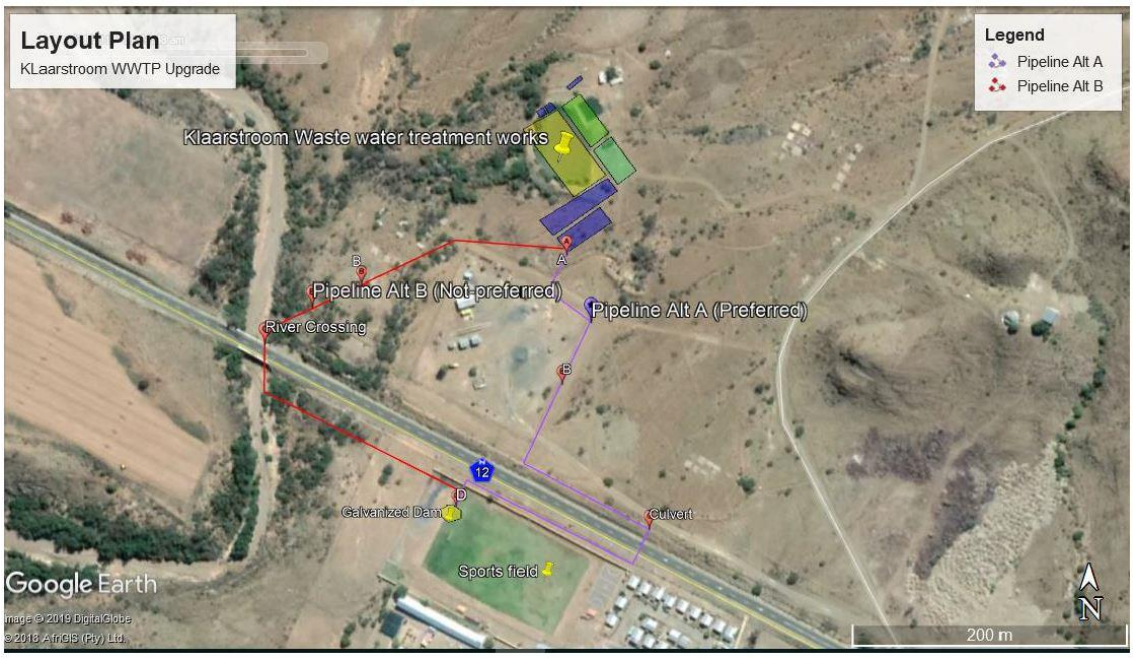
PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL ASSESSMENT

KLAARSTROOM WWTW UPGRADE

PROPOSED UPGRADE OF THE KLAARSTROOM OXIDATION POND SYSTEM & NEW PIPELINE, PRINCE ALBERT MUNICIPALITY, WESTERN CAPE PROVINCE.



28 February 2019

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SUMMARY - MAIN CONCLUSIONS

VEGETATION TYPE	**Prince Albert Succulent Karoo** Only one broad vegetation type is expected in the proposed area and its immediate vicinity, namely Prince Albert Succulent Karoo. This vegetation type is considered "Least Threatened" (GN 1002, December 2011), but only 3% is currently statutorily conserved.
VEGETATION ENCOUNTERED	The area that will be impacted by the proposed WWTW upgrade and pipeline is very small. If it is taken into account that the existing WWTW (0.6 ha) is already transformed, the additional footprint will be only about ±5000 m^2, while the pipeline will have a temporary impact on between 500- 800 m of veld of which most is located in areas already disturbed or within the transformed urban edge of Klaarstroom.
CONSERVATION PRIORITY AREAS	According to the WCBSP (Refer to Figure 6), the proposed development will be located within a terrestrial CBA, the alternative pipeline route will also impact on the ESA associated with the Sand River. However, it must be noted that although the proposed infrastructure will be located within a terrestrial CBA, these areas are for the most part already degraded. <u>There is also no viable alternative for the proposed upgrade that will fall outside of the CBA</u>. In addition the permanent enlargement of the footprint will be relative small (5000 m^2) while the impacts associated with the pipeline route should be temporary of nature. It is also expected that mitigation and rehabilitation can further reduce the impact. The site will not impact on any recognised centre of endemism.
CONNECTIVITY	Because of the small scale of the development (and the temporary nature of the pipeline route) it is not expected that the proposed development will have any significant additional impact on connectivity.
LAND-USE	The pipeline will cross municipal land which might be used for grazing, but which has been specifically set aside for potential industry enlargements. The potential impact on socio-economic activities is thus expected to be minimal, while there should be Social gain from re-using the treated wastewater, and most importantly ensuring save disposal of treated effluent (the current WWTW is a health risk).
PROTECTED PLANT SPECIES	No protected or red-listed plant species were observed.
WATER COURSES AND WETLANDS	The proposed preferred development should not result in any significant additional impacts on any water course. However, proposed alternative pipeline route will result in a localised impact of the banks of the seasonal Sand River.
MAIN CONCLUSION	The proposed development will result in a small permanent footprint enlargement of approximately 5000 m^2 of the existing WWTW and a temporary impact along the short (<500 m) pipeline route, most of which will be located in already disturbed or transformed veld. However, the footprint enlargement and the pipeline east of the N15 are located within a proposed CBA area, while the proposed alternative pipeline route will have a temporary impact on the seasonal Sand River (even though very localized). According to the impact assessment given in Table 5 the development is likely to result in a relative **<u>Low</u>** impact on the environment, which can be reduced to almost insignificant with good environmental control during construction. With the correct mitigation it is unlikely that the development will contribute significantly to any of the following: • Significant loss of vegetation type and associated habitat. • Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities. • Loss of local biodiversity and threatened plant species. • Loss of ecosystem connectivity. **WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT PROJECT BE APPROVED, WITH THE PROPOSED MITIGATION ACTIONS.**
NO-GO OPTION	The development may result in potential significant beneficial socio-economic gain, while the no-go option will not contribute significantly to national or provincial conservation targets.

INDEPENDENCE & CONDITIONS

PB Consult is an independent entity with 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 OTR and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity en environmental legal compliance audits.

During 2010 he joined EnviroAfrica in order to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes NEMA EIA applications, environmental management plans for various industries, environmental compliance audits, environmental control work as well as more than 70 biodiversity & botanical specialist studies.

Towards the end of 2017, Mr Botes started his own small environmental consulting business focusing on biodiversity & botanical assessments, biodiversity management plans and environmental compliance audits.

Mr. Botes is a registered Professional Botanical, Environmental and Ecological Scientists 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.

DECLARATION OF INDEPENDENCE

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I Petrus, Jacobus, Johannes Botes, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014, as amended, and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 13 of GN No. R. 326.

Note: The terms of reference must be attached.

Signature of the specialist:

PB Consult (Sole Proprietor)

Name of company:

8 October 2018

Date:

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1. INTRODUCTION

Klaarstroom is a small village at the foot of the Swartberg Mountains, just north of Meiringspoort, the spectacular "poort" that links the Great Karoo with the Little Karoo (Klein Karoo). The village is located on the N12 between Beaufort West (125 km to the north) and De Rust (25 km to the south) in the Western Cape Province. Klaarstroom was established in the mid-19th century and the name means "clear-water". It presented the first opportunity to farmers traveling from the Great Karoo, en route to the small port of Mossel Bay, to wash their precious cargo of wool in the clear mountain streams. The town also used to be well known for its lucerne production (www.karoo-information.co.za).

