PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL ASSESSMENT

WAGENBOOMS RIVER, WEIR & PIPELINE

CONSTRUCTION OF A NEW PIPELINE AND WEIR WITHIN THE SNEL RIVER BREEDE RIVER LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE.

7 August 2018

PJJ Botes (Pri. Sci. Nat.)

22 Buitekant Street
Bredasdorp
7280

Cell: 082 921 5949
Fax: 086 611 0726
Email: peet@pbconsult.co.za

SUMMARY - MAIN CONCLUSIONS

VEGETATION TYPE

According to the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated) the proposed pipeline route will potentially cross two broad vegetation types namely Breede Alluvium Fynbos and Breede Shale Fynbos (Figure 4). Breede Alluvium Fynbos is expected along the lower reaches of the proposed pipeline and Breede Shale Fynbos along the upper half of the proposed pipeline route. According to the National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), Breede Alluvium Fynbos is classified as **Endangered**, while Breede Shale Fynbos is classified as Least Threatened.

VEGETATION ENCOUNTERED

The proposed footprint for both the pipeline route and the distribution chamber was chosen to follow or be placed within existing disturbed or transformed areas. The only remaining natural veld that were encountered associated with the proposed footprint was at the foot of the Waaihoek Mountains, where the distribution chamber will be located and the first section of the pipeline will overlap. But it is important to note, that even here the distribution chamber will be located in a very disturbed area, while the pipeline will follow old access roads down towards the valley bottom. It is also important that this section of the lower foothills is overall much degraded as a result of dense alien infestation and past human activities (roads, quarry sites etc.).

CONSERVATION PRIORITY AREAS

Both the proposed pipeline route and the distribution chamber are located in CBA areas proposed within the Western Cape Biodiversity Spatial Plan (2017). But since the footprints were chosen specifically to overlay already disturbed areas and the impact of construction is temporary, the potential impact on the CBA's are expected to be insignificant.

CONNECTIVITY

The impact is temporary of nature and is not expected to have any permanent impact on connectivity.

MAIN CONCLUSION

According Table 4, the main impact associated with the proposed construction is the potential impact on a destabilisation of the river bank and associated impact on riparian vegetation. Alien infestation and indiscriminate alien clearing may also result in river bank destabilisation

The cumulative impact is expected to be Medium/low but it is still important that mitigation measures are implemented in order to reduce the potential environmental impact to a potential Low significance.

With the correct mitigation it is considered highly unlikely that the proposed development will contributed 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 SINCE IT IS UNLIKELY TO RESULT IN IRREVERSIBLE ENVIRONMENTAL IMPACT.

NO-GO OPTION

The proposed development is likely to result in significant social gain and will support the findings of the court.

The no-go option on the other hand 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. 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 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.

Yours sincerely,

P.J.J. Botes *(Pr.Sci.Nat: 400184/05)*
Registered Professional Botanical, Environmental and Ecological Scientist

CONTENTS

LIST OF PHOTOS:

LIST OF TABLES:

1. INTRODUCTION

The Darlingbrug and Wagenboomsrivier Irrigation boards, as well as farmers along the river, extract water for agricultural irrigation from the Wabooms River, which is a tributary to the Breede River. The Wabooms River is located within the Breede Valley (Breede Valley Local Municipality) in the Western Cape and its upper reach is known as the Snel River. Sarel Bester Engineers was appointed by the Darlingbrug and Wagenboomsrivier Irrigation boards to design and propose a water distribution structure in the Snel River for the various rightful entities in accordance with a Supreme Court Ruling dated 22 February 2017.

According to the ruling, the proposed distribution structure must allow for a 17% ecological reserve to flow past before dividing the remaining water into an 80/20 allocation. The engineering design proposed the construction of a new weir the upper parts of the Snel River and a distribution structure next to the river. This will allow for the 17% reserve flowing past, while the remaining water will be divided in an 80/20 allocation. It proposes that the 80% allocated to the Darlingbrug and Wagenboomsrivier Irrigation board is piped with a new (2.7 km long, 350 mm diameter) pipeline and then released back into the river just upstream of the existing downstream extraction point. The 20% will be distributed *via* an existing pipeline from the dividing structure to the other rightful users (Arbeidsvreugd Trust and Vredehoek Trust) as per the high court ruling.

In short it proposes the construction of a new weir within the upper reaches of the Snel River, the construction of a dividing chamber outside of the river on an open disturbed portion of land. An existing pipeline (not part of this report) will transport the 20% allocation to the rightful farms, while a new pipeline will be constructed next to the river (within or adjacent to existing roads) in order to transport the 80% allocation downstream (to minimise losses) where it will be released back into the river just before the existing extraction point of the two irrigation boards. Please note that this lower weir will also undergo maintenance work.

It is important to note that a Freshwater Specialist was appointed to address the impacts of the proposed works within the river and that this report focuses on the vegetation that might be impacted by the footprint of the new distribution chamber (outside of the river) and the pipeline footprint adjacent to the river. As a result, although this report might speak to the vegetation encountered along the river banks, it is mainly focusing on the vegetation that might be impacted along the footprint outside of the riparian zone.

The Wabooms River Valley (also known as the Breede River Valley) is known for its rich agricultural heritage left by generations of wine or fruit farmers. However, generations of farming has left almost no remaining natural veld in the lower reaches of this valley and even the Wabooms River has been severely constricted, channelized (in certain areas) and degraded as a result alien infestation and the constant efforts by adjacent land owners to contain the river in this constricted channel (in its natural state the river would most likely have changed its path from time to time, but is now restricted as a result of agricultural pastures right up to the river banks). Riparian vegetation is mostly replaced by invasive alien plants and is very seldom wider than two meters. Unfortunately, this combination of being restricted, alien infestation and loss of its riparian buffer zone has resulted in the river frequently eroding its banks and overflowing into adjacent agricultural land (which leads to further disturbances as landowners struggle to repair these breaches / contain the river).

