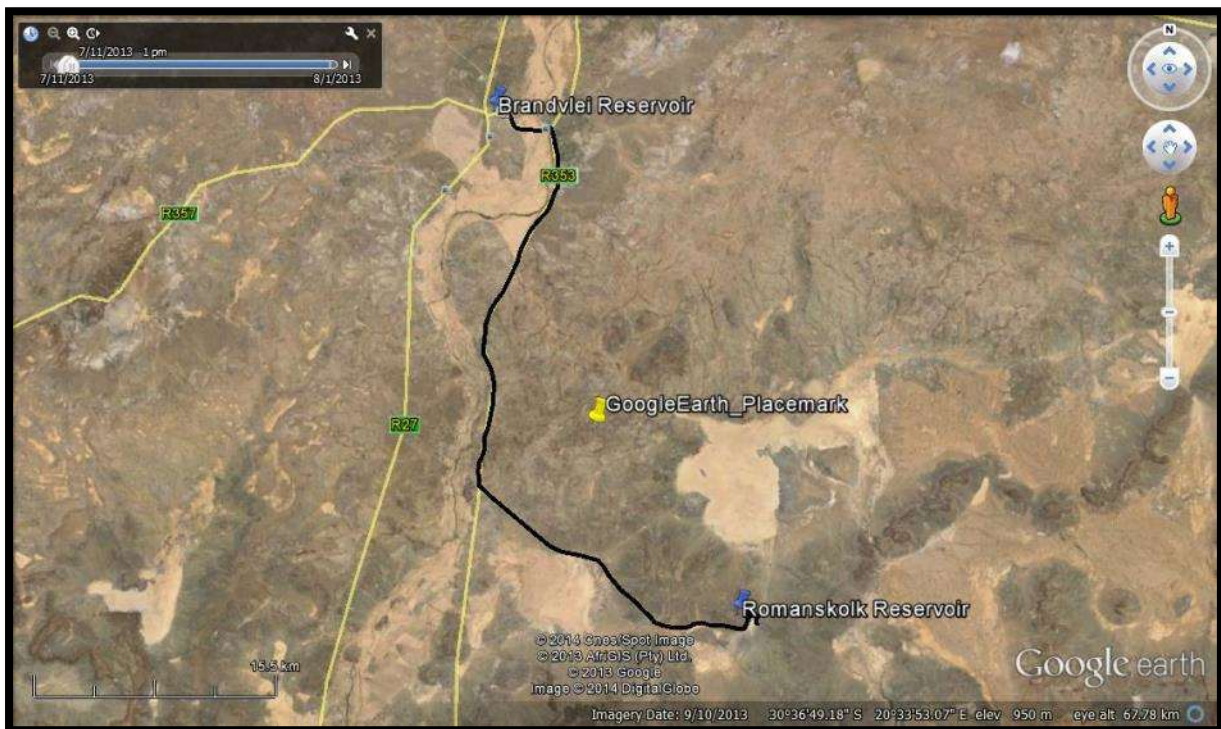
BRANDVLEI BULK WATER SUPPLY

Proposed construction of a 51 km new bulk water supply pipeline (replacing the existing pipeline) from Romanskolk Reservoir to the Brandvlei Reservoir, Brandvlei (Northern Cape Province).

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).

25 February, 2014



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PREPARED FOR: ENVIROAFRICA CC

REQUESTED BY: BVI ENGINEERS PTY. LTD.

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INDEPENDENCE & CONDITIONS

PB Consult is an independent consultant to BVi Engineers 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 QUALIFICATIONS & 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 and 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.

Mr. Botes is also a registered Professional Environmental and Ecological Scientist at SACNASP (South African Council for Natural Scientific Professions) as required in terms of Section 18(1)(a) of the Natural Scientific Professions Act, 2003, since 2005.

Yours sincerely,



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SUMMARY - MAIN CONCLUSIONS

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SUMMARY OF POSSIBLE SIGNIFICANT BIODIVERSITY FEATURES		
Geology & soils	Geology & soils vary only slightly in the larger study 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. Potential Impact = low
Land use and cover	The proposed route will follow existing road reserves and with little impact on any farming activity.	The area is been utilised mainly for grazing. The impact is considered short term, temporary and localised with regards to land use. Potential Impact is considered to be <u>low and temporary of nature</u>.
Vegetation type(s)	Two vegetation types encountered namely: Bushmanland Basin Shrubland Bushmanland Vloere	Both vegetation types are classified as “Least threatened” but not protected. The proposed footprint runs along existing road verges. Associated infrastructure (e.g. additional roads) will not be required. In addition the impact will be short term and temporary of nature and is therefore not considered significant. Potential impact is considered as <u>low</u> (localised).
Corridors and conservation priority areas/networks.	Namakwa District Biodiversity Sector Plan	According to the Namakwa District Biodiversity Sector Plan a portion of the proposed route will fall within the ecological support area associated with the Sak River. However, in this section the proposed route will fall within the road verge of firstly the R353, then the R357 and then next to roads within the town of Brandvlei. It is thus not expected to have any significant impact on the support area (as it is located within an already disturbed area). Furthermore the impact will be temporary of nature and localised. Where the route crosses the Sak River it will be strapped to the existing bridge (again minimising impact). Potential impact is considered as <u>low</u>.
Protected plant species	Ten plant species protected in terms of the NCNCA was observed.	No SA Red List species were observed. No protected tree species in terms of the NFA was observed. Ten plant species protected in terms of the NCNCA was observed and is likely to be impacted by the proposed development. However, the impact will be temporary of nature and with good mitigation (topsoil conservation) the impact can be minimised. Please note that none of these species are considered endangered according to the SA Red list of plant species. However, permits in terms of the NCNCA will be needed for the removal of these plants. Potential impact = medium-low.
Fauna & Avi-fauna	The proposed route will follow existing road reserves and with low impact on habitat.	Because of the temporary and localised nature of the activity it is considered highly unlikely that it will have any significant impact on fauna or avi-fauna. Potential Impact very <u>low</u> and temporary of nature.
Rivers & wetlands	A number of smaller ephemeral streams and two salt pans were observed in the vicinity of the route.	The flatness of the basin area has resulted in networks of seasonal surface drainage lines (or ephemeral streams) draining rainwater towards the pans or river systems. These drainage lines are mostly poorly defined and seldom associated with any riparian vegetation. Their only function being to drain the basin landscape. At present these features can hardly be seen as fulfilling the function of a river ecological system. Two salt pans were observed in the vicinity of the route. In both cases the

		route runs north of the salt pan and should not have any direct impact on the pan itself. Potential impact = medium-low
Invasive alien infestation	<i>Prosopis</i> species was observed along the route.	All listed invasive alien species must be removed during the construction. Possible Impact = positive.
Direct impacts	Refers to those impacts with a direct impact on biodiversity features.	The proposed pipeline will have a direct impact on natural vegetation, which is likely to include protected plant species in terms of the NCNCA, small seasonal ephemeral streams and an ecological support area associated with the Sak River. The impact on soil, landuse, fauna and avi-fauna and veld fire is considered to be negligible. Normally the possible impact on protected plant species, the ecological support area and the ephemeral streams would have resulted in a higher significance rating. However, since the impacts are all short termed, temporary and localized it is considered unlikely that the cumulative direct impact will be of high significance. Potential impact = low to medium-low
Indirect impacts	Refers to impacts that are not a direct result of the main activity, but are impacts associated or resulting from the main activity.	It is likely that the proposed project will have indirect impacts, but it is not considered to add significant load on the natural environment. It is considered that indirect impacts will have a much lower impact than direct impacts with very little cumulative effect on the environment. In addition indirect impacts can be reduced through good environmental control during construction. Potential impact = low
Cumulative impacts	Refers to the cumulative loss of ecological function and other biodiversity features on a regional basis.	The proposed project will have a temporary and localised impact, which should not result in significant additional permanent impacts (apart from the new reservoir at Brandvlei). Overall it is not considered likely that the cumulative impact will result in any significant additional impact on regional biodiversity targets, but because of the likelihood of the medium-low impacts associated with protected plant species, ecological support areas and seasonal ephemeral streams the overall cumulative rating slightly increase. However, good environmental control should offset the additional impact. Potential impact = medium-low (with good environmental control during construction)
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.	However, it is important to note that the current water supply system to Brandvlei is dated. The old pipeline cannot supply enough water and the system is in poor state of maintenance. Additional water is needed and the proposed activity provides the most viable long term solution. Should the activity not be approved, Brandvlei will have to resort to other measures of water supply (none of these viable at present). In addition this will lead to major maintenance works to the current system which may lead to additional (uncontrolled) environmental impacts.

RECOMMENDATION

Having evaluated the biodiversity aspects and associated impacts pertaining to the proposed development, the author is of the opinion that the proposed development route matches the most logical choice from a biodiversity perspective, by not impacting or mitigating impacts on threatened habitats, vegetation and species, while conforming with the objectives of the Namakwa District Biodiversity Sectors Plan's identified CBA's (even with regards to the potential impact on the ESA's associated with the Sak River).

With mitigation it is expected that the proposed development will not pose any additional significant impacts on the environment and it is considered highly unlikely that the proposed development will have any significant biodiversity impact in terms of local or regional conservation targets.

With the available information to the author's disposal it is recommended that the project be approved, but that all mitigation measures described in this document is implemented.

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1. INTRODUCTION: BRANDVLEI BULK WATER SUPPLY

Brandvlei is a small town in the Karoo region of the Northern Cape, South Africa located near the north-eastern boundary of the Hantam Local Municipality (Namakwa District Municipality). According to history Brandvlei got its name from a 19th-century trekboer called “*Ou Brand*”. Brand camped and later settled at this spot next to the Sak River. The Sak River is a dry river bed, subject to occasionally flooding after good rains (typically resulting in flash floods). The Brandvlei settlement was cut in two by such a flood in 1961. After it was recovered, a municipality was formed in 1962. Brandvlei is located in the Bushmanland, also known as the “*Dorsland*”. Fossil found in this area supports the theory that this area was once sub-tropical, such as during the Miocene period.

Although farmers once used an irrigation method comparable to one used for thousands of years by the Egyptians it had only allows crop growth on a very small scale. However, this was unfeasible over the long run, as evaporating water leaves behind salt and other minerals. Today this method is no longer used and the area is mostly used as large open grazing for wildlife and stock (mostly sheep) farming. Vegetation of this desert like landscape is sparse open very low shrubland with grasses prominent after good rains.

Drinking water used by the community of the town of Brandvlei is extracted from boreholes next to an artificial wetland at Romanskolk (some 50 km away from Brandvlei). The old pipeline had become degraded and unreliable over time and can also not deliver the water demand. BVi Engineers was approach by the Hantam Municipality to evaluate additional or alternative sources of water supply. The result indicates that Romanskolk underground water supply remains the only long terms feasible option. In order to meet the increased demand, BVi suggested that the existing pipeline is upgraded (replaced) by a new pipeline. The original pipeline runs almost strait from Romanskolk to Brandvlei. In order to minimise environmental impact and to enable better maintenance it was suggested that the new pipeline will follow existing road reserves from Romanskolk to the Brandvlei Reservoir (This a new route).