The existing wastewater treatment works (WWTW) was constructed during 1970 and consists of a very simple two pond anaerobic treatment works. The design capacity of the original WWTW is approximately 50 m^3 per day. At present this treatment works is operated well over its design capacity and is in urgent need of upgrading. BVi Engineers (Upington) was appointed by the local Municipality to evaluate and propose a viable upgrade that will allow for the treatment of the current sewerage volumes.

The proposed upgrade will trigger listed activities under the National Environmental Management Act, (Act 107 of 1998) (NEMA) and the EIA regulations (as amended). EnviroAfrica was appointed to perform the NEMA EIA application and PB Consult was appointed to conduct a botanical assessment of the proposed site expansion and route locations, which, although disturbed, still supports natural vegetation.

Only one vegetation type is expected to be impacted by the proposed development, namely Prince Albert Succulent Karoo (considered "Least Threatened" in terms of the National list of ecosystems that are threatened and in need of protection).

The proposed development footprint is mostly (except for the alternative pipeline route) located on Municipal land. It is in close proximity of the small town of Klaarstroom and located next to existing industrial and urban areas. As a result most of the proposed footprint area had been subject to urban influences and the vegetation shows all the signs of disturbance as a result of its proximity to urban development.

However, the site also falls within a proposed terrestrial critical biodiversity area (CBA1) as identified in the 2017 Western Cape Biodiversity Spatial Plan.

1.1. TERMS OF REFERENCE

The terms of reference for this appointment were to:

- Evaluate the proposed site(s) in order to determine whether any significant botanical features will be impacted as a result of the proposed development.
- Determine and record the position of any plant species of special significance (e.g. protected tree species, or rare or endangered plant species) that should be avoided or that may require "search & rescue" intervention.
- Make recommendations on impact minimization should it be required
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

2. STUDY AREA

2.1. LOCATION & LAYOUT

Klaarstroom is located on the N12 between Beaufort West (125 km to the north) and De Rust (25 km to the south), at the northern entrance to Meiringspoort in the Western Cape Province. Prince Albert is about 60 km to the west of Klaarstroom, which is located in the Prince Albert Local Municipal Area (Central Karoo District Municipality) (Figure 1). The existing WWTW is located just north of Klaarstroom (north of the N12) on the Remainder of Portion 32 of the Farm Klaarstroom No. 178, Prince Albert.

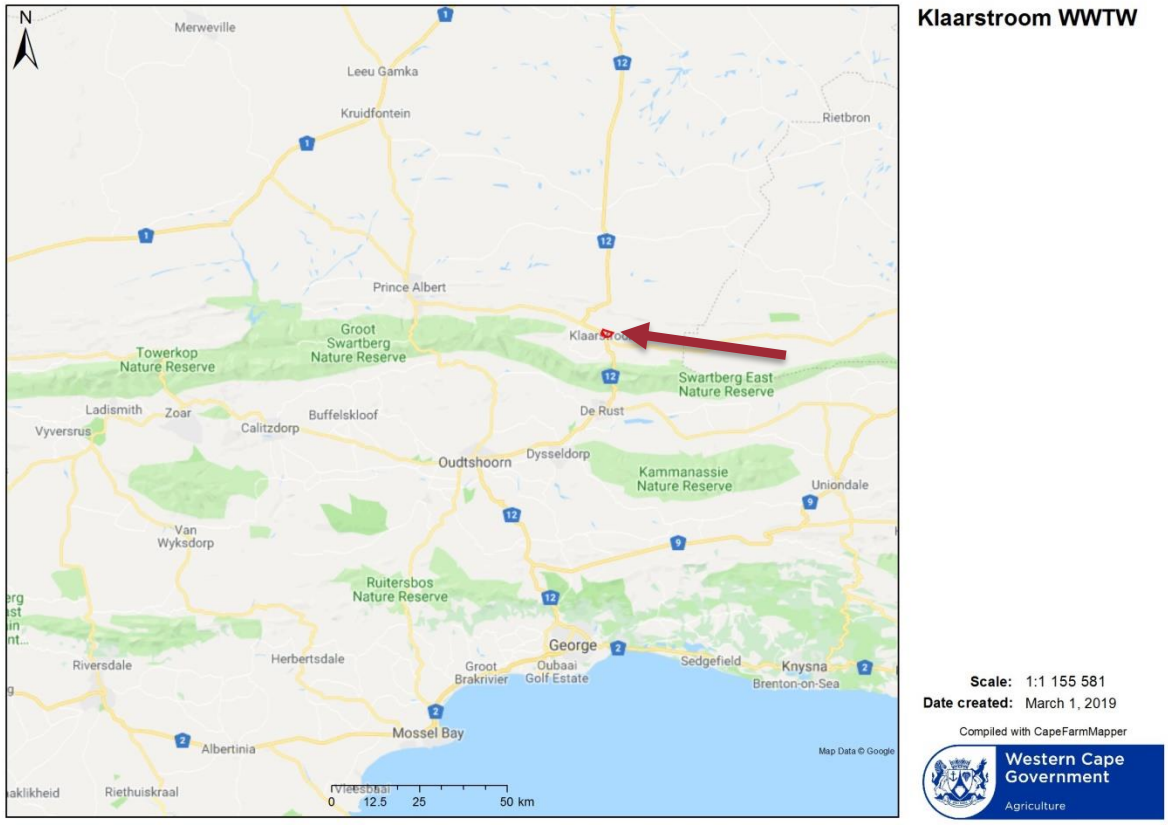


Figure 1: Map showing the location of Klaarstroom in the Western Cape Province

The existing WWTW consists comprises of an inlet works and two ponds. The first pond being anaerobic followed by a single facultative pond from where the final effluent is piped to the north of the existing site and irrigated onto natural veld *via* an overhead sprinkler system.

At present the WWTW has a footprint of approximately 0.6 ha. BVi proposes to upgrade the system by adding aerobic and anaerobic ponds, refurbishing the facultative pond after which a horizontal flow reed bed and a final effluent storage pond will be established. Most of the new pond systems will be placed in the existing WWTW footprint, so that the final footprint will only entails a slight enlargement of the WWTW. The final footprint is expected to be 8 400 m^2 (0.84 ha) in total (Figure 2). It is also proposed that the final effluent be re-used through the principle of beneficial irrigation for the irrigation of the existing sport fields at Klaarstroom. A new pipeline of between 500 to 800 m (depending on the alternative chosen) will have to be constructed to transfer the treated water from the WWTW to the sporting fields.

