CONSTRUCTION OF CLEAR WATER SUPPLY PIPELINES FROM SANDILE WATER TREATMENT WORKS TO BURNSHILL AND BRITISH RIDGE RESERVOIRS

VEGETATION IMPACT ASSESSMENT

Prepared for:

Aurecon - Environmental Management

No 1 Pearce Street, Berea,
East London
Phone: +27 43 721 0900

Prepared by:

EOH Coastal & Environmental Services
25 Tecoma Street, Berea
East London, 5201

Tel: 043 742 3302
Also in Grahamstown, Cape Town, Johannesburg, Port Elizabeth and Maputo
www.cesnet.co.za | www.eoh.co.za

October 2017

REVISIONS TRACKING TABLE

EOH Coastal and Environmental Services

Report Title: Construction of Clear Water Supply pipelines from Sandile Water Treatment Works to Burnshill and British Ridge Reservoirs Vegetation Impact Assessment

Report Version: Final

Project Number: P40700061

Name	Responsibility	Date
Ms Jaclyn Smith	Report Writer	October 2017
Mr Roy de Kock	Report Reviewer	October 2017

INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In terms of Appendix 6 of the Environmental Impact Assessment Regulations (G. NR. 326) as regulated by the National Environmental Management Act (Act no. 107 of 1998 and amended in 2014; NEMA), a Specialist Report must contain all the information necessary for a proper understanding of the nature of issues identified, and must include–

1. (1) A specialist report prepared in terms of the NEMA (2014) (amended 2017) Regulations must contain-

(a) details of-
  (i) the specialist who prepared the report; and
  (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;
(c) an indication of the scope of, and the purpose for which, the report was prepared;
(cA) an indication of the quality and age of base data used for the specialist report;
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;
(g) an identification of any areas to be avoided, including buffers;
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;
(k) any mitigation measures for inclusion in the EMPr;
(l) any conditions for inclusion in the environmental authorisation;
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;
(n) a reasoned opinion-
  (i) whether the proposed activity, activities or portions thereof should be authorised;
  (iA) regarding the acceptability of the proposed activity or activities; and
  (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
(q) any other information requested by the competent authority.

(2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.

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1 THE PROJECT TEAM

In terms of Appendix 6 (1)(1) of the EIA Regulations (2014) (amended 2017) a specialist report must contain-

(a) details of-
  (i) the specialist who prepared the report; and
  (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;

1.1 Details of specialist

Ms Jaclyn Smith (BSc Hons)
(Report writer and junior ecological specialist)

Jaclyn is an environmental consultant. She holds a BSc with majors in Environmental Science and Geology from Rhodes University, as well as a BSc (Hons) in Geology from Nelson Mandela Metropolitan University. Jaclyn's honours dissertation looked at the sediment disturbance depth over two beaches in the Port Elizabeth. Jaclyn's interest lies in the botanical sector. She has assisted ecological specialists with vegetation impact assessment and has assessed the vegetation for a number of environmental impact assessments.

Mr Roy de Kock
(Report reviewer and principal ecological specialist)

Roy is a Principal Consultant holding a BSc Honours in Geology and an MSc in Botany from the Nelson Mandela Metropolitan University in Port Elizabeth. His MSc thesis focused on Rehabilitation Ecology using an open-cast mine as a case study. He has been working for CES since 2010, and is based at the East London branch where he focuses on Ecological and Agricultural Assessments, Geological and Geotechnical analysis, Environmental Management Plans, mining applications and various environmental impact studies. Roy has worked on numerous projects in South Africa, Mozambique and Malawi.

1.2 Expertise

Projects Roy has worked on include:

Name of project	Description of responsibility	Date completed
Department of Rural Development and Agrarian Reform Lambasi Feedlot	Ecological Impact Assessment	September 2016
Element Debe Water Supply Scheme Phase 2 EIA (EC)	Ecological Impact Assessment	March 2016
BCMM Haven Hills Cemetery EIA (EC)	Ecological Impact Assessment	March 2016
InnoWind Riverbank Wind Energy Facility Ground truthing and permitting (EC)	Wetland Impact Assessment	February 2016
Mbhashe Local Municipality Road Upgrade (EC)	Ecological Impact Assessment and Wetland Impact Assessment	June 2015
GIBB SANRAL N2 Green River to Zwelitsha Road Upgrade (EC)	Ecological Impact Assessment	November 2015
GIBB SANRAL N2 Bypass (EC)	Ecological Impact Assessment	February 2016
Expansion of the Mkhambathi Forest Plantation (EC)	Aquatic Impact Assessment	April 2016

1.3 Declaration

- I, Jaclyn Smith, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014;
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this report are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

2 INTRODUCTION

In terms of Appendix 6 (1)(1) of the EIA Regulations (2014) (amended 2017) a specialist report must contain-

(c) an indication of the scope of, and the purpose for which, the report was prepared;
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
(q) any other information requested by the competent authority.

2.1 Project description and location

Amatola Water is proposing to construct two new rising main pipelines which will run parallel to each other in the Burnshill area in the Eastern Cape Province (Figure 2.1). The first pipeline runs from the Sandile Water Treatment Works to the Burnshill Reservoir. The second pipeline runs from the Sandile Water Treatment Works, it passes the Burnshill Reservoir and continues to the British Ridge Reservoir. This project forms part of the greater Ndlambe Bulk Water Supply Scheme project.

The pipeline supplying clear water to the Burnshill reservoir is approximately 2 km long pipeline with a diameter of 800mm. The pipeline supplying the British Ridge Reservoir is approximately 6.5 km long with an estimated diameter of 600mm. There is an existing water main supplying water to the British Ridge Reservoir but it cannot be utilised as it will exceed the pipelines pressure capacity.

The pipeline routes will follow the existing British Ridge pipeline route as well as existing cadastral boundaries and service corridors so as to cause minimal disruption to farming activities and be easily accessible for future maintenance.

Pipe materials that will be considered include glass reinforced polyester and carbon steel pipe. Pipework that will be permanently submerged, cast into concrete, or inaccessible for maintenance and repair will be manufactured from stainless steel.

EOH Coastal and Environmental Services (EOH CES) were appointed to conduct a Vegetation Impact Assessment as input in the Basic Environmental Assessment process.

2.2 Alternatives

Two pipeline (river crossing) alternatives were considered in this impact assessment namely:

1. Strapping the pipeline to an existing bridge structure
2. Trenching pipelines

2.2.1 Pipelines strapped to existing bridge (if available) or pipe bridge.

Pipelines are attached to the existing bridge structure or constructed as a pipe bridge over the watercourse.

2.2.2 Trenched pipelines

This consists of digging an open trench in the stream bottom, laying the pipe and then backfilling the trench. Depending on the prevailing conditions (weather, stream flow, etc.) this can be achieved with or without the use of temporary coffer dams and stream diversion techniques.

Table 2.1: Pipeline alternatives considered in this report.

Pipeline alternative	Advantages	Disadvantages
Alternative A – pipelines strapped to existing bridge or construction of pipe bridge	• Less damage to the aquatic environment as trenching is not required. • Minimal leakage as pipe can be repaired easily and leaks are easily detected.	• Pipeline is easily damaged • Sagging of pipeline • Vulnerable to vandalism
Alternative B - trenched pipeline	• No additional surface support is required • Less vulnerable to vandalism/theft • Cheaper to construct	• Trenching is more invasive to the aquatic environment • If leaks occur pipe will need to be excavated to repair them • Leaks are not easily detectable

Figure 2.1: The proposed pipeline routes from Sandile Water Treatment Works.

2.3 Terms of Reference

The Terms of Reference (ToR) for the Ecological Impact Assessment are provided below.

A detailed survey of the site will be undertaken to determine the possibility of there being listed threatened or protected ecosystems and species on the proposed project site. If any of these are found, the Environmental Management Programme (EMPr) will include recommended measures to remove or otherwise protect plant species found on the site that are afforded protection under the National Environmental Management: Biodiversity Act (no. 10 of 2004; NEMBA), during construction.

The ToR for an Ecological Impact Assessment includes:

1. Record the plant species that occur within the study area, based on field surveys;
2. Identify, and locate where possible, any plant Species of Conservation Concern (SCC), namely Threatened, Near Threatened, Rare (species with conservation status or which are) and endemic species (to the area);
3. All SCC's will be discussed in detail;
4. Provide a sensitivity map of the study areas in order for the proponent to better place the layout of the project's infrastructure;
5. Once a sensitivity map has been created, the consultant must suggest ecological corridors around or adjacent to the suggested project area, especially through sensitive sites or vegetation;
6. Identify and assess the environmental significance of the identified botanical impacts using the methodology prescribed by EOH, as this methodology is compliant with international best practice in EIA; and
7. Provide practical and realistic recommendations to mitigate the identified ecological impacts.

2.4 Methodology

The aim of this assessment is to identify areas of ecological importance and to evaluate these in terms of their conservation importance. In order to do so, the ecological sensitivity of the area is assessed as well as an identification of potential plant Species of Conservation Concern (SCC) that may occur in habitats present in the area.

It is not the aim of this study to produce a complete list of all plant species occurring in the region, but rather to examine a representative sample. It is however, important to note that areas of high sensitivity as well as SCC have been identified as far as possible, either from records from the site or a review of their habitat requirements, and whether or not these habitats occur within the site. The aim of this study is to identify areas of high sensitivity and those that may be subject to significant impacts from the project. It is important to note that an aquatic impact assessment has been conducted and as such those areas of ecological importance will be included in the sensitivity section of this report. Aspects that would increase impact significance include:

- Presence of plant SCC.
- Vegetation types (which also constitute faunal habitats) of conservation concern.
- Areas of high biodiversity.
- The presence of process areas:
    - Ecological corridors
    - Complex topographical features (especially steep and rocky slopes that provide niche habitats for plants).

2.4.1 Species of Conservation Concern

Data on the known distribution and conservation status for each potential plant SCC needs to be obtained in order to develop a list of SCC present on site. These plant species are those that may be impacted significantly by the proposed activity. In general these will be species that are already known to be threatened or at risk. Efforts to provide the conservation status ('red list' status) of individual species may provide additional valuable information on SCC (see http://www.iucnredlist.org/). Species that are afforded special protection, which are protected by CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) are also regarded as SCC (see http://www.cites.org/).

Definitions

The following definitions of the conservation status of plant SCC are provided (Source: SANBI Red Data List):

- **Critically Endangered (CR)** - A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V of the Red Data List), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
- **Endangered (EN)** - A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V of the Red Data List), and it is therefore considered to be facing a very high risk of extinction in the wild.
- **Vulnerable (VU)** - A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
- **Near Threatened (NT)** - A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
- **Sensitive species** - Species not falling in the categories above but listed in:
    - Appendix 1 or 2 of the Convention of International Trade in Endangered Species (CITES).
- **Endemic species** - Species endemic to South Africa, and more specifically Eastern Cape.
- **Least concern (LC)** – A taxon is of Least Concern when it does not qualify for any of the other categories. Widespread and abundant taxa are typically listed in this category.

2.4.2 Sampling protocol

The entire site was observed to evaluate the vegetation of the study area and to add detailed information on the plant communities present. The site observation took into account the amount of time available for the study and limitations such as the seasonality of the vegetation.

Vegetation within the entire site was observed and vegetation communities were then described according to the dominant species recorded from each type. These were then mapped and assigned a sensitivity score.

2.4.3 Vegetation mapping

Mucina and Rutherford developed the National Vegetation map in 2006 with an update in 2012 (Mucina and Rutherford 2012) as part of a South African National Biodiversity Institute (SANBI) funded project: "It was compiled in order to provide floristically based vegetation units of South Africa, Lesotho and Swaziland at a greater level of detail than had been available before." The map was developed using a wealth of data from several contributors and has allowed for the best national vegetation map to date, the last being that of Acocks developed over 50 years ago. The SANBI Vegetation map informs finer scale bioregional plans such as in fall STEP. This SANBI Vegetation map project has two main aims:

- To determine the variation in and units of southern African vegetation based on the analysis and synthesis of data from vegetation studies throughout the region, and
- To compile a vegetation map. The aim of the map was to accurately reflect the distribution and variation on the vegetation and indicate the relationship of the vegetation with the environment. For this reason the collective expertise of vegetation scientists from universities and state departments were harnessed to make this project as comprehensive as possible.

The map and accompanying book describes each vegetation type in detail, along with the most important species including endemic species and those that are biogeographically important. This is the most comprehensive data for vegetation types in South Africa.

This is compared to actual conditions of vegetation observed onsite during the site assessment through mapping from aerial photographs, satellite images, literature descriptions (e.g. SANBI and ECBCP) and related data gathered on the ground.

2.4.4 Sensitivity assessment

This section of the report explains the approach to determining the ecological sensitivity of the study area on a broad scale. The approach identifies zones of high, moderate and low sensitivity according to a system developed by EOH and used in numerous ecological studies. It must be noted that the sensitivity zonings in this study are based solely on ecological characteristics and social and economic factors have not been taken into consideration. The sensitivity analysis described here is based on 10 criteria which are considered to be of importance in determining ecosystem and landscape sensitivity. The method predominantly involves identifying sensitive vegetation or habitat types, topography and land transformation (Table 2.1).

Although very simple, this method of analysis provides a good, yet conservative and precautionary assessment of the ecological sensitivity.

Table 2.2: Criteria used for the analysis of the sensitivity of the area.

CRITERIA		LOW SENSITIVITY	MODERATE SENSITIVITY	HIGH SENSITIVITY
1	**Topography**	Level or even	Undulating; fairly steep slopes	Complex and uneven with steep slopes
2	**Vegetation -** Extent or habitat type in the region	Extensive	Restricted to a particular region / zone	Restricted to a specific locality / site
3	**Conservation status** of fauna / flora or habitats	Well conserved independent of conservation value	Not well conserved, moderate conservation value	Not conserved - has a high conservation value
4	**Species of special concern** - Presence and number	None, although occasional regional endemics	No endangered or vulnerable species, some indeterminate or rare endemics	One or more endangered and vulnerable species, or more than 2 endemics or rare species
5	**Habitat fragmentation** leading to loss of viable populations	Extensive areas of preferred habitat present elsewhere in region not susceptible to fragmentation	Reasonably extensive areas of preferred habitat elsewhere and habitat susceptible to fragmentation	Limited areas of this habitat, susceptible to fragmentation
6	**Biodiversity** contribution	Low diversity or species richness	Moderate diversity, and moderately high species richness	High species diversity, complex plant communities
7	**Visual quality** of the site or landscape from other vantage	Site is hidden or barely visible from any vantage points	Site is visible from some or a few vantage points but is not obtrusive or very conspicuous	Site is visible from many or all angles or vantage points

CRITERIA		LOW SENSITIVITY	MODERATE SENSITIVITY	HIGH SENSITIVITY
	points	with the exception in some cases from the sea		
8	**Erosion potential** or instability of the region	Very stable and an area not subjected to erosion	Some possibility of erosion or change due to episodic events	Large possibility of erosion, change to the site or destruction due to climatic or other factors
9	**Rehabilitation** potential of the area or region	Site is easily rehabilitated	There is some degree of difficulty in rehabilitation of the site	Site is difficult to rehabilitate due to the terrain, type of habitat or species required to reintroduce
10	**Disturbance** due to human habitation or other influences (alien invasive species)	Site is very disturbed or degraded	There is some degree of disturbance of the site	The site is hardly or very slightly impacted upon by human disturbance

A sensitivity map was drawn up with the aid of a satellite image so that the sensitive regions and vegetation types could be plotted. The following was also taken into account:

2.4.5 Biodiversity

Eastern Cape Biodiversity Conservation Plan (ECBCP) is a detailed, low-level conservation mapping tool for land-use planning purposes. The aim of ECBCP is to map critical biodiversity areas through a systematic conservation planning process. The current biodiversity plan includes the mapping of priority aquatic features, land-use pressures, critical biodiversity areas and develops guidelines for land and resource-use planning and decision-making.

The main outputs of the ECBCP are "*critical biodiversity areas*" (CBAs), which are allocated the following management categories:

CBA 1 = Maintain in a natural state
CBA 2 = Maintain in a near-natural state

Land use outputs not classified as CBAs are called Biodiversity Land Management Classes (BLMCs) and are allocated the following management categories.

BLMC 3 = Functional Landscapes
BLMC 4 = Towns & Settlements
BLMC 4 = Woodlots & Plantations
BLMC 4 = Cultivated Land

ECBCP maps the CBAs based on extensive biological data and input from key stakeholders. Although ECBCP is mapped at a finer scale than the National Spatial Biodiversity Assessment (Driver *et al*., 2005) it is still, for the large part, inaccurate and "coarse". Therefore it is imperative that the status of the environment, for any proposed development MUST first be verified before the management recommendations associated with the ECBCP are considered (Berliner and Desmet, 2007). It is also important to note that in absence of any other biodiversity plan, the ECBCP has been adopted by the Provincial Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) as a strategic biodiversity plan for the Eastern Cape.