BVi Engineers (Pty) Ltd. appointed EnviroAfrica to undertake the NEMA environmental application process. PB Consult was appointed by EnviroAfrica to conduct a biodiversity and botanical scan of the proposed route.

1.1 TERMS OF REFERENCE

EnviroAfrica (Pty) Ltd was appointed by BVi Engineers (Pty) Ltd 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 and botanical scan of the proposed route.

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.

The study includes the following:

- A brief discussion of the local environment in order to give some background on the ecological factors influencing the ecological drivers associated with the specific area.
- A brief discussion of the vegetation types expected and encountered with emphasis on protected species encountered.
- A species list encountered during the site visit.
- Determination of the occurrence, or possible occurrence of threatened or sensitive plant species, and sensitive plant communities, on the basis of the field survey and records obtained from the South African National Biodiversity Institute (SANBI) and available literature.
- Assessment of habitat sensitivity, incorporating faunal distribution on the hand of the field survey and from available literature.
- An evaluation of the potential impact of the proposed project on habitat and species.
- A discussion of significant impacts focusing on possible mitigation and amendments to the development proposal.

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): which provides for the sustainable utilization of wild animals, aquatic biota and plants.

3. DEFINITIONS & ABBREVIATIONS

3.1 DEFINITIONS

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/aesthetic) 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 a river, a water course and an ephemeral stream as encountered in the study area.

- **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.
- **Water course:** 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.
- **Ephemeral stream:** 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)
DEA	Department of Environmental Affairs
EAP	Environmental assessment practitioner

EIA	Environmental impact assessment
EMF	(Municipal) Environmental Management Framework
EMP	Environmental management plan
NCNCA	Northern Cape Nature Conservation Act, 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 DESCRIPTION

The proposed project entails the installation of a new bulk water supply line from Romanskolk Reservoir (on the Remainder of the Farm Erfdeel no. 57) to the Brandvlei Reservoir in the town of Brandvlei, a distance of approximately 52 km. The proposed route will follow existing roads for the whole length of the pipeline and will, according to current planning, be placed within the existing road reserve. A new bulk Reservoir will also be constructed next to the existing Brandvlei Reservoir in order to increase storage capacity.

The proposed route will start at the Romanskolk Reservoir and follows the servitude of the existing dirt road (OG 86) for approximately 23.1 km, where it will link up with the R353 (the Blomberg turn-off). Within this section the proposed pipeline route crosses a number of small ephemeral streams. It will then follow the road reserve along the R353 northwards for approximately 24.6 km, until it link up with the R357. In this section the proposed pipeline will cross two seasonal streams (indicated on the BGIS maps), one unnamed and one known as the Rooddam se Laagte. However, please note that the site inspection shows that both these streams are also only small ephemeral drainage lines (Refer to Photo 3). Finally the proposed route will follow the R357 westwards across the Sak River (attached to the existing bridge) and into the town of Brandvlei. In Brandvlei it will follow Waterkant Street for the last portion till it reaches the secondary dirt road leading up to the existing Brandvlei Reservoir (a total distance of approximately 4.8 km).

5.1 METHODS

Desktop studies were conducted, coupled by three physical site visits on the 30th of July 2013, the 7th of November 2013 and the 10th of February 2014. The timing of the various site visit enabled the author to experience the route through different seasons and which mean that essentially all perennial plants and a good number of seasonal plants were identifiable and although the possibility remains that a few species may have been missed, the author is confident that a fairly good understanding of the vegetation status in the area was obtained.

The survey was conducted by walking and driving the route, examining, marking and photographing any area of interest. 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. salt marsh areas, rocky outcrops or silcrete patches).

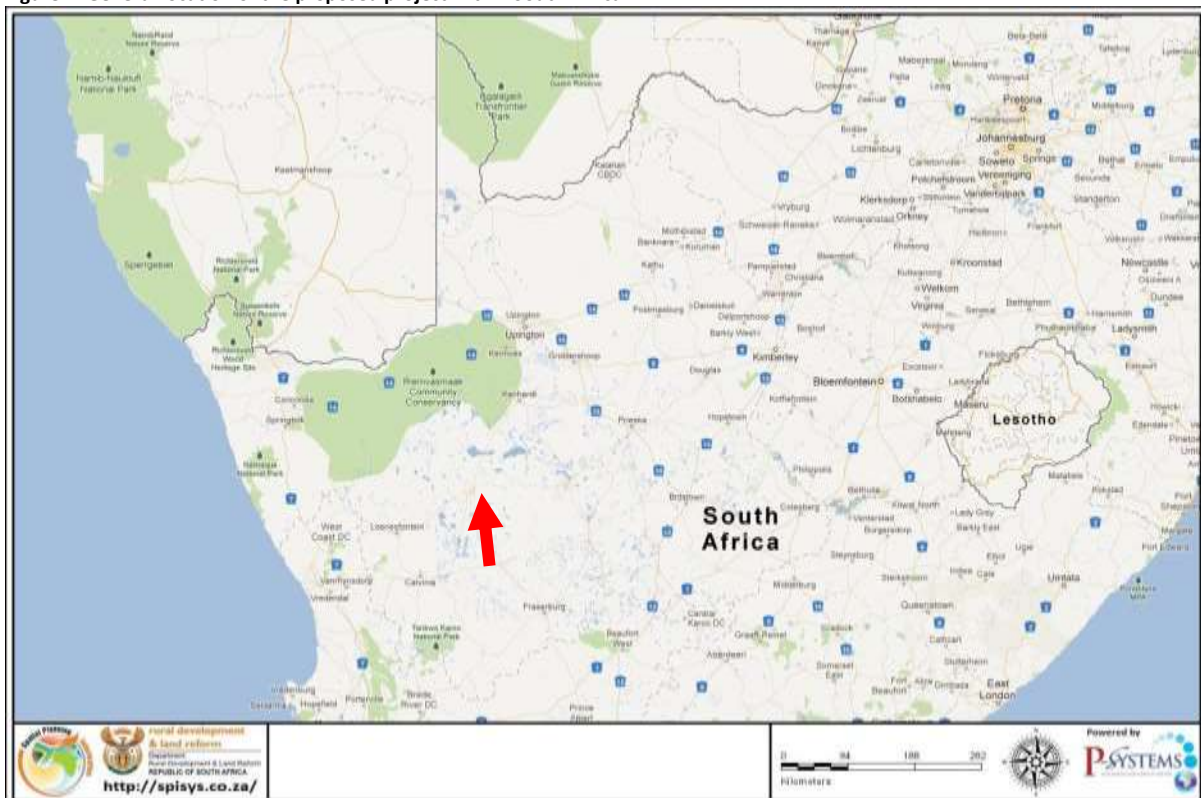
6. DESCRIPTION OF ENVIRONMENT

The aim of this description is to put the study area in perspective with regards to all significant biodiversity features which are expected and or encountered within the study area. The study area has been taken as the proposed route 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 Biodiversity Sector Plans and Municipal Critical Biodiversity Areas (CBA's) into account where applicable.

6.1 LOCATION & LAYOUT

The town of Brandvlei is located on the R27, between Calvinia (approximately 150 km north off) and Kenhardt (approximately 140 km south off) in the Namakwa District Municipality, Northern Cape Province. The proposed route spans both the Hantam- and the Karoo Hoogland local Municipalities.

Figure 1: General location of the proposed project within South Africa



The proposed route will start at the Romanskolk Reservoir and follows the servitude of the existing dirt road (OG 86) for approximately 23.1 km, where it will link up with the R353 (the Blomberg turn-off). It will then follow the road reserve along the R353 northwards for approximately 24.6 km, until it link up with the R357.

Finally the proposed route will follow the R357 westwards across the Sak River (attached to the existing bridge) and into the town of Brandvlei. In Brandvlei it will follow Waterkant Street for the last portion till it reaches the secondary dirt road leading up to the existing Brandvlei Reservoir (a total distance of approximately 4.8 km).

Figure 2: Map indicating the proposed route (in red) from Romanskolk to Brandvlei

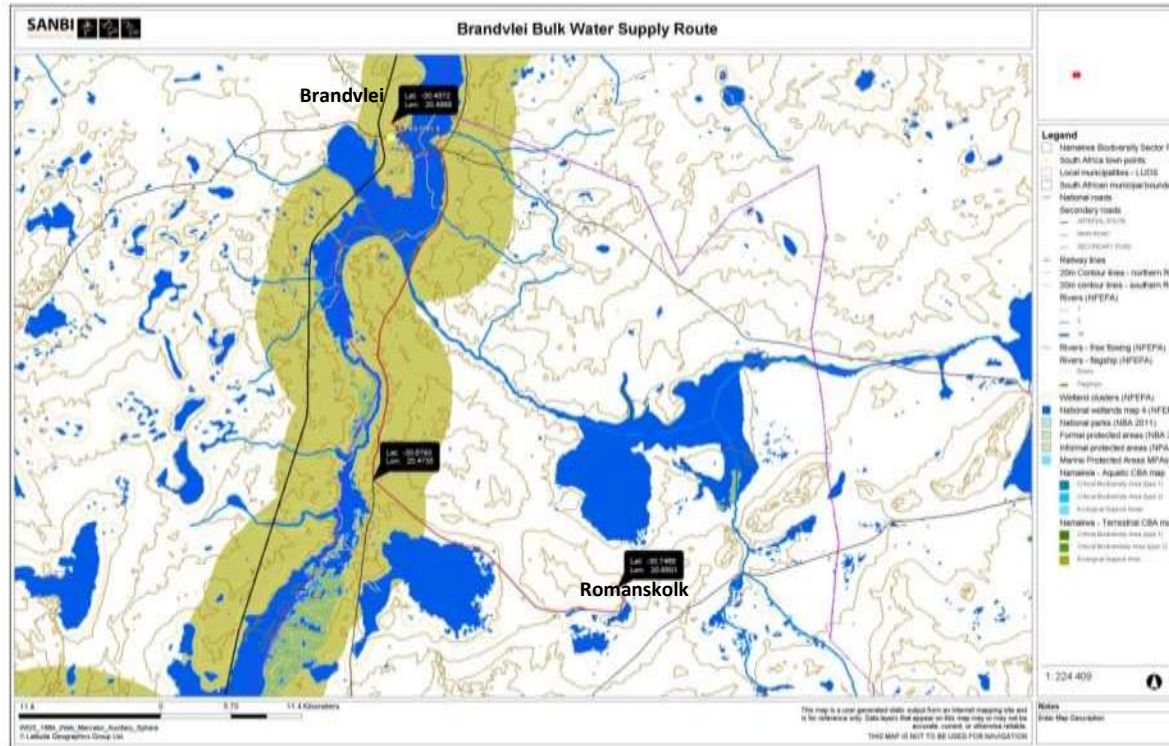


Table 1: GPS coordinates for Brandvlei Bulk water supply route

DESCRIPTION	LATITUDE AND LONGITUDE	ALTITUDE
Brandvlei Reservoir	S30 27 25.8 E20 29 12.4	927 m
Romanskolk Reservoir	S30 44 48.3 E20 39 00.2	998 m

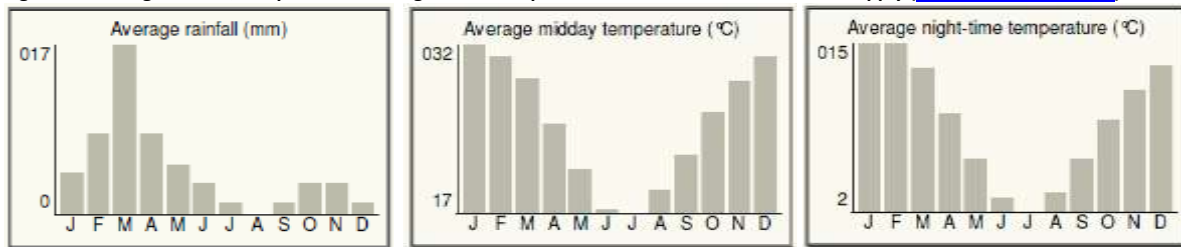
6.2 TOPOGRAPHY

The topography can be described as relatively flat basin with slightly irregular plains or an undulating hilly landscape which shows a slight slope towards the Sak River basin (Refer to Figure 2 above). Elevation varies from 998 m at Romanskolk Reservoir to 927 m at Brandvlei Reservoir (Refer to Table 1). Gravity feed will this be achieved from Romanskolk to Brandvlei. Small ephemeral streams drain this basin into the Sak River or other seasonal water bodies or “panne” in the vicinity.