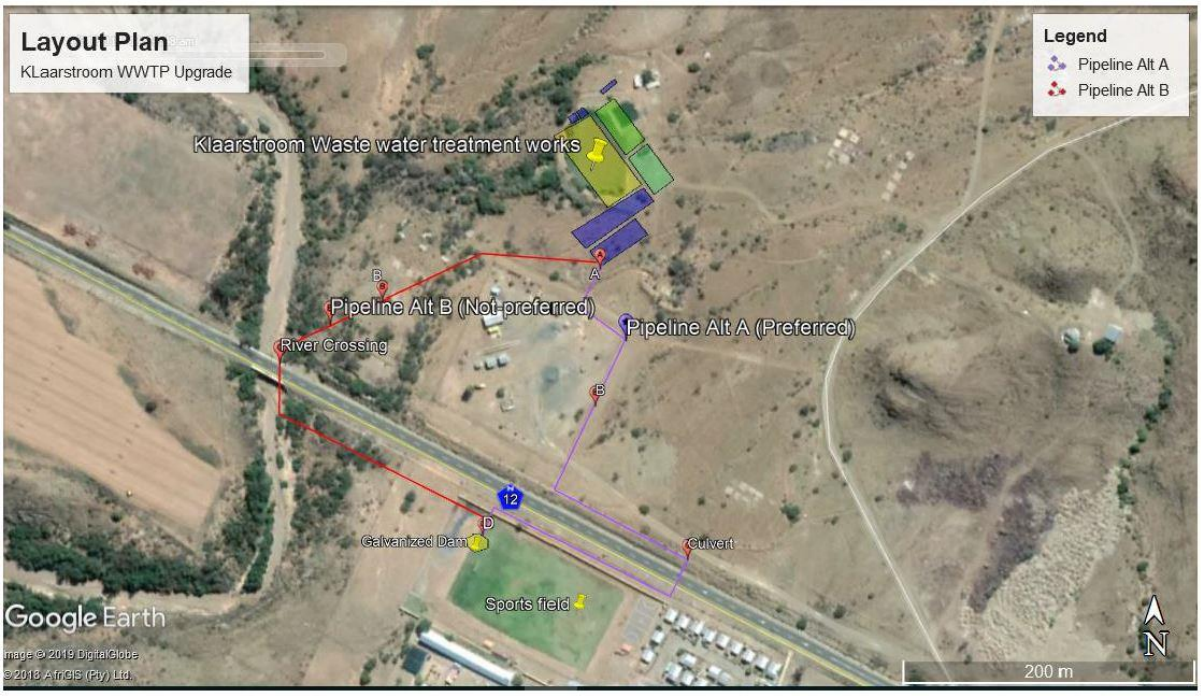
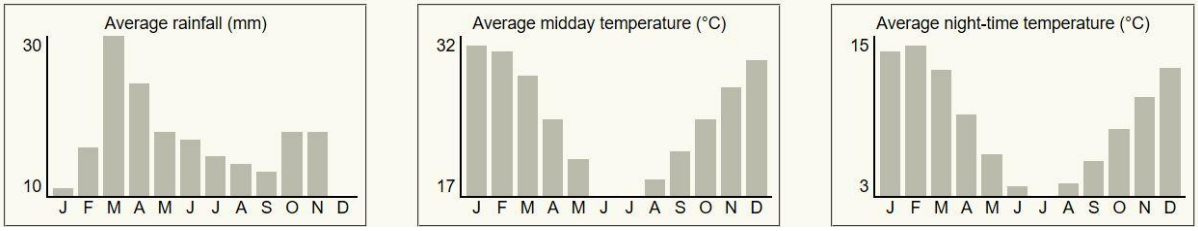


Figure 2: The location of the proposed Klaarstroom WWTW upgrades and potential pipeline routes

2.2. CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Prince Albert, which is located just west of Klaarstroom, normally receives about 204 mm of rain per year, mainly in mid-summer. The chart below (lower left) shows the average rainfall values for Prince Albert per month. It receives the lowest rainfall (10 mm) in December and the highest (30 mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Prince Albert range from 17.2°C in July to 31.2°C in January. The region is the coldest during July (3.3°C on average during the night). The lower right chart gives an indication of the monthly variation of average minimum daily temperatures (www.saexplorer.co.za).

Table 1: Average rainfall and temperatures at Prince Albert, just west of Klaarstroom (www.saexplorer.co.za)



2.3. TOPOGRAPHY

Klaarstroom is located in the valley bottom at the foot of the Swartberg Mountains where the Meiringspoort gorge opens up into the Great Karoo. The WWTW upgrade and pipeline will be located on an almost level area within this open valley. The slight slopes very slightly from northeast to southwest, from the WWTW, which is located at approximately 735 m above mean sea level, towards the town of Klaarstroom, which is located at approximately 730 m above mean sea level. The seasonal Sand River, passes to the northwest of the WWTW

and drains into the Groot River, which passes behind (to the west) of Klaarstroom. It was clear that aspect did not have any significant influence on the vegetation encountered.

2.4. GEOLOGY AND SOILS

According to Mucina and Rutherford (2006), the geology and soils can be described as sedimentary rocks of the Ecca Group (particularly the Fort Brown and Prince Albert Formations) together with diamictite of the Dwyka Group (most important in the area), and to a lesser extent shales and quartzites of the Devonian Witteberg Group. In places, Tertiary alluvial and slope deposits overlie these Karoo and Cape Supergroup rocks. This geology supports development of various cambisols and leptosols. Fc is the dominant land type, while Ag land type plays only a minor role.

3. EVALUATION METHOD

Desktop studies coupled with a site visit were performed. The site visit was conducted during January of 2019. The timing of the site visit was reasonable in that, even though the veld was very dry, almost all perennial plants were identifiable. Unfortunately, very little summer rains had been received and as a result very few herbaceous species was visible.

Figure 3: The proposed larger footprint that was studied during the site visit (Yellow line indicating areas that was visited)

However, the author is confident that a fairly good understanding of the biodiversity status of the site was obtained. The survey was conducted by walking the site and 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. rocky outcrops or silcrete patches).

4. THE VEGETATION

The Karoo is a vast arid plain occupying large portions of the interior of South Africa. Even though it is an arid region, it is astoundingly rich in flora with over 7 000 different plant species estimated to occur in this area. It used to support millions of antelope, mainly springbuck, but also numerous other larger antelope (and other grazing animal). These animals roamed the vast plains of the Karoo, utilizing different selections of plants and allowing for long "rest" periods as they move around, and as a result preventing overgrazing (Shearing, 1994).

In accordance with the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated in the 2012 beta version) only one broad vegetation type is expected in the proposed area and its immediate vicinity, namely **Prince Albert Succulent Karoo**. This vegetation type is considered "Least Threatened" (GN 1002, December 2011), but only 3% is currently statutorily conserved. The vegetation is described as a low shrub where dominance is shared between leaf-succulent vygies and small-leaved Karoo shrubs. Heuweltjies are an important feature of this vegetation and can occur at densities of up to two per hectare, supporting salt-tolerant plant combinations like *Augea*, *Brownanthus*, *Drosanthemum*, *Malephora*, *Psilocaulon*, *Ruschia* and *Salsola* species.