According to the 2012 (beta 2) version of the Vegetation map of SA (Mucina & Rutherford, 2006) the proposed footprint may overlap, Breede Alluvium Fynbos (an Endangered Vegetation type) along the lower reaches of the proposed pipeline and Breede Shale Fynbos (Least Threatened) along the upper half of the proposed pipeline route.

However, along the lower reaches of the proposed pipeline route (within the Breede Alluvium Fynbos) no remaining natural veld was encountered within the proposed footprint. Along the upper parts of the proposed footprint (Breede Shale Fynbos) remaining natural veld was only found at the foothills of the Waaihoek

Mountains (areas too steep for agriculture) and even there the vegetation was very degraded as a result of past agricultural activities, old roads and tracks, excavated quarry areas and dense alien infestation.

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.
- Locate and record sensitive areas from a botanical perspective within the proposed development footprint that may be interpreted as obstacles to the proposed development.
- 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.

1.2. PROJECT DESCRIPTION

Alternative 1 proposes the construction of a massfill and reinforced concrete weir within the Snel River, which will connect (via a 10 m uPVC pipeline, ø900 mm) to a division chamber (10 x 4.2 m) outside the river, along with the necessary piped outlet works from which a proposed new ±2.7 km ø350mm pipeline originates.

The weir will have a maximum total height of ±2 m, a length of ±5 m and a top width of ±300 mm. It will be based on a foundation of ±9 m wide and 800 mm deep and will be equipped with a downstream flush valve. Coordinates for the proposed weir and division chamber is: 33°29'55.06"S, 19°16'48.07"E.

The new proposed ±2,7km ø350mm pipeline will follow the Wabooms River (Snel River) downstream, located within farm roads. Two different pipeline routes were investigated, with alternative 1 chosen as the preferred alternative after discussions with the various landowners.

Reserve and surplus water would be directed back to the main stream with a 15m long, 0,5m deep and 2m wide concrete or gabion channel structure.

2. STUDY AREA

2.1. LOCATION & LAYOUT

The Breede River Valley is located about 30 km north of Worcester, just off the R43 road towards Wolseley and Ceres (Figure 1).

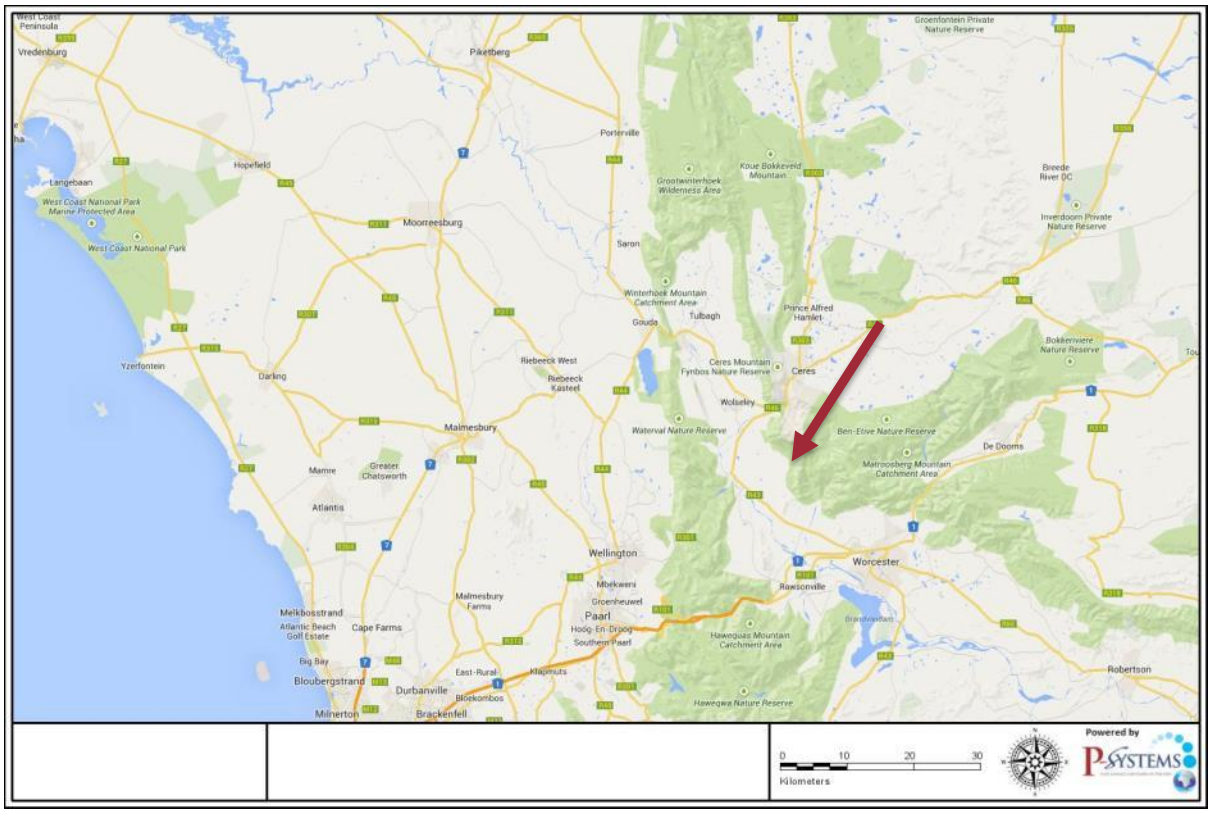


Figure 1: Map showing the location of the Wagenbooms River in the Western Cape Province

Figure 2: Showing the proposed pipeline route within the larger Breed River Valley

Figure 3: The proposed pipeline in relation to existing farm boundaries (red)