6.3 CLIMATE

Brandvlei normally receives about 54 mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (lower left) shows the average rainfall values for Brandvlei per month. It receives the lowest rainfall (0mm) in August and the highest (17mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Brandvlei range from 17.1°C in July to 32°C in January. The region is the coldest during July when the mercury drops to 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. (www.saexplorer.co.za).

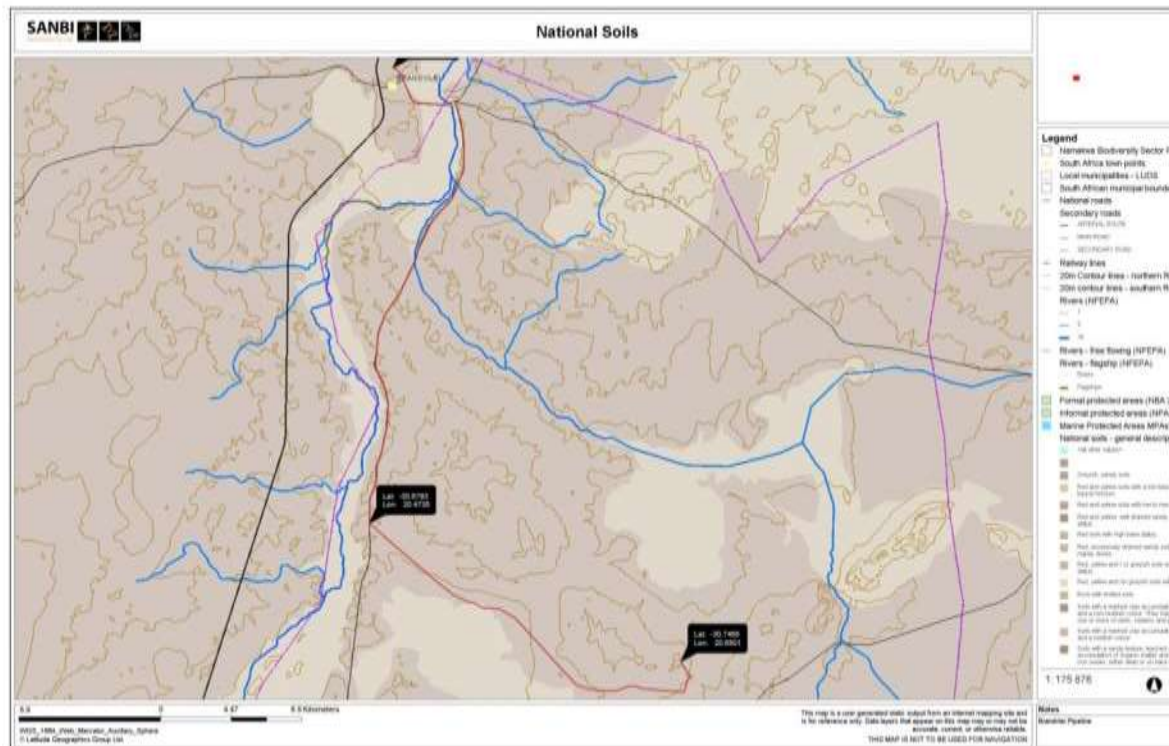
Figure 3: Average rainfall, temperature and night-time temperatures for Brandvlei Bulk Water Supply (www.saexplorer.co.za)



6.4 GEOLOGY & SOILS

According to Mucina and Rutherford (2006) and the SANBI Biodiversity Geographical Information System, the geology and soils of the area is described as mudstones and shales of the Ecca Group (Prince Albert and Volksrust Formations) and Dwyka tillites dominate, both or early Karoo age.

Figure 4: Soil map showing the soils expected



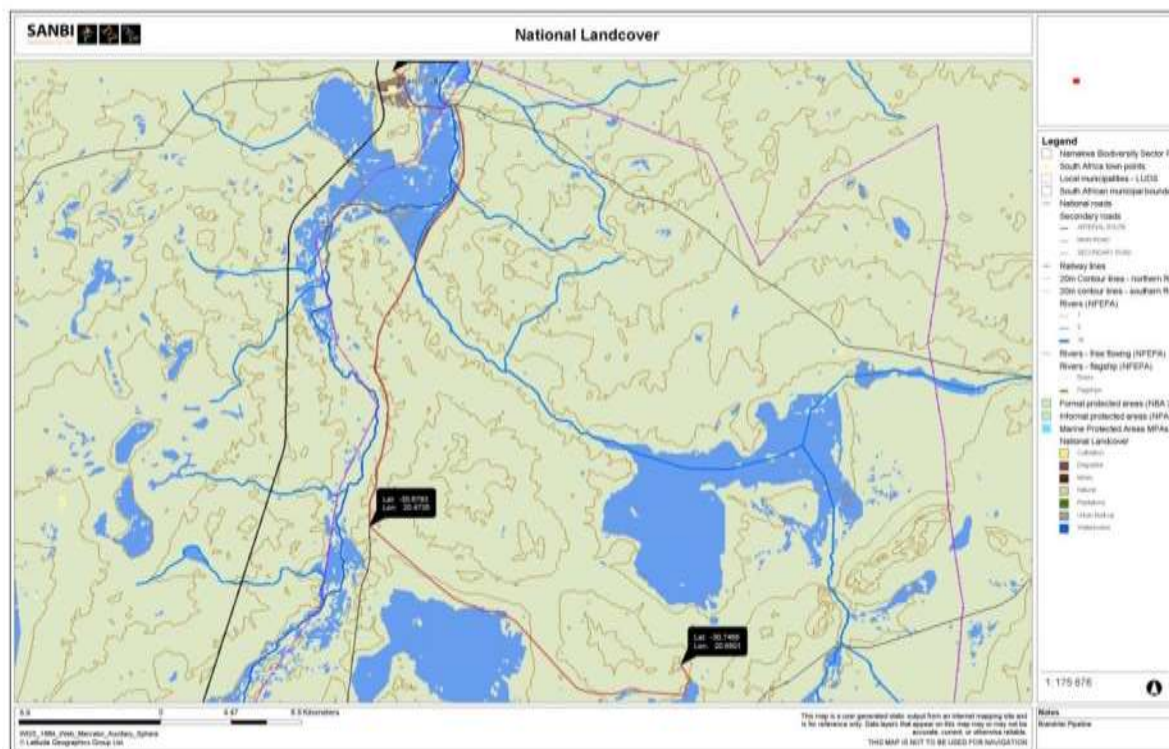
About 20% of rock outcrops is formed by Jurassic intrusive dolerite sheets and dykes. Soils are shallow Glenrosa and Mispah forms, with lime generally present in the entire landscape (Fc land type) and, to a lesser extent, red-yellow apedal, freely drained soils with a high base status and usually <15% clay (Ah and Ai land types) are also found. The salt content in these soils is very high.

The geology and soils varied only slightly in along the proposed route. 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.

6.5 LANDUSE AND COVER

The proposed route is located within an area that is still covered mostly by natural vegetation with numerous seasonal water bodies (or “panne”) into which this relative flat landscape drains. It is important to note that the proposed route will follow existing road reserves and will not impact on farm properties (or with little impact on any farming activity). This coupled with the fact that the installation of such a pipeline only results in a temporary disturbance period, during the construction phase, it is highly unlikely that it will lead to any long term impacts on current land-use.

Figure 5: Land-use map for the proposed sites and surroundings

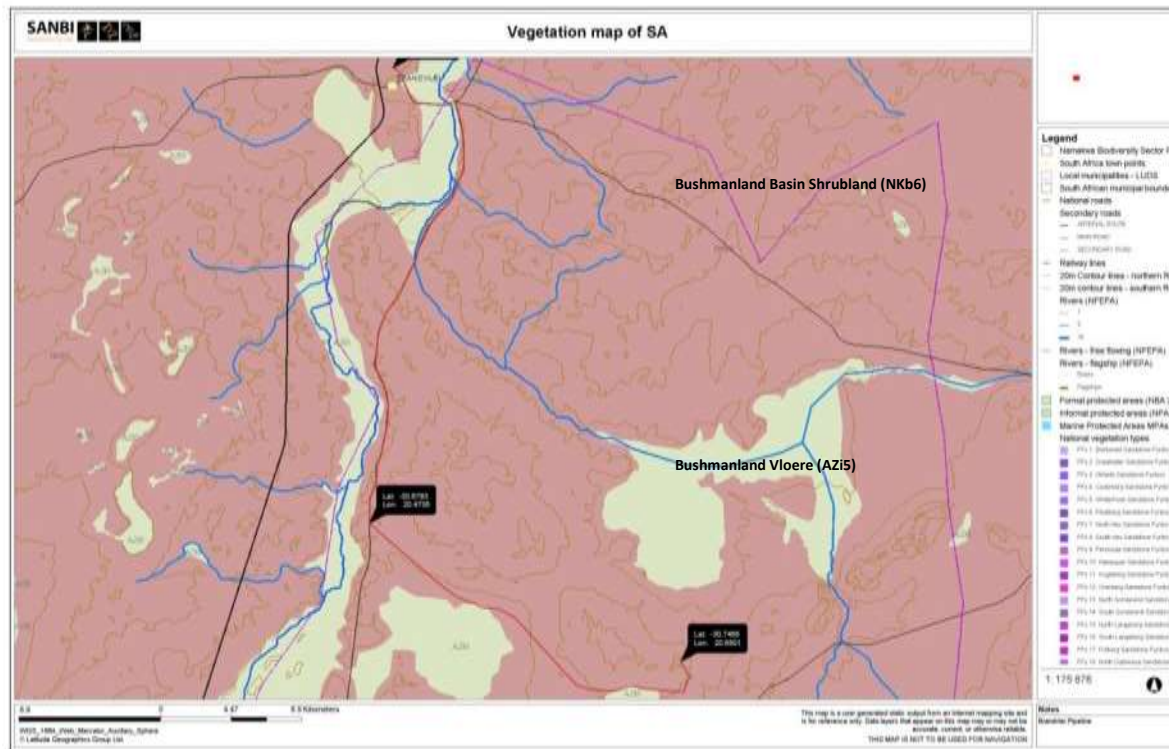


6.6 BROAD SCALE VEGETATION EXPECTED

In accordance with the 2006 Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) two broad vegetation types are expected in the vicinity of the proposed bulk water supply route and new reservoir (Refer to Figure 6). They are:

- Bushmanland Basin Shrubland (NKb 6) – covering almost all of the pipeline route, and
- Bushmanland Vloere vegetation (AZi 5) – on and along the water bodies encountered in this area.