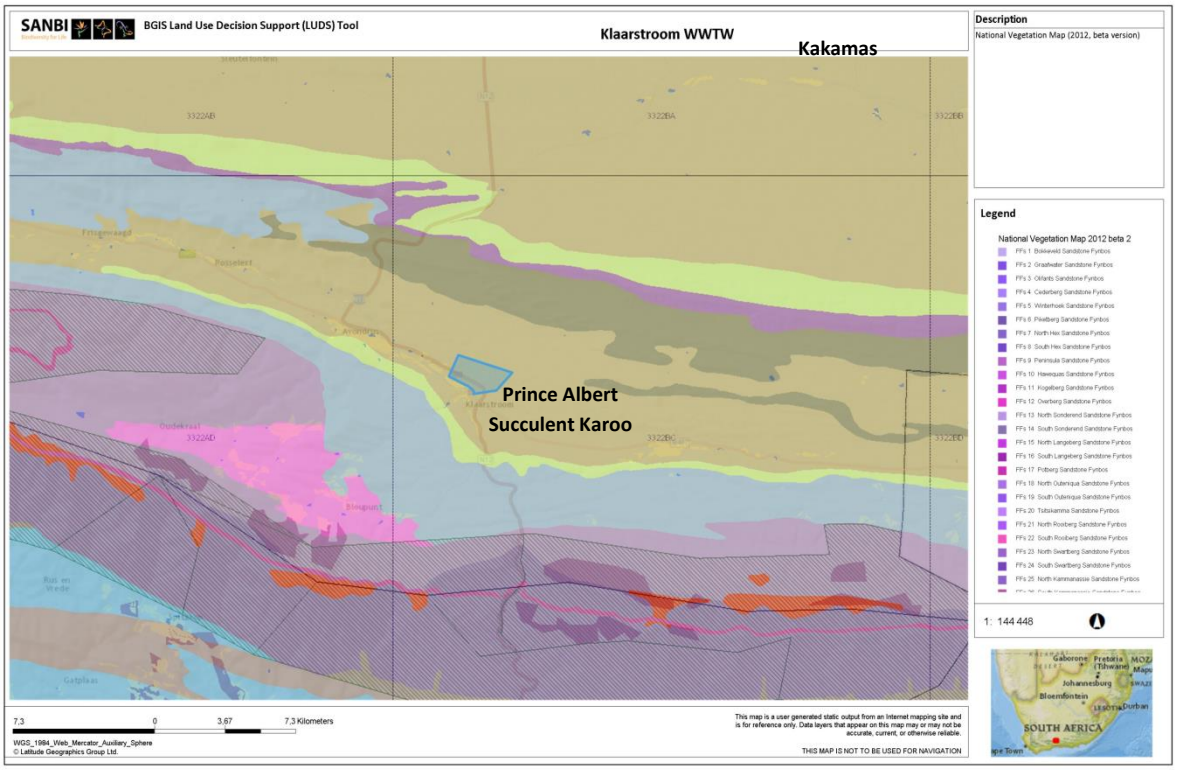


Figure 4: Vegetation map of South Africa (2012 beta 2 version), showing the larger area (blue polygon) and expected vegetation (Prince Albert Succulent Karoo)

4.1. THE VEGETATION IN CONTEXT

Prince Albert Succulent Karoo is part of the Succulent Karoo Biome, which is a semi-desert region characterized by even, mild climate. It is the fourth largest biome in South Africa. It interfaces with the Fynbos Biome, with which it also shares its greatest floristic affinity, to the south and east, the Nama-Karoo to the north and west and the Desert Biome to the north. Globally there are few other places than can claim to be as biologically distinct as the Succulent Karoo Biome. It is unrivalled in its status as the world's only entirely arid region diversity hotspot and has a high diversity of dwarf leaf-succulent shrubs. "Vygies" or members of the Aizoaceae are

particularly prominent, with "spurges" or Euphorbiaceae and "stone crops" or Crassulaceae and succulent members of the Asteraceae, Iridaceae and Hyacinthaceae also prominent (Mucina *et. al*., 2006).

According to Mucina, *et. al*. (2006) only 5.8% of the Succulent Karoo Biome is formally protected, stressing the fact that the current conservation areas does not incorporate key ecological processes and evolutionary biodiversity drivers (e.g. riverine and sand movement corridors, quartz patches, edaphic interfaces, climate and upland-lowland gradients).

4.2. VEGETATION ENCOUNTERED

The area that will be impacted by the proposed WWTW upgrade and pipeline is very small. If it is taken into account that the existing WWTW (0.6 ha) is already basically transformed, the additional footprint will be only about ±5000 m^2, while the pipeline will have a temporary impact on between 500- 800 m of veld of which most is located in already disturbed or transformed (within the urban edge) veld portions.

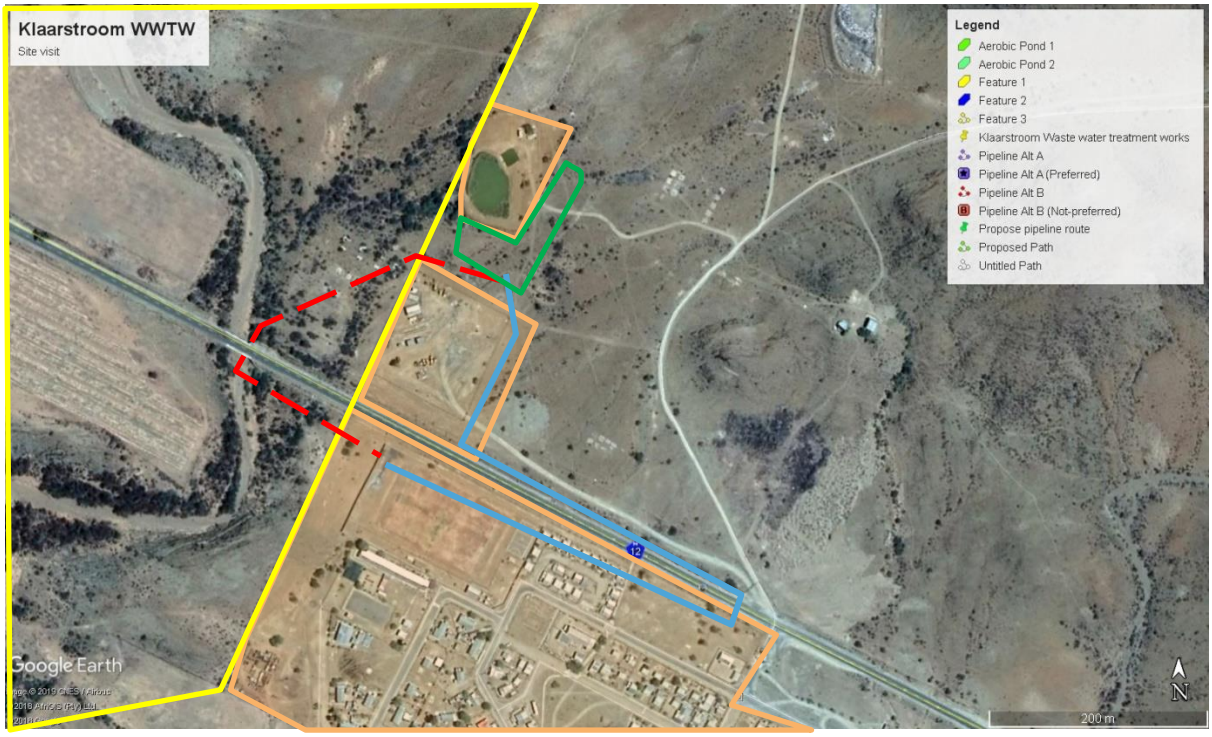


Figure 5: Google overview of the study area, showing the additional area that will be impacted by the proposed WWTW (green polygon), the preferred pipeline route in blue, the alternative pipeline route in red, in relation to areas that were basically transformed as a result of urban activities (in orange). The yellow area indicating private property.