2.4.6 Protected Areas

The purposes of identifying areas that are protected according to the National Environmental Management: Protected Areas (Act No. 57 of 2003; NEMPAA) are:

- To protect ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes in a system of protected area.
- To preserve the ecological integrity of these areas.
- To conserve biodiversity in these areas.
- To protect areas representative of all ecosystems, habitats and species naturally occurring in South Africa.
- To protect South Africa's threatened or rare species.
- To protect an area this is vulnerable or ecologically sensitive.
- To assist in ensuring the sustained supply of environmental goods and services.
- To provide for the sustainable use of natural or biological resources.
- To create or augment destinations for nature based tourism.
- To manage the inter-relationship between natural environment biodiversity, human settlement and economic development.
- Generally to contribute to human, social, cultural, spiritual and economic development.
- To rehabilitate and restore degraded ecosystems and promote the recovery of endangered and vulnerable species.

The goal of the National Protected Areas Expansion Strategy (NPAES) is to achieve cost-effective protected area expansion for ecological sustainability and increased resilience to climate change. It sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. The NPAES has classified protected areas into three categories: formally protected areas, informally protected areas and focus areas. Focus areas are large, intact and unfragmented areas suitable for the creation or expansion of large protected areas.

2.5 Impact assessment

2.5.1 Impact rating methodology

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to **temporal scales** - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

- Relationship of the impact to **spatial scales** - the spatial scale defines the physical extent of the impact.

- The severity of the impact - the **severity/beneficial scale** is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.

- The severity of impacts can be evaluated with and without **mitigation** in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

- The l**ikelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

- Each criterion is ranked with scores assigned as presented in Table 3-2 to determine the **overall significance** of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in Table 3-3, to determine the overall significance of the impact. The overall significance is either negative or positive.

- The **significance scale** is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of a social nature need to reflect the values of the affected society.

Cumulative Impacts

Cumulative impacts affect the significance ranking of an impact because the impact is taken in consideration of both onsite and offsite sources. For example, pollution making its way into a river from a development may be within acceptable national standards. Activities in the surrounding area may also create pollution which does not exceed these standards. However, if both onsite and offsite activities take place simultaneously, the total pollution level may exceed the standards. For this reason it is important to consider impacts in terms of their cumulative nature.

Seasonality

Although seasonality is not considered in the ranking of the significance, it may influence the evaluation during various times of the year. As seasonality will only influence certain impacts, it will only be considered for these, with management measures being imposed accordingly (i.e. dust suppression measures being implemented during the dry season).

Table 2.3: Significance Rating Table.

Temporal Scale (The duration of the impact)	
Short term	Less than 5 years (many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (from a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
Spatial Scale (The area in which any impact will have an affect)	
Individual	Impacts affect an individual.
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.

Project Level	Impacts affect the entire project area.
Surrounding Areas	Impacts that affect the area surrounding the development
Municipal	Impacts affect either the Local Municipality, or any towns within them.
Regional	Impacts affect the wider district municipality or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
Will definitely occur	Impacts will definitely occur.
Degree of Confidence or Certainty (The confidence with which one has predicted the significance of an impact)	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.

Table 2.4: Impact Severity Rating.

Overall Significance **(The combination of all the above criteria as an overall significance)**	
VERY HIGH NEGATIVE	VERY BENEFICIAL
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in **severe** or **very severe** effects, or **beneficial** or **very beneficial** effects. **Example:** The loss of a species would be viewed by informed society as being of VERY HIGH significance. **Example:** The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.	
HIGH NEGATIVE	BENEFICIAL
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. **Example:** The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. **Example:** The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.	
MODERATE NEGATIVE	SOME BENEFITS
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. **Example:** The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.	
LOW NEGATIVE	FEW BENEFITS

These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. **Example:** The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels. **Example:** The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.
NO SIGNIFICANCE
There are no primary or secondary effects at all that are important to scientists or the public. **Example:** A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.
DON'T KNOW
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. **Example:** The effect of a particular development on people's psychological perspective of the environment.

2.6 Assumptions and Limitations

This report is based on currently available information and, as a result, the following limitations and assumptions are implicit–

- The data analysed in this report is based on one site survey of plant species. Therefore seasonal trends are not assessed. In addition, some plant species, with particular seasonal/short-lived flowering, may have gone undetected.

3 RELEVANT LEGISLATION

The proposed construction of the pipelines will be subject to the requirements of various items of South African legislation. These are described below.

Table 3.1: Environmental legislation considered in the preparation of the Vegetation Impact Assessment for the proposed pipeline routes.

Title of Environmental legislation, policy or guideline	Implications for the proposed pipeline routes
Constitution Act (No. 108 of 1996)	Obligation to ensure that the proposed development will not result in pollution and ecological degradation; and Obligation to ensure that the proposed development is ecologically sustainable, while demonstrating economic and social development.
National Environmental Management Act (NEMA) (No. 107 of 1998)	The developer must apply the NEMA principles, the fair decision-making and conflict management procedures that are provided for in NEMA. The developer must apply the principles of Integrated Environmental Management and consider, investigate and assess the potential impact of existing and planned activities on the environment, socio-economic conditions and the cultural heritage.
National Environment Management: Biodiversity Act (NEMBA) (No. 10 of 2004)	The proposed development must conserve endangered ecosystems and protect and promote biodiversity; Must assess the impacts of the proposed development on endangered ecosystems; No protected species may be removed or damaged without a permit; The proposed site must be cleared of alien vegetation using appropriate means.
National Environmental Management: Protected Areas Act (NEMPAA) (No. 57 of 2003)	The objective of this Act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. In terms of Section 50 (1)(a)(ii) of this Act, the management authority may "*Carry out or allow an activity in the reserve aimed at raising revenue*". However, Section 50 (2) states that such activity may not negatively affect the survival of any species in, or significantly disrupt the integrity of the ecological system of the nature reserve. Furthermore, in terms Section 51 (a), the Minister or MEC is responsible for the regulations or restrictions of the development and other activities in a protected environment, "*which may be inappropriate for the area, given the purpose for which the area was declared*".
National Forest Act (NFA) (No 84 of 1998)	Requires that a permit be obtained should any forests be removed or affected during the construction phase of the project.
National Water Act (NWA) (No. 36 of 1998)	This Act provides details of measures intended to ensure the comprehensive protection of all water resources, including the water reserve and water quality. This proposed development will likely trigger the need for a water-use license according to Sections 21 (c) and (i) of the Act (See Aquatic Impact Assessment).
National Heritage Resource Act (NHRA) (25 of 1999)	Protection of natural and cultural heritage sites into the layout and operation of the project, where applicable. Ensuring compliance with both the South African Heritage Resources Agency (SAHRA) and the Eastern Cape Provincial Heritage Resources Agency (ECPHRA)

4 DESCRIPTION OF THE ENVIRONMENT

In terms of Appendix 6(1)(1) of the EIA Regulations (2014) (amended 2017) a specialist report must contain-

(f) Details of an assessment of a specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying alternatives;
(g) An identification of any areas to be avoided, including buffers;
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

The study sites and surrounding areas were described using a two-phased approach. Firstly, a desktop assessment of the site was conducted in terms of current vegetation classifications and biodiversity programmes and plans. This was followed by a site visit in order to assess the actual ecological state, current land-use, identify potential sensitive ecosystems and identify plant species located on the proposed project site.

4.1 Background and Literature review

Published literature on the ecology of the area was referenced in order to describe the study site in the context of the region and the Eastern Cape Province. The following documents/plans are referenced:

- SANBI vegetation (Mucina & Rutherford, 2012);
- Eastern Cape Biodiversity Conservation Plan (ECBCP);
- The National Freshwater Ecosystem Priority Areas (NFEPA);
- National Protected Areas Act (NO. 57 of 2003; NEMPAA);
- National Protected Areas Expansion Strategy (NPAES);
- Review of the SANBI Red Data List;
- Convention on International Trade in Endangered Species (CITES);
- International Union for Conservation of Nature (IUCN);
- Provincial Nature Conservation Ordinance (PNCO);
- National Biodiversity Management: Biodiversity Act (NEMBA) List of Threatened or Protected Species;
- National Biodiversity Management: Biodiversity Act (NEMBA) List of Alien Invasive Vegetation;
- Department of Agriculture, Forestry and Fisheries (DAFF) List of Protected Trees; and
- National Biodiversity Management: Biodiversity Act (NEMBA) list of threatened ecosystems

4.1.1 Climate

The area surrounding the proposed pipeline route receives about 659mm of rain per year, with most rainfall occurring mainly during summer. Figure 4.1 below shows the average rainfall values for the area per month. The site receives the lowest rainfall (13mm) in July and the highest (96mm) in March. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for the site range from 19.7°C in July to 26.7°C in February. The region is the coldest during July when the temperature drops to 6.5°C on average during the night.

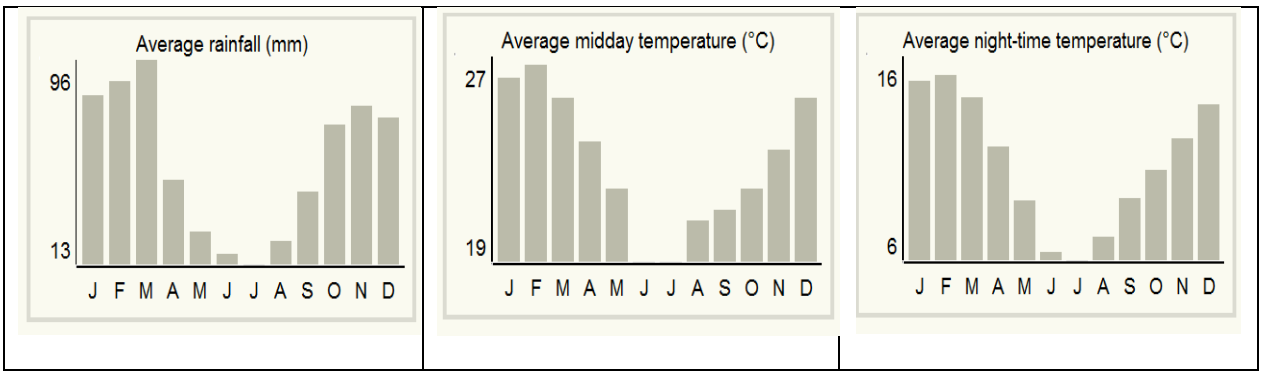

Figure 4.1: Average temperature and rainfall for the pipeline route area (www.saexplorer.co.za)

4.1.2 Topography and Geology

The topography of the study area ranges between 520m to 666m above sea level, as indicated by Figure 4.2 below. Typically, the area is characterised by undulating plains to moderately steeped sloped landscapes sometimes with shallow, incised drainage valleys.

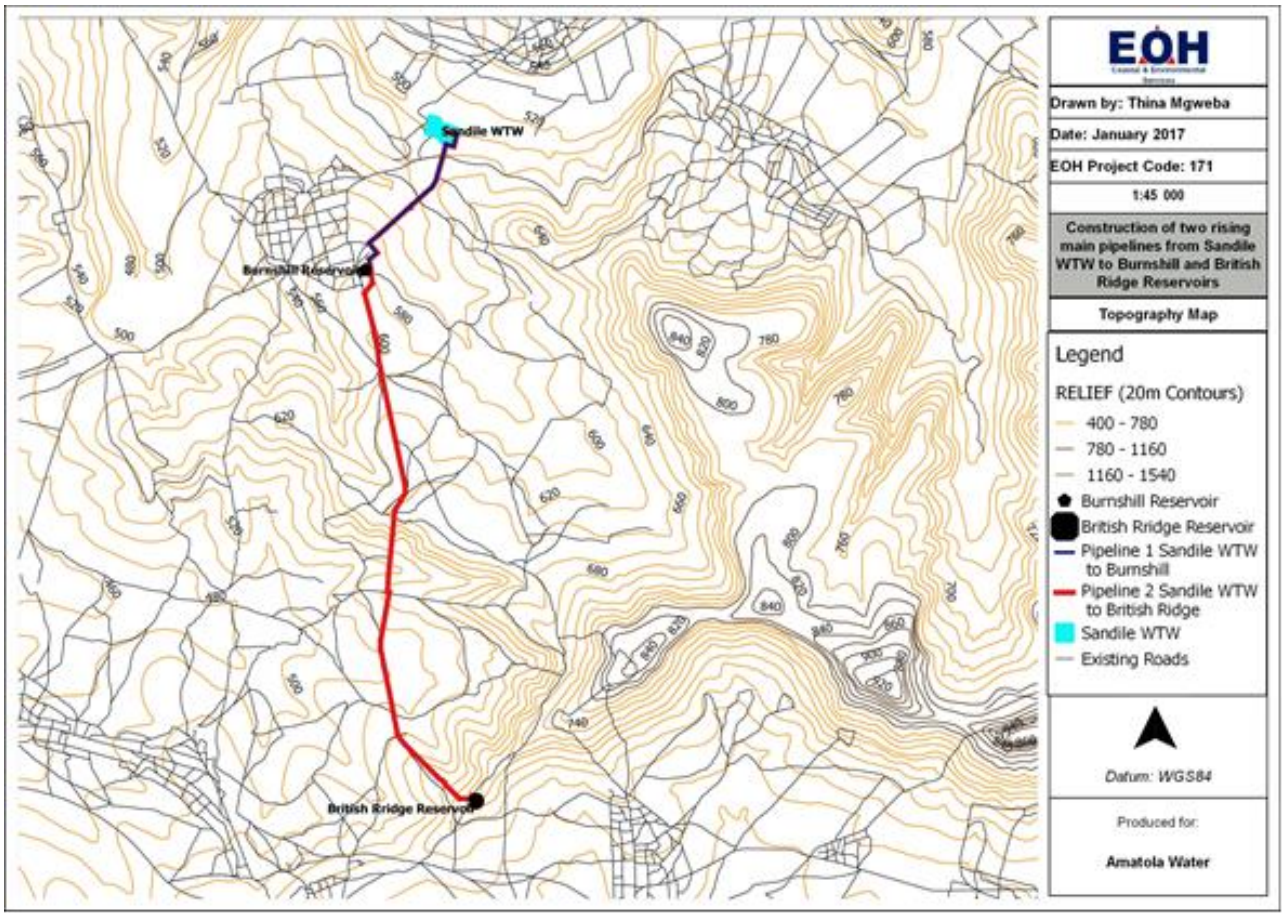

Figure 4.2: Topographic profile of the pipeline routes.

The site occurs within alternating mudstones and sandstones from the Adelaide subgroup of the Karoo Supergroup of rocks found on site (Figure 4.3).

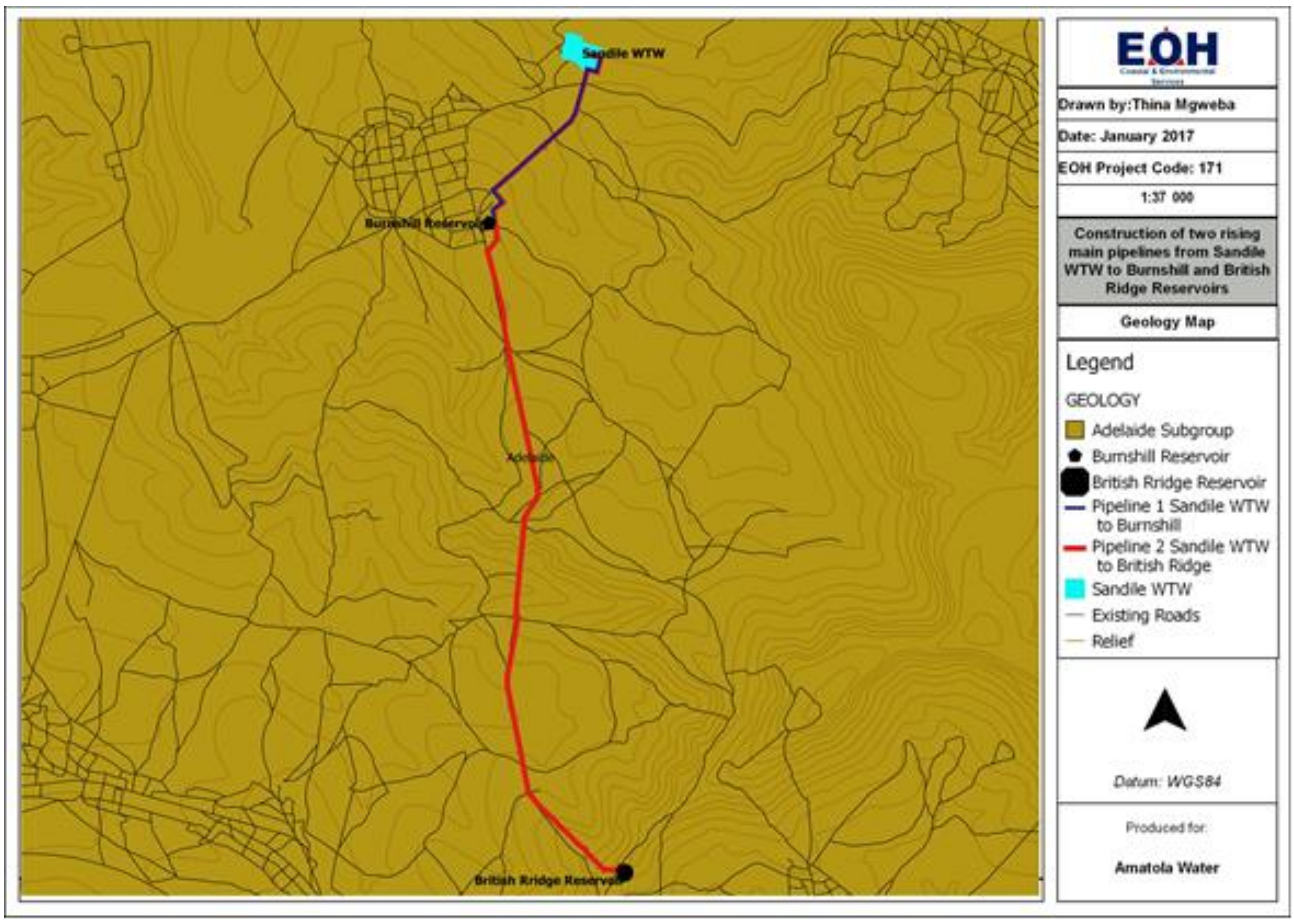

Figure 4.3: Geology Map of the pipeline routes.