Figure 6: Vegetation map of SA, Lesotho and Swaziland (2006)



According to the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011) these vegetation types are currently classified as follows

Table 2: Vegetation status according to the 2004 & 2011 National Spatial Biodiversity Assessment

VEGETATION TYPE	NATIONAL STATUS 2011	REMAINING (2004)	CONSERVATION TARGET	FORMALLY CONSERVED
Bushmanland Basin Shrubland	Least Threatened	99.5%	21%	-
Bushmanland Vloere	Least Threatened	97.7%	24%	-

6.6.1 Bushmanland Basin Shrubland

Mucina & Rutherford (2006) noted that this vegetation type is found in the large Bushmanland Basin centred on Brandvlei and Van Wyksvlei area, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt vicinity in the north to Williston vicinity in the south. Altitude ranges mostly from 800-1 200 m. It forms part of the Nama Karoo Biome and is described as occurring on slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny (and sometimes also succulent) shrubs (*Rhigozum*,

Salsola, *Pentzia*, *Erioccephalus*), “white” grasses (*Stipagrostis*) and in years of high rainfall also by abundant annuals such as species of *Gazania* and *Leysera*.

According to Mucina & Rutherford (2006) important taxa includes **Tall Shrubs:** *Lycium cinereum*, *Rhigozum trichotomum*. **Low Shrubs:** *Aptosimum spinescens*, *Hermannia spinosa*, *Pentzia spinescens*, *Zygophyllum microphyllum*, *Aptosimum elongatum*, *A. marlothii*, *Berkheya annectens*, *Erioccephalus microphyllum* var. *pubescens*, *E. pauperrimus*, *E. spinescens*, *Felicia clavipilosa* subsp. *clavipilosa*, *Limeum aethiopicum*, *Osteospermum armatum*, *O. spinescens*, *Pegolettia retrofracta*, *Phaeoptilum spinosum*, *Plinthus karoocicus*, *Polygala seminuda*, *Pteronia glauca*, *R inflexa*, *R leucoclada*, *R mucronata*, *P. sordida*, *Rosenia humilis*, *Selago albida*, *Senecio niveus*, *Tetragonia arbuscula*, *Zygophyllum lichtensteinianum*. **Succulent Shrubs:** *Salsola tuberculata*, *Aridaria noctiflora* subsp. *straminea*, *Brownanthus ciliatus* subsp. *ciliatus*, *Galenia sarcophylla*, *Lycium bosciifolium*, *Ruschia intricata*, *Salsola namibica*, *Sarcocaulon patersonii*, *S. salmoniflorum*, *Tripteris sinuata* var. *linearis*, *Zygophyllum flexuosum*. **Semi-parasitic Shrub:** *Thesium hystrix*. **Herbs:** *Gazania lichtensteinii*, *Leysera tenella*, *Amaranthus praetermissus*, *Chamaesyce inaequilatera*, *Dicoma capensis*, *Indigastrum argyraeum*, *Lepidium desertorum*, *Monsonia umbellata*, *Radyera urens*, *Sesamum capense*, *Tribulus terrestris*, *T. zeyheri*. **Succulent Herbs:** *Mesembryanthemum crystallinum*, *M. stenandrum*, *Trianthema parvifolia*, *Zygophyllum simplex*. **Graminoids:** *Aristida adscensionis*, *Enneapogon desvauxii*, *Stipagrostis ciliata*, *S. obtusa*, *Aristida congesta*, *Enneapogon scaber*, *Stipagrostis anomala*, *Tragus berteronianus* and *T racemosus*.

6.6.2 Bushmanland Vloere

According to Mucina & Rutherford (2004) this vegetation type is found in association with the “vloere” (salt pans) of the central Bushmanland Basin as well as the broad riverbeds of the intermittent Sak River (functioning as temporary connection between some of the pans) as well as its numerous ancient (today dysfunctional) tributaries. The patches of this vegetation unit are embedded especially within NKb 6 Bushmanland Basin Shrubland and NKb 3 Bushmanland Arid Grassland and to a lesser extent also within NKb 4, Nku 1, NKu 2 as well as marginal Succulent Karoo units summarised within the bioregion of Trans-Escarpment Succulent Karoo at altitudes varying between 850 – 1 450 m.

Important taxa include (Mucina & Rutherford, 2004): **Tall Shrubs:** *Parkinsonia africana*, *Xerocladia viridiramis*. **Low Shrubs:** *Rhigozum trichotomum*, *Aizoon schellenbergii*, *Asparagus glaucus*, *Erioccephalus decussatus*, *E. spinescens*, *Pegolettia retrofracta*. **Succulent Shrubs:** *Salsola aphylla*, *S. glabrescens*, *S. rabieana*, *Lycium pumilum*, *Salsola gemmifera*. **Herbs:** *Amaranthus dinteri* subsp. *dinteri*, *Lotononis minima*. **Geophytic Herb:** *Crinum variabile*. **Graminoids:** *Stipagrostis ciliata*, *S. obtusa*, *Sporobolus nervosus*, *Stipagrostis namaquensis*.

6.7 FINE-SCALE MAPPING (CBA's)

The Namakwa District Biodiversity Sector Plan is intended to help guide land-use planning, environmental assessments and authorisations; and, natural resource management in order to promote sustainable development. It has been developed to further the awareness of the unique biodiversity in the area, the value this biodiversity represents to people and promote the management mechanisms that can ensure its protection and sustainable utilisation.

The purpose of this document is to ensure that biodiversity information can be accessed and utilized by local municipalities within the Namakwa District Municipality (NDM) to inform land use planning and development as well as decision making processes within the NDM. To achieve this, this biodiversity profile information has been incorporated into the environmental planning section of the Spatial Development Frameworks (SDF's) for each of the six local municipalities in the district. This information includes maps and land use guidelines, which form part of the Integrated Development Plans (IDP's) of the municipalities. Thus, it is hoped that environmental considerations will be better taken into account within land use planning processes, especially within the identified Critical Biodiversity Areas (CBA) – which are areas that have been identified through conservation planning processes as irreplaceable, as well as key to the maintenance of ecosystem services.

In terms of the National Environment Management Act (NEMA) 107 of 1998, all organs of state are obligated to take biodiversity considerations into account and to ensure decisions are informed by the most up to date information. NEMA also states that, although the environment is a functional area of concurrent national and provincial legislative competence, all spheres of government and all organs of state must co-operate with, consult and support one another. Use of the CBA map and associated land use guidelines will support municipalities and other sectors as they provide a common reference point of Critical Biodiversity Areas in the NDM for incorporation into multi-sectoral planning processes.

Critical Biodiversity Areas (CBA's) are those areas required to meet biodiversity thresholds. They are areas of land or aquatic features (or riparian buffer vegetation alongside CBA aquatic features) which must be safeguarded in their natural state if biodiversity is to persist and ecosystems are to continue functioning. These Critical Biodiversity Areas incorporate:

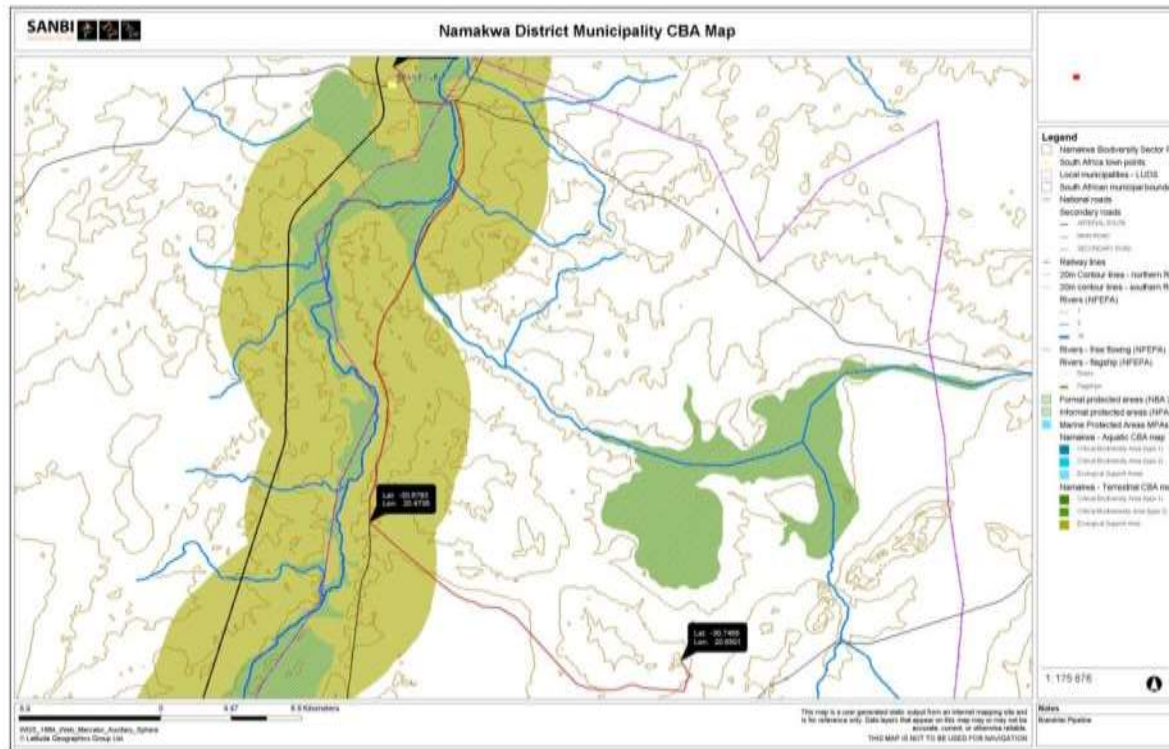
- (i) areas that need to be safeguarded in order to meet national biodiversity pattern thresholds (target area),
- (ii) areas required to ensure the continued existence and functioning of species and ecosystems (including the delivery of ecosystem services); and/or
- (iii) important locations for biodiversity features or rare species.