Figure 5 above, tries to illustrate the status of the veld as encountered during the site visit. The areas in light orange are either transformed or much degraded as result of urban and associated impacts. No natural veld remains in these areas and only a few hardy or weedy indigenous plants were encountered. This includes the existing fenced off WWTW, where the only remaining natural species (apart from weeds growing in the slightly damper areas) is a number of *Vachellia karroo* (=*Acacia karroo*) trees around the property and the reed *Phragmites australis* within the existing ponds (refer to Photo 1 & 2).

Photo 1: The existing WWTW looking almost from north to south over the treatment works. Note the absence of natural vegetation apart from the Phragmites australis reeds in the second pond and the *Vachellia karroo* trees behind the ponds.

Photo 2: The existing WWTW looking from an easterly direction back towards the existing inlet structure of the WWTW. Again the absence of any natural vegetation within the fenced of treatment works footprint should be noted. A beautiful *Vachellia karroo* in the background next to the inlet works – clearly benefitting from the water on site.

It must be noted that all around the existing WWTW, the small tree *Vachellia karroo* were frequently encountered, clearly benefiting from the water bodies of the treatment works (Photo 3).

Photo 3: The area just east of the existing WWTW that will be impacted by the proposed upgrades.

The area just south of the existing WWTW, between the WWTW and the Department of Transports road camp (Photo 4 & 5), are covered by slightly more natural vegetation (seemingly slightly less impacted, although it had been degraded by the dumping of building rubble and road waste like tar chips). Since this area represented some of the best preserved natural veld in the whole of the proposed footprint (in terms of species encountered) it was used as basis to describe the vegetation expected in the area (including the pipeline route).

The veld still showed signs of being disturbed and cannot be described as typical Prince Albert Succulent Karoo vegetation. However, it is considered a disturbed form of this vegetation type, which was still dominated by leaf succulent vygies and small-leaved shrubs with *Vachellia karroo* and occasional other larger shrubs (e.g. *Lycium cinereum &* occasionally *Cadaba aphylla*) scattered within (Photo 4 & 5).

Photo 4: Showing the vegetation to the south of the WWTW (with the Road camp in the background of the picture). Note the sparse low shrub bottom stratum and the top stratum of *Vachellia karroo* and *Lycium*. The green area, showing the approximate area that will be impacted.

Photo 5: The vegetation to the south of the WWTW, looking from east westwards towards the Sand River in the background. The green area representing the (approximate) proposed area that will be impacted.

The vegetation can be described as a low (<0.5 m) sparse shrubland with a *Vachellia karroo* top stratum scattered throughout. The density of the *Vachellia karroo* over layer is probably slightly higher than expected (which is likely the result of the nearby WWTW and its water bodies). In between these trees the following species were observed: the alien *Atriplex nummularia*, the low growing *Augea capensis* (common), the spiny *Blepharis mitrata, Cadaba aphylla, Carpobrotus edulis, Chrysocoma ciliata, Drosanthemum* species, *Eriocephalus* species, the disturbance indicator *Galenia africana,* the hardy *Lycium cinereum*, *Mesembryanthemum noctiflorum*, *Mesembryanthemum* cf. *junceum* (=*Psilocaulon*) species, *Mesembryanthemum guerichianum* ("soutslaai"), *Polygala leptophylla*, *Pteronia glabrata*, *Pteronia* cf. *pallens*, the thorny *Ruschia spinosa*, *Salsola kali* (disturbance indicator), *Salsola* cf. *aphylla,, Tetraena lichtensteinianum*, *Tetraena simplex*, the semi-parasitic *Thesium lineatum* and *Tripteris* cf. *sinuata*. The absence of many of the more palatable species suggests that the veld is grazed, although no domestic stock was observed on site. Grasses was notably absent, which is probably a combination of drought and grazing.

4.2.1. The preferred Pipeline route

The preferred pipeline route will start within at the extended WWTW within the area described above (Refer to the blue line in Figure 5). It will then be placed next to the fence of the Road camp within an area that has been cleared of vegetation (potentially a fire break) (Refer to Photo 6).

Photo 6: The preferred pipeline route location next to the Roads camp. It will be placed within an existing disturbed area (e.g. potential fire-break) with almost no vegetation remaining.

From the road camp the pipeline will follow the N14 south for about 250 – 300 m (Photo 7) where it will cross underneath the N14 (through an existing culvert), after which it turns north again back towards the sporting grounds (within the urban edge, with no vegetation of significance). The vegetation in this area has also been subject to past disturbance. As a result only a few small Vachellia karroo and hardy or weedy pioneer species were observed like *Augea capensis*, *Galenia africana*, young *Lycium cinereum*, *Kali* species, and *Tetraena simplex.*

Photo 7: Preferred pipeline route along the N14 from the Road camp to the culvert where it will cross underneath the N14. Again the vegetation in this area had been subject to past disturbance (clearing actions).

4.2.2. Alternative pipeline route

The alternative pipeline route will start at the same point as the preferred route, but will run to the west onto private land; from where it will take the shortest route to the bridge were the Sand River runs underneath the N14 (Refer to Figure 5). It is proposed that the pipeline will be attached to the bridge where it crosses underneath the road.

The vegetation on the private land was in slightly better condition and slightly more "closed" (Photo 8). It is probably the result of a lower grazing pressure, but it is also attributed to this area being in closer proximity to the seasonal Sand River. The area just west of the WWTW and roads camp, seems to have been used for housing or other buildings in the past as numerous old concrete foundations were observed in this area (Photo 8). In terms of vegetation the veld remains the same, as that found on the adjacent proposed WWTW extension site. The only difference being that the *Vachellia karroo* now occurred in denser stands and the trees were generally

larger. The bottom layer remains very similar to that found just south of the WWTW although the *Cadaba* and *Carpobrotus* were not observed in these areas.

Photo 8: The disturbed vegetation encountered to the west of the WWTW (and the Roads camp) on the private land. Note the old concrete slabs in the forefront and even in the background.

The riparian vegetation along the Sand River (in the area near to the N14) was basically dominated by *Vachellia karroo*, with *Phragmites australis* patches also common, with *Melianthus comosus* and *Searsia lancea* occasionally (Photo 9).

Photo 9: Showing the typical vegetation associated with the Sand River. This photo was taken at the point where the Sand River goes crosses the N14 (looking upstream).

Photo 10: The bridge underneath the N14. The pipeline is proposed to be attached to this bridge.

Once the pipeline has crossed the N14 it will turn south following the N14 (still on private land) back towards the Klaarstroom sport fields (Photo 11). The vegetation remains the same as discusses above, with dense stands of *Vachellia karroo* next to the Sand River, which becomes less dense as you move away from the river corridor (Photo 11).