4.2 Vegetation and Floristics

4.2.1 SANBI classification (Mucina and Rutherford, 2012)

The South African National Biodiversity Institute (SANBI) vegetation map for the proposed pipeline routes is provided in Figure 4.4 below. The map shows that there are three vegetation types which are found along the pipeline routes namely:

- Buffels Thicket
- Bhisho Thornveld
- Amathole Montane Grassland

Bhisho Thornveld (Orange areas in Figure 4.4) vegetation is a sub-escarpment savanna type and forms part of the Savanna Biome. This vegetation type is found on undulating to moderately steep slopes in large sections of the Eastern Cape Province. It is an open savanna characterised by small trees of *Acacia natalitia* with a short to medium, dense, sour grassy understorey, which is dominated by *Themeda triandra* when in good condition. A diversity of other woody species also occurs, often increasing under conditions of overgrazing. SANBI classify Bhisho Thornveld as **LEAST THREATENED**. The NSBA Conservation Target for this vegetation type is 25%.

Buffels Thicket (Green areas in Figure 4.4) vegetation is found in river valleys around the East London and King Williams Town area as well as in the valley bottom in Keiskammahoek north of Dimbaza. This vegetation is characterised by dense and tangled thicket stands along the steep slopes of river valleys in highly dissected hills and moderately undulating plains. The dense thicket grades into more open, shorter thornveld at the edges of the valley slopes. SANBI classify Buffels Thicket as **VULNERABLE**. The NSBA Conservation Target for this vegetation type is 19%.

Amathole Montane Grassland (Lime green in Figure 5), of the Grassland Biome, is found low mountain ranges and moderately undulating landscapes characterised by short grassland with high species richness of forbs, especially those of the Asteraceae family. The grasslands are dominated by a variety of grasses including *Themeda triandra*, *Elionurus muticus* and *Sporobolus africanus*. SANBI classify Amathole Montane Grassland as **LEAST THREATENED**. The NSBA Conservation Target for this vegetation type is 27%

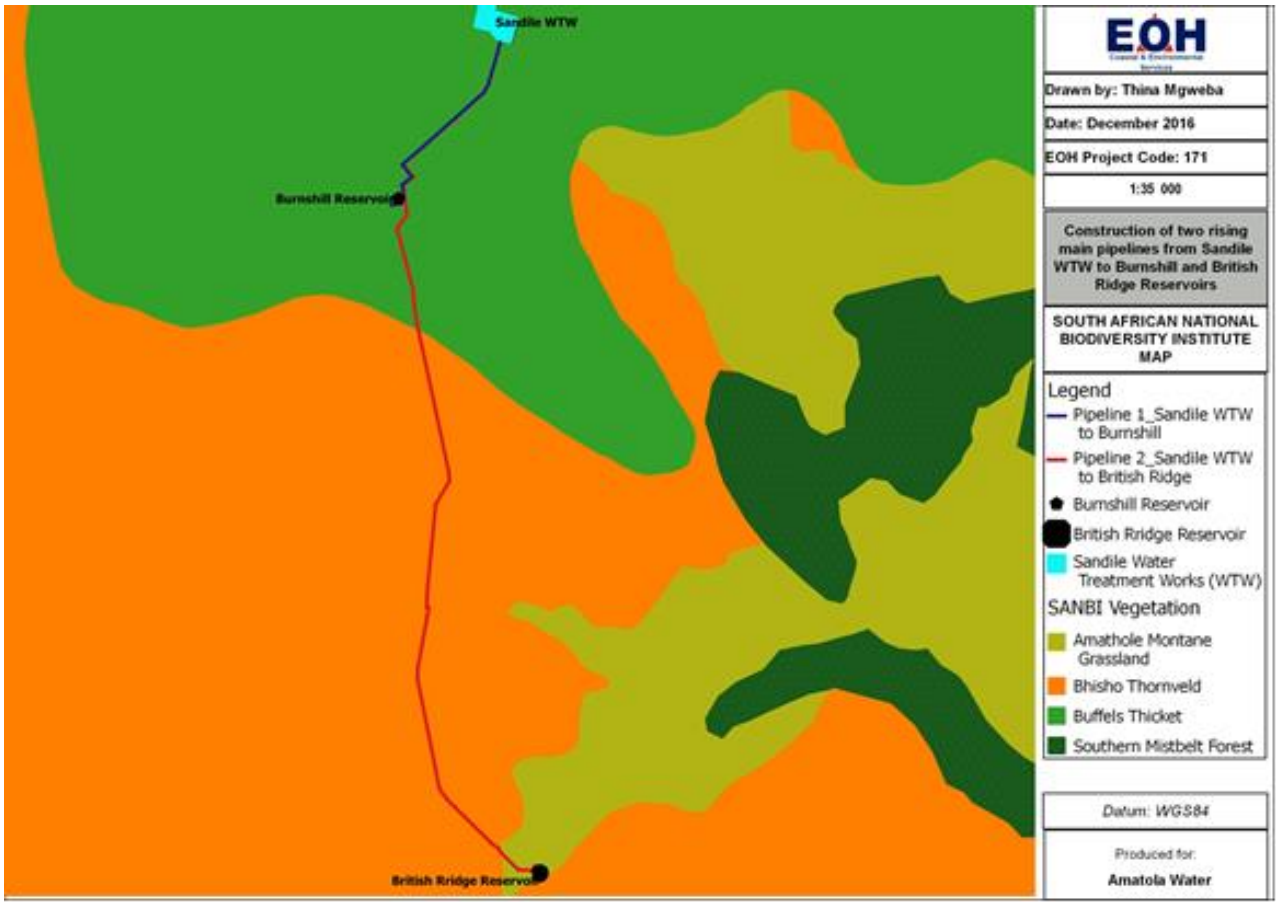

Figure 4.4: Map representing the SANBI Vegetation classification of the pipeline routes (Mucina & Rutherford, 2012).

4.2.2 Forest classification

The proposed pipeline route falls within a section of the Albany Scarp Forest of the Amatole Mistbelt Forest. The Amatole Mistbelt forests range from tall forest to scrub forest and can found along cool mountain slopes with heavy summer mists to the lowland areas in the Eastern Cape Province. Albany Scarp Forests are a subtype of Amatole Mistbelt Forests and occur in small forest patches in the lower west-east quartzite ridges between the Zuurberg Mountains and the surrounding of King Williams Town. Grassy Fynbos typically occurs on the upper ridges and thicket vegetation occurs at the foot of the mountains. Prominent canopy trees found within the forest include: *Podocarpus falcatus, Rhus chiridensis* and *Vepris lanceolata.* The conservation target for this vegetation is 62% and are considered to be **NEAR THREATENED** (CSIR, 2003).

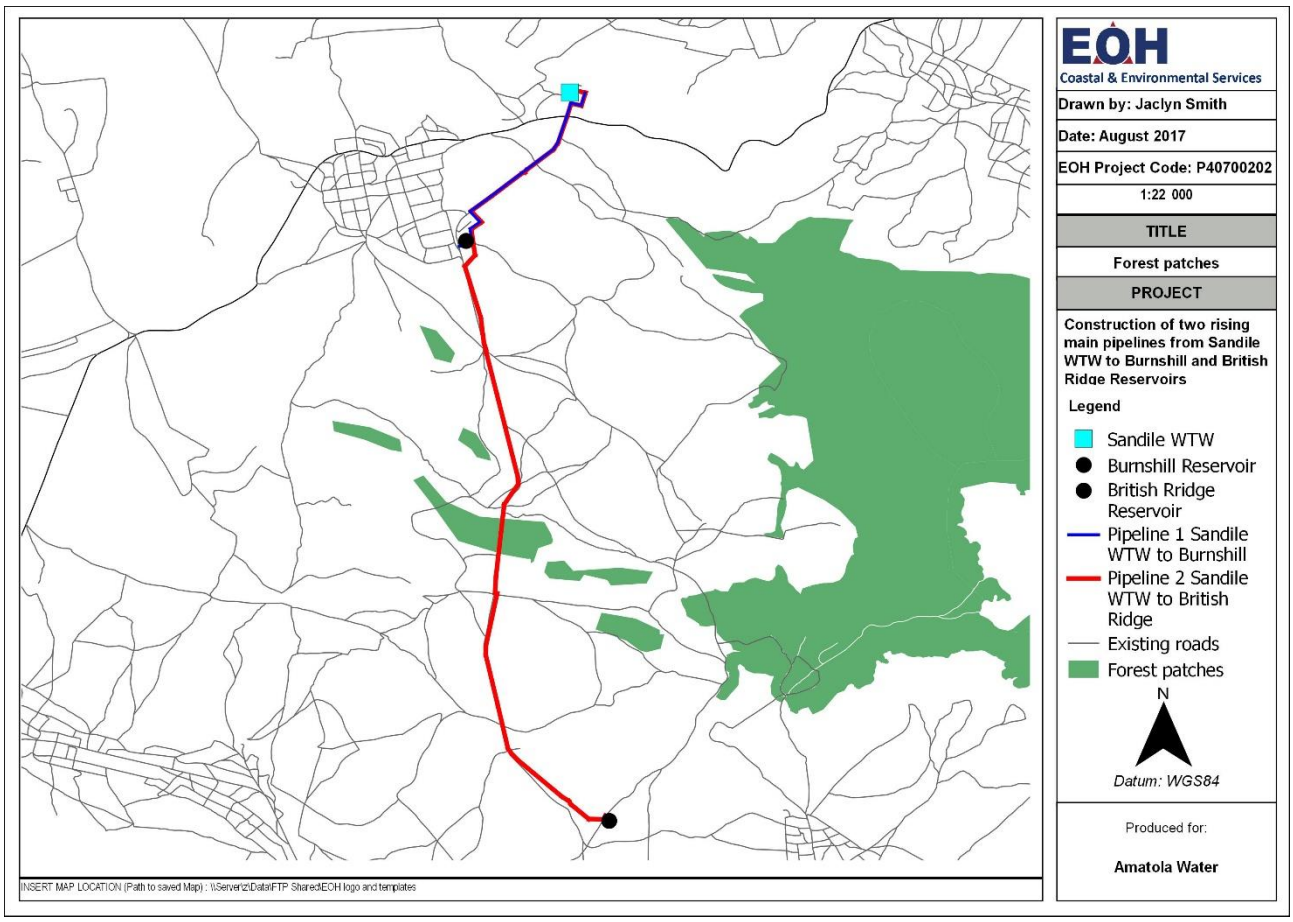

Figure 4.5: Map showing the forest patches within the proposed pipeline routes.

4.3 Surface Hydrology

The site falls within the quaternary catchment R10D and falls within Water Management Area (WMA) 7 between the Mzimvubu to Tsitsikamma rivers. The proposed pipelines traverse a number of non-perennial tributaries of the Keiskamma River and fall within a 500m radius of numerous NFEPA artificial wetlands (Figure 4.6).

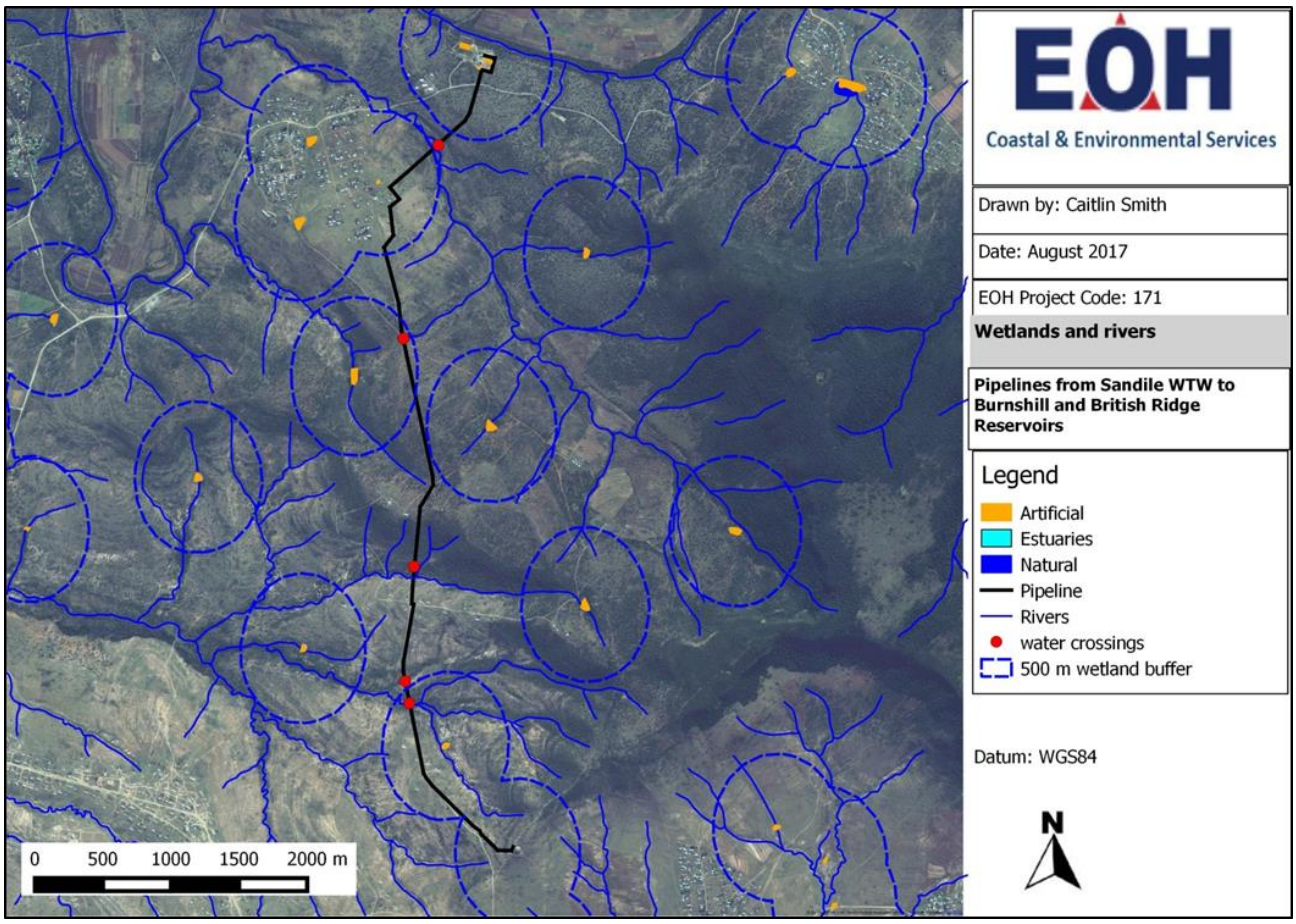

Figure 4.6: Surface hydrology within proximity to the proposed pipeline routes.

4.4 Land use

The current land uses in the vicinity of the pipeline routes are explained in Table 4.1 below and shown in Figure 4.5 overleaf.

Table 4.1: The main land uses in the vicinity of the proposed pipeline routes.

Land use Type	Colour in Figure 4.5	Affected by proposed pipeline routes (Yes/No/Maybe)
Degraded land	Light green	Yes
Cultivated land/agricultural land	Purple	Yes
Urban areas	Light grey	No
Shrubland, Fynbos and Bushland	Light brown	Yes
Forest/Forest plantations	Dark green	No
Grassland	Light orange/yellow	No
NFEPA artificial wetlands	Dark blue	Maybe
Rivers, tributaries and drainage lines	Light blue	Yes
Existing roads	Dark grey	Yes

The land uses that are likely to be impacted by the proposed pipeline routes are:

- wetlands;
- rivers, drainage lines and tributaries;
- existing roads,
- cultivated land;
- shrubland, fynbos and bushland; and

- degraded land.