The CBA network represents the most land-efficient option to achieving all biodiversity targets and terrestrial CBA includes:

- All remaining patches of critically endangered vegetation,

- All known point localities of Species of Special Concern
- Endangered, Vulnerable or Least Threatened vegetation required to meet national thresholds
- Landscape corridors required to meet the predefined thresholds for spatially explicit ecological processes (e.g. upland – lowland corridors, coastal-and-sand movement corridors).

Figure 7: Biodiversity Sector plan indicating identified CBA area in and around the study area



According to the Namakwa District Municipality's Critical Biodiversity Areas (CBA) map (Refer to Figure 7, above), a large portion of the proposed pipeline route will fall within an ecological support area (ESA), with a portion of the route also crossing a type 2 CBA. However, it is important to note that within these ESA and CBA areas, the proposed pipeline route will follow existing roads (thus already disturbed areas) and will also stay within the existing road reserves (further minimising the impact on natural veld). In addition the disturbance resulting from the installation of the bulk water supply line would be temporary of nature (being underground).

Please note that the proposed road was chosen to co-inside with existing roads so that it would not be necessary to construct new roads through natural veld (thus also minimising additional impact and reducing accumulative impact).

6.8 VEGETATION ENCOUNTERED

It must be noted that the arid Nama-Karoo flora is not particularly rich and does not contain any centre of endemism. Unlike other biomes of South Africa, local endemism is very low, which might indicate a relatively

youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulents to dominate (like in the Succulent Karoo), while summers are too dry for dominance by perennial grasses alone, and the soils are generally too shallow and rainfall too low for trees. On the other hand, soil type, soil depth and local differences in moisture availability can cause abrupt changes in vegetation structure and composition.

By walking and driving the route (coupled with a desktop study) a very good understanding of the vegetation encountered were obtained. It was also clear that by locating the proposed pipeline within the existing road reserves, the impact will be much negated, especially along the R353 and R357 (since it is already impacted and does not form a road verge corridor of any importance, such as sometimes found in Fynbos or Renosterveld where the vegetation is highly fragmented).

Along the whole of the route the vegetation encountered was in actual fact very similar, with local dominance of *Rhigozum trichotomum* in places, and grasses in other places. Near the salt pans the vegetation also showed a slight variation in species composition, while indications of riparian vegetation were sometimes also encountered along the small seasonal ephemeral streams (e.g. *Stipagrostis namaquensis* sometimes present).

6.8.1 Vegetation from Romanskolk to the R353

The first portion of the pipeline, from the Romanskolk Reservoir to the Blomberg turn-off (at the R353) comprise of a more open natural veld but with a lower density of grasses (probably as a result of continual livestock grazing). The vegetation show great homogeny over most of the length of this first portion of the route. Typical Bushmanland Basin Shrubland were encountered along most of this portion of the route, with the exception of intrusions of Bushmanland Vloere vegetation on two locations (as the route passes the two “panne” areas) (Refer to Photo 1 and Figure 8).

Photo 1: Typical vegetation encountered along the OG86 dirt road (Romanskolk to the R353) showing the proposed pipeline route



Photo 1 shows the typical species composition, *Lycium ferocissimum*, dominant while *Augea capensis* are also common as are *Pentzia* and grass species. In areas the dominant *Lycium* species is replaced by a dominant *Rhigozum trichotomum* layer. Please note that single *Prosopis* trees were also encountered along the route. This invasive species will have to be removed.

The following species were encountered along the route: *Aptosimum spinescens*, *Aridaria noctiflora*, *Aspazoma* species, *Atriplex lindleyi*, *Augea capensis*, *Brownanthus vaginatus*, *Cephalophyllum ebracteatum*, *Delosperma* species, *Enneapogon desvauxii*, *Erioccephalus* cf. *microphyllus*, *Euphorbia* cf. *lignosa*, *Ficinia* cf. *nigrescens*, *Fingerhuthia africana*, *Gomphocarpus filiformis*, *Lebeckia* species, *Lycium cinereum*, *Lycium ferocissimum*, *Mesembryanthemum nodiflorum*, *M.* species, *Pechuel-Loeschea leubnitziae*, *Phaeoptilum spinosum*, *Prosopis grandulosa*, *Psilocaulon* cf. *dinteri*, *Psilocaulon subnodosum*, *Pteronia glabrata*, *Pteronia viscosa*, *Rosenia humilis*, *Rhigozum trichotomum*, *Rogeria longiflora*, *Salsola* cf. *aphylla*, *Stipagrostis ciliata*, *Stipagrostis namaquensis*, *Stipagrostis obtusa*, *Tripteria sinuata*, *Zygophyllum chrysopterum*, *Zygophyllum lichtensteinianum* and *Zygophyllum simplex*

Figure 8: Vegetation map of South Africa, overlaid with the Namakwa Critical Biodiversity Areas Map for the first portion of the route

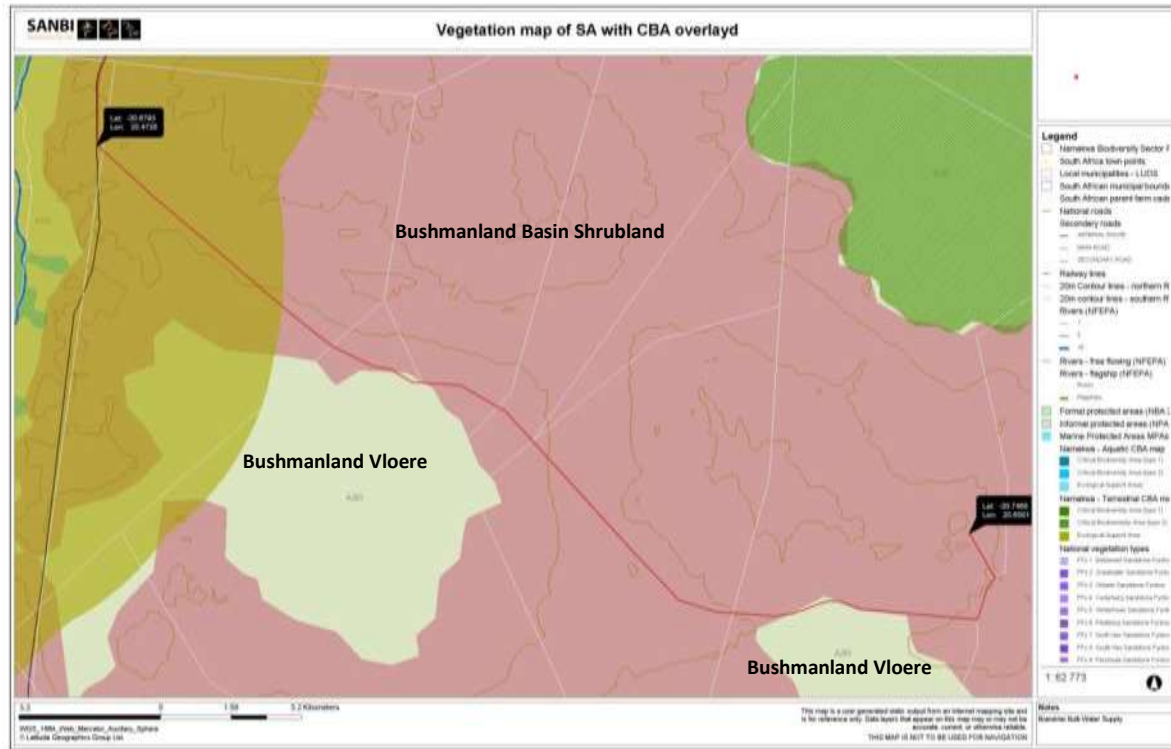


Photo 2: Vegetation encountered near the salt pans



Near the salt pans the vegetation normally were even less dense with a much lower shrub layer, which included, *Rhigozum trichotomum*, *Eriocephalus* species and *Salsola* more prominent.

Photo 3: One of the ephemeral streams encountered along the proposed route



6.8.2 Vegetation along the R353 and 357 up to the Brandvlei Reservoir

The vegetation again showed a very homogenous composition, very similar to that encountered along the OG 86. On the road verges of the R353, grasses like *Stipagrostis ciliata* and *Stipagrostis obtusa* are more common even dominating in some areas (likely because of exclusion of livestock). Note that *Melianthus pectinatus* were also sometimes encountered, but outside of the study area (to the west of the R353).

Photo 4: Typical vegetation encountered along the R353



Along the R357 the vegetation composition again differs slightly with a very sparse distribution of vegetation (which might be as a result of urban crept and impact, but is more likely a because of the floodplains next to the river's edge and the salt accumulation associated with the lower lying areas in this relative flat landscape).

Photo 5: Typical vegetation along the R357 just southeast of Brandvlei



6.8.3 Proposed Brandvlei Reservoir

Part of the proposed pipeline upgrade is the installation of an additional bulk water reservoir next to the existing reservoir at Brandvlei. The new reservoir will be the same size as the existing reservoir (footprint of less than 50 x 50 m and will be located just east of the existing reservoir. Again the vegetation is very similar in composition as have been found along the pipeline route. *Lycium ferocissimum* and *Eriocephalus* species dominate with *Rhigozum trichotomum* and *Hermannia spinosa* also encountered.

Photo 6: Vegetation encountered in the location for the proposed new reservoir at Brandvlei



6.9 FLORA ENCOUNTERED

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. Table 3 gives a list of the species encountered on the two sites. Table 3: List of species encountered on the sites (excluding grass species)

Table 3: List of species encountered on the sites (excluding grass species)