Photo 11: The vegetation to the west of the N14 looking from south to north. Note the railings of the bridge underneath the N14 towards the back of the picture.

4.2.3. Reservoir site

A small storage tank or reservoir will be placed within the existing Klaarstroom sport fields from where the sport fields can be irrigated. This reservoir will be located in this site with no natural veld remaining (Photo 12).

Photo 12: The Klaarstroom sport fields, indicating the proposed location for the small balancing reservoir.

4.3. CRITICAL BIODIVERSITY AREAS MAPS

The 2017 Western Cape Biodiversity Spatial Plan (WCBSP) includes a map of biodiversity importance for the entire province, covering both the terrestrial and freshwater realms, as well as major coastal and estuarine habitats (Pool-Starvliet, 2017). The product is referred to as the Biodiversity Spatial Plan (BSP) Map.

The BSP Map is the product of a systematic biodiversity plan that delineates, on a map, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services.Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. CBA's can also be used to inform protected area expansion and development plans.

- **Critical biodiversity areas (CBA's)** are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained

in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

- **Ecological support areas (ESA's)** are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

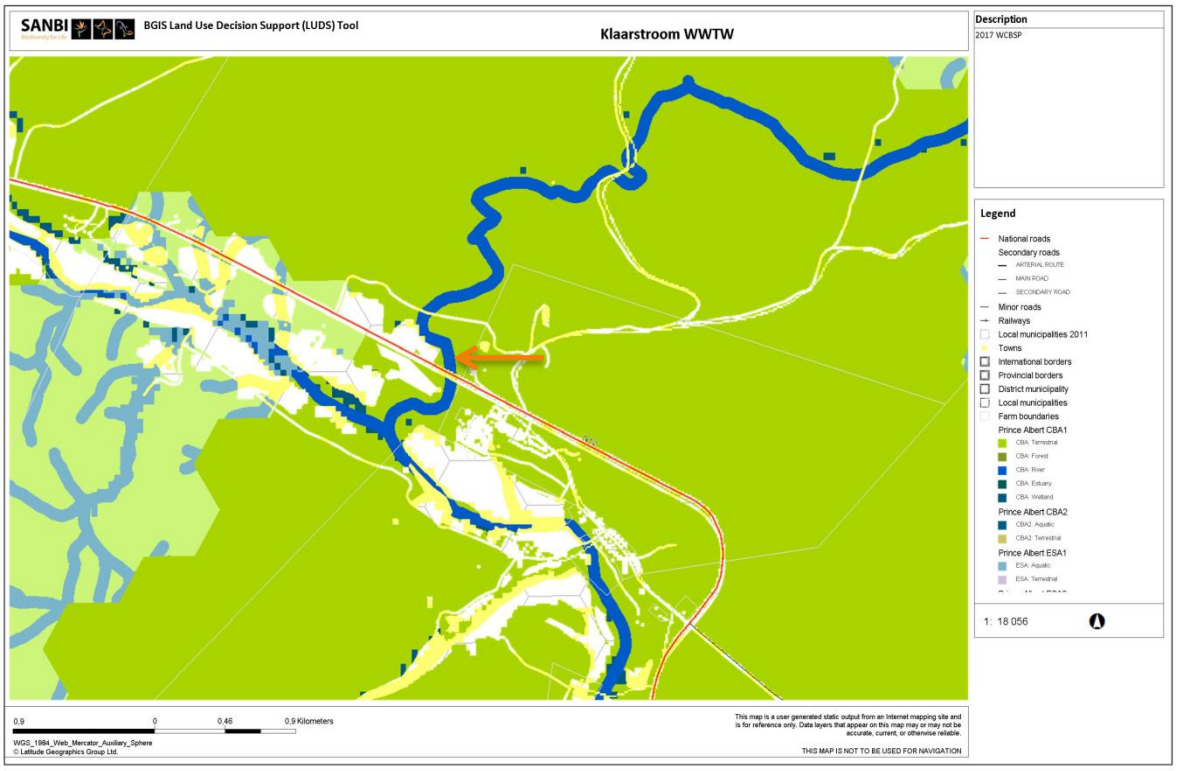


Figure 6: The Western Cape Biodiversity Spatial Plan (2017) showing the location of the proposed development

From a land-use planning perspective it is useful to think of the difference between CBA's and ESA's in terms of where in the landscape the biodiversity impact of any land-use activity action is most significant:

- For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).

- For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity).

According to the WCBSP (Refer to Figure 6), the proposed development will be located within a terrestrial CBA, the alternative pipeline route will also impact on the ESA associated with the Sand River.

Please note that although the proposed infrastructure will be located within a terrestrial CBA for the purposes of the impact assessment it was taken into account that the pipeline will be located in areas already very much disturbed and that with the current CBA map, there is no alternative location that will fall outside of the CBA. It was also taken into account that the permanent enlargement of the footprint will be relative small (±5000 m^2) and that the impact associated with the pipeline route will be temporary. It is also expected that with mitigation and rehabilitation the impact associated with the construction of the pipeline can be minimal.

4.4. POTENTIAL IMPACT ON CENTRES OF ENDEMISM

The proposed development does not impact on any recognised centre of endemism, although the Little Karoo Centre of Endemism is just south of the Swart Berge (Van Wyk & Smith, 2001).

The proposed site does not fall within any recognised centre of endemism.

4.5. FLORA ENCOUNTERED

Table 2 gives a list of the plant species encountered during this study. Because of the limitations (timing and a single site visit as well as the drought) it is likely that a number of annuals might have been missed.

Table 2: List of indigenous species encountered within or near the proposed footprint

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
1.	*Atriplex nummularia*	AMARANTHACEAE	Exotic Weed	**Category 2 AIP**
2.	*Augea capensis*	ZYGOPHYLLACEAE	LC	
3.	*Blepharis mitrata*	ACANTHACEAEA	LC	
4.	*Cadaba aphylla*	BRASSICACEAE	LC	
5.	*Carpobrotus edulis*	AIZOACEAE	LC	
6.	*Chrysocoma ciliata*	ASTERACEAE	LC	
7.	*Drosanthemum* species	AIZOACEAE		
8.	*Eriocephalus* species	ASTERACEAE	LC	
9.	*Galenia africana*	AIZOACEAE	LC	
10.	*Lycium cinereum*	SOLANACEAE	LC	
11.	*Melianthus comosus*	MELIANTHACEAE	LC	
12.	*Mesembryanthemum guerichianum*	AIZOACEAE	LC	
13.	*Mesembryanthemum junceum (=Psilocaulon junceum)*	AIZOACEAE	LC	
14.	*Mesembryanthemum noctiflorum (=Aridaria noctiflora)*	AIZOACEAE	LC	
15.	*Mesembryanthemum noctiflorum (=Aridaria noctiflora)*	AIZOACEAE	LC	
16.	*Osteospermum* cf. *sinuatum (=Tripteris* cf. *sinuata*	ASTERACEAE	LC	
17.	*Phragmites australis*	POACEAE	LC	
18.	*Polygala leptophylla*	POLYGALCEAE	LC	
19.	*Pteronia* cf. *pallens*	ASTERACEAE	LC	
20.	*Pteronia glabrata*	ASTERACEAE	LC	
21.	*Ruschia spinosa*	AIZOACEAE	LC	
22.	*Salsola aphylla*	AMARANTHACEAE	LC	
23.	*Salsola kali*	AMARANTHACEAE	Naturalised invasive	**1b**

