APPENDIX D:

SPECIALIST REPORTS

DRIEFONTEIN PIPE LINE: VEGETATION ASSESSMENT OF THE PROPOSED ALIGNMENT

FINAL REPORT

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ECOLOGICAL AND VEGETATION ASSESSMENT OF THE PROPOSED DRIEFONTEIN WATER PIPE LINE AND ANCILLARY INFRASTRUCTURE, EXTENDING FROM LADYSMITH (EMNAMBITHI LOCAL MUNICIPALITY) TO EKUVUKHENI (INDAKA LOCAL MUNICIPALITY)

FINAL REPORT

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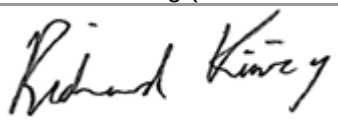
Signature:	
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Declaration

We, Dr. Richard Grant Kinvig and David Styles, **declare that we** –

- act as independent consultants in the field of Ecology and Botany and have undertaken the **Ecological and Vegetation Assessment** for the site identified for assessment for the proposed development known as the Driefontein Pipe Line in the **Uthukela District Municipality**;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not

ECOLOGICAL AND VEGETATION ASSESSMENT OF THE PROPOSED DRIEFONTEIN WATER PIPE LINE AND ANCILLARY INFRASTRUCTURE, EXTENDING FROM LADYSMITH (EMNAMBITHI LOCAL MUNICIPALITY) TO EKUVUKHENI (INDAKA LOCAL MUNICIPALITY) FINAL REPORT

1. INTRODUCTION

SiVEST Environmental Division in conjunction with **David Styles Vegetation Surveys, Advice and Consulting.** The reason for the collaboration was in order to alleviate any potential that existed for inferred bias, because the vegetation specialist and the Environmental Impact Assessment Practitioner work for the same company.

2. PROJECT DESCRIPTION & MOTIVATION

Uthukela District Municipality proposes to construct approximately 56 kilometres of potable bulk water pipe mains ranging between 500 & 600 mm Ø from the existing Observation Hill reservoir site in Ladysmith to Hobsland in the Driefontein Complex, from where it will extend further to the existing Zandbult Reservoir at Ekuvukheni, including the construction of a new 5 Ml reservoir along the pipe route to aid as a balancing and storage structure.

The proposed pipe line forms part of a larger project, which aims to upgrade infrastructure and supply potable water to the greater part of the uThukela District Municipality area. This pipeline will provide potable water to a number of communities in the greater Emnambithi and Indaka Local Municipality areas. This project will improve the infrastructure and services in the area, as well as to improve the lifestyle of the communities. In turn will potentially promote Local Economic Development.

3. TERMS OF REFERENCE

The following Terms of Reference were provided by KSEMS regarding the requirements for the assessments.

- *Undertake a vegetation and ecological assessment of the proposed pipe line alignment, which will result in the provision of water to a number of communities both within the Emnambithi and Indaka Local Municipality*.

Further to the Terms of Reference, the following protocol is extracted from the National Environmental Management Act, Act 108 of 1998. The relevant Section is **Section 32** and is included below for your ease of reference.

Specialist reports and reports on specialised processes

32.

(1) An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.

(2) the Person referred to in sub-regulation (1) must comply with the requirements of Regulation 17.

(3) A specialist report or a report on a specialised process prepared in terms of these Regulations must contain –

(a) details of –

(i) the person who prepared the report; and

(ii) the expertise of that person to carry out the specialist study or specialised process;

(b) a declaration that the person 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;
(d) a description of the methodology adopted in preparing the report or carrying out the specialised process;
(e) a description of any assumptions made and any uncertainties or gaps in knowledge;
(f) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
(h) a description of any consultation process that was undertaken during the course of carrying out the study;
(i) a summary and copies of any comments that were received during any consultation process, and;
(j) any other information requested by the competent authority.

4. METHODOLOGY

4.1. Vegetation Sampling

A random vegetation sampling technique was employed along with a detailed drive through assessment and a "hotspot" assessment. Once the initial desktop assessment was undertaken areas were identified from the mapping that indicated areas which were considered to be of potential conservation significance. At each sample point/area, individual plant species observed were recorded to give an indication of species diversity and assemblage. Please note that the intensity of the sampling procedure is prescribed by budgetary constraints. The sampling procedure proposed for this study is satisfactory for providing a general overview and rapid assessment of the plant diversity and assemblages that occur along the pipe alignment.

A site assessment was conducted on the 23rd and 24th of January 2013, during which areas identified were sampled.