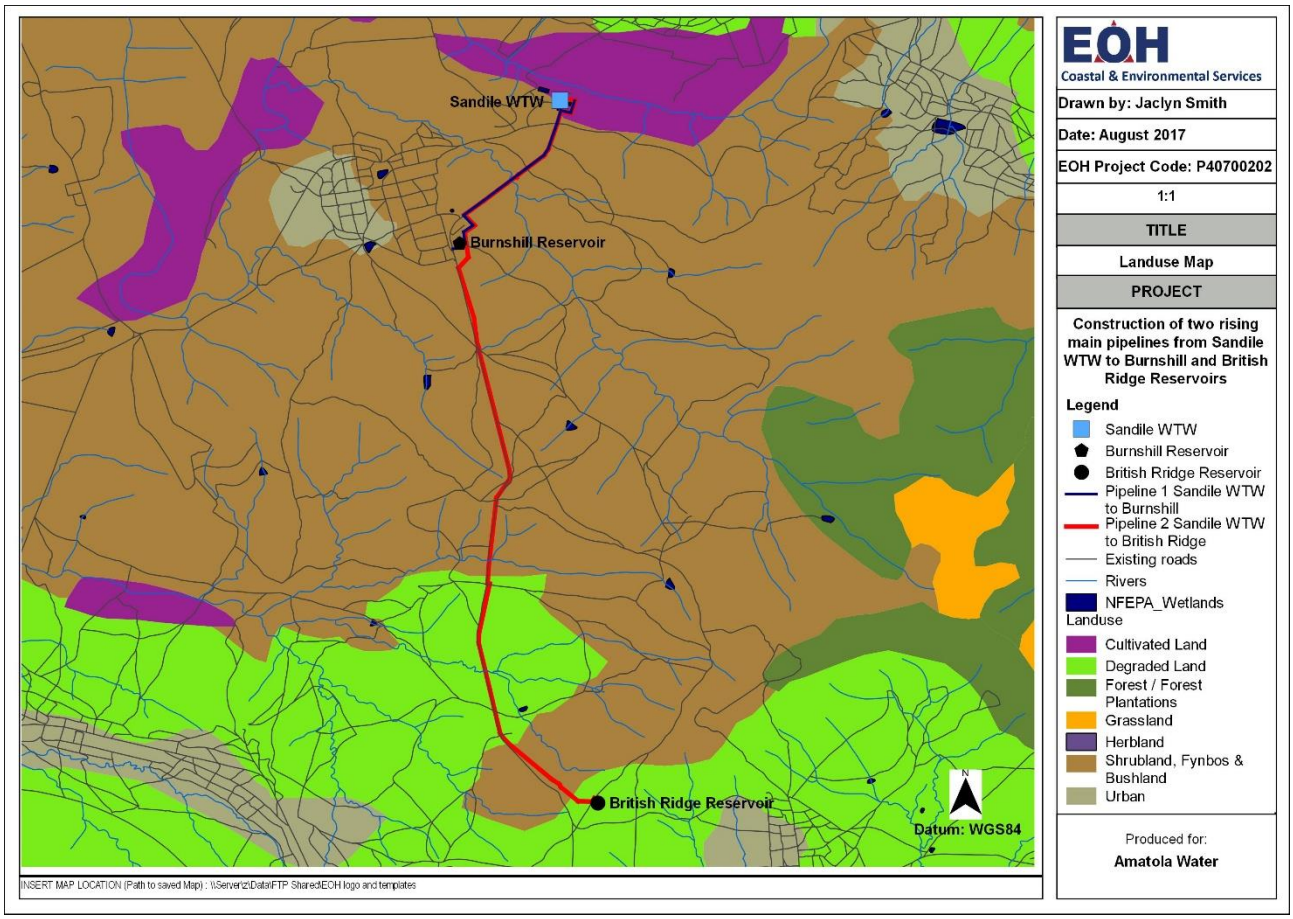

Figure 4.7: Land Use map for the proposed pipeline routes.

4.5 Biodiversity Conservation

South Africa's policy and legislative framework for biodiversity is well developed, providing a strong basis for the conservation and sustainable use of biodiversity. South Africa is one of the few countries in the world to have a Biodiversity Act and a National Biodiversity Institute.

Key components of the national policy and legislative framework for biodiversity include:

- The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997)
- The National Environmental Management: Biodiversity Act (Act 10 of 2004)
- The National Environmental Management: Protected Areas Act (Act 57 of 2003)
- The National Biodiversity Strategy and Action Plan (NBSAP) (2005)
- The National Spatial Biodiversity Assessment (NSBA) (2004, currently being reviewed and updated)
- The National Biodiversity Framework (NBF) (2008)
- The National Protected Area Expansion Strategy (NPAES) (2008)

In addition to national legislation, some of South Africa's nine provinces have their own provincial biodiversity legislation, as nature conservation is a concurrent function of national and provincial government in terms of the Constitution (Act 108 of 1996). The relevant biodiversity plan in the Eastern Cape is the ECBCP (2007).

4.5.1 Protected Areas (NEMPAA & NPAES)

NEMPAA provides for the protection and conservation of ecologically viable areas that is representative of South Africa's biological diversity and its natural landscapes by listing a national register of all national, provincial and local protected areas. No National Protected Areas were identified within the general study area.

4.5.2 Threatened ecosystems

The NEMBA National *List of Ecosystems that are Threatened and in Need of Protection* was released in 2011 and contains the first national list of threatened terrestrial ecosystems. The following categories were listed:

- **critically endangered (CR) ecosystems**, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- **endangered (EN) ecosystems**, being ecosystems that have undergone degradation of ecological structure, function .or composition as a result of human intervention, although they are not critically endangered ecosystems;
- **vulnerable (VU) ecosystems**, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems;
- **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable

There were no NEMBA threatened or protected ecosystems identified within the study area.

4.5.3 Eastern Cape Biodiversity Conservation Plan

The pipeline routes fall predominantly within areas classified as CBA 2 and sections of the pipeline route falls within areas classified as CBA 1 (Figure 4.6).

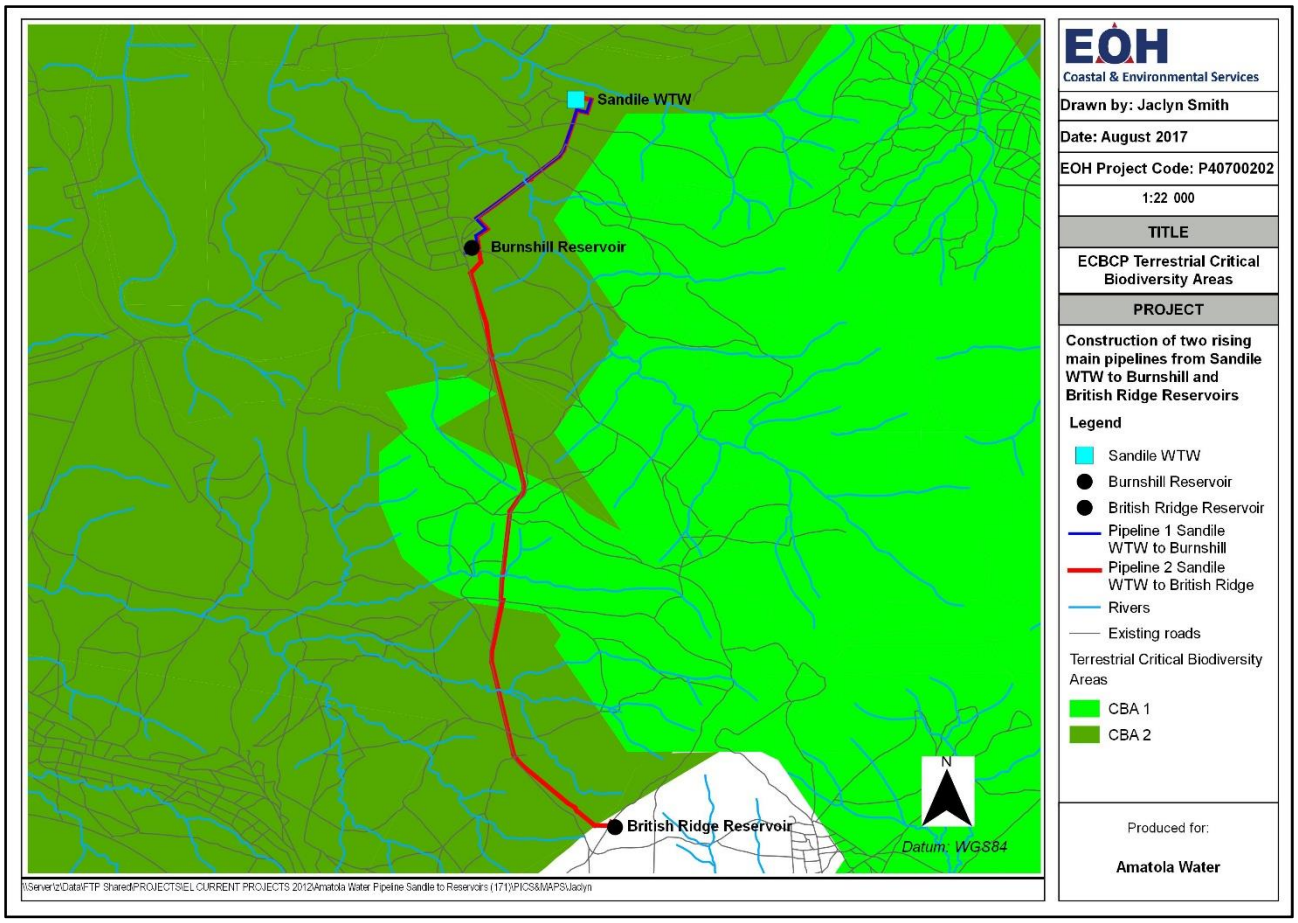

Figure 4.8: ECBCP Terrestrial Critical Biodiversity Areas within the proposed pipeline routes.

4.5.4 Conservation Status of plant species: Rare, or Threatened species

No plant SCC were observed along the proposed pipeline route. The following is a list of plant SCC that may potentially be found along the pipeline route. It was derived from current literature for vegetation found in the area as well as the international IUCN Red Data List, the South African Red Data List, DAFF protected trees (NEMBA) and PNCO.

Table 4.2: List of potential plant SCC that may be found onsite.

Family	Species	Common Name	Threat status
AMARYLLIDACEAE	*Brunsvigia grandiflora Lindl.*	Candelabra flower	PNCO: Protected
AMARYLLIDACEAE	*Cyrtanthus brachyscyphus Baker*	Dobo Lily	PNCO: Protected
AMARYLLIDACEAE	*Cyrtanthus breviflorus Harv.*	Yellow fire lily	PNCO: Protected
AMARYLLIDACEAE	*Nerine filifolia Baker*	Grass-leaved nerine	PNCO: Protected
AMARYLLIDACEAE	*Nerine undulata (L.) Herb.*	Nerine	PNCO: Protected
APOCYNACEAE	*Acokanthera oblongifolia (Hochst.) Codd*	Dune poison-bush	PNCO: Protected
APOCYNACEAE	*Acokanthera oppositifolia (Lam.) Codd*	Bushman's poison	PNCO: Protected
APOCYNACEAE	*Carissa bispinosa*	Beta-umtumzi, Fork-spined Carissa	PNCO: Protected
APOCYNACEAE	*Cynanchum ellipticum*	Bobbejaantou	PNCO: Protected
APOCYNACEAE	*Secamone alpini Schult.*	Monkey rope	PNCO: Protected
APOCYNACEAE	*Strophanthus speciosus*	Bobbejaantou,	PNCO: Protected

Family	Species	Common Name	Threat status
		Forest Poison-rope	
AQUIFOLIACEAE	*Ilex mitis*	African Holly	PNCO: Endangered
ASTERACEAE	*Macowania revoluta Oliv.*	Amathole macowania	Red data list: DDD
CUNONIACEAE	*Cunonia capensis*	Botterlepelboom	Red data list: Near Threatened NFA: Protected
CURTISIACEAE	*Curtisia dentata*	Asgaaiboom, Assegai Tree	Red data list: Near Threatened NFA: Protected
ERICACEAE	*Erica brownleeae Bolus*		PNCO: Protected
GESNERIACEAE	*Streptocarpus rexii*	Rexia, Twin Sisters	PNCO: Protected
GUNNERACEAE	*Gunnera perpensa L.*	River pumpkin, wild rhubarb	Red data list: Declining
ICACINACEAE	*Apodytes dimidiata*	Bird's-eye Tree	NFA: Protected
IRIDACEAE	*Dietes iridioides*	Wild Iris	PNCO: Protected
IRIDACEAE	*Hesperantha coccinea (Backh. & Harv.) Goldblatt & J.C.Manning*	Scarlet river lily	PNCO: Protected
IRIDACEAE	*Hesperantha pulchra Baker*		PNCO: Protected
IRIDACEAE	*Moraea polystachya (Thunb.) Ker Gawl.*	Bloutulp	PNCO: Protected
IRIDACEAE	*Watsonia angusta Ker Gawl.*	Red watsonia	PNCO: Protected
MESEMBRYANTHEMACEAE	*Aptenia cordata*		PNCO: Protected NFA: Protected
MESEMBRYANTHEMACEAE	*Bergeranthus concavus L.Bolus*		PNCO: Protected
ORCHIDACEAE	*Calanthe sylvatica (Thouars) Lindl.*	Forest Calanthe	PNCO: Protected
ORCHIDACEAE	*Habenaria arenaria Lindl.*		PNCO: Protected
ORCHIDACEAE	*Holothrix orthoceras (Harv.) Rchb.f.*	Tryphia	PNCO: Protected
ORCHIDACEAE	*Holothrix scopularia (Lindl.) Rchb.f.*	Brushy holothrix	PNCO: Protected
ORCHIDACEAE	*Polystachya pubescens (Lindl.) Rchb.f.*	Amabelejongosi	PNCO: Protected
PITTOSPORACEAE	*Pittosporum viridiflorum Sims*	Cheesewood	NFA: Protected
PITTOSPORACEAE	*Pittosporum undulatum Vent.*	Australian chessewood	NEMBA: Protected
PODOCARPACEAE	*Podocarpus falcatus*	Bastard yellowwood	NFA: Protected
PODOCARPACEAE	*Podocarpus latifolius*	Broad-leaved yellowwood	NFA: Protected
PROTEACEAE	*Protea caffra Meisn. subsp. caffra*	Sugar bush	PNCO: Protected
PROTEACEAE	*Protea subvestita N.E.Br.*	Waterlily sugarbush	PNCO: Protected Red data list: Vulnerable
RHIZOPHORACEAE	*Cassipourea flanaganii (Schinz) Alston*	Cape Onionwood	Red data list: Endangered NEMBA: Endangered
SAPOTACEAE	*Sideroxylon inerme*	White Milkwood	NFA: Protected
THYMELAEACEAE	*Gnidia chrysophylla Meisn.*	Goldleaf Stripper	Red data list: Vulnerable

Family	Species	Common Name	Threat status
ZAMIACEAE	*Encephalartos altensteinii Lehm.*	Eastern Cape cycad	PNCO: Endangered Red data list: Vulnerable NEMBA: Vulnerable

5 SITE OBSERVATIONS AND DESCRIPTIONS

While National level vegetation maps have described broad vegetation types, local conditions and micro-habitats (rainfall, soil structure, rocky outcrops, etc.) can result in variations in plant composition. A site investigation was therefore conducted on the 15 July 2017 in order to confirm desktop findings, to assess the actual ecological state, current land-use, identify potential sensitive ecosystems and identify plant species located within the proposed project site. The site visit also served to inform potential impacts of the proposed project and how significantly it would impact on the surrounding ecological environment.

5.1 Vegetation communities and description

Three distinct vegetation communities were observed within and close to the proposed study site, namely:

- Thicket
- Thornveld
- Grassland
- Forest patch
- Riparian vegetation
- Transformed landscape

The vegetation communities observed are described below.

Thicket

- This vegetation community comprises mostly of the Pipeline 1 route and approximately 25% of the Pipeline 2 route.
- This vegetation community comprises predominantly of *Acacia natalitia.*
- Other plant species observed on site include: *Searsia lucida* and *Aloe ferox*.
- Alien invasive plants like *Opuntia ficus-indica* and *Agave americana* were found in this community.
- Areas of this vegetation in close proximity to transformed land was found to be degraded.
- Existing degraded road and pipeline servitude run through the area.

Thornveld

- This vegetation community comprises approximately 31% of the entire length of the pipeline route.
- This vegetation community is usually characterised by small tress of *Acacia natalitia* and a short to medium, dense, sour grassy understorey dominated by *Themeda triandra*.
- A diversity of woody species can also occur especially in areas that are overgrazed.
- Species observed on site include: *Euphorbia triangularis*.
- A number of alien invasive *Eucalyptus* species were found in this community.
- Areas of this vegetation in close proximity to transformed land was found to be degraded.

Grassland

- Comprises a relatively small section of the pipeline route (10 % of the entire pipeline route).
- Scattered *Acacia natalitia* and some grass species were observed.
- Some areas were degraded where it is in close proximity to already transformed land.

Riparian vegetation

- This vegetation comprises approximately 7% of the entire length of the pipeline route.
- The vegetation of this area consists largely of dense vegetation from the vegetation community in which the drainage lines are found.
- No aquatic (hydrophyllic) vegetation identified.
- Some alien invasive species (*Ricinus communis*) were observed along existing crossings where the vegetation has been disturbed.

Forest

- Comprises approximately 7% of the entire length of the pipeline route.
- Existing disturbed corridor from the existing pipeline and transmission currently transects this community..
- Likely to have the presence of many plant SCC in this area.
- Plants identified within this community include *Azima tetracanthe, Aloe ferox* and large *Cussonia spicata* and *Euphorbia triangularis*.