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
24.	*Searsia lancea*	ANACARDIACEAE	LC	
25.	*Tetraena lichtensteinianum (=Zygophyllum lichtensteinianum)*	ZYGOPHYLLACEAE	LC	
26.	*Tetraena simplex*	ZYGOPHYLLACEAE	LC	
27.	*Thesium lineatum*	SANTALACEAE	LC	
28.	*Vachellia karroo*	FABACEAE	LC	
29.	*Ziziphus mucronata*	RHAMNACEAE	LC	

4.6. THREATENED AND PROTECTED PLANT SPECIES

South Africa has become the first country to fully assess the status of its entire flora. Major threats to the South African flora are identified in terms of the number of plant taxa Red-Listed as threatened with extinction as a result of threats like, habitat loss (e.g. infrastructure development, urban expansion, crop cultivation and mines), invasive alien plant infestation (e.g. outcompeting indigenous plant species), habitat degradation (e.g. overgrazing, inappropriate fire management etc.), unsustainable harvesting, demographic factors, pollution, loss of pollinators or dispersers, climate change and natural disasters (e.g. such as droughts and floods). South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. However, due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction, but may nonetheless be of high conservation importance. As a result a SANBI uses an amended system of categories in order to highlight species that may be of low risk of extinction but are still of conservation concern (SANBI, 2015).

In the Northern Cape, species of conservation concern are also protected in terms of national and provincial legislation, namely:

- The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the "*Lists of critically endangered, endangered, vulnerable and protected species*" (GN. R. 152 of 23 February 2007).
- National Forest Act, Act 84 of 1998, provides for the protection of forests as well as specific tree species through the "*List of protected tree species*" (GN 908 of 21 November 2014).
- Northern Cape Nature Conservation Act, Act of 2009, provides for the protection of "*specially protected species*" (Schedule 1), "*protected species*" (Schedule 2) and "*common indigenous species"* (Schedule 3).

4.6.1. Red list of South African plant species

The Red List of South African Plants online provides up to date information on the national conservation status of South Africa's indigenous plants (SANBI, 2015).

- **No red-listed species** was observed.

4.6.2. NEM: BA protected plant species

The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the "Lists of critically endangered, endangered, vulnerable and protected species" (GN. R. 152 of 23 February 2007).

- **No NEM: BA protected species was observed.**

4.6.3. NFA Protected plant species

The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (as updated).

- **No species protected in terms of the NFA** was observed.

5. IMPACT ASSESSMENT METHOD

The objective of this study was to evaluate the botanical diversity of the property area in order to identify significant environmental features which might have been impacted as a result of the development. The Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), were used to evaluate the botanical significance of the property with emphasis on:

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

5.1. DETERMINING SIGNIFICANCE

Determining impact significance from predictions of the nature of the impact has been a source of debate and will remain a source of debate. The author used a combination of scaling and weighting methods to determine significance based on a simple formula. The formula used is based on the method proposed by Edwards (2011). However, the criteria used were adjusted to suite its use for botanical assessment. In this document significance rating was evaluated using the following criteria (Refer to **Error! Reference source not found.**).

Significance = Conservation Value x (Likelihood + Duration + Extent + Severity) (Edwards 2011)

Table 3: Categories and criteria used for the evaluation of the significance of a potential impact

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
CONSERVATION VALUE Refers to the intrinsic value of an attribute or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and fragmentation or its value in terms of the protection of habitat or species	The attribute is transformed, degraded not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition but not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with unlikely possibility of species loss.	The attribute is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare & endangered species.	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.
LIKELIHOOD Refers to the probability of the specific impact occurring as a result of the proposed activity	Under normal circumstances it is almost certain that the impact will not occur.	The possibility of the impact occurring is very low, but there is a small likelihood under normal circumstances.	The likelihood of the impact occurring, under normal circumstances is 50/50, it may or it may not occur.	It is very likely that the impact will occur under normal circumstances.	The proposed activity is of such a nature that it is certain that the impact will occur under normal circumstances.
DURATION Refers to the length in time during which the activity is expected to impact on the environment.	Impact is temporary and easily reversible through natural process or with mitigation. Rehabilitation time is expected to be short (1-2 years).	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5 years).	Impact is medium-term and reversible with mitigation, but will last for some time after construction and may require on-going mitigation. Rehabilitation time is expected to be longer (5-15 years).	Impact is long-term and reversible but only with long term mitigation. It will last for a long time after construction and is likely to require on-going mitigation. Rehabilitation time is expected to be longer (15-50 years).	The impact is expected to be permanent.
EXTENT Refers to the spatial area that is likely to be impacted or over which the impact will have influence, should it occur.	Under normal circumstances the impact will be contained within the construction footprint.	Under normal circumstances the impact might extent outside of the construction site (e.g. within a 2 km radius), but will not affect surrounding properties.	Under normal circumstances the impact might extent outside of the property boundaries and will affect surrounding land owners or –users, but still within the local area (e.g. within a 50 km radius).	Under normal circumstances the impact might extent to the surrounding region (e.g. within a 200 km radius), and will regional land owners or –users.	Under normal circumstances the effects of the impact might extent to a large geographical area (>200 km radius).
SEVERITY Refers to the direct physical or biophysical impact of the activity on the surrounding environment should it occur.	It is expected that the impact will have little or no affect (barely perceptible) on the integrity of the surrounding environment. Rehabilitation not needed or easily achieved.	It is expected that the impact will have a perceptible impact on the surrounding environment, but it will maintain its function, even if slightly modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have an impact on the surrounding environment, but it will maintain its function, even if moderately modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have a severe impact on the surrounding environment. Functioning may be severely impaired and may temporarily cease. Rehabilitation will be needed to restore system integrity.	It is expected that the impact will have a very severe to permanent impact on the surrounding environment. Functioning irreversibly impaired. Rehabilitation often impossible or unfeasible due to cost.

5.2. SIGNIFICANCE CATEGORIES

The formal NEMA EIA application process was developed to assess the significance of impacts on the surrounding environment (including socio-economic factors), associated with any specific development proposal in order to allow the competent authority to make informed decisions. Specialist studies must advise the environmental assessment practitioner (EAP) on the significance of impacts in his field of specialty. In order to do this, the specialist must identify all potentially significant environmental impacts, predict the nature of the impact and evaluate the significance of that impact should it occur. Potential significant impacts are evaluated, using the method described above, in order to determine its potential significance. The potential significance is then described in terms of the categories given in Table 4.