Proposed pipeline route 1 (preferred alternative): The pipe will connect to the division chamber outside the river bed at point 33°29'55.06"S 19°16'48.07"E on Portion 2 of Farm Vredehoek 602 from where it will follow existing farm roads to the north of the river banks for approximately 1km. The pipeline will continue on existing farm roads on the northern banks of the river on the Remaining Extent of Farm Vredehoek 602 for approximately 500m to point 33°30'19.79"S 19°16'01.51"E on the northern bank of the river. From there it is proposed that the pipe will cross the river to the southern bank of the river point 33°30'20.85"S 19°16'01.88"E (approximately 34m) and continue on the southern banks of river (RE Vredehoek 602) for another 25m. The pipeline will briefly cross onto Portion 5 of Farm Rietvalley 198 (15m) and Remaining extent of Farm 706 (107m) on existing farm roads along the southern banks of the river. The pipeline will continue for Portion 9 Farm Rietvalley 198 for another approximately 860m on existing farm roads along the southern banks of the river. The pipeline will stop under the bridge on Farm Onverwacht 918. Water will flow in the river towards an existing weir and division canal (33°30'35.87"S19°15'23.71"E) which will divide the water further according to the designated 40/60 ratio for the Darlingbrug and Wagemboomsrivier irrigation boards.

Proposed pipeline Route 2 will also connect to the division chamber outside the river bed at point 33°29'55.06"S 19°16'48.07"E on Portion 2 of Farm Vredehoek 602 where it will follow existing farm roads to

the north of the river banks for approximately 1km. It is proposed that the pipeline will cross the river via an existing bridge on Remaining Extent of Farm Vredehoek 602 from where is will follow existing farm roads all along the southern banks of the river across Portion 5 of Farm Rietvalley 198, Remaining extent of Farm 706 and Portion 9 Farm Rietvalley 198.

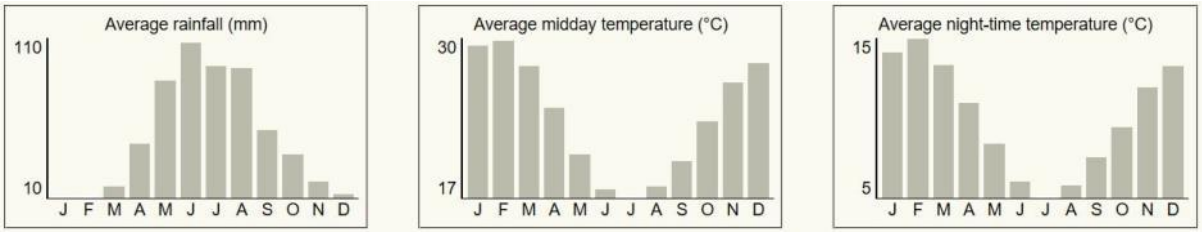
The pipeline will stop under the bridge on Farm Onverwacht 918. Water will flow in the river towards an existing weir and division canal (33°30'35.87"S19°15'23.71"E) which will divide the water further according to the designated 40/60 ratio for the Darlingbrug and Wagemboomsrivier irrigation boards.

This pipeline route could not be agreed upon as the owner of Remaining Extent of Farm Vredehoek 602, would not give consent to use the existing bridge as a river crossing.

2.2. CLIMATE

Wolseley normally receives about 575mm of rain per year and because it receives most of its rainfall during winter it has a Mediterranean climate. The chart below (lower left) shows the average rainfall values for Wolseley per month. It receives the lowest rainfall (10mm) in January and the highest (107mm) in June. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Wolseley range from 16.7°C in July to 29.7°C in February. The region is the coldest during July when the mercury drops to 4.7°C on average during the night (www.saexplorer.co.za).

Table 1: Average rainfall and temperatures at Wolseley, located just north of the Breede Valley (www.saexplorer.co.za)



2.3. GEOLOGY AND SOILS

The Geology and soils associated with Breede Alluvium Fynbos is: Quaternary alluvial deposits consisting of round cobbles embedded in fine loamy sand, over metasediments of the Malmesbury Group and Bokkeveld Group shales. Soils are usually of alluvial land type Ia, with some Fa land type (with typical Glenrosa and Mispah forms). Hb and Ad land types also present (Mucina & Rutherford, 2006).

The Geology and soils associated with Breede Shale Fynbos is: Acidic, moist clay-loam, Glenrosa or Mispah forms derived from Bokkeveld Shales, underlain by rocks of the Malmesbury Group. Land types mainly Fa, Fb and Ic (Mucina & Rutherford, 2006).

2.4. TOPOGRAPHY

The proposed new Weir and distribution chamber will be located at the lower foothills of the Waaihoek Mountains at an altitude of approximately 528 m above mean sea level. The proposed pipeline will connect to this chamber and follow the river down a steady decline (Average slope 1.2%) along the 2.7 km to exit at a point approximately 391 m above mean sea level lower down in the valley.

3. LIMITATIONS, ASSUMPTIONS & METHOLOGY

Desktop studies and two site visits were performed to evaluate the proposed sites in terms of potential impacts on biodiversity and to make recommendations on potential alternative sites where necessary. The site visits was conducted during September 2017 and July 2018.

The main survey was conducted as a one day site visit during July 2018. The timing of the visit was reasonable in that all perennial plants were identifiable and although the possibility remains that a few species may have been missed, especially in terms of spring annuals and bulbs, the author is confident that a fairly good understanding of the vegetation status in the study area was obtained. Confidence in the findings is high.

During the site visit the author endeavoured to identify and locate all significant biodiversity features, special plant species and or specific soil conditions which might indicate special botanical features.

4. BROAD VEGETATION TYPES EXPECTED

According to the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated) the proposed pipeline route will potentially cross two broad vegetation types namely Breede Alluvium Fynbos and Breede Shale Fynbos (Figure 4). Breede Alluvium Fynbos is expected along the lower reaches of the proposed pipeline and Breede Shale Fynbos along the upper half of the proposed pipeline route. According to the National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), Breede Alluvium Fynbos is classified as **Endangered**, while Breede Shale Fynbos is classified as Least Threatened.