SPECIES NAME	COMMON NAME	FAMILY	SANBI / NCNCA / NFA Status
1. <i>Aptosimum spinescens</i>	Doringviooltjie	SCROPHULARACEAE	LC
2. <i>Aridaria noctiflora</i>	Vleisbos	AIZOACEAE	LC, but all species protected in terms of the NCNCA
3. <i>Aspazoma</i> species		MESEMBRYANTHEMACEAE	LC, but all species protected in terms of the NCNCA
4. <i>Atriplex lindleyi</i>	Klappiesbrak	CHENOPODIACEAE	Alien weed
5. <i>Augea capensis</i>	Boesmandruiwe	ZYGOPHYLLACEAE	LC
6. <i>Brownanthus vaginatus</i>		MESEMBRYANTHEMACEAE	LC, but all species protected in terms of the NCNCA
7. <i>Cephalophyllum ebracteatum</i>	Rank-t'nouroe	MESEMBRYANTHEMACEAE	LC, but all species protected in terms of the NCNCA
8. <i>Enneapogon desvauxii</i>	Eight day grass	POACEAE	LC
9. <i>Eriocephalus cf. microphyllus</i>	Kapokbos	ASTERACEAE	LC
10. <i>Euphorbia cf. lignosa</i>		EUPHORBIACEAE	Protected in terms of the NCNCA
11. <i>Ficinia cf. nigrescens</i>	Swartkopbiesie	CYPERACEAE	
12. <i>Fingerhuthia africana</i>	Vingerhoedgras	POACEAE	LC
13. <i>Gomphocarpus filiformis</i>	Melkbos, Lammergat	APOCYANACEAE	LC, but all species protected in terms of the NCNCA
14. <i>Lebeckia</i> species		FABACEAE	Not expected to be protected.
15. <i>Hermannia spinosa</i>	Steekbossie	STERCULIACEAE	LC
16. <i>Lycium cinereum</i>	Kriedoring	SOLANACEAE	LC
17. <i>Lycium ferocissimum</i>	Karriedoring	SOLANACEAE	LC
18. <i>Melianthus pectinatus</i>	Kruidjie-roer-my-nie	MELIANTHACEAE	LC
19. <i>Mesembryanthemum nodiflorum</i>		AIZOACEAE	LC, but all species protected in terms of the NCNCA
20. <i>Mesembryanthemum</i> species		AIZOACEAE	LC, but all species protected in terms of the NCNCA
21. <i>Pechuel-Loeschea leubnitziae</i>	Sweet bush, Wild sage	ASTERACEAE	LC
22. <i>Phaeoptilum spinosum</i>	Brosdoring, blou doringbos	NYCTAGINACEAE	LC
23. <i>Prosopis grandulosa</i>	Honey mesquite	FABACEAE	Category 2 invader
24. <i>Psilocaulon cf. dinteri</i>		MESEMBRYANTHEMACEAE	LC, but all species protected in terms of the NCNCA
25. <i>Psilocaulon subnodosum</i>		MESEMBRYANTHEMACEAE	LC, but all species protected in terms of the NCNCA
26. <i>Pteronia glabrata</i>	Knoppiesgombos	ASTERACEAE	LC
27. <i>Pteronia viscosa</i>		ASTERACEAE	LC
28. <i>Rosenia humilis</i>	Perdekaroo	ASTERACEAE	LC
29. <i>Rhigozum trichotomum</i>	Driedoring	BIGNONIACEAE	LC
30. <i>Rogeria longiflora</i>	Djirrie, witblom	PEDALIACEAE	LC
31. <i>Salsola cf. aphylla</i>	Blomkoolganna	CHENOPODIACEAE	LC
32. <i>Stipagrostis ciliata</i>	Langbeenboesman-gras	POACEAE	LC
33. <i>Stipagrostis namaquensis</i>	River bushman grass	POACEAE	LC
34. <i>Stipagrostis obtusa</i>	kortbeenboesmangras	POACEAE	LC
35. <i>Tripteris sinuata</i>	Skaapbos	ASTERACEAE	LC
36. <i>Zygophyllum chrysopteron</i>	Kleinskilpadbossie	ZYGOPHYLLACEAE	LC

SPECIES NAME	COMMON NAME	FAMILY	SANBI / NCNCA / NFA Status
37. <i>Zygophyllum lichtensteinianum</i>	Skilpadbos	ZYGOPHYLLACEAE	LC
38. <i>Zygophyllum simplex</i>	Volstruisdruive	ZYGOPHYLLACEAE	LC

6.10 SIGNIFICANT AND/OR PROTECTED PLANT SPECIES

South Africa has become the first country to fully assess the status of its entire flora.

6.10.1 Red list of South African Plants

The Red List of South African Plants online provides up to date information on the national conservation status of South Africa's indigenous plants (www.redlist.sanbi.org). The table below provides guidelines for specialists on appropriate recommendations for species of conservation concern found on a proposed development site. The recommendations differ depending on both the Red List status of the species, as well as the Red List criteria met.

Table 4: Guidelines for specialists on appropriate recommendations for species of conservation concern (www.redlist.sanbi.org)

STATUS	CRITERION	GUIDELINES FOR RECOMMENDATION
Critically Endangered	PE	No further loss of natural habitat should be permitted as the species is on the brink of extinction, and all other known subpopulations have been lost. The subpopulation in question is likely to be newly discovered and the only remaining subpopulation of this species.
Critically Endangered	A,B,C,D	No further loss of natural habitat should be permitted as the species is on the verge of extinction.
Endangered	B,C,D	No further loss of habitat should be permitted as the species is likely to go extinct in the near future if current pressures continue. All remaining subpopulations have to be conserved if this species is to survive in the long term.
Endangered	Listed under A only	If the species has a restricted range (EOO < 2 000 km ²), recommend no further loss of habitat. If range size is larger, the species is possibly long-lived but widespread, and limited habitat loss may be considered under certain circumstances, such as the implementation of an offset whereby another viable, known subpopulation is formally conserved in terms of the National Environmental Management: Protected Areas Act (Act 57 of 2003), and provided that the subpopulation to be destroyed does not occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.
Vulnerable	D	This species either constitutes less than 1 000 individuals or is known from a very restricted range. No further loss of habitat should be permitted as the species' status will immediately become either Critically Endangered or Endangered, should habitat be lost.
Vulnerable	B,C	The species is approaching extinction but there are still a number of subpopulations in existence. Recommend no further loss of habitat as this will increase the extinction risk of the species.
Vulnerable	Listed under A only	If the species has a restricted range, EOO < 2 000 km ² , recommend no further loss of habitat. If range size is larger, the species is possibly long-lived but widespread, and limited habitat loss may be considered under certain circumstances, such as the implementation of an offset whereby another viable, known subpopulation is formally conserved in terms of the Protected Areas Act, and provided that the subpopulation to be destroyed does not occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.
Data Deficient	D	This species is very poorly known, with insufficient information on its habitat, population status or distribution to assess it. However, it is highly likely to be threatened. If a Data Deficient species will be affected by a proposed activity, the subpopulation should be well surveyed and the data sent to the Threatened Species Programme. The species will be reassessed and the new status of the species, with a recommendation, will be provided within a short timeframe.
Data Deficient	T	There is uncertainty regarding the taxonomic status of this species, but it is likely to be threatened. Contact the taxonomist working on this group to resolve its taxonomic status; the species will then be reassessed by the Threatened Species Programme.
Near Threatened	D	Currently known from fewer than 10 locations, therefore preferably recommend no loss of habitat. Should loss of this species' habitat be considered, then an offset that includes conserving another viable subpopulation (in terms of the Protected Areas Act) should be implemented, provided that the subpopulation to be destroyed does not occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.
Near Threatened	B,C	The species is approaching thresholds for listing as threatened but there are still a number of subpopulations in existence and therefore there is need to minimise loss of habitat. Conservation of subpopulations is essential if they occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant spatial biodiversity plan or (iii) on a site associated with additional ecological sensitivities.
Near Threatened	Listed under A only	If the species has a restricted range, EOO < 2 000 km ² , then recommend no further loss of habitat. If range size is larger, the species is possibly long-lived but widespread, and limited habitat loss may be considered. Conservation of subpopulations is essential if they occur (i) within a threatened ecosystem or (ii) within an area required for biodiversity conservation in terms of a relevant biodiversity conservation plan or (iii) on a site associated with additional ecological sensitivities.
Critically Rare		This is a highly range-restricted species, known from a single site, and therefore no loss of habitat should be permitted as it may lead to extinction of the species. The Threatened Species Programme is not aware of any

STATUS	CRITERION	GUIDELINES FOR RECOMMENDATION
		current threats to this species and should be notified without delay.
Rare		The species is likely to have a restricted range, or be highly habitat specific, or have small numbers of individuals, all of which makes it vulnerable to extinction should it lose habitat. Recommend no loss of habitat. The Threatened Species Programme is not aware of any current threats to this species and should be notified without delay.
Declining		The species is declining but the population has not yet reached a threshold of concern; limited loss of habitat may be permitted. Should the species is known to be used for traditional medicine and if individuals will not be conserved in situ, plants should be rescued and used as mother stock for medicinal plant cultivation programmes.

No species of conservation concern was recorded in terms of the latest Red List of species for South Africa

(Refer to Table 3).

6.10.2 *Protected species in terms of the NFA*

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).

No Species listed in terms of the NFA was encountered during the study.

6.10.3 *Species protected in terms of the NCNCA*

The Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, and 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.

Ten (10) species listed in terms of the NCNCA were encountered along the route. However, all of these species are considered to be of Least Concern in terms of IUCN status (the International Union for the Conservation of Nature). In most cases these species was locally abundant, however, a flora permit will have to be applied for in terms of the NCNCA since there remains a possibility that some of these species will be impacted.

6.11 FAUNA AND AVI-FAUNA

Avi-fauna: The arid gravel plains between Brandvlei and Loeriesfontein in the Northern Cape may appear barren of life at first glance but are in fact an excellent destination for a variety of bird species that includes, localized Damara Canaries, Black-Eared Finch-Larks and Starks Lark. The area also hosts one of only a few breeding colonies of European Bee-Eater in South Africa. Red Lark is another special of the area and may occur in good numbers in suitable habitat. The salt pans are transformed into bird sanctuaries after the summer rains (Nov-Mar), while the Acacia thickets along the water-courses are also good for finding Fairy Flycatcher, Rufous-Eared Warbler, Pirit Batis and Karoo Eremomelas. Namaqua Sandgrouse is regular visitors and Larklike Buntings, Grey-Backed Finch Larks and Black-Headed Canaries also occur in good numbers. The hilly

areas are good for raptors with Jackal Buzzard, Rock Kestrel, Southern-Pale Chanting Goshawk and Black-Breasted Snake-Eagle being reliable sightings.

However, the temporary and localised nature of the activity is not expected to impact adversely on avi-fauna and as a result the **impact is deemed low**.

Mammals: The site falls within the distribution range of approximately 50 mammal species indicating moderate diversity. Human activity in the area is low, but the area is used as agricultural land it is highly unlikely that a fair representation of these mammals will be found on the property. Mammal species that are endemic or near endemic to the area are Van Zyl's Golden Mole (*Cryptochloris zylii*), Cape Dune Molerat (*Batyergus suillus*), Cape Gerbil (*Tatera afra*) and Grant's Golden Mole (*Eremitalpa granti*). Van Zyl's Golden Mole (*Cryptochloris zylii*) belongs to the golden mole family which is comprised of 18 species, all endemic to the African continent. Very little is known about this Critically Endangered species as it spends most of its life underground in shallow sandy soils of the temperate, Strandveld Succulent Karoo. This golden mole is mainly threatened due to habitat loss through overgrazing, crop cultivation, irrigation and mining. Today, there is only one locality known to have the Van Zyl's golden mole, i.e. Compagnies Drift, 16 km inland from Lamberts Bay. Conservation initiatives should aim to conserve this species through the establishing of more Private Conservation areas such as Conservancies and Private Nature Reserves and statutory conservation areas, thereby protecting the golden moles habitat. It is considered unlikely that the proposed development will impact on this endangered species.

It is highly unlikely that the proposed development(s) will pose a significant impact on mammal species and as a result the impact is deemed **low**.

Reptiles: The diversity of reptile species is relatively high in the drier succulent Karoo area along the west coast. Seven species of girdled lizards of the genus *Cordylus*, including the armadillo girdled lizard (*Cordylus cataphractus*, VU) are endemic to the area. Two endemic tortoise species occur in the area, namely the Namaqualand tent tortoise (*Psammobates tentorius trimeni*) and the Namaqualand speckled padloper (*Homopus signatus signatus*). As a result of the current practices on site the reptile composition is likely to be dominated by species which inhabit open areas, such as snakes, lizards, tortoises and geckos.