Transformed landscape

- Comprises approximately 20% of the entire length of the pipeline route.
- Transformed land in the study area includes all areas that have been transformed by human activities.
- This includes human settlements, areas used for grazing and existing roads, pipeline and transmission line servitudes.
- Transformed areas as a result of overgrazing were observed .

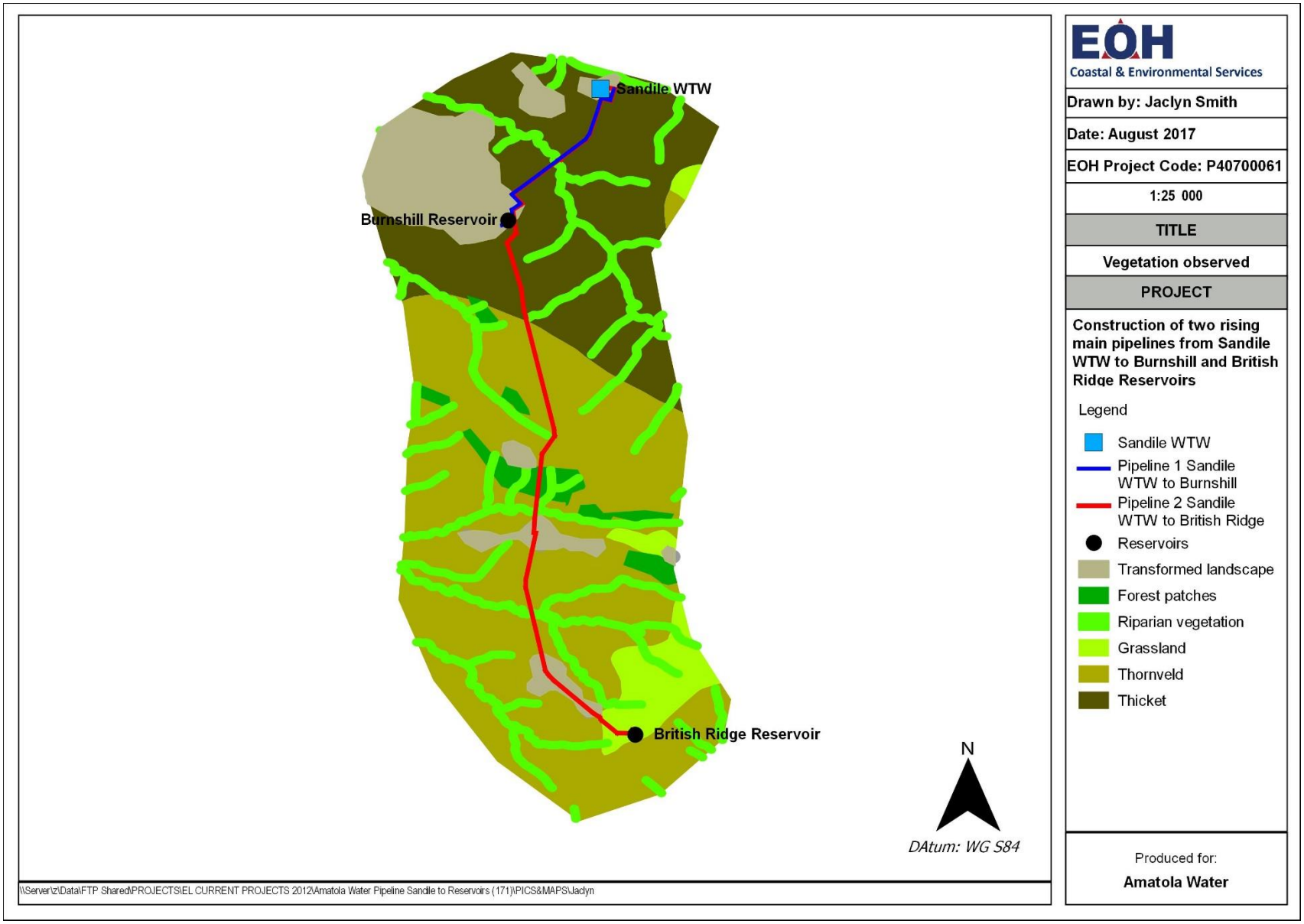

Figure 5.1: Vegetation communities observed onsite.

5.2 Plant Species Observed

A number of plant species were identified within and surrounding the study area (Appendix 1). Of the species identified, 33 are listed as potential SCC (Table 4.1). These species are all Schedule 2 & 3 species on the Provincial Nature Conservation Ordinance Act 19 of 1974, species protected by NEMBA or protected tree species under the National Forest Act,1998 (Act No. 84 of 1998).

5.3 Alien Invasive Species

Below is a list of all alien invasive plant species identified within the study site. These plants are classified according to the Conservation of Agricultural Resources Act (Act No. 43 of 1983 or CARA) and the National Environmental Management: Biodiversity Act (Act No. 10 of 2004): Alien and Invasive Species List, 2014. The CARA alien invasive list is only referenced were an alien invasive species that does not appear on the NEMBA list appears on the CARA list.

As alien invasive plants are commonly found onsite, it is advised that an alien invasive management plan is developed and implemented during the construction phase and that active management of alien species listed as category 1b in impacted areas is carried out.

The following list includes alien and invasive plant species that were not observed on site but may still occur:

Table 5.1: List of all alien and invasive plant species that may occur on site.

Plant name	Common name	Comment
Category 1b		
Cirsium vulgare	Spear thistle	1) According to NEMBA category 1b Listed species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be contained. 2) A landowner upon whose land a Category 1 b Listed Invasive Species occurs and which species is under the landowner's control must: (a) comply with the provisions of section 73(2) of the Act; and (b) contain the listed invasive species in compliance with section 75 (1), (2) and (3) of the Act; 3) If an Invasive Species Management Programme has been developed in terms of regulation 7, a landowner must control the listed invasive species in accordance with such programme. 4) A landowner contemplated in sub-regulation (2) must allow an authorised official from the Department to enter onto the land to monitor, assist with or implement the containment of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in regulation 7.
Eucalyptus species		
Ipomoea purpurea	Morning Glory	
Opuntia ficus-indica	Prickly Pear	
Pittosporum undulatum	Australian cheesewood	
Category 2		
Acacia mearnsii	Black wattle	(1) Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be. (2) A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit, must ensure that the specimens of the species do
Ricinus communus	Castor oil plant	

		not spread outside of the land or the area specified in the Notice or permit. (3) Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1 b Listed Invasive Species and must be managed according to Regulation 3. (4) Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species published in Government Gazette No. 37886, Notice 599 of 1 August 2014 (as amended), any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control.
Category 3		
Agave americana	Silver wattle	1. Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice. 2. Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3. 3. If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.

5.4 Biodiversity observations

According to ECBCP the project site falls within Terrestrial CBA 1 and CBA 2 areas. Where the project site falls within a CBA 1 Category, the site was found to be in a relatively natural state with forest occurring in these areas. The CBA 2 areas were found be near-natural however, there were sections of completely transformed landscape and degraded sections of the vegetation communities within these areas.

6 SITE SENSITIVITY

In terms of Appendix 6 (1)(1) of the EIA Regulations (2014) (amended 2017) a specialist report must contain-

(f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying alternatives;
(g) An identification of any areas to be avoided, including buffers;
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

6.1 Sensitivity map

The following sensitivity allocations were made based on the weighting of the below mentioned criteria on the vegetation components found along the proposed pipeline routes.

Table 6.1: Site sensitivity

CRITERIA		LOW SENSITIVITY	MODERATE SENSITIVITY	HIGH SENSITIVITY
1	**Topography**	Level or even	Undulating; fairly steep slopes (**for all vegetation types and riparian areas**)	Complex and uneven with steep slopes
2	**Vegetation -** Extent or habitat type in the region	Extensive **(for all vegetation types other than forest**)	Restricted to a particular region / zone	Restricted to a specific locality / site **(for forest and riparian areas)**
3	**Conservation status** of fauna / flora or habitats	Well conserved independent of conservation value (**for Amathole Montane Grassland and Bisho Thornveld**)	Not well conserved, moderate conservation value (**for Buffel's thicket and riparian areas**)	Not conserved - has a high conservation value (**for forest**)
4	**Species of special concern** - Presence and number	None, although occasional regional endemics	No endangered or vulnerable species, some indeterminate or rare endemics	One or more endangered and vulnerable species, or more than 2 endemics or rare species (**for all vegetation and riparian vegetation**)
5	**Habitat fragmentation** leading to loss of viable populations	Extensive areas of preferred habitat present elsewhere in region not susceptible to fragmentation (**for all vegetation types and riparian areas except forest**).	Reasonably extensive areas of preferred habitat elsewhere and habitat susceptible to fragmentation	Limited areas of this habitat, susceptible to fragmentation (**for forest)**
6	**Biodiversity** contribution	Low diversity or species richness (**Amathole Montane Grassland and Bisho Thornveld**).	Moderate diversity, and moderately high species richness (**Buffels Thicket and riparian areas**)	High species diversity, complex plant communities (**for forest**)
7	**Visual quality** of the site or landscape from other vantage points	Site is hidden or barely visible from any vantage points with the exception in some cases from the	Site is visible from some or a few vantage points but is not obtrusive or very conspicuous (**for all vegetation types and riparian areas)**	Site is visible from many or all angles or vantage points

CRITERIA		LOW SENSITIVITY	MODERATE SENSITIVITY	HIGH SENSITIVITY
		sea		
8	**Erosion potential** or instability of the region	Very stable and an area not subjected to erosion	Some possibility of erosion or change due to episodic events (**for all vegetation types**)	Large possibility of erosion, change to the site or destruction due to climatic or other factors (**for riparian areas)**
9	**Rehabilitation** potential of the area or region	Site is easily rehabilitated (for all vegetation types (**for all vegetation types except forest**)	There is some degree of difficulty in rehabilitation of the site	Site is difficult to rehabilitate due to the terrain, type of habitat or species required to reintroduce (**forest and riparian areas**)
10	**Disturbance** due to human habitation or other influences (alien invasive species)	Site is very disturbed or degraded	There is some degree of disturbance of the site **(for all vegetation types and riparian areas)**	The site is hardly or very slightly impacted upon by human disturbance

A sensitivity map (Figure 6.1 below) was developed based on desktop and site information gathered, and was classified into areas of high, moderate and low sensitivity.

High Sensitivity

All forest patches were classified as high sensitive areas and are likely to comprise many SCC and require permits from DAFF and DEDEAT for removal of the SCC (coloured red in Figure 6.1).

Moderate Sensitivity

Buffel's thicket is considered as moderately sensitivity due to its biodiversity contribution and conservation status. Riparian areas are also considered as moderately sensitive given its conservation status and biodiversity contribution (coloured orange in Figure 6.1). These areas will require authorisation from the Department of Water & Sanitation (DWS) prior to commencement of activities. The Buffel's thicket and riparian areas also have a low rehabilitation potential. A Search & Rescue (S&R) exercise must be conducted prior to commencement of activities in these areas. The relevant vegetation permits must also be applied for.

Low Sensitivity

These areas are considered as severely disturbed or transformed by human activities (coloured grey in Figure 6.1). These areas are suitable for development but may have some SCC present. These areas include transformed landscape and the Bisho Thornveld and Amathole Montane Grassland areas. It is recommended that an S&R exercise will be required given that some of the intact vegetated areas of these vegetation types may contain plant SCC.

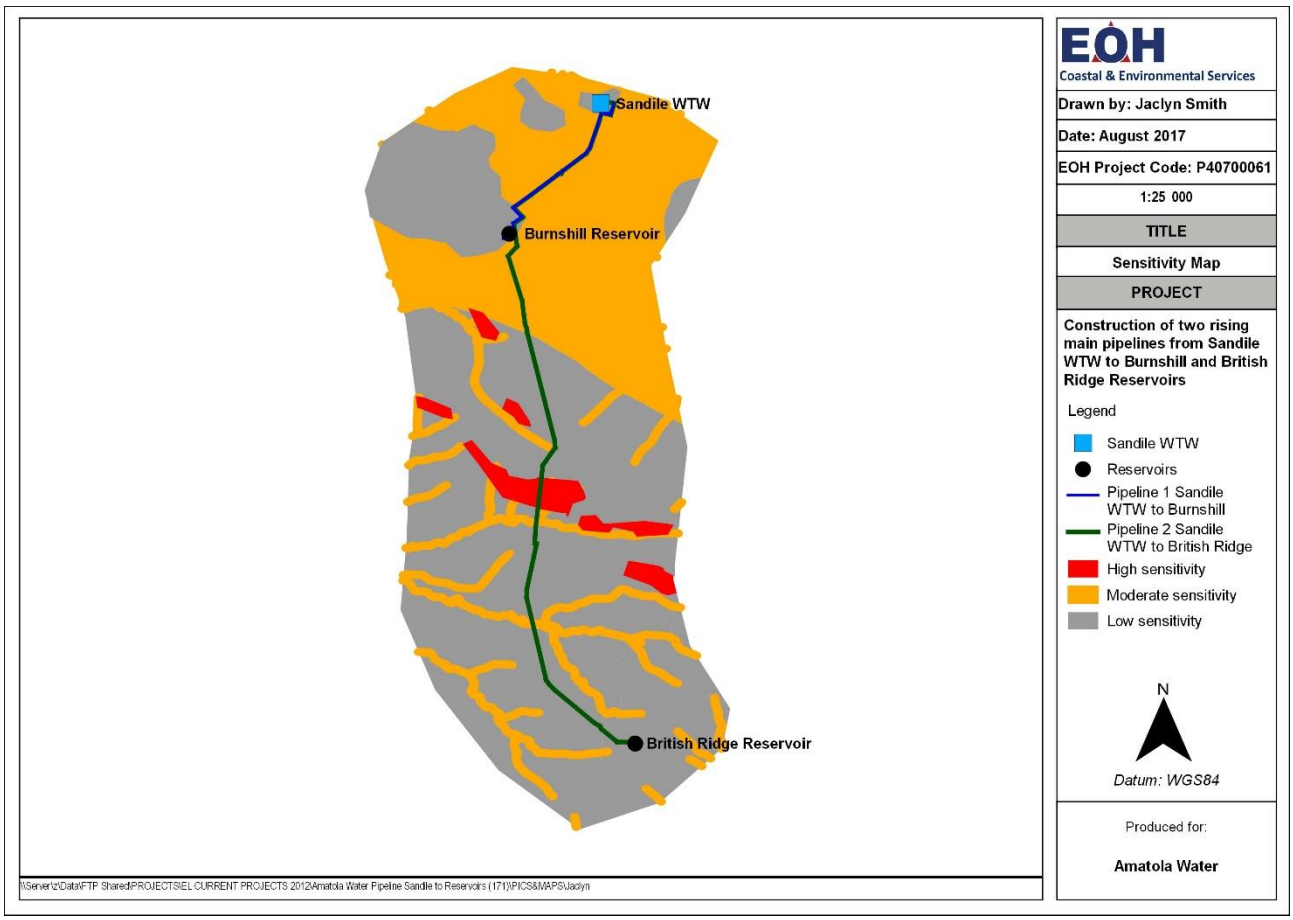

Figure 6.1. Sensitivity map for areas surrounding the proposed pipeline routes.

6.2 Issues identified

The following issues were identified during the sensitivity assessment of the proposed project.

Table 6.2: Issues identified during the sensitivity assessment of the proposed study site and the different phases of development.

MIND MAP: Ecological Impact for the proposed pipeline routes				
THEMES	**CATEGORIES**	**PLANNING & DESIGN PHASE**	**CONSTRUCTION PHASE**	**OPERATIONAL PHASE**
Ecological Environments	Legal and policy compliance	**X**		
	Stormwater management and erosion	**X**	**X**	**X**
	Riparian Vegetation		**X**	
	Loss of natural vegetation	**X**	**X**	**X**
	Loss of SCC	**X**	**X**	**X**
	Invasion of alien species	**X**	**X**	**X**
	Rehabilitation of disturbed areas		**X**	

7 MANNER IN WHICH THE ENVIRONMENT MAY BE AFFECTED

In terms of Appendix 6(1)(1) of the EIA Regulations (2014) (amended 2017) a specialist report must contain-

(cB) A description of the existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;
(k) Any mitigation measures for inclusion in the EMPr;

7.1 Impacts identified

Ecological impacts that were identified during the Planning and Design, Construction and Operational phases of the proposed project are indicated in Table 7.1. These included the consideration of direct, indirect and cumulative impacts that may occur.

Table 7.1: Impacts identified during the phases of the proposed project.

Categories	Applicability to each phase		
	Planning and Design	**Construction**	**Operation**
Legal and policy compliance	YES Non-compliance with the laws and policies of South Africa as they pertain to the ecological environment	N/A	N/A
Stormwater management and erosion	YES Inappropriate stormwater design may lead to erosion.	YES Extensive clearing of ground cover and inappropriate routing of stormwater may lead to soil erosion	N/A
Loss of natural vegetation	YES Unnecessary loss of vegetation.	YES Unnecessary loss of vegetation.	N/A
	NO	YES Incorrect managing of topsoil	N/A
Loss of plant SCC	YES Inappropriate design of the project infrastructure.	YES Clearing of natural vegetation may result in the loss of identified and unidentified SCC.	N/A
Invasion of alien species	YES Failure to plan for the removal and management of alien vegetation.	YES Removal of existing natural vegetation resulting in invasion by alien species.	YES Lack of effective alien management plan resulting in invasion by alien species.
Rehabilitation of disturbed areas	N/A	YES Poor rehabilitation throughout construction	YES Continued rehabilitation in open spaces.