4.1. BREEDE ALLUVIUM FYNBOS

According to Mucina and Rutherford (20016), Breede Alluvium Fynbos can be described as open emergent tall proteoids in a moderately tall shrub matrix with a graminoid understory in which asteraceous and proteoid fynbos are dominant, with localized restioid fynbos and ericaceous fynbos. Normally found on slightly undulating plains and adjacent high mountains, with numerous alluvial fans and streams.

4.2. BREEDE SHALE FYNBOS

According to Mucina and Rutherford (20016), Breede Shale Fynbos can be described as a moderately tall and dense shrubland; mostly restioid, proteoid and asteraceous (mesotrophic) fynbos located on the steep upper slopes below mountains grading to slightly undulating plains, which is normally well dissected by rivers. A remarkably tall and dense post-fire component dominates early seral communities on wetter slopes.

4.3. GENERAL CONDITION OF THE VELD

Generations of farming has left almost no remaining natural veld in the lower reaches of this valley and even the Wabooms River has been severely constricted, channelized (in certain areas) and degraded as a result alien infestation and the constant efforts by adjacent land owners to contain the river in this constricted channel (in its natural state the river would most likely have changed its path from time to time, but is now restricted as a

result of agricultural pastures right up to the river banks). Riparian vegetation is mostly replaced by invasive alien plants and is very seldom wider than two meters. Unfortunately, this combination of being restricted, alien infestation and loss of its riparian buffer zone has resulted in the river frequently eroding its banks and overflowing into adjacent agricultural land (which leads to further disturbances as landowners struggle to repair these breaches / contain the river).

Along the lower reaches of the proposed pipeline route (within the Breede Alluvium Fynbos) no remaining natural veld was encountered within the proposed footprint (apart from small sections of riparian vegetation). Along the upper parts of the proposed footprint (Breede Shale Fynbos) remaining natural veld was only found at the foothills of the Waaihoek Mountains (areas too steep for agriculture) and even there the vegetation was very degraded as a result of past agricultural activities, old roads and tracks, excavated quarry areas and dense alien infestation.

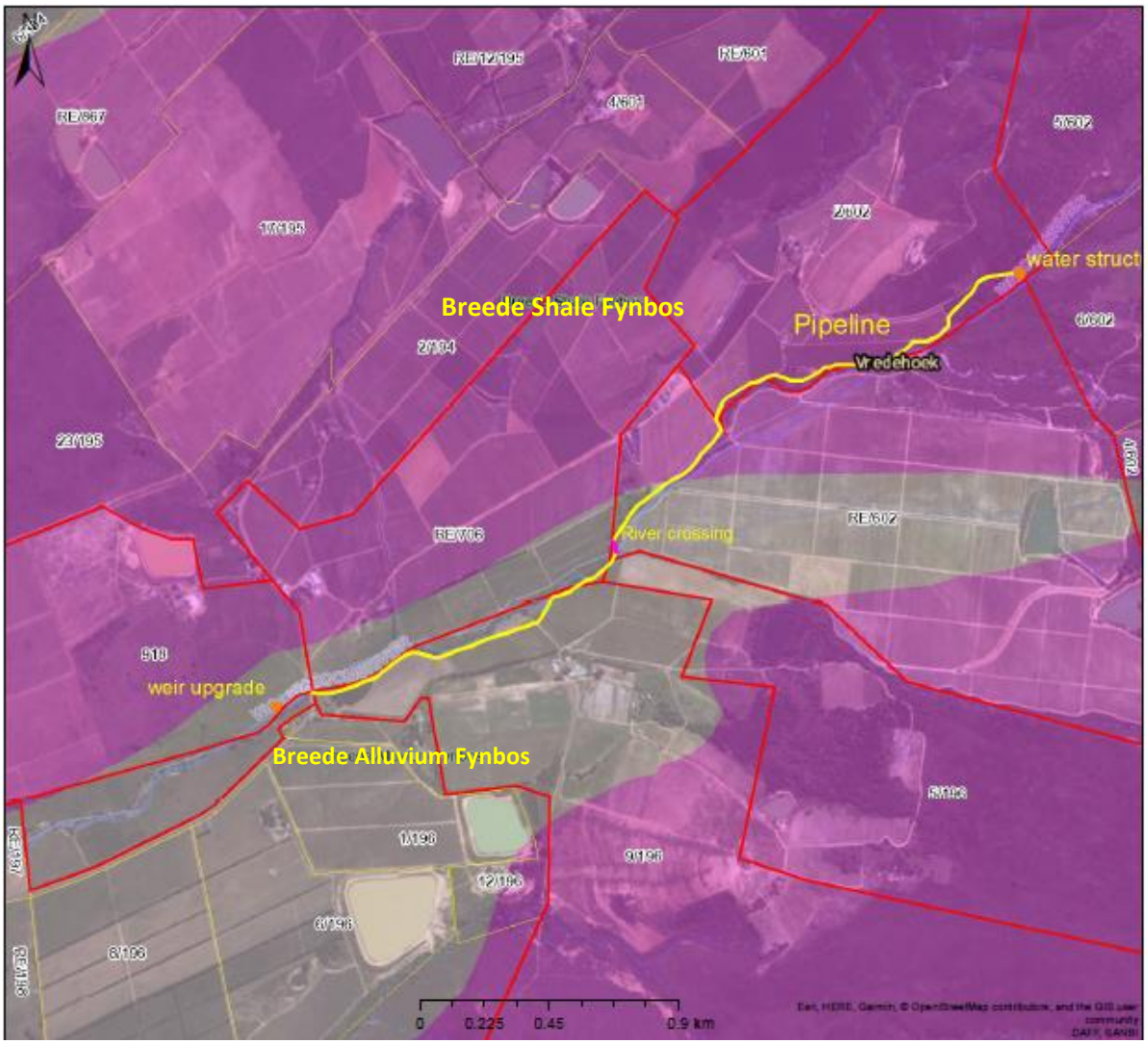


Figure 4: Vegetation map of South Africa (2012 beta 2 version), showing the larger area and expected vegetation

5. 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.