Please note that the majority of pipe line runs in close proximity to the road reserve or within close proximity to the railway line which runs between Ladysmith and Newcastle. It must be clearly stated that the majority of the route is dominated by degraded open grasslands; secondary degraded woody vegetation (in close proximity to Ladysmith Town) and a number of wetland systems and associated vegetation. The pipe line alignment is represented in the Map series attached at **Appendix 1**.

4.2. Conservation Importance Assessment

Within the context of this vegetation assessment, conservation importance is broadly defined as the importance of the encountered vegetation communities (vegetation fragment) as a whole in terms of the role these areas will fulfill in the preservation and maintenance of biodiversity in the local area. Biodiversity maintenance / importance are a function of the specific biodiversity attributes and noteworthiness of the vegetation communities in question and the biotic integrity and future viability of these features.

The biodiversity noteworthiness of the system is a function of the following:

- species richness/diversity;
- rarity of the system;
- conservation status of the system;
- habitat (real or potential) for Red Data Species; and
- presence of unique and/or special features,

The integrity and future viability of the system is a function of the following:

- Extent of buffer around the system;

- Connectivity of system to other natural areas in the landscape;
- Level of alteration to indigenous vegetation communities within the system;
- Level of invasive and pioneer species encroachment system; and
- Presence of hazardous and/or obstructive boundaries to fauna.

The scores for each function of biodiversity maintenance were determined according to the scoring system shown in **Table 1** below. The scores were totaled and averaged to determine the biodiversity maintenance services score. Thereafter, the overall scores were rated according to the rating scale in **Table 2** below.

Table 1. Biodiversity maintenance services score sheet (Template and Description)

	Scores				
Biodiversity Noteworthiness	**0**	**1**	**2**	**3**	**4**
Diversity	Low	Med-Low	Medium	Med-High	High
Rarity	Low	Med-Low	Medium	Med-High	High
Conservation Status	Least Concern	Near-Threatened	Vulnerable	Endangered	Critically Endangered
Red Data	No	-	-	-	Yes
Uniqueness / Special features	None	Med-Low	Medium	Med-High	High
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer	Low	Med-Low	Medium	Med-High	High
Connectivity	Low	Med-Low	Medium	Med-High	High
Alteration	>50%	25-50%	5-25%	1-5%	<1%
Invasive/pioneers	>50%	25-50%	5-25%	1-5%	<1%
Size	<1 ha	1 – 2 ha	3 - 10 ha	10 – 15 ha	>15 ha

Table 2. Ranking Scale for Biodiversity Maintenance services based on Assessment scores

Score:	0-0.8	0.9-1.6	1.7-2.4	2.5-3.2	3.3-4.0
Rating of the likely extent to which a service is being performed	Low	Moderately Low	Intermediate	Moderately High	High

5. LEGISLATION GOVERNING VEGETATION

5.1. National Forests Act (Act No. 84 of 1998)

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that;

'No person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Any disturbance, removal, pruning or transplanting of this species would require a licence from the administrators of the National Forests Act, who are an extension of the Department of Water Affairs (DAFF) based in Pietermaritzburg.

5.2. National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

5.3. Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- **Category 1** plants: are prohibited and must be controlled.
- **Category 2** plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- **Category 3** plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

5.4. Permit / Licence requirements

In terms of the National Forests Act, 1998 (Act No. 84 of 1998) and Government Notice 1339 of 6 August 1976 (promulgated under the Forest Act, 1984 (Act No. 122 of 1984) for protected tree species), the removal, relocation or pruning of any protected plants will require a license.

Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation. In KZN the relevant statute is the 1974 Provincial Nature Conservation Ordinance. In terms of this Ordinance, a permit must be obtained from *Ezemvelo* KZN Wildlife to remove or destroy any plants listed in the Ordinance.

In terms of the vegetation that was recorded during our field survey only plant species which are protected by Provincial Legislation were noted to be recorded along the pipe line routing. No tree species, which are afforded National Protection and will require a licence, were recorded. Further no forest[1] will be impacted upon by the proposed pipe line.

Provincially Protected Species:

- *Crinum bulbispermum*
- *Ledebouria sp.*
- *Cyrtanthus stenophylla* (likely)

Nationally Protected Species:

- None

6. DATABASE INTERROGATION / DESKTOP ANALYSIS

One of the major advantages that technology has provided is the access to information. As a result of this and the ongoing pursuance of environmental knowledge, databases which can be interrogated to provide general information regarding the site have been developed.