The impact of the proposed activities will be relatively localised and temporary of nature. Search and rescue of many species (e.g. tortoises) can further minimise the impact. The possible impact on reptiles is considered **low**.

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 (since the proposed are mostly well away from any wetland area). Most amphibians require perennial water and should thus not be affected at all.

6.12 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.

Only one significant river system falls within the footprint of the proposed pipeline route, namely the Sak River. However, the surface of the Brandvlei area and surroundings are generally very flat, and water does not run away easily. This has resulted in many small ephemeral streams that drain the basin into the Sak River or other seasonal water bodies or salt pans in the vicinity. The salt pans itself are significant seasonal features and that they are renowned bird sanctuaries after good rains. It is not expected that the short term temporary impact associated with the installation of the pipeline will have any significant impact on the few seasonal ephemeral drainage lines that was encountered along the route. Almost all of these seasonal ephemeral streams are very small (generally less than 2 m across and only in a few instances where they associated with some indications of riparian vegetation). However, the Sak River is a very prominent and large seasonal river that runs just east of Brandvlei. The proposed pipeline route will cross the Sak River diagonally and will be attached to an existing bridge structure as was the original pipeline (Refer to Photo 7). As result the impact on the Sak River will also be very low and temporary of nature.

Photo 7: Bridge over the Sak River, showing the location of the existing pipeline attached to the bridge



With regards to the salt pans, the route only runs near the vicinity of one salt pan, for the rest the route is well away from these wetland features (Refer to Photo 8).

Photo 8: One of the salt pans in the background with the small ephemeral streams leading into the pan in the foreground



Because of the specific route, the temporary and short term nature of the proposed impact the overall impact on water courses and wetlands are expected to be low. However, all construction work in the vicinity of these features must be done during the dry season to further minimise possible impact.

6.13 INVASIVE ALIEN INFESTATION

The whole of the proposed route show very little alien invader species, although the immediate river banks of the Sak River are more impacted. A few individuals of the alien tree *Prosopis grandulosa* (a category 2 invader) were encountered along the route. According to regulation 15 and 16 of CARA all category 2 plants has the proven potential of becoming invasive, but may have certain beneficial properties. The regulations makes provisions for category 2 plants to be retained in special areas demarcated for that purpose, but those occurring outside demarcated areas must be controlled.

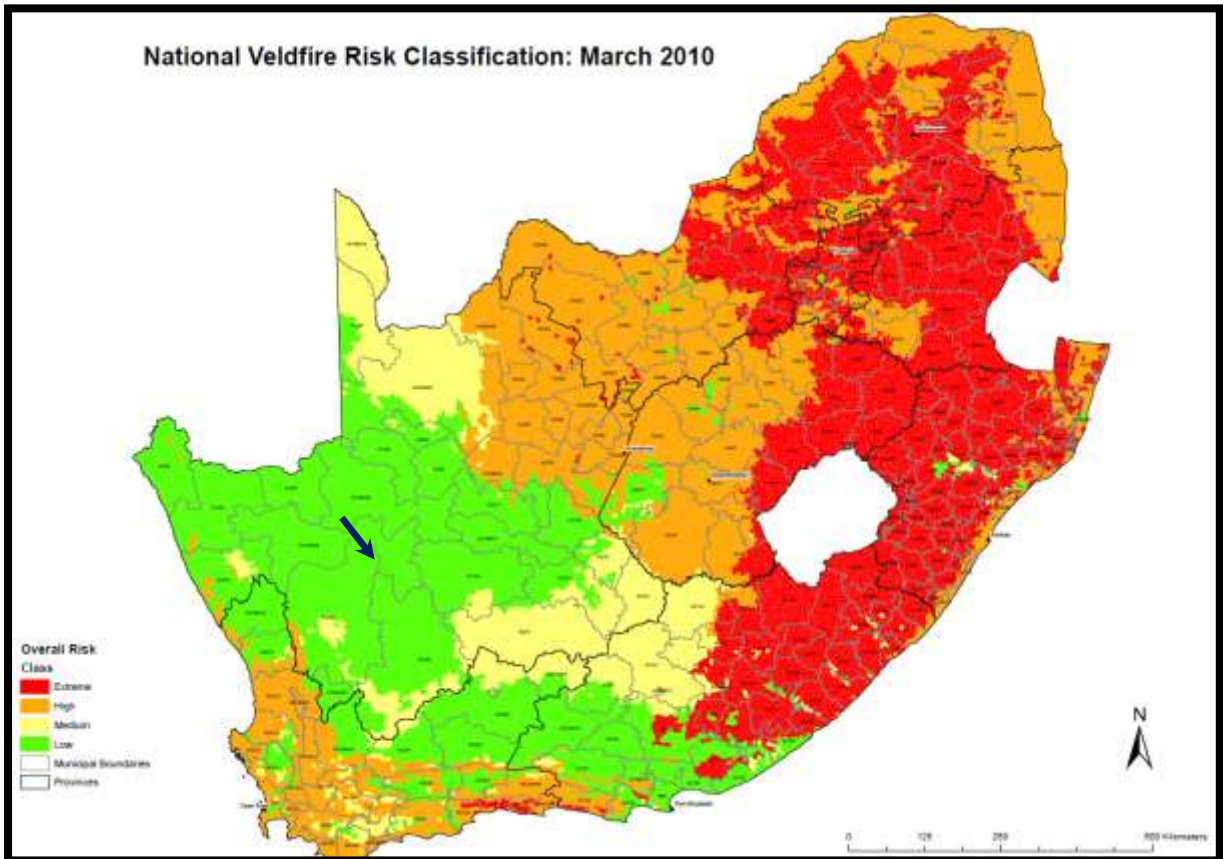
In this case all *Prosopis* individuals and other listed alien invader species encountered must be removed from the footprint and its immediate vicinity.

7. VELD FIRE RISK

Brandvlei Bulk Water Supply is in the Nama Karoo Biome which is not prone to fire (Mucina & Rutherford, 2006). The revised veldfire risk classification (Forsyth, 2010) in terms of the National Veld and Forest Fire Act 101 of 1998 was promulgated in March 2010. 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.

Brandvlei Bulk Water Supply is situated in an area supporting very low and almost desert like vegetation, which has been classified with a **low fire risk classification** (Refer to Figure 9). Although, the fire risk is not high 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.

Figure 9: South African National Veldfire Risk Classification (March 2010)



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 SUMMARY OF POTENTIAL IMPACT

The Brandvlei Bulk Water Supply pipeline and reservoir entails the construction of a new pipeline from the existing Romanskolk Reservoir (on the Remainder of the Farm Erfdeel no. 57) to the Brandvlei Reservoir in the town of Brandvlei, a distance of approximately 52 km. The proposed route will follow existing roads for the whole length of the pipeline and will, according to current planning, be placed within the existing road reserve. A new bulk Reservoir will also be constructed next to the existing Brandvlei Reservoir in order to increase storage capacity.

Direct impacts will be associated with the relative short construction period (months) and are considered temporary, since the pipeline will be located underground. However, even though the impact will be localised and temporary in nature it will have (even though temporary) direct impacts on remaining natural vegetation and small ephemeral streams. The vegetation supports species listed as protected in terms of the Northern

Cape Nature Conservation Act, 9 of 2009 (NCNCA). Some alien vegetation (mostly *Prosopis* trees) was encountered and if not handled correctly can lead to further infestation.

The vegetation types encountered are both considered Least Threatened (thus under any immediate threat in terms of extinction), but both types are very poorly-, or not protected at all (meaning that none of this vegetation are included in a formal protection area). However, it is also very important to understand that this vegetation types are not particularly rich in plant species and does not contain any centre of endemism. Unlike other biomes of South Africa, local endemism is also very low. **Meaning that the vegetation type is fairly similar over extended areas and it would be unlikely that small localised impacts will have any significant impact on any specific species or the vegetation type as a whole.** The vegetation is also not fragmented in any way with extended areas of excellent connectivity remaining throughout the basin.

Even though 10 species protected in terms of the NCNCA was encountered, and the likelihood is high that individuals of these species may be impacted during the construction phase, it **is considered unlikely that the construction activities will have any significant impact on these populations.** Especially since none of the identified species are listed in the South African Red data list (all classified as of Least Concern).

The possible impact on the ephemeral streams are also considered to be short term and very localised which cannot be constituted as significant impacts. The flatness of the basin area has resulted in networks of seasonal surface drainage lines (or ephemeral streams) draining rainwater towards the pans or river systems. These drainage lines are mostly poorly defined and seldom associated with any riparian vegetation. Their only function being to drain the basin landscape. At present these features can hardly be seen as fulfilling the function of a river ecological system.

8.2 EVALUATION OF ENVIRONMENTAL IMPACTS

8.2.1 *Threatened or protected ecosystems*

According to the *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 both vegetation types are considered **Least Threatened**. However, although both of these vegetation types still show good representation of its original distribution, both are also in urgent need of further formal conservation. The Namakwa District Biodiversity Sector Plan aims to ensure that such conservation targets areas are identified and maintained. Although the proposed development will impact not impact on any identified critical biodiversity areas (CBA's) it will impact on an ecological support area (ESA) identified (the river corridor associated with the Sak River. However, the proposed route follows existing roads within the ESA, and thus areas which are already disturbed to some degree. In terms of placement, the proposed route will most probably have the least impact on the ESA.

The proposed route is perceived as being well chosen/located and should not constitute a significant impact on any of the identified terrestrial conservation priority areas. In addition any other proposed route will have to cross the ecological support area (ESA) and will most likely have a more significant impact on the ESA (there are no other roads, thus such a route will have to cross natural land and additional roads will have to be constructed to allow for maintenance).

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

8.2.2 *Special habitats*

The vegetation itself is not considered to belong to a threatened or protected ecosystem and is classified as “Least threatened”. The Namakwa District Biodiversity Sector Plan aims to ensure that such conservation targets areas are identified and maintained and the proposed development will not impact on any identified terrestrial CBA.

The Namakwa District Biodiversity Sector Plan aims to ensure that such conservation targets areas are identified and maintained. Although the proposed development will not impact on any identified critical biodiversity areas (CBA’s) it will impact on an ecological support area (ESA) identified (the river corridor associated with the Sak River). However, the proposed route follows existing roads within the ESA, and thus areas which are already disturbed to some degree. In terms of placement, the proposed route will most probably have the least impact on the ESA.

The possible impact on the ephemeral streams are also considered to be short term and very localised which cannot be constituted as significant impacts. The flatness of the basin area has resulted in networks of seasonal surface drainage lines (or ephemeral streams) draining rainwater towards the pans or river systems. These drainage lines are mostly poorly defined and seldom associated with any riparian vegetation. Their only function being to drain the basin landscape. At present these features can hardly be seen as fulfilling the function of a river ecological system.

The impacts associated with the proposed development location is perceived as generally well located and will not impact on any of the areas targeted as terrestrial conservation priority areas, and even though it will impact on Ecological Support areas, the impact is well mitigated through the specific placement.