Categories	Applicability to each phase		
	Planning and Design	**Construction**	**Operation**
		may lead to the degradation of ecosystems.	

7.2 Impact assessment

The impacts identified in Section 7.1 are assessed in terms of the criteria described in Section 2.4.7 and are summarised in the table below (Table 7.2).

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Table 7.2: Assessment and mitigation of impacts during all phases of the proposed development.

ISSUE	DESCRIPTION OF IMPACT	NATURE OF IMPACT	SPATIAL SCALE (EXTENT)	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY / BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
For all alternatives									
PLANNING & DESIGN PHASE									
ECOLOGICAL IMPACT ASSESSMENT									
Legal and policy compliance	During the planning and design phase non-compliance with the laws and policies of South Africa as they pertain to the ecological environment could lead to damage of the ecological environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the non-compliance, being brought against the proponent and his/her contractors.	**Direct, Cumulative**	**Localised**	**Short-term**	**Probable**	**Moderately severe**	**Moderate Negative**	• All legal matters pertaining to permitting must be completed prior to any construction activity. • In particular, all necessary Water Use Licences must be in order for construction activities within 32 metres of a watercourse and within 500 m of a wetland. • The relevant permits must be obtained from the competent authority in order to remove any protected plant species.	**Low Negative**
Stormwater management and erosion	During the planning and design phase the inappropriate design of stormwater structures may lead to an increase in surface soil erosion.	**Direct**	**Localised**	**Long-term**	**Possible**	**Severe**	**Moderate Negative**	• Appropriate stormwater structures must be designed to minimise erosion. • All infrastructure situated on slopes must incorporate stormwater diversion. • Flood attenuation and stormwater management plans must be drawn up by a qualified engineer and approved by DEA, the ECO and DWS. • Stormwater design must be in line with DWS requirements.	**Low Negative**
Loss of natural vegetation	During the planning and design phase the inappropriate design of the project infrastructure will lead to the unnecessary loss of natural vegetation.	**Direct, indirect, cumulative**	**Localised**	**Permanent**	**Definite**	**Moderately severe**	**Low Negative**	• The layout of the project infrastructure must have as minimal impact on natural vegetation as possible.	**Low Negative**
Loss of plant SCC	During the planning and design phase the inappropriate design of the project infrastructure will lead to the unnecessary loss of SCC.	**Direct**	**Localised**	**Permanent**	**Probable**	**Moderately severe**	**Moderate Negative**	• All plant SCC must be relocated to outside the construction footprint prior to commencement of activities. • The relevant permits must be obtained from the competent authority in order to remove any plant SCC.	**Low Negative**
Invasion of alien plant species	During the planning and design phase the failure to plan for the removal and management of alien vegetation could result in the invasion of alien vegetation in riparian areas during the construction and operation phase.	**Indirect**	**Project Level**	**Medium-term**	**Probable**	**Moderately severe**	**Moderate Negative**	• A Rehabilitation and Alien Vegetation Management Plan must be designed to reduce the establishment and spread of undesirable alien plant species.	**Low Negative**
CONSTRUCTION PHASE									
Stormwater management and erosion	During the construction phase extensive clearing of ground cover and the inappropriate routing of stormwater may lead to soil erosion.	**Direct**	**Localised**	**Medium-term**	**Possible**	**Moderately severe**	**Moderate Negative**	• The contractor must develop and implement an Erosion Action Plan. • Wind screening and stormwater control must be undertaken to prevent soil loss from the site. • All erosion control mechanisms must be regularly maintained. • Vegetation must be retained where possible to avoid soil erosion. • Construction must be phased in order to minimise the area of exposed soil at any one time. • Re-vegetation of disturbed surfaces must	**Low Negative**

ISSUE	DESCRIPTION OF IMPACT	NATURE OF IMPACT	SPATIAL SCALE (EXTENT)	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY / BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
								occur immediately after the construction activities are completed. • Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent further soil erosion.	
Loss of natural vegetation	During the construction phase the uncontrolled clearing of vegetation outside of the project footprint will result in the unnecessary loss of natural vegetation.	**Direct, Indirect, Cumulative**	**Localised**	**Permanent**	**Possible**	**Moderately severe**	**Moderate Negative**	• Construction activities must be limited to the designated project footprint. • The construction footprint must be surveyed and demarcated prior to construction commencing. • The surveyed construction footprint must be approved by an ECO to ensure that natural vegetation is not unnecessarily damaged. • Where vegetation has been cleared, site rehabilitation in terms of soil stabilisation and re-vegetation must be undertaken.	**Low Negative**
	Incorrect handling of topsoil will result in limited or no vegetation regrowth during rehabilitation							• Separate topsoil from subsoil during stockpiling. • Remove top 200mm of soil as topsoil. Rest is all subsoil. • Landscape the impacted areas with 150-200mm of topsoil on top of subsoil during rehabilitation. • Topsoil must not be stockpiled higher than 2m of for longer than 1 year.	
Loss of SCC	During the construction phase the clearing of natural vegetation may lead to the destruction of habitats and the loss of identified and unidentified plant SCC.	**Direct, Indirect, Cumulative**	**Localised**	**Permanent**	**Possible**	**Severe**	**High Negative**	• All areas that will be impacted must be surveyed by a suitably qualified botanist/ecologist prior to topsoil removal in order to locate and rescue any SCC within the area and relocate them. • No SCC must be removed from site. All SCC must be relocated immediately outside of the construction and operational footprint. • Search and rescue must be undertaken by a professional and qualified botanist. • The contractor's staff must not harvest any natural vegetation.	**Low Negative**
Invasion of Alien Species	During the construction phase the removal of natural vegetation (including riparian vegetation) creates 'open' habitats that will favour the establishment of undesirable alien plant species in areas that are typically very difficult to eradicate and may pose a threat to neighbouring natural ecosystems.	**Indirect**	**Localised**	**Long-term**	**Probable**	**Moderately severe**	**Moderate Negative**	• An Alien Management Plan must be developed and implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species. • Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting, etc. • Removal must occur prior to plants developing seeds.	**Low Negative**
Rehabilitation of Disturbed Areas	During the construction phase poor continuous rehabilitation of disturbed areas may lead to the permanent degradation of ecosystems as well as allow alien vegetation species to expand.	**Direct, Indirect, Cumulative**	**Localised**	**Long-term**	**Probable**	**Moderately severe**	**Moderate Negative**	• All impacted areas must be rehabilitated with indigenous vegetation. • Only topsoil from the immediate area must be used for rehabilitation. • All impacted areas must be restored as per the Rehabilitation Management Plan.	**Low Negative**
OPERATIONAL PHASE									
Invasion of Alien Species	During the operational phase the loss of natural vegetation will increase the	**Direct, Indirect,**	**Project level**	**Long-Term**	**Possible**	**Moderately Severe**	**Moderate Negative**	• An Alien Vegetation Management Plan must be implemented during the operational phase	**Low Negative**

ISSUE	DESCRIPTION OF IMPACT	NATURE OF IMPACT	SPATIAL SCALE (EXTENT)	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY / BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
	potential invasion by alien plant species. This coupled with the lack of an effective alien vegetation management plan may result in large scale alien plant invasion.	**Cumulative**						to reduce the establishment and spread of undesirable alien plant species. • Alien plants must be removed through appropriate methods such as hand pulling, application of chemicals, cutting, etc. as in accordance to the NEMBA: Alien Invasive Species Regulations.	
Rehabilitation of disturbed areas	During the Operational Phase, continuous rehabilitation of disturbed areas may lead to the permanent degradation of ecosystems as well as allow alien vegetation species to expand.	**Direct, Indirect, Cumulative**	**Project level**	**Long-Term**	**Possible**	**Moderately Severe**	**Moderate Negative**	• All cleared areas must be continuously rehabilitated with indigenous vegetation for 6 months after the Operational Phase of the project begins, or until such time that the ECO is satisfied the all affected areas have been rehabilitated.	**Low Negative**

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8 IMPACT STATEMENT, CONCLUSION AND RECOMMENDATIONS

In terms of Appendix 6(1)(1) of the EIA Regulations (2014) (amended 2017) a specialist report must contain-

(l) any conditions for inclusion in the environmental authorisation;
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;
(n)a reasoned opinion-
(i) whether the proposed activity, activities or portions thereof should be authorised;
(iA) regarding the acceptability of the proposed activity or activities; and
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;
(q) any other information requested by the competent authority.

8.1 Conclusions

The following table summarises the change in impacts from pre- to post- mitigation for the proposed pipelines from Sandile WTW to Burnshill and British Ridge Reservoirs.

Table 8.1: Assessment of pre- and post- mitigation impact significance.

	PRE-MITIGATION				POST-MITIGATION			
	LOW	MODERATE	HIGH	VERY HIGH	LOW	MODERATE	HIGH	VERY HIGH
Planning and Design	1	4	0	0	5	0	0	0
Construction	0	4	1	0	5	0	0	0
Operational	0	2	0	0	2	0	0	0
TOTAL	1	10	1	0	12	0	0	0

It can be clearly seen that through correct mitigations the overall impact significance can be reduced from mainly Low with limited moderate and high significance to overall low significance.

It is of the specialist's opinion that the proposed pipeline routes are not fatally flawed.

8.2 Alternatives

The alternatives that were considered in this report include:

- Placing pipelines above ground where there will be watercourse crossings; and
- Trenched pipelines through the watercourses.

Both alternatives were assessed and are considered to have the same overall environmental risk given that the clearance of vegetation will be a similar amount if there is a trenched pipeline through the watercourse or a pipeline which goes above ground and avoids the watercourse.

8.3 Current status

The vegetation on the study site is intact in certain sections but not pristine around the towns and small settlements where it was found to be relatively transformed. A number of SCC's are likely to occur within the project site and will require permits before they can be removed.

8.4 Recommendations

All the mitigation measures provided below are to be implemented in the Planning and Design, Construction and Operational Phases for the proposed two proposed pipeline routes from Sandile WTW to Burnshill and British Ridge Reservoirs.

8.4.1 Planning and Design Phase

The following conditions associated with Planning and Design Phase must be implemented:

Legal and Policy Compliance
- All legal matters pertaining to permitting must be completed prior to any construction activity.
- In particular, all necessary Water Use Licences must be in order for construction activities within 32 metres of a watercourse and within 500 m of a wetland.
- The relevant permits must be obtained from the competent authority in order to remove any protected plant species.

Stormwater management and erosion
- Appropriate stormwater structures must be designed to minimise erosion.
- All infrastructure situated on slopes must incorporate stormwater diversion.
- Flood attenuation and stormwater management plans must be drawn up by a qualified engineer and approved by DEA, the ECO and DWS.
- Stormwater design must be in line with DWS requirements.

Loss of natural vegetation
- The layout of the project infrastructure must have as minimal impact on natural vegetation as possible.

Loss of plant SCC
- All plant SCC must be relocated to outside the construction footprint prior to commencement of activities.
- The relevant permits must be obtained from the competent authority in order to remove any plant SCC.

Invasion of alien plant species
- A Rehabilitation and Alien Vegetation Management Plan must be designed to reduce the establishment and spread of undesirable alien plant species.

8.4.2 Construction Phase

The following conditions associated with Construction Phase must be implemented:

Stormwater management and erosion
- The contractor must develop and implement an Erosion Action Plan.
- Wind screening and stormwater control must be undertaken to prevent soil loss from the site.
- All erosion control mechanisms must be regularly maintained.
- Vegetation must be retained where possible to avoid soil erosion.
- Construction must be phased in order to minimise the area of exposed soil at any one time.
- Re-vegetation of disturbed surfaces must occur immediately after the construction activities are completed.
- Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent further soil erosion.

Loss of natural vegetation

- Construction activities must be limited to the designated project footprint.
- The construction footprint must be surveyed and demarcated prior to construction commencing.
- The surveyed construction footprint must be approved by an ECO to ensure that natural vegetation is not unnecessarily damaged.
- Where vegetation has been cleared, site rehabilitation in terms of soil stabilisation and re-vegetation must be undertaken.
- Separate topsoil from subsoil during stockpiling.
- Remove top 200mm of soil as topsoil. Rest is all subsoil.
- Landscape the impacted areas with 150-200mm of topsoil on top of subsoil during rehabilitation.
- Topsoil must not be stockpiled higher than 2m of for longer than 1 year.

Loss of SCC

- All areas that will be impacted must be surveyed by a suitably qualified botanist/ecologist prior to topsoil removal in order to locate and rescue any SCC within the area and relocate them.
- No SCC must be removed from site. All SCC must be relocated immediately outside of the construction and operational footprint.
- Search and rescue must be undertaken by a professional and qualified botanist.
- The contractor's staff must not harvest any natural vegetation.

Invasion of alien species

- An Alien Management Plan must be developed and implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species.
- Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting, etc.
- Removal must occur prior to plants developing seeds.

Rehabilitation of disturbed areas

- All temporarily impacted areas must be rehabilitated with indigenous vegetation.
- Only topsoil from the immediate area must be used for rehabilitation.
- All temporarily impacted areas must be restored as per the Rehabilitation Management Plan.

8.4.3 Operational Phase

The following conditions associated with the Operational Phase must be implemented:

Invasion of alien plant species

- An Alien Plant Management Plan must be implemented during the operational phase to reduce the establishment and spread of undesirable alien plant species.
- Alien plants must be removed through appropriate methods such as hand pulling, application of chemicals, cutting, etc. as in accordance to the NEMBA: Alien Invasive Species Regulations.

Rehabilitation of disturbed areas

- All cleared areas must be continuously rehabilitated with indigenous vegetation for 6 months after the Operational Phase of the project begins, or until such time that the ECO is satisfied the all affected areas have been rehabilitated.

8.5 Proposed management plans to be developed and implemented as part of the final EMPr

In summary, the following plans need to be developed as part of the final EMPr and Project monitoring, incorporating all the issues, conclusions and recommendations of this report:

- Erosion and Sediment Management Plan
- Rehabilitation and Alien Vegetation Management Plan

8.6 Environmental Statement and Opinion of the Specialist

The ecological impacts of all aspects for the proposed two proposed pipelines from Sandile WTW to Burnshill and British Ridge Reservoirs were assessed and considered to be ecologically acceptable, provided that the mitigation measures provided in this report are implemented. All impacts are rated as **MODERATE to HIGH pre-mitigation** (Table 8.1), therefore implementation of recommended mitigation measures coupled with comprehensive rehabilitation and monitoring in terms of re-vegetation and restoration is an important element of the mitigation strategy. Implementing the recommended mitigations measures will **reduce impacts to LOW**.