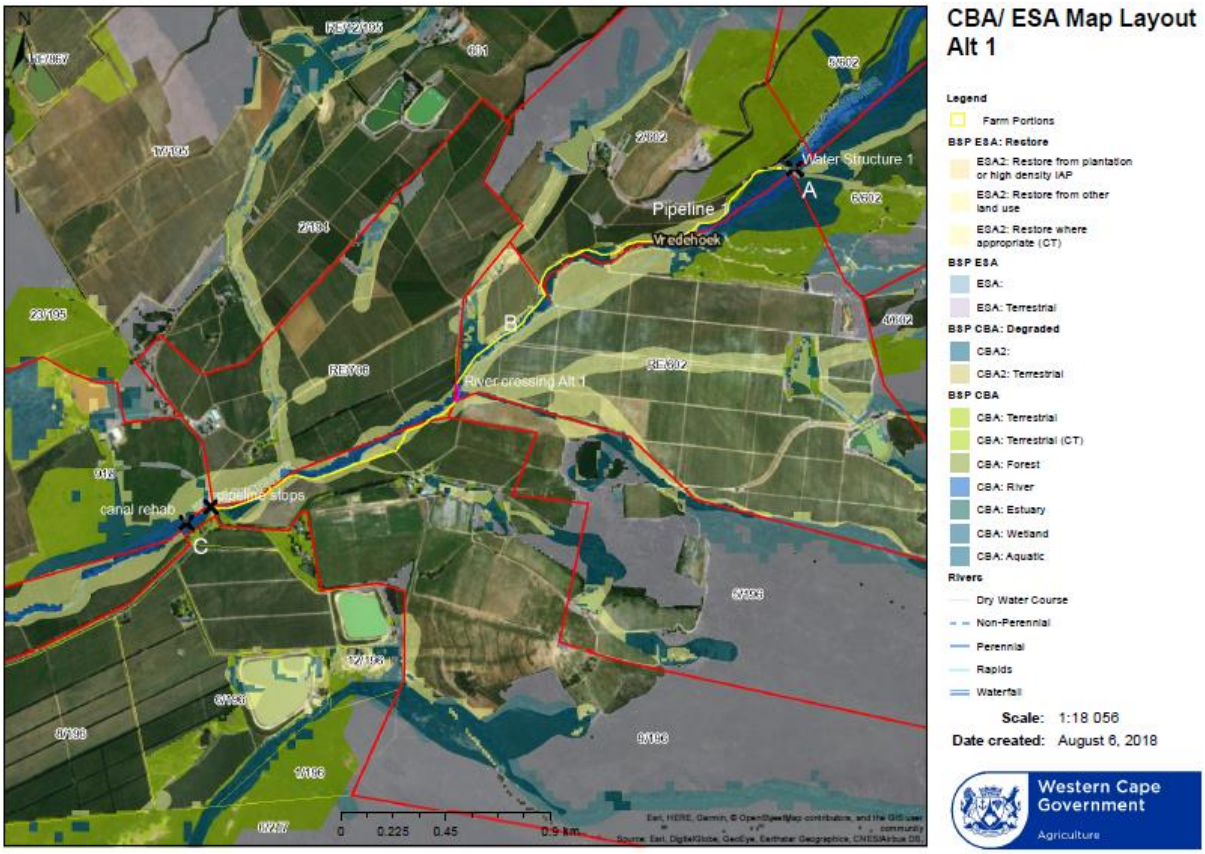


Figure 5: The WCBSP (2017) showing proposed development footprint and associated CBA and ESA areas

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.

According to the WCBSP (Pool-Starvliet, 2017) the proposed pipeline and distribution chamber will be located within proposed critical biodiversity areas (CBA's) both terrestrial and aquatic. However, the proposed pipeline route and distribution chamber will located within existing transformed areas (e.g. roads) and is unlikely to add significantly to the proposed CBA's. It is also proposed that at the point where the pipeline will cross the river, it will be done by lifting the pipeline over the river (not under the river), which will minimise the impact considerably with regards to the potential impact on the river and its remaining riparian zone (Refer to the Freshwater Specialist report).

6. VEGETATION ENCOUNTERED

The proposed footprint for both the pipeline route and the distribution chamber was chosen to follow or be placed within existing disturbed or transformed areas. The only remaining natural veld that were encountered associated with the proposed footprint was at the foot of the Waaihoek Mountains, where the distribution chamber will be located and the first section of the pipeline will overlap. But it is important to note, that even here the distribution chamber will be located in a very disturbed area, while the pipeline will follow old access roads down towards the valley bottom. It is also important that this section of the lower foothills is overall much degraded as a result of dense alien infestation and past human activities (roads, quarry sites etc.).

6.1.1. Distribution chamber

The vegetation in the vicinity of the proposed distribution chamber location can only be described as disturbed fynbos, presently almost replaced by dense stands of alien invasive plant species such as *Acacia Cyclops* (Port Jackson), *Acacia mearnsii* (Black wattle), *Eucalyptus* species (Gum trees), *Pinus* species (Pine trees) and *Rubus* species (Bramble). The under layer was often dominated by Pennisetum clandestinum (Kikuyu grass) and even single *Opuntia* species (Prickly pear) individuals were observed. Almost the only remaining indigenous plants observed (apart from a few weedy species) were the hardy fern, *Pteridium aquilinum*, *Cannomois virgate* (Besemriet, next to the stream) and *Searsia angustifolia* (which was also common along most of the stream).

Photo 1: The proposed location for the new Distribution Chamber. Note the degraded area and dominated by alien invasive species.

At this point the Snel River was similarly impacted by alien invasive species.

6.2. PIPELINE ROUTE: UPPER SECTION

Coming down from the distribution chamber the upper section of the pipeline route (Figure 6, between the arrows) will follow an old road (Photo 2) through the dense alien infested area, before it links up with farm roads on Portion 2 of the Farm Vredehoek no. 602. The vegetation type expected was Breede Shale Fynbos.

Figure 6: The preferred route (Light blue) within dense alien infested woodland (Alternative pipeline route - green)

Apart from *Zantedeschia aethiopica* (Arum lily), and stands of young *Dodonaea viscosa*, the only other indigenous plants observed in the immediate vicinity (not in the footprint) was *Cliffortia ruscifolia*, *Elytropappus rhinocerotis, Eriocephalus africanus* and *Stoebe cinerea*. Evidence of alien clearing can be seen, which resulted in indigenous plants slowly coming back. Slightly to the north of this section (higher up the mountain) a more natural veld starts to appear.

Photo 2: The upper section of the pipeline route, following an old road through densely alien infested areas.

The alternative pipeline route (Refer to the green line in Figure 6: The preferred route (Light blue) within dense alien infested woodland (Alternative pipeline route - green) will go through a much more natural veld (Photo 3), with evidence of seepage areas also present. The potential impact natural vegetation and ecosystems would be much higher. Please note that this option was not investigated in detail as the landowners already indicated that they do not approve of the pipeline over this section of their property. This is supported in this report, since the preferred option would result in a much lower environmental impact than the alternative (Both being located within CBA areas, but the preferred option is placed within disturbed / transformed footprint, while the alternative would have resulted in an impact on remaining indigenous vegetation).

Photo 3: Showing the remaining much more natural veld on the southern side of Snel River that would be impacted by the alternative option (not recommended).

6.3. PIPELINE ROUTE: MIDDLE SECTION

In this report the middle section refers to the section of the pipeline route that will be located within existing farm roads next to the stream on Portion 2 of Farm Vredehoek no. 602 and the Remainder of Farm Vredehoek no. 602, owned by Mr. Roos (Refer to the area between the arrows in Figure 7).

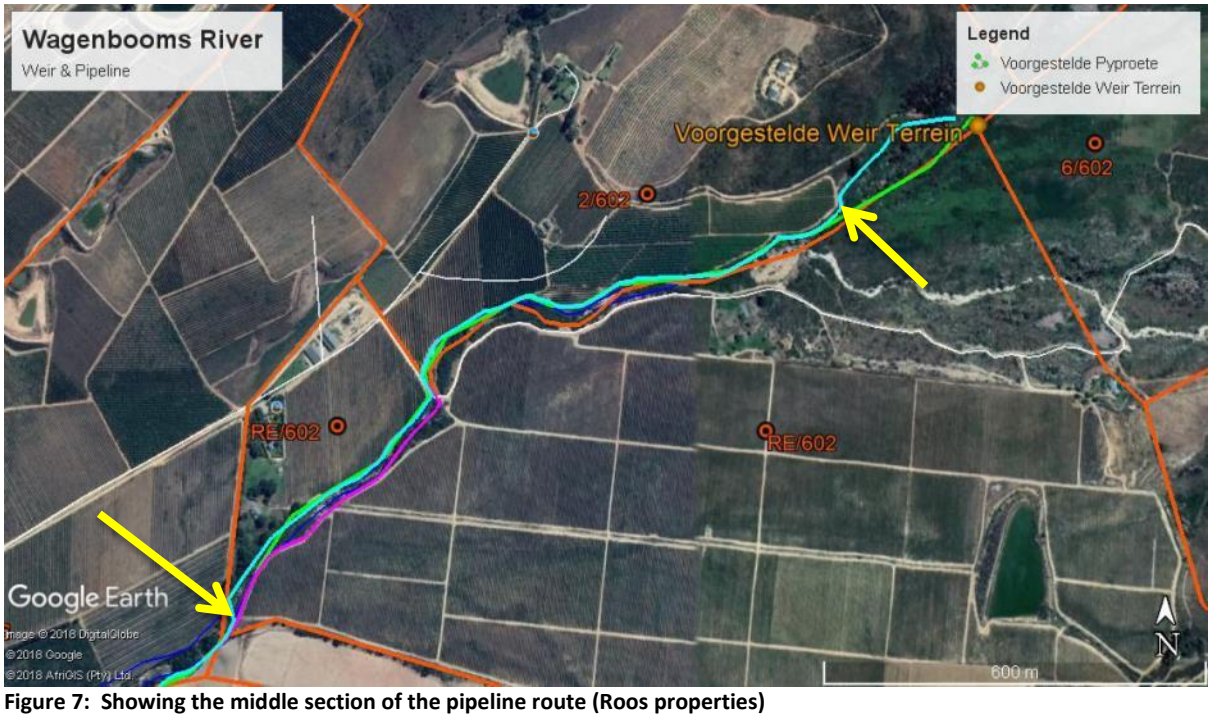


Figure 7: Showing the middle section of the pipeline route (Roos properties)

The preferred pipeline (light blue) will be located within existing farm roads, between existing vineyards and the riparian vegetation along the river (Photo 4). The route was specifically chosen to fall within degraded / transformed areas and will in itself not result in any additional impact on any remaining natural veld (since there is no natural veld remaining). However, the proposed route will be located very close to the edge of the riparian vegetation along the Wagenbooms River and no impact on the riparian vegetation or destabilisation of the river bank may result.

Photo 4: Showing the road in which the pipeline will be installed (transformed). However, please not the well-kept indigenous riparian zone next to the river itself (to the left of the picture). All efforts must be made to ensure that the riparian zone is not impacted.

On these properties, even though the riparian buffer zone was mostly very narrow (sometimes less than 2 m), it stood out from the rest of the river properties visited in that it still shows an almost natural species composition and remains in the best condition of all that was investigated during this study (Photo 5). The land owner should be commended for his efforts.

Photo 5: Healthy riparian vegetation along the middle section of the pipeline route (Vredehoek Farm).

Invasive alien plant species seems to be well controlled and has resulted in a healthy (although very narrow) buffer zone along the river. It also seems as if this pay's-off huge dividends as erosion issues are much less visible in this section (a slightly wider buffer zone would have been the only improvement). This section of the river supports a number of indigenous plants, including a number of beautiful indigenous trees.

The riparian vegetation was mostly dominated by *Searsia angustifolia* (forming dense clumps or bushes) but also included species like *Brabejum stellatifolium* (Wild almond), *Cassine peragua*, *Chasmanthe* species, *Cliffortia strobilifera*, *Freylinia lanceolata* (Honey bells), *Grubbia* cf. *rosmarinifolia*, *Halleria eliptica* (Bush honeysuckle), *Ilex mitis*, *Kiggelaria africana* (Wild Peach), *Myrsine africana*, *Searsia glauca* and *Zantedeschia aethiopica*.

Photo 6: Slightly lower down still on the Farm Vredehoek. Note the narrow but still indigenous riparian vegetation. However, erosion is now more prone to impact on the river banks.

The alternative option (purple line in Figure 7) will have the pipeline crossing to the south side of the river over an existing bridge running along the south of river from here on to its end. Again the pipeline will run within existing farm roads next to the river. Even though this is potentially also a viable option, it might result in impact in an impact on a very dense and beautiful section of indigenous riparian vegetation (which is not recommended), in which case the preferred option will remain the option with the least impact.

6.4. PROPOSED RIVER CROSSING

The preferred river crossing is located on the boundary between the Remainder of Farm Vredehoek 602 and the Remainder of Farm Arbeidsvreugd 706. It is proposed that concrete pillars be built on either side of the river (away from the riparian zone) with a ladder like bridge on top of these pillars on which the pipeline will be attached. The pipeline will thus cross "over" the river and not underneath the river. This will result in a much smaller construction footprint with almost no impact on the riparian vegetation. The river crossing location and method is supported by the author, since it will result in the minimum impact.

Photo 7: The proposed location for crossing the river with the pipeline (an area already showing signs of degradation).

6.5. PIPELINE ROUTE: LOWER SECTION

The last section of the pipeline will run to the south of the Wabooms River, again within existing farm roads or within agricultural land (no natural veld remaining, apart from some indigenous plants still remaining in a much compromised riparian zone next to the river). Again the footprint will not impact on any remaining natural vegetation. At this point the construction footprint is not restricted since the adjacent land is mostly grazing pastures (which will easier accommodate construction). Unfortunately, the riparian vegetation along

this section of the river is in poor condition and mostly dominated by alien invasive species (with erosion much more prominent).

Figure 8: Lower section of the proposed pipeline route (light blue)

From where the pipeline cross the river to its southern bank the pipeline will run in degraded agricultural land with no additional impact on any remaining natural veld (expected to be Breede Alluvial Fynbos). As long as the pipeline and construction does not impact on the riparian zone (even though it is also in poor condition) there should be no additional impact on natural vegetation.

Photo 8: Showing the road in which the pipeline will be located with the compromised (alien infested) riparian zone to the left.

Photo 9: Some remaining indigenous species in between dense stands of alien vegetation. *Searsia angustifolia* prominent towards the middle of the picture.

Photo 9 shows some remaining natural vegetation within the riparian zone.

Photo 10 shows a poplar bush (*Populus* cf. *alba*) which is located within the yellow circle in Figure 8. The preferred alternative (light blue line in Figure 8) shows the pipeline going through this bush (in order to follow the stream more closely). This is not recommended. Even though the bush is dominated by Poplar trees, there is still some indigenous vegetation in between the poplar trees which can be used as a basis for transforming the riparian vegetation back to more natural vegetation. Going through the bush also increases the risk of future erosion, which may result in costly erosion control measures. It is recommended that the green line option is followed around this bush back to the river.

Photo 10: Poplar bush located within the yellow circle in Figure 8.

Photo 11: The lower existing weir from where water is extracted for the Darlingbrug and Wagenboomsrivier Irrigation boards. Maintenance work is also proposed on this weir (Refer to the Freshwater specialist report).

Photo 12: The point where the pipeline will dispose its water back into the Wabooms River (with the Poplar bush just showing in the back ground).

7. 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

7.1. 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 Table 2).

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

Table 2: 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	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5	Impact is medium-term and reversible with mitigation, but will last for some time after construction and may require on-	Impact is long-term and reversible but only with long term mitigation. It will last for a long time after construction and	The impact is expected to be permanent.

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
	short (1-2 years).	years).	going mitigation. Rehabilitation time is expected to be longer (5-15 years).	is likely to require on-going mitigation. Rehabilitation time is expected to be longer (15-50 years).	
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.

7.2. 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 3.

Table 3: 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.

8. 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 taken into account.

8.1. CONSERVATION VALUE

The proposed development is expected to result in the temporary disturbance along the proposed construction footprint. Please note that this report does not address impact on the river system as this will be addressed in the Freshwater Specialist report. The proposed pipeline route was specifically chosen to fall within areas already disturbed and should not result in any significant impact on remaining natural veld (apart from potential impact on riparian vegetation where it cross the river). Impacts on natural vegetation outside of the remaining riparian zone are expected to be almost zero. The main environmental risk regarding this project is seen as potential destabilisation of the river bank (which may lead to future erosion), including potential impacts on the riparian zone itself (because of the restricted work area).

Geology & Soils: No special geology or soils were observed which may result in specialized vegetation. However, the soils associated with the areas adjacent to the stream are likely to unstable and care will have to be taken during construction to ensure that the river banks are not destabilised.

Vegetation status: Breede Alluvial Fynbos is an endangered vegetation type. However, the proposed footprint is located within already disturbed areas and no remaining natural veld that might be impacted by the proposed project was observed.

Breede Shale Fynbos is classified as Least Threatened. The proposed footprint will have a temporary impact on small section of a very disturbed version of this vegetation type. However, even in this area, the pipeline will be located in old roads (previously disturbed areas).