Table 4: Categories used to describe significance rating (adjusted from DEAT, 2002)

SIGNIFICANCE	DESCRIPTION
Insignificant or Positive (4-22)	There is no impact or the impact is insignificant in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or the impact may be positive.
Low (23-36)	An impact barely noticeable in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium Low (37-45)	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved. Social, cultural and economic activities can continue unchanged, or impacts may have medium to short term effects on the social and/or natural environment within site boundaries.
Medium (46-55)	Impact is real, but not substantial. Mitigation is both feasible and fairly easily possible, but may require modification of the project design or layout. Social, cultural and economic activities of communities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long term effect on the social and/or natural environment, within site boundary.
Medium high (56-63)	Impact is real, substantial and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. Social, cultural and economic activities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long-term effect on the social and/or natural environment, beyond site boundary within local area.
High (64-79)	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted and may come to a halt. These impacts will usually result in long-term change to the social and/or natural environment, beyond site boundaries, regional or widespread.
Unacceptable (80-100)	An impact of the highest order possible. There is no possible mitigation that could offset the impact. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. The impact will result in permanent change. Very often these impacts cannot be mitigated and usually result in very severe effects, beyond site boundaries, national or international.

6. DISCUSSING BOTANICAL SENSITIVITY

The aim of impact assessment is to determine the vulnerability of a habitat to a specific impact. In order to do so, the sensitivity of the habitat should be determined by identifying and assessing the most significant environmental aspects of the site against the potential impact(s). For this development the following biodiversity aspects was considered:

- **Location**: The proposed development footprint is located on Municipal property (apart from the alternative pipeline route) on disturbed to transformed veld (urban related influences over a long period of time coupled with grazing).
- **Activity**: The proposed activity is expected to result in a small permanent footprint enlargement of approximately 5000 m^2 and a temporary disturbance along the approximately less than 500 m pipeline route.
- **Geology & Soils**: No special features such as true quarts patches or heuweltjies were observed in or near to the larger footprint area that may result in specialised plant habitat. Please note that heuweltjies are often associated with this veld type, but none were observed within the footprint.
- **Land use and cover**: The pipeline will cross municipal land in close proximity to the town of Klaarstroom. Most of the proposed footprint has already been subject to some sort of physical alteration or is used for industry (e.g. WWTW), while the remainder of the veld show signs of degradation as a result of urban influences and grazing by livestock. The potential impact on socio-economic activities will be localised and short term.
- **Vegetation status**: The vegetation is not considered a threatened vegetation type, but conservation targets have not yet been met. However, the vegetation on site is considered a disturbed version of this vegetation type.
- **Conservation priority areas:** According to the WCBSP the proposed site will impact on a CBA area, but the site is already much degraded as a result of urban influences. The site will not impact on any recognised centre of endemism.
- **Connectivity**: The proposed activity will result in a small permanent footprint enlargement and a temporary impact along the short pipeline route within a CBA. Connectivity is unlikely to be compromised.
- **Watercourses and wetlands**: One seasonal water courses (the Sand River) runs to the west of the proposed development, but will only be impacted if the alternative pipeline route is used.
- **Protected or endangered plant species**: No protected or endangered plants were observed.
- **Alien and Invasive Plant species**: Two AIP species were observed, of which one (Salsola kali) is a hardy pioneer species.

6.1. IMPACT ASSESSMENT

The following table rates the significance of environmental impacts associated with the proposed development. It also evaluates the expected accumulative effect of the proposed development as well as the No-Go option.

Table 5: Impact assessment associated with the proposed development

Impact assessment Pipeline route								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Geology & soils: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	1	1	2	1	2	6	No special habitats observed, apart from a few rocky outcrops, but no special botanical significance associated with these outcrops.
	With mitigation	1	1	2	1	1	5	Minimise footprint
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	1	2	2	1	2	7	Temporary disturbance within Municipal land, used by local inhabitants.
	With mitigation	1	1	2	1	1	5	Minimise footprint and disturbance period.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	1	2	2	1	2	7	Temporary impact on disturbed Prince Albert Succulent Karoo (Least Threatened), but it overlaps a CBA (future protection area).
	With mitigation	1	1	2	1	1	5	Minimise footprint.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	2	2	2	1	2	14	Site overlaps a CBA (proposed future protection support area) but is already very disturbed.
	With mitigation	2	1	2	1	1	10	Minimise the footprint (there is no viable alternative which will not impact on the CBA).
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	1	2	2	1	2	7	Connectivity is unlikely to be (significantly) further compromised.
	With mitigation	1	1	2	1	1	5	Minimise the disturbance footprint.
Watercourses and wetlands: Potential impact on natural water courses and its ecological support areas.	Without mitigation	3	2	2	1	2	21	The alternative pipeline route will result in a localised disturbance of its river banks.
	With mitigation	2	1	2	1	1	10	Minimise the footprint at, implement erosion prevention measures.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	2	2	2	2	24	Mostly associated with the fact that the site overlaps a CBA, and may potentially cross a water courses.
	With mitigation	3	2	2	1	1	18	Minimise the disturbance footprint.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	3	1	1	1	1	12	No impact on disturbed natural veld, but also no social gain.
	With mitigation	2	1	1	1	1	8	Social gain from re-using the treated wastewater, and most importantly ensuring save disposal of treated effluent (the current WWTW is a health risk).

According Table 5, the main impacts associated with the proposed development will be on:

- A disturbed conservation priority area (CBA);
- A potential impact on a seasonal water course (if the alternative pipeline route is chosen).

Because of the degraded status of the site and the temporary nature of the proposed impact, the cumulative impact (even without mitigation) is expected to be relatively **Low**, but this can be further reduced mitigation.

7. IMPACT MINIMISATION RECOMMENDATIONS

The proposed development will result in a small permanent footprint enlargement of approximately 5000 m^2 of the existing WWTW and a temporary impact along the short (<500 m) pipeline route, most of which will be located in already disturbed or transformed veld. However, the footprint enlargement and the pipeline east of the N15 are located within a proposed CBA area. The proposed alternative pipeline route will have a temporary impact on the seasonal San River (even though very localized).

According to the impact assessment given in Table 5 the development is likely to result in a relative Low impact on the environment, which can be reduced to almost insignificant with good environmental control during construction.

With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:

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

7.1. MITIGATION ACTIONS

The following mitigation actions should be implemented to ensure that the proposed development does not pose a significant threat to the environment:

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must include the recommendations made in this report.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and any other conditions pertaining to specialist studies.
- If required, water course should be crossed in such a manner as to minimise the disturbance footprint and potential erosion as a result of construction
- **Before any work is done** the development footprint and access routes must be clearly demarcated and approved by the ECO. The demarcation must include the total footprint necessary to execute the work, but must aim at minimum disturbance.
- Lay-down areas or construction sites must be located within already disturbed areas or areas of low ecological value and must be pre-approved by the ECO.
- Indiscriminate clearing of any area outside of the construction footprint must be avoided.
- All areas impacted as a result of construction must be rehabilitated on completion of the project.
    - This includes the removal of all excavated material, spoil and rocks, all construction related material and all waste material.
    - It also included replacing the topsoil back on top of the excavation as well as shaping the area to represent the original shape of the environment.
- An integrated waste management approach must be implemented during construction.
    - Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
    - All rubble and rubbish should be collected and removed from the site to a suitable registered waste disposal site.
- All alien invasive species within the footprint and at least 5 m to the side of the footprint must be removed.

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