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

8.2.3 Corridors and or conservancy networks

Looking at the larger site and its surroundings the vegetation still shows excellent connectivity with the surroundings. The placement of the proposed route along existing roads (and taking into account that it will be a temporary disturbance) is perceived as the best route option (especially taking cumulative impacts into account). Even though there will be a very localised and temporary impact on the ecological support area associated with the Sak River, the placement of the pipeline (next to existing roads) negate this impact to a large degree.

It is thus considered highly unlikely that the proposed activity (temporary in nature) will have any significant additional impacts on corridors or conservancy networks.

The impact is thus rated as low.

8.2.4 Protected species

No species of conservation concern was recorded in terms of the 2013-1 Red List of species for South Africa and no species protected in terms of the National Forests Act (NFA) of 1998 (Act 84 of 1998) was encountered during the study.

Even though 10 species protected in terms of the NCNCA was encountered, and the likelihood is high that individuals of these species may be impacted during the construction phase, it is considered unlikely that the construction activities will have any significant impact on these populations. Especially since none of the identified species are listed in the South African Red data list (all classified as of Least Concern).

The impact is thus rated as low.

8.2.5 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 for 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 33).
- Loss of local biodiversity and threatened plant species (Refer to page 34)
- Loss of ecosystem connectivity (Refer to page 36)

According to the 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 both vegetation types are considered Least Threatened. However, although both of these vegetation types still show good representation of its original distribution, both are also in urgent need of further formal conservation.

The Namakwa District Biodiversity Sector Plan aims to ensure that such conservation targets areas are identified and maintained. Although the proposed development will impact not impact on any identified critical biodiversity areas (CBA's) it will impact on an ecological support area (ESA) identified (the river corridor associated with the Sak River. However, the proposed route follows existing roads within the ESA, and thus areas which are already disturbed to some degree. In terms of placement, the proposed route will most probably have the least impact on the ESA.

The possible impact on the ephemeral streams are also considered to be short term and very localised which cannot be constituted as significant impacts. The flatness of the basin area has resulted in networks of seasonal surface drainage lines (or ephemeral streams) draining rainwater towards the pans or river systems. These drainage lines are mostly poorly defined and seldom associated with any riparian vegetation. Their only function being to drain the basin landscape. At present these features can hardly be seen as fulfilling the function of a river ecological system.

The impacts associated with the proposed development are perceived as generally well located and does not constitute a significant impact on any of the identified terrestrial conservation priority areas. In addition any other route from the Romanskolk reservoir to the Brandvlei Reservoir would have to impact on the Ecological Support areas – Buffer areas.

Taking the above into account the direct impact on the environment is **rated as medium-low.**

8.2.6 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:

- Establishment of a temporary construction associated infrastructure or facilities.
- Temporary storage areas (e.g. pipe's and fittings and concrete mixing material).
- Waste management.

It is likely that the proposed project will have indirect impacts, but it is not considered to add significant load on the natural environment. It is considered that indirect impacts will have a much lower impact than direct

impacts with very little cumulative effect on the environment. In addition indirect impacts can be reduced through good environmental control during construction.

On its own the impact is considered to be low.

8.2.7 *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.

Having discussed the various possible environmental impacts above, it is concluded that:

- The construction will be temporary of nature over a short period of time and will be located within the road reserve along existing roads.
- All aspects of the proposed project will be located outside of any identified CBA, but will impact on the ESA's associated with the Sak River. However, the route location mitigates the significance of this impact together with the fact that the impact will be of a temporary nature.
- The vegetation encountered on is considered least threatened with good connectivity and good representation.
- The potential impact plant species of conservation concern is expected to be low and can be further reduced through dedicated topsoil re-allocation.
- The potential impact on fauna and avi-fauna is considered to be low.
- The potential impact on corridors is regarded as low, which could be reduced through good environmental control.

The proposed project will thus have a temporary and localised impact, which should not result in significant additional permanent impacts (apart from the new reservoir at Brandvlei).

On the whole the cumulative impact is considered to be medium-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 immediate additional impact on the vegetation species or river corridors.

However, it is important to note that the current water supply system to Brandvlei is dated. The old pipeline cannot supply enough water and the system is in poor state of maintenance. Additional water is needed and the proposed activity provides the most viable long term solution. Should the activity not be approved, Brandvlei will have to resort to other measures of water supply (none of these viable at present). In addition

this will lead to major maintenance works to the current system which may lead to additional (uncontrolled) environmental impacts.

8.4 SUMMARY OF 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
Potential impacts on biophysical environment		
Geology & soils	Geology & soils vary only slightly in the larger study 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. Potential Impact = low
Land use and cover	The proposed route will follow existing road reserves and with little impact on any farming activity.	The area is been utilised mainly for grazing. The impact is considered short term, temporary and localised with regards to land use. Potential Impact is considered to be <u>low and temporary of nature</u>.
Potential impacts on threatened or protected ecosystems		
Vegetation type(s)	Two vegetation types encountered namely: Bushmanland Basin Shrubland Bushmanland Vloere	Both vegetation types are classified as "Least threatened" but not protected. The proposed footprint runs along existing road verges. Associated infrastructure (e.g. additional roads) will not be required. In addition the impact will be short term and temporary of nature and is therefore not considered significant. Potential impact is considered as <u>low</u> (localised).
Corridors and conservation priority areas/networks.	Namakwa District Biodiversity Sector Plan	According to the Namakwa District Biodiversity Sector Plan a portion of the proposed route will fall within the ecological support area associated with the Sak River. However, in this section the proposed route will fall within the road verge of firstly the R353, then the R357 and then next to roads within the town of Brandvlei. It is thus not expected to have any significant impact on the support area (as it is located within an already disturbed area). Furthermore the impact will be temporary of nature and localised. Where the route crosses the Sak River it will be strapped to the existing bridge (again minimising impact). Potential impact is considered as <u>low</u>.
Protected plant species	Ten plant species protected in terms of the NCNCA was observed.	No SA Red List species were observed. No protected tree species in terms of the NFA was observed. Ten plant species protected in terms of the NCNCA was observed and is likely to be impacted by the proposed development. However, the impact will be temporary of nature and with good mitigation (topsoil conservation) the impact can be minimised. Please note that none of these species are considered endangered according to the SA Red list of plant species. However, permits in terms of the NCNCA will be needed for the removal of these plants. Potential impact = medium-low.
Fauna & Avi-fauna	The proposed route will follow existing road reserves and with low impact on habitat.	Because of the temporary and localised nature of the activity it is considered highly unlikely that it will have any significant impact on fauna or avi-fauna. Potential Impact very <u>low</u> and temporary of nature.
Rivers & wetlands	A number of smaller ephemeral streams and two salt pans were observed in the vicinity of the route.	The flatness of the basin area has resulted in networks of seasonal surface drainage lines (or ephemeral streams) draining rainwater towards the pans or river systems. These drainage lines are mostly poorly defined and seldom associated with any riparian vegetation. Their only function being to drain the basin landscape. At present these features can hardly be seen as fulfilling the function of a river ecological system. Two salt pans were observed in the vicinity of the route. In both cases the

BIODIVERSITY ASPECT	SHORT DESCRIPTION	SIGNIFICANCE RATING
		route runs north of the salt pan and should not have any direct impact on the pan itself. Potential impact = medium-low
Invasive alien infestation	<i>Prosopis</i> species was observed along the route.	All listed invasive alien species must be removed during the construction. Possible Impact = positive.
Potential direct impacts		
Direct impacts	Refers to those impacts with a direct impact on biodiversity features.	The proposed pipeline will have a direct impact on natural vegetation, which is likely to include protected plant species in terms of the NCNCA, small seasonal ephemeral streams and an ecological support area associated with the Sak River. The impact on soil, landuse, fauna and avi-fauna and veld fire is considered to be negligible. Normally the possible impact on protected plant species, the ecological support area and the ephemeral streams would have resulted in a higher significance rating. However, since the impacts are all short termed, temporary and localized it is considered unlikely that the cumulative direct impact will be of high significance. Potential impact = low to medium-low
Potential indirect impacts		
Indirect impacts	Refers to impacts that are not a direct result of the main activity, but are impacts associated or resulting from the main activity.	It is likely that the proposed project will have indirect impacts, but it is not considered to add significant load on the natural environment. It is considered that indirect impacts will have a much lower impact than direct impacts with very little cumulative effect on the environment. In addition indirect impacts can be reduced through good environmental control during construction. Potential impact = low
Potential cumulative impacts		
Cumulative impacts	Refers to the cumulative loss of ecological function and other biodiversity features on a regional basis.	The proposed project will have a temporary and localised impact, which should not result in significant additional permanent impacts (apart from the new reservoir at Brandvlei). Overall it is not considered likely that the cumulative impact will result in any significant additional impact on regional biodiversity targets, but because of the likelihood of the medium-low impacts associated with protected plant species, ecological support areas and seasonal ephemeral streams the overall cumulative rating slightly increase. However, good environmental control should offset the additional impact. Potential impact = medium-low (with good environmental control during construction)
The No-Go Option		
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.	However, it is important to note that the current water supply system to Brandvlei is dated. The old pipeline cannot supply enough water and the system is in poor state of maintenance. Additional water is needed and the proposed activity provides the most viable long term solution. Should the activity not be approved, Brandvlei will have to resort to other measures of water supply (none of these viable at present). In addition this will lead to major maintenance works to the current system which may lead to additional (uncontrolled) environmental impacts.

9. RECOMMENDATIONS & IMPACT MINIMIZATION

Having evaluated the biodiversity aspects and associated impacts pertaining to the proposed development, the author is of the opinion that the proposed route most probably matches the most logical choice from a biodiversity perspective, by not impacting on threatened habitats, vegetation or species, while conforming with the objectives of the Namakwa District Biodiversity Sectors Plan's identified CBA's (apart from the relative localised potential impact on an ESA). With mitigation it is possible that the proposed development will have a very low temporary impact on the environment and most importantly will adhere to the objectives of the Namakwa District Biodiversity Sector Plan.

Having evaluated and discussed the various biodiversity aspects associated with the proposed development, the most significant possible impacts identified are:

- The medium-low potential impact on the threatened and protected ecosystems relating to the low possible impact on the ecological support area associated with the Sak River.
- The potential medium-low impact on small seasonal ephemeral streams.
- The potential low impact on protected plant species, especially plant protected in terms of the NCNCA.

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 development and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity

Lastly it is felt that with good environmental planning and control during development (the appointment of a suitably qualified ECO and the implementation of an approved EMP) could significantly reduce environmental impact.

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

9.1 IMPACT MINIMIZATION

- 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 application for a flora permit for the possible temporary disturbance of listed species identified in terms of Schedule 1 and 2 of the NCNCA. Please note that all Aloe species and other viable transplantable species should be transplanted as part of a search & rescue operation before topsoil removal.
- The top 10-20 cm layer of soil (which should contain 80-90% of the seed bearing material and bulbs) must be removed from the footprint and stored separately. The topsoil and vegetation must be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of plant species.
- An integrated waste management system must be implemented during the construction phase.
- All alien vegetation must be removed from along the footprints of the construction area.
- Indiscriminate clearing of areas must be avoided.