This information in turn potentially records what may occur on the site and the sites value from a regional / provincial perspective in terms of conservation and biodiversity. The caveat here is that the majority of these databases are created at the landscape level. In addition, the factors which are often utilized to determine many of the outputs are related to abiotic characteristics, such as rainfall,

[1] **(xx) "natural forest" means a group of indigenous trees -**
(a) whose crowns are largely contiguous: or
***(b)* which have been declared by the Minister to be a natural forest under section 7(2): (xxviii) 15**

temperature, soil types, underlying geology, elevation and aspect. The result therefore is the development of a database that provides a high level assessment of the area, which requires substantial ground-truthing to illustrate the various components that comprise the landscape. The field survey will highlight areas of conservation significance and biodiversity richness as well as provide information regarding the *status quo* and what will be required in terms of management to ensure improvement in the *status quo* and ensure the limited long term impacts being imparted. A number of databases have been interrogated in the process of undertaking the Desktop Analysis. A summary of the methodology utilised for the generation of each of the databases, as well as the pertinent results for each are included below under the various titled sub-sections.

6.1 Ezemvelo KZN wildlife C-Plan & SEA Database

The C-Plan is a systematic conservation-planning package that runs with the GIS software ArcGIS, which analyses biodiversity features and landscape units. C-Plan is used to identify a national reserve system that will satisfy specified conservation targets for biodiversity features (**Lombard et al. 2003**). Biodiversity features can be land classes or species, and targets are set in area units either for land classes, or as numbers of occurrences of species for species locality data sets (**Lombard et al. 2003**). These units or measurements are used as surrogates for un-sampled data. The C-Plan is an effective conservation tool when determining priority areas at a regional level and is being used in South Africa to identify areas of high conservation value.

6.1.1. Irreplaceability Analysis

The following is referenced from **Goodman (2004)**: "The first product of the conservation planning analysis in C-Plan is an irreplaceability map of the planning area, in this case the province of KwaZulu-Natal. This map is divided into 1 by 1 km grid cells called 'planning units'.

Each cell has associated with it an 'Irreplaceability Value', which is a reflection of the cells' importance with respect to the conservation of biodiversity. Irreplaceability reflects the planning unit's ability to meet set 'targets' for selected biodiversity 'features'. The irreplaceability value is scaled between 0 and 1.

Irreplaceability value – 0. Where a planning unit has an irreplaceability value of 0, all biodiversity features recorded here are conserved to the target amount, and there is unlikely to be a biodiversity concern with the development of the site.

Irreplaceability value – 1. These planning units are referred to as totally irreplaceable and the conservation of the features within them is critical to meet conservation targets. (EIA very definitely required and depending on the nature of the proposal unlikely to be granted).

Irreplaceability value > 0 but < 1. Some of these planning units are required to meet biodiversity conservation targets. If the value is high (e.g. 0.9) then most units are required (few options available for alternative choices). If the value is low, then many options are available for meeting the biodiversity targets. (EIA required and depending on the nature of the proposed development, permission could be granted)."

6.1.2. C-Plan Biodiversity Features / Species within Project Area

In terms of the desktop analysis undertaken, the entire pipeline route is classified as 0 - 0.2, i.e. slightly irreplaceable . The Minset analysis mirrors the C-Plan data with the irreplaceable area being deemed a Negotiated Reserve.

There are potentially five features present on site which are considered to be of environmental significance and conservation importance. The five features are as follows:

Vegetation Type – Glencoe Moist Grassland
Vegetation Type – KwaZulu-Natal Highland Thornveld
Vegetation Type – Northern KwaZulu-Natal Moist Grassland

Vegetation Type – Income Sandy Grassland
Vegetation Type – Thukela Thornveld

6.1.3. KZN Wildlife SEA

In terms of the SEA data generated, through the physical characteristics that are present on site, a number of groups have been identified as potentially present on the site, and these groups are wholly significant in terms of conservation significance or parts thereof. The Table below identifies which groups are significant.

Table 3. SEA Data taken from *Ezemvelo* KZN Wildlife

YES	NO
Avi-faunal	Mammals
Vegetation - Grasslands	Vegetation - Forests
Vegetation - Wetlands	Medicinal Plants
Invertebrates	Frogs
Reptiles	Aquatic Fauna
	Protected Plants

6.2 Bio Resource Units

In terms of Camp, 1998, there are three Bio Resource Unit for the route. The general characteristics of each are as follows:

6.2.1. Vc9

Bioresource Group