9 REFERENCES

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APPENDIX A

Family	Species	Threat status	Lifecycle	Growth forms
ACANTHACEAE	*Hypoestes aristata*	LC	Perennial	Shrub
ACANTHACEAE	*Hypoestes triflora (Forssk.) Roem. & Schult.*	LC	Perennial	Dwarf shrub, herb
ACANTHACEAE	*Isoglassa eckloniana*	LC	Perennial	Small Shrub
ACANTHACEAE	*Isoglossa woodii*	LC	Perennial	Shrub, small tree
ACHARIACEAE	*Kiggelaria africana L.*	LC	Perennial	Shrub, tree
AGAVACEAE	*Chlorophytum comosum*	LC	Perennial	Shrub, herb
AMARYLLIDACEAE	*Brunsvigia grandiflora Lindl.*	PNCO: Protected	Perennial	Geophyte
AMARYLLIDACEAE	*Cyrtanthus brachyscyphus Baker*	PNCO: Protected	Perennial	Geophyte
AMARYLLIDACEAE	*Cyrtanthus breviflorus Harv.*	PNCO: Protected	Perennial	Geophyte
AMARYLLIDACEAE	*Nerine filifolia Baker*	PNCO: Protected	Perennial	Geophyte
AMARYLLIDACEAE	*Nerine undulata (L.) Herb.*	PNCO: Protected	Perennial	Geophyte
ANACARDIACEAE	*Harpephyllum caffrum*	LC		Tree
ANACARDIACEAE	*Protorhus longifolia*	LC		Tree
ANACARDIACEAE	*Searsia chirindensis*	LC		Tree
ANACARDIACEAE	*Searsia gueinzii (Sond.) F.A.Barkley*	LC	Perennial	Shrub, tree
ANACARDIACEAE	*Searsia lucida (L.) F.A.Barkley forma lucida*	Not Evaluated	Perennial	Shrub, tree
ANTHERICACEAE	*Chlorophytum capense (L.) Voss*	LC	Perennial	Herb
APIACEAE	*Afrosciadium platycarpum (Sond.) P.J.D.Winter*	LC	Perennial	Herb
APIACEAE	*Alepidea capensis (P.J.Bergius) R.A.Dyer var. capensis*	LC	Perennial	Herb
APIACEAE	*Centella eriantha*	LC	Perennial	Shrub
APIACEAE	*Heteromorpha trifoliata*			Tree
APIACEAE	*Sanicula alata*	LC	Perennial	Herb
APOCYNACEAE	*Acokanthera oblongifolia (Hochst.) Codd*	PNCO: Protected	Perennial	Shrub, tree
APOCYNACEAE	*Acokanthera oppositifolia (Lam.) Codd*	PNCO: Protected	Perennial	Shrub, tree
APOCYNACEAE	*Carissa bispinosa*	PNCO: Protected	Perennial	Shrub, tree
APOCYNACEAE	*Cynanchum ellipticum*	PNCO: Protected	Perennial	Climber
APOCYNACEAE	*Secamone alpini Schult.*	PNCO: Protected	Perennial	Climber

APOCYNACEAE	*Strophanthus speciosus*	PNCO: Protected	Perennial	Tree, Shrub
AQUIFOLIACEAE	*Ilex mitis*	PNCO: Protected	Perennial	Shrub, tree
ARALIACEAE	*Cussonia spicata Thunb.*	LC	Perennial	Schrub, tree
ARALIACEAE	*Cussonia thyrsiflora Thunb.*	LC	Perennial	Shrub, succulent, tree
ASPARAGACEAE	*Asparagus asparagoides*	LC	Perennial	Shrub
ASPARAGACEAE	*Asparagus densus*			Not evaluated
ASPARAGACEAE	*Asparagus setaceus*	LC	Perennial	Shrub
ASPARAGACEAE	*Asparagus virgatus*	LC	Perennial	Shrub
ASPARAGACEAE	*Behnia reticulata*	LC	Perennial	Shrub
ASPHODELACEAE	*Aloe ferox Mill.*	LC		Succulent
ASPHODELACEAE	*Haworthia cooperi Baker var. pilifera (Baker) M.B.Bayer*	LC	Perennial	Succulent
ASPHODELACEAE	*Haworthia cymbiformis (Haw.) Duval var. cymbiformis*	LC	Perennial	Succulent
ASPHODELACEAE	*Haworthia cymbiformis (Haw.) Duval var. setulifera (Poelln.) M.B.Bayer*	DDT	Perennial	Succulent
ASPHODELACEAE	*Kniphofia fibrosa Baker*	LC	Perennial	Herb
ASPHODELACEAE	*Kniphofia rooperi (T.Moore) Lem.*	LC	Perennial	Herb
ASPHODELACEAE	*Kniphofia uvaria (L.) Oken*	LC	Perennial	Herb
ASPLENIACEAE	*Asplenium aethiopicum (Burm.f.) Bech.*	LC	Perennial	Epiphyte, geophyte, herb, lithophyte
ASPLENIACEAE	*Asplenium erectum*	LC	Perennial	Epiphyte
ASPLENIACEAE	*Asplenium lunulatum*	LC	Perennial	Epiphyte
ASPLENIACEAE	*Asplenium protensum Schrad.*	LC	Perennial	Epiphyte, herb, lithophyte
ASPLENIACEAE	*Asplenium rutifolium*	LC	Perennial	Epiphyte
ASPLENIACEAE	*Asplenium simii*	LC	Perennial	Epiphyte
ASPLENIACEAE	*Asplenium varians Wall. ex Hook. & Grev. subsp. fimbriatum (Kunze) Schelpe*	LC	Perennial	Geophyte, herb, lithophyte
ASTERACEAE	*Arrowsmithia styphelioides DC.*	LC	Perennial	Dwarf shrub
ASTERACEAE	*Brachylaena elliptica*	LC		Shrub
ASTERACEAE	*Brachylaena glabra*	LC		Shrub
ASTERACEAE	*Cirsium vulgare (Savi) Ten.*	Not Evaluated	Annual	Herb
ASTERACEAE	*Denekia capensis Thunb.*	LC	Perennial	Herb

ASTERACEAE	*Dimorphotheca barberae Harv.*	LC	Perennial	Herb
ASTERACEAE	*Garuleum sonchifolium (DC.) Norl.*	LC	Perennial	Herb, shrub
ASTERACEAE	*Haplocarpha nervosa (Thunb.) Beauverd*	LC	Perennial	Herb
ASTERACEAE	*Helichrysum anomalum Less.*	LC	Perennial	Dwarf shrub
ASTERACEAE	*Helichrysum argyrophyllum DC.*	LC	Perennial	Dwarf shrub
ASTERACEAE	*Helichrysum felinum Less.*	LC	Perennial	Herb
ASTERACEAE	*Helichrysum foetidum (L.) Moench var. foetidum*	Not Evaluated	Biennial	Herb
ASTERACEAE	*Helichrysum rosum (P.J.Bergius) Less. var. rosum*	LC	Perennial	Dwarf shrub, shrub
ASTERACEAE	*Helichrysum rugulosum Less.*	LC	Perennial	Herb
ASTERACEAE	*Macowania revoluta Oliv.*	DDD	Perennial	Shrub
ASTERACEAE	*Nidorella auriculata DC.*	LC	Perennial	Herb
ASTERACEAE	*Oligocarpus calendulaceus (L.f.) Less.*	LC	Annual	Herb
ASTERACEAE	*Osteospermum grandidentatum DC.*	LC	Perennial	Herb
ASTERACEAE	*Schistostephium flabelliforme Less.*	LC	Perennial	Shrub
ASTERACEAE	*Senecio adnatus DC.*	LC	Perennial	Herb
ASTERACEAE	*Senecio brachypodus*	LC	Perennial	Climber
ASTERACEAE	*Senecio deltoideus*	LC	Perennial	Climber
ASTERACEAE	*Senecio ilicifolius L.*	LC	Perennial	Herb, shrub
ASTERACEAE	*Senecio oxyodontus DC.*	LC	Perennial	Herb, shrub, succulent
ASTERACEAE	*Senecio quinquelobus*	LC	Perennial	Climber
ASTERACEAE	*Senecio rosmarinifolius L.f.*	LC	Perennial	Dwarf shrub, shrub
ASTERACEAE	*Senecio serratuloides DC.*	LC	Perennial	Herb
ASTERACEAE	*Senecio speciosus Willd.*	LC	Perennial	Herb
ASTERACEAE	*Senecio tamoides*	LC	Perennial	Climber
ASTERACEAE	*Syncarpha striata (Thunb.) B.Nord.*	LC	Perennial	Shrub
ASTERACEAE	*Tarchonanthus camphoratus*	LC	Perennial	Shrub, small tree
ASTERACEAE	*Vernonia mespilifolia*		Perennial	Shrub, tree
AYTONIACEAE	*Asterella marginata (Nees) S.W.Arnell*		Perennial	Bryophyte
BALSAMINACEAE	*Impatiens hochstetteri Warb. subsp. hochstetteri*	LC	Annual (occ. perennial)	Herb
BLECHNACEAE	*Blechnum inflexum (Kunze) Kuhn*	LC	Perennial	Geophyte, herb

BLECHNACEAE	*Blechnum punctulatum*	LC	Perennial	Epiphyte
BORAGINACEAE	*Cynoglossum hispidum Thunb.*	LC	Biennial	Herb
BORAGINACEAE	*Ehretia rigida*	lc		
BRACHYTHECIACEAE	*Palamocladium leskeoides (Hook.) E.Britton*		Perennial	Bryophyte, epiphyte
BRASSICACEAE	*Capparis sepiaria*	LC	Perennial	Shrub, tree
BRASSICACEAE	*Heliophila elongata (Thunb.) DC.*	LC	Perennial	Dwarf shrub
BRASSICACEAE	*Maerua caffra*	LC	Perennial	Shrub, tree
BRYACEAE	*Bryum argenteum Hedw.*		Perennial	Bryophyte
BRYACEAE	*Bryum pycnophyllum (Dixon) Mohamed*		Perennial	Bryophyte, epiphyte
BUDDLEJACEAE	*Buddleja saligna Willd.*	LC	Perennial	Shrub, tree
BURSERACEAE	*Commiphora woodii*	LC	Perennial	Tree
CAMPANULACEAE	*Wahlenbergia rivularis Diels*	LC	Perennial	Herb
CELASTRACEAE	*Cassine peragua*	LC	Perennial	Tree
CELASTRACEAE	*Elaeodendron croceum*	LC	Perennial	Tree
CELASTRACEAE	*Gymnosporia acuminata*			
CELASTRACEAE	*Gymnosporia buxifolia*	LC		Shrub, tree
CELASTRACEAE	*Gymnosporia nemorosa*	LC	Perennial	Shrub, tree
CELASTRACEAE	*Maytenus acuminata*	Not Evaluated	Perennial	Tree
CELASTRACEAE	*Maytenus peduncularis (Sond.) Loes.*	LC	Perennial	Shrub, tree
CELASTRACEAE	*Maytenus procumbens*	LC	Perennial	Shrub, tree
CELASTRACEAE	*Maytenus undata*	LC	Perennial	Tree
CELASTRACEAE	*Mystroxylon aethiopicum (Thunb.) Loes. subsp. aethiopicum*	LC	Perennial	Shrub, tree
CELASTRACEAE	*Pleurostylia capensis (Turcz.) Loes.*	LC	Perennial	Shrub, tree
CELASTRACEAE	*Pterocelastrus tricuspidatus*	LC	Perennial	Tree
CELASTRACEAE	*Putterlickia pyracantha*	LC	perennial	Shrub
CELASTRACEAE	*Putterlickia verrucosa (E.Mey. ex Sond.) Szyszyl.*	LC	Perennial	Shrub, tree
CELTIDACEAE	*Celtis africana*	LC		
COMMELINACEAE	*Commelina africana*	LC	Perennial	Herb
CONVOLVULACEAE	*Cuscuta appendiculata Engelm.*	LC	Annual	Herb, parasite
CONVOLVULACEAE	*Ipomoea obscura (L.) Ker Gawl. var. obscura*	LC	Perennial	Herb

CONVOLVULACEAE	*Ipomoea purpurea (L.) Roth*	Not Evaluated	Annual	Climber, herb
CUNONIACEAE	*Cunonia capensis*	PNCO: Protected	Perennial	Tree
CUPRESSACEAE	*Cupressus sempervirens L. var. sempervirens*	Not Evaluated	[No lifecycle defined]	[No lifeform defined]
CURTISIACEAE	*Curtisia dentata*	NFA: Protected		Tree
CYPERACEAE	*Bulbostylis humilis (Kunth) C.B.Clarke*	LC	Annual	Cyperoid, herb, mesophyte
CYPERACEAE	*Cyperus albostriatus*	LC	Perennial	
CYPERACEAE	*Cyperus pulcher Thunb.*	LC	Perennial	Cyperoid, helophyte, herb, mesophyte
CYPERACEAE	*Schoenoplectus paludicola (Kunth) Palla*	LC	Perennial	Cyperoid, emergent hydrophyte, helophyte, herb
CYPERACEAE	*Schoenoxiphium lanceum*	LC		
CYPERACEAE	*Schoenoxiphium llehmannii*	LC		
DENNSTAEDTIACEAE	*Hypolepis sparsisora*	LC	Perennial	Fern
DIOSCOREACEAE	*Dioscorea retusa*	LC	Perennial	Shrub
DITRICHACEAE	*Pleuridium nervosum (Hook.) Mitt.*		Perennial	Bryophyte
DRACAENACEAE	*Sansevieria hyacinthoides (L.) Druce*	LC	Perennial	Geophyte, succulent
DRYOPTERIDACEAE	*Dryopteris inaequalis*	LC	Perennial	Fern
DRYOPTERIDACEAE	*Dryopteris lewalleana Pic.Serm.*	LC	Perennial	Geophyte, herb, lithophyte
DRYOPTERIDACEAE	*Polystichum luctuosum (Kunze) T.Moore*	LC	Perennial	Geophyte, herb, lithophyte
DRYOPTERIDACEAE	*Polystichum pungens*	LC	Perennial	Fern
DRYOPTERIDACEAE	*Rumohra adiantiformis*	LC	Perennial	Epiphyte
EBENACEAE	*Diospyros lyciodes*	LC	Perennial	Shrub, tree
EBENACEAE	*Diospyros scabrida*	LC	Perennial	Tree
EBENACEAE	*Diospyros villosa*	LC	Perennial	Tree
EBENACEAE	*Diospyros whyteana (Hiern) F.White*	LC	Perennial	Shrub, tree
EBENACEAE	*Euclea natalensis*	LC	Perennial	Tree
EBENACEAE	*Euclea schimperi*	LC	Perennial	Tree
ERICACEAE	*Erica brownleeae Bolus*	PNCO: Protected	Perennial	Shrub
EUPHORBIACEAE	*Clutia affinis Sond.*	LC	Perennial	Shrub

EUPHORBIACEAE	*Clutia heterophylla Thunb.*	LC	Perennial	Dwarf shrub, shrub
EUPHORBIACEAE	*Croton rivularis Müll.Arg.*	LC	Perennial	Shrub
EUPHORBIACEAE	*Dalechampia capensis A.Spreng.*	LC	Perennial	Dwarf shrub
EUPHORBIACEAE	*Euphorbia kraussiana*	LC	Perennial	Dward shrub, succulent
EUPHORBIACEAE	*Euphorbia squarrosa Haw.*	LC	Perennial	Dwarf shrub, shrub, succulent
EUPHORBIACEAE	*Euphorbia triangularis Desf.*	LC		Shrub, tree
EUPHORBIACEAE	*Euphorbia tridentata Lam.*	LC	Perennial	Dwarf shrub, succulent
EUPHORBIACEAE	*Excoecaria simii*	LC		Shrub
EUPHORBIACEAE	*Suregada africana (Sond.) Kuntze*	LC	Perennial	Shrub, tree
FABACEAE	*Acacia mearnsii De Wild.*	Not Evaluated	Perennial	Tree
FABACEAE	*Calpurnia aurea*			
FABACEAE	*Chamaecrista capensis (Thunb.) E.Mey. var. flavescens (Thunb.) E.Mey.*	LC	Perennial	Herb
FABACEAE	*Erythrina humeana Spreng.*	LC	Perennial	Shrub, tree
FABACEAE	*Indigofera hedyantha Eckl. & Zeyh.*	LC	Perennial	Herb
FABACEAE	*Lotononis pulchella (E.Mey.) B.-E.van Wyk*	LC	Perennial	Dwarf shrub, shrub
FABACEAE	*Melolobium microphyllum (L.f.) Eckl. & Zeyh.*	LC	Perennial	Dwarf shrub, shrub
FABACEAE	*Rhynchosia harveyi Eckl. & Zeyh.*	LC	Perennial	Climber, herb
FABACEAE	*Schotia latifolia Jacq.*	LC	Perennial	Tree
FABACEAE	*Trifolium burchellianum Ser. subsp. burchellianum*	LC	Perennial	Herb
FABACEAE	*Vachellia natalitia*	LC		Tree
FUNARIACEAE	*Funaria rottleri (Schwägr.) Broth.*		Annual (occ. perennial)	Bryophyte
GENTIANACEAE	*Sebaea leiostyla Gilg*	LC	Annual (occ. perennial)	Herb
GERANIACEAE	*Pelargonium alchemilloides (L.) L'Hér.*	LC	Perennial	Dwarf shrub
GERANIACEAE	*Pelargonium cordifolium (Cav.) Curtis*	LC	Perennial	Shrub
GESNERIACEAE	*Streptocarpus rexii*	PNCO: Protected	Perennial	Herb
GRIMMIACEAE	*Grimmia laevigata (Brid.) Brid.*		Perennial	Bryophyte
GUNNERACEAE	*Gunnera perpensa L.*	Declining	Perennial	Herb, hydrophyte
HAMAMELIDACEAE	*Trichocladus crinitus*	LC	Perennial	Small shrub