Conservation priority areas: Both the proposed pipeline route and the distribution chamber is located in CBA areas proposed within the Western Cape Biodiversity Spatial Plan (2017). But since the footprints were chosen specifically to overlay already disturbed areas and the impact of construction is temporary, the potential impact on the CBA's are expected to be insignificant.

Connectivity: The impact is temporary of nature and is not expected to have any significant impact on connectivity.

Protected or endangered plant species: No protected or endangered plant species was observed.

Invasive alien species: Special care must be taken with the removal of invasive alien plant species within the riparian buffer zone in order to ensure that it does not lead to future erosion.

8.2. IMPACT ASSESSMENT

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

Table 4: Impact assessment associated with the construction of the new pipeline route

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	3	3	4	2	4	39	No special habitats observed (rivers addressed by Freshwater Specialist). However, the soils next to the river may be unstable which can result in erosion.
	With mitigation	3	2	2	1	1	18	Minimise footprint and prevent destabilization of the river bank.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	2	2	2	1	1	12	No Impact on Endangered Breede Alluvial Fynbos; Insignificant impact on Breede Shale Fynbos (Least Threatened)
	With mitigation	2	2	1	1	1	10	Minimise the footprint and ensure good rehabilitation practices.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	2	2	1	2	21	Footprint overlaps into an ESA and CBA areas, but mostly located in already disturbed areas. Disturbance temporary.
	With mitigation	3	2	1	1	1	15	Minimise the footprint and ensure good rehabilitation practices.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	1	1	1	1	1	4	Disturbance will be temporary, within already disturbed areas, but falls within an ESA and CBA.
	With mitigation	1	1	1	1	1	4	Minimise the footprint and ensure good rehabilitation practices.
Invasive alien plant species: Potential invasive plant infestation as a result of the activities.	Without mitigation	3	4	4	2	4	42	Much of the footprint, especially riparian vegetation compromised as a result of alien infestation, which may also lead to future erosion problems.
	With mitigation	3	1	2	1	1	15	Remove all IAP within the footprint, but take care that removal of IAP within the riparian zone does not lead to destabilisation of the river bank.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	4	4	2	3	39	Mostly associated with the fact that the proposed route might impact on the riparian zone or destabilize the river banks.
	With mitigation	3	2	2	1	1	18	Minimise the footprint and ensure good rehabilitation practices.

According Table 4, the main impact associated with the proposed construction is the potential impact on a destabilisation of the river bank and associated impact on riparian vegetation. Alien infestation and indiscriminate alien clearing may also result in river bank destabilisation.

The cumulative impact is expected to be Medium/low but it is still important that mitigation measures are implemented in order to reduce the potential environmental impact to a potential Low significance.

9. SUMMARY AND MITIGATION RECOMMENDATIONS

According to the impact assessment given in Table 4, it is clear that the preferred pipeline route is viable. In both cases the alternative routes is likely to lead to a higher impact.

With the correct mitigation it is considered highly unlikely that the preferred alternative will contributed 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.

Having evaluated the proposed site and its immediate surroundings, it is unlikely that the proposed development will lead to any significant impact on the botanical features as a result of its placement as long as the following impact minimisation recommendations are implemented.

9.1. MITIGATION RECOMMENDATIONS

- 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.
- Access must be limited to routes approved by the ECO.
- When working in any remaining natural veld and next to the river, the natural veld and riparian vegetation must be demarcated and access routes pre-determined and approved by the ECO.
- All efforts must be made to protect the remaining buffer zone and its vegetation next to the stream.
- When working next to the river, the pipeline must be placed as far away from the riverbank as possible in order to minimise the risk or riverbank destabilisation.
- All alien invasive plant species within the footprint must be removed. In the riparian zone alien vegetation must be removed by hand, leaving the root system intact so that it can still bind the soil. However, where necessary the correct chemicals must be used to ensure that the alien invasive plant will die.
- It is recommended that the pipeline is placed outside of the Poplar bush (Yellow circle in Figure 8) in order to prevent riverbank destabilisation and to minimise impacts on remaining indigenous riparian species.
- 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.

10. REFERENCES

Acocks, J.P.H. 1953. Veld types of South Africa. *Mem. Bot. Surv. .S. Afr*. No. 28: 1-192.

Anon, 2008. Guideline regarding the determination of bioregions and the preparation and publication of Bioregional Plans. April 2008. Government Notice No. 291 of 16 March 2009.

De Villiers C.C., Driver, A., Brownlie, S., Clark, B., Day, E.G., Euston-Brown, D.I.W., Helme, N.A., Holmes, P.M., Job, N. & Rebelo, A.B. 2005. Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum, c/o Botanical Society of South Africa: Conservation Unit, Kirstenbosch, Cape Town.

DEAT, 2002. Impact significance. Integrated Environmental Management, Information series 5. Department of Environmental Affairs and Tourism (DEAT). Pretoria.

Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria

Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J.L., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2005. National spatial biodiversity assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia, 17. South African National Biodiversity Institute, Pretoria.

Edwards, R. 2011. Environmental impact assessment method. Unpublished report for SiVest (Pty) Ltd. Environmental division. 9 May 2011.

Low, A.B. & Rebelo, A.(T.)G. (eds.) 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs and Tourism, Pretoria.

Mucina, L. & Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Pool-Starvliet, R. 2017. Western Cape Biodiversity Spatial Plan Handbook. Biodiversity GIS Home. http://bgis.sanbi.org.

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. South Africa National Spatial Biodiversity Assessment 2004: Technical report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.

South African National Biodiversity Institute. 2006. South African National Botanical Institute: Biodiversity GIS Home. http://bgis.sanbi.org (as updated).

South African National Biodiversity Institute. 2015. Statistics: Red List of South African Plants version (as updated). Downloaded from Redlist.sanbi.org on 2017/06/15.

South African National Biodiversity Institute. 2012. Vegetation map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2012.

Van Wyk, A.E., & Smith, G.F. 2001. Regions of floristic endemism in South Africa. A review with emphasis on succulents. Umdaus press. Hatfield.