HAMAMELIDACEAE	*Trichocladus ellipticus Eckl. & Zeyh. subsp. ellipticus*	LC	Perennial	Shrub, tree
HYACINTHACEAE	*Drimia calcarata (Baker) Stedje*	LC	Perennial	Geophyte
HYACINTHACEAE	*Ornithogalum juncifolium Jacq. var. juncifolium*	LC	Perennial	Geophyte, succulent
HYMENOPHYLLACEAE	*Hymenophyllum capense Schrad.*	LC	Perennial	Epiphyte, herb, lithophyte
HYPOPTERYGIACEAE	*Hypopterygium tamarisci (Sw.) Brid. ex Müll.Hal.*		Perennial	Bryophyte, epiphyte
ICACINACEAE	*Apodytes dimidiata*	NFA: Protected		
IRIDACEAE	*Dietes iridioides*	PNCO: Protected	Perennial	Herb
IRIDACEAE	*Hesperantha coccinea (Backh. & Harv.) Goldblatt & J.C.Manning*	PNCO: Protected	Perennial	Geophyte, herb
IRIDACEAE	*Hesperantha pulchra Baker*	PNCO: Protected	Perennial	Geophyte, herb
IRIDACEAE	*Moraea polystachya (Thunb.) Ker Gawl.*	PNCO: Protected	Perennial	Geophyte, herb
IRIDACEAE	*Watsonia angusta Ker Gawl.*	PNCO: Protected	Perennial	Geophyte, herb
JUBULACEAE	*Frullania arecae (Spreng.) Gottsche*	LC	Perennial	Bryophyte
LAMIACEAE	*Mentha longifolia (L.) Huds. subsp. capensis (Thunb.) Briq.*	LC	Perennial	Herb
LAMIACEAE	*Plectranthus ambiguus (Bolus) Codd*	LC	Perennial	Dwarf shrub, herb
LAMIACEAE	*Plectranthus ecklonii Benth.*	LC	Perennial	Shrub
LAMIACEAE	*Plectranthus fruticosus L'Hér.*	LC	Perennial	Herb, shrub
LAMIACEAE	*Plectranthus grallatus Briq.*	LC	Perennial	Herb
LAMIACEAE	*Rabdosiella calycina (Benth.) Codd*	LC	Perennial	Herb
LAMIACEAE	*Stachys aethiopica L.*	LC	Perennial	Herb
LAMIACEAE	*Stachys caffra E.Mey. ex Benth.*	LC	Perennial	Shrub
LAMIACEAE	*Stachys dregeana Benth.*	LC	Perennial	Herb
LAMIACEAE	*Stachys graciliflora C.Presl*	LC	Perennial	Herb
LAMIACEAE	*Stachys grandifolia E.Mey. ex Benth.*	LC	Perennial	Herb
LAMIACEAE	*Stachys humifusa Burch. ex Benth.*	LC	Perennial	Herb
LAMIACEAE	*Syncolostemon densiflorus Benth.*	LC	Perennial	Shrub
LAMIACEAE	*Syncolostemon teucriifolius (Hochst.) D.F.Otieno*	LC	Perennial	Herb
LAMIACEAE	*Teucrium trifidum Retz.*	LC	Perennial	Herb
LAURACEAE	*Cryptocarya woodii*	LC	Perennial	Shrub, small tree
LOBELICACEAE	*Cyphia digitata*	LC	Perennial	Geophyte

LOGANIACEAE	*Strychnos henningsii*	LC	Perennial	Shrub, tree
LYCOPODIACEAE	*Huperzia gnidioides (L.f.) Trevis.*	LC	Perennial	Epiphyte, herb, lithophyte
MAESACEAE	*Maesa alnifolia Harv.*	LC	Perennial	Shrub
MALVACEAE	*Grewia occidentalis*	LC	Perennial	Tree
MALVACEAE	*Hermannia parviflora Eckl. & Zeyh.*	LC	Perennial	Dwarf shrub
MELIACEAE	*Ekebergia capensis*	LC	Perennial	Tree
MELIANTHACEAE	*Melianthus dregeanus Sond. subsp. dregeanus*	LC	Perennial	Shrub
MELIANTHACEAE	*Melianthus major L.*	LC	Perennial	Shrub
MENYANTHACEAE	*Nymphoides thunbergiana (Griseb.) Kuntze*	LC	Perennial	Hydrophyte
MESEMBRYANTHEMACEAE	*Aptenia cordata*	PNCO: Protected NFA: Protected		Groundcover
MESEMBRYANTHEMACEAE	*Bergeranthus concavus L.Bolus*	PNCO: Protected	Perennial	Succulent
METZGERIACEAE	*Metzgeria furcata (L.) Dumort.*		Perennial	Bryophyte
MNIACEAE	*Pohlia elongata Hedw.*		Perennial	Bryophyte
MONIMIACEAE	*Xymalos monospora*	LC		Tree
MORACEAE	*Ficus sur*	LC	Perennial	Tree
MYRSINACEAE	*Myrsine africana L.*	LC	Perennial	Shrub
MYRSINACEAE	*Rapanea melanophloeos*	LC		Tree
MYRTACEAE	*Eugenia capensis (Eckl. & Zeyh.) Sond. subsp. capensis*	LC	Perennial	Shrub, tree
NECKERACEAE	*Orthostichella pandurifolia (Müll.Hal) W.R.Buck*		Perennial	Bryophyte, epiphyte
OCHNACEAE	*Ochna arborea*	LC	Perennial	Shrub, tree
OCHNACEAE	*Ochna natalitia*	LC	Perennial	Tree
OCHNACEAE	*Ochna serrulata*	LC	Perennial	Shrub
OLEACEAE	*Chionanthus foveolatus*	LC	Perennial	Tree
OLEACEAE	*Chionanthus peglerae*	LC	perennial	Tree
OLEACEAE	*Jasminium angulare*	LC	Perennial	Creeper, shrub
OLEACEAE	*Olea capensis*	LC		
OLEACEAE	*Olea europaea*	LC	Perennial	Tree
OLEACEAE	*Olea woodiana*	LC	Perennial	Tree
ORCHIDACEAE	*Calanthe sylvatica (Thouars) Lindl.*	PNCO: Protected	Perennial	Herb, succulent
ORCHIDACEAE	*Habenaria arenaria Lindl.*	PNCO: Protected	Perennial	Geophyte, herb

ORCHIDACEAE	*Holothrix orthoceras (Harv.) Rchb.f.*	PNCO: Protected	Perennial	Geophyte, herb
ORCHIDACEAE	*Holothrix scopularia (Lindl.) Rchb.f.*	PNCO: Protected	Perennial	Geophyte, herb
ORCHIDACEAE	*Polystachya pubescens (Lindl.) Rchb.f.*	PNCO: Protected	Perennial	Epiphyte, herb, succulent
OROBANCHACEAE	*Melasma scabrum P.J.Bergius var. scabrum*	LC	Perennial	Herb, parasite
PHYLLANTHACEAE	*Lachnostylis hirta*	LC		Tree
PIPERACEAE	*Peperomia rotundifolia (L.) Kunth*	LC	Perennial	Epiphyte, herb, succulent
PITTOSPORACEAE	*Pittosporum undulatum Vent.*	Not Evaluated	Perennial	Tree
PITTOSPORACEAE	*Pittosporum viridiflorum Sims*	LC NFA: Protected	Perennial	Shrub, tree
PLUMBAGINACEAE	*Plumbago auriculata*	LC	Perennial	Shrub
POACEAE	*Andropogon appendiculatus Nees*	LC	Perennial	Graminoid
POACEAE	*Anthoxanthum ecklonii (Nees ex Trin.) Stapf*	LC	Perennial	Graminoid
POACEAE	*Aristida congesta Roem. & Schult. subsp. congesta*	LC	Perennial	Graminoid
POACEAE	*Brachypodium flexum Nees*	LC	Perennial	Graminoid
POACEAE	*Cymbopogon pospischilii (K.Schum.) C.E.Hubb.*	Not Evaluated	Perennial	Graminoid
POACEAE	*Digitaria ternata (A.Rich.) Stapf*	LC	Annual	Graminoid
POACEAE	*Ehrharta calycina Sm.*	LC	Perennial (occ. annual)	Graminoid
POACEAE	*Eragrostis patentissima Hack.*	LC	Perennial	Graminoid
POACEAE	*Eragrostis planiculmis Nees*	LC	Perennial	Graminoid
POACEAE	*Imperata cylindrica (L.) Raeusch.*	LC	Perennial	Graminoid
POACEAE	*Koeleria capensis (Steud.) Nees*	LC	Perennial	Graminoid
POACEAE	*Oplismenus hirtellus*	LC	Perennial	
POACEAE	*Oplismenus undulatifolius (Ard.) Roem. & Schult.*	LC	Perennial	Graminoid
POACEAE	*Panicum aequinerve Nees*	LC	Annual (occ. perennial)	Graminoid, scrambler
POACEAE	*Panicum deustum*	LC	Perennial	
POACEAE	*Panicum subalbidum Kunth*	LC	Annual (occ. perennial)	Graminoid
POACEAE	*Poa binata Nees*	LC	Perennial	Graminoid
POACEAE	*Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. torta (Stapf) Clayton*	LC	Perennial	Graminoid
POACEAE	*Stiburus alopecuroides (Hack.) Stapf*	LC	Perennial	Graminoid

POACEAE	*Stipa dregeana Steud. var. dregeana*	LC	Perennial	Graminoid
POACEAE	*Tragus berteronianus Schult.*	LC	Annual	Graminoid
PODOCARPACEAE	*Podocarpus falcatus*	LC NFA: Protected	Perennial	Tree
PODOCARPACEAE	*Podocarpus latifolius*	LC NFA: Protected		Tree
POLYGALACEAE	*Polygala asbestina Burch.*	LC	Perennial	Dwarf shrub, herb
POLYGALACEAE	*Polygala virgata Thunb. var. decora (Sond.) Harv.*	LC	Perennial	Dwarf shrub, shrub
POLYPODIACEAE	*Pleopeltis polypodioides (L.) E.G.Andrews & Windham subsp. ecklonii (Kunze) J.P.Roux*	LC	[No lifecycle defined]	Epiphyte, herb, lithophyte
POLYPODIACEAE	*Polypodium luctosum*			
POLYTRICHACEAE	*Polytrichum juniperinum Hedw.*		Perennial	Bryophyte
POTTIACEAE	*Didymodon tophaceus (Brid.) Lisa*		Perennial	Bryophyte
POTTIACEAE	*Trichostomum brachydontium Bruch*		Perennial	Bryophyte
POTTIACEAE	*Weissia controversa Hedw.*		Perennial	Bryophyte
PROTEACEAE	*Protea caffra Meisn. subsp. caffra*	LC	Perennial	Shrub, tree
PROTEACEAE	*Protea subvestita N.E.Br.*	VU	Perennial	Shrub
PTERIDACEAE	*Adiantum aethiopicum*	LC	Perennial	Epiphyte
PTERIDACEAE	*Cheilanthes bergiana*	LC	Perennial	Epiphyte
PTERIDACEAE	*Cheilanthes viridis*	LC	Perennial	Epiphyte
PTERIDACEAE	*Pteris buchananii*	LC	Perennial	Epiphyte
PTERIDACEAE	*Pteris cretica*	LC	Perennial	Epiphyte
RACOPILACEAE	*Racopilum capense Müll.Hal. ex Broth.*		Perennial	Bryophyte, epiphyte
RADULACEAE	*Radula lindenbergiana Gottsche ex C.Hartm.*		Perennial	Bryophyte, epiphyte
RANUNCULACEAE	*Ranunculus multifidus*	LC	Perennial	Groundcover
RESTIONACEAE	*Elegia asperiflora (Nees) Kunth*	LC	Perennial	Dwarf shrub, restioid
RESTIONACEAE	*Restio paniculatus Rottb.*	LC	[No lifecycle defined]	[No lifeform defined]
RHAMNACEAE	*Phylica paniculata Willd.*	LC	Perennial	Shrub, tree
RHAMNACEAE	*Rhamnus prinoides*	LC	Perennial	tree
RHAMNACEAE	*Scutia myrtina*	LC	Perennial	Shrub
RHAMNACEAE	*Ziziphus mucronata Willd. subsp. mucronata*	LC	Perennial	Shrub, tree

RHIZOPHORACEAE	*Cassipourea flanaganii (Schinz) Alston*	EN	Perennial	Shrub, tree
RICCIACEAE	*Riccia simii Perold*		Perennial	Bryophyte
ROSACEAE	*Rubus apetalus Poir. var. apetalus*	Not Evaluated	Perennial	Scrambler, shrub
RUBIACEAE	*Bruchellia bubalina*	LC	Perennial	Shrub, tree
RUBIACEAE	*Canthium ciliatum*	LC	Perennial	Shrub, tree
RUBIACEAE	*Canthium inerme*	LC	Perennial	Tree
RUBIACEAE	*Canthium mundianum*	LC	Perennial	Tree
RUBIACEAE	*Galopina circaeoides*	LC	Perennial	Herb
RUBIACEAE	*Gardenia thunbergia*	LC		Shrub, small tree
RUBIACEAE	*Hypercanthus amoenus*	LC		
RUBIACEAE	*Pavetta lanceolata*	LC	Perennial	Shrub, tree
RUBIACEAE	*Psychotria capensis*	Not Evaluated	Perennial	Shrub, small tree
RUBIACEAE	*Psydrax obovata*	LC	Perennial	Tree
RUBIACEAE	*Rothmannia capensis*	LC	perennial	Tree
RUSCACEAE	*Dracaena alectriformis*	LC	Perennial	Tree
RUTACEAE	*Calodendrum capense*	LC	Perennial	Shrub, small tree
RUTACEAE	*Clausena anisata (Willd.) Hook.f. ex Benth. var. anisata*	LC	Perennial	Shrub, tree
RUTACEAE	*Ptaeroxylon obliquum*	LC	Perennial	Shrub, tree
RUTACEAE	*Teclea natalensis (Sond.) Engl.*	LC	Perennial	Shrub, tree
RUTACEAE	*Vepris lanceolata*	LC	Perennial	Shrub, tree
RUTACEAE	*Zanthoxylum davyi*	LC		Tree
RUTACEAE	*Zanthoxylum capense*	LC		Tree
SALICACEAE	*Dovyalis caffra*	LC	Perennial	Small tree
SALICACEAE	*Dovyalis lucida Sim*	LC	Perennial	Shrub, tree
SALICACEAE	*Dovaylis rhamnoides*		Perennial	Shrub, tree
SALICACEAE	*Dovyalis zeyheri*	LC	Perennial	Tree
SALICACEAE	*Scolopia flanaganii (Bolus) Sim*	LC	Perennial	Shrub, tree
SALICACEAE	*Scolopia mundii (Eckl. & Zeyh.) Warb.*	LC	Perennial	Shrub, tree
SALICACEAE	*Scolopia zeyheri (Nees) Harv.*	LC	Perennial	Shrub, tree
SALICACEAE	*Trimeria grandifolia*	LC	Perennial	Shrub, small tree

SALICACEAE	*Trimeria trinervis*	LC		
SALVADORACEAE	*Azima tetracantha*	LC	Perennial	Shrub
SANTALACEAE	*Thesium angulosum DC.*	LC	Perennial	Parasite, shrub
SAPINDACEAE	*Allophylus decipiens*	LC	Perennial	Tree
SAPINDACEAE	*Hippobromus pauciflorus*	LC	Perennial	Tree
SAPOTACEAE	*Mimusops obovata Nees ex Sond.*	LC	Perennial	Shrub, tree
SAPOTACEAE	*Sideroxylon inerme*	LC NFA: Protected		Tree
SCROPHULARIACEAE	*Diclis reptans Benth.*	LC	Perennial (occ. annual)	Herb
SCROPHULARIACEAE	*Jamesbrittenia albanensis Hilliard*	LC	Perennial	Dwarf shrub
SCROPHULARIACEAE	*Nemesia denticulata (Benth.) Grant ex Fourc.*	LC	Perennial	Herb
SCROPHULARIACEAE	*Selago dolosa Hilliard*	LC	Perennial	Dwarf shrub
SCROPHULARIACEAE	*Selago geniculata L.f.*	LC	Perennial	Dwarf shrub
SPHAGNACEAE	*Sphagnum truncatum Hornsch.*		Perennial	Bryophyte, hydrophyte
STILBACEAE	*Halleria lucida*	LC	Perennial	
STILBACEAE	*Nuxia floribunda*	LC	Perennial	Tree
THELYPTERIDACEAE	*Amauropelta bergiana (Schltdl.) Holttum var. bergiana*	LC	Perennial	Geophyte, herb, lithophyte
THELYPTERIDACEAE	*Christella dentata (Forssk.) Brownsey & Jermy*	LC	Perennial	Geophyte, herb
THELYPTERIDACEAE	*Cyclosorus interruptus (Willd.) H.Itô*	LC	Perennial	Herb, hydrophyte
THELYPTERIDACEAE	*Stegnogramma pozoi (Lag.) K.Iwats.*	LC	Perennial	Geophyte, herb, lithophyte
THYMELAEACEAE	*Englerodaphne pilosa*	LC	Perennial	Tree
THYMELAEACEAE	*Gnidia chrysophylla Meisn.*	VU	Perennial	Dwarf shrub, shrub
THYMELAEACEAE	*Struthiola parviflora Bartl. ex Meisn.*	LC	Perennial	Dwarf shrub, shrub
ULMACEAE	*Celtis africana*	LC		Tree
ULMACEAE	*Chaetacme aristata*	LC		
URTICACEAE	*Didymodoxa caffra (Thunb.) Friis & Wilmot-Dear*	LC	Annual	Herb
VERBENACEAE	*Lantana rugosa Thunb.*	LC	Perennial	Shrub
VERBENACEAE	*Verbena aristigera S.Moore*	Not Evaluated	Perennial	Herb
VITACEAE	*Rhoicissus digitata*	LC	Perennial	Climber

VITACEAE	*Rhoicissus revoilii Planch.*	LC	Perennial	Climber, shrub, tree
VITACEAE	*Rhoicissus tomentosa*	LC	Perennial	Climber
VITACEAE	*Rhoicissus tridentata (L.f.) Wild & R.B.Drumm. subsp. tridentata*	Not Evaluated	Perennial	Shrub
ZAMIACEAE	*Encephalartos altensteinii Lehm.*	Red data list: Vulnerable PNCO: Protected	Perennial	Tree
	Barthramia compacta			
	Orthotrichum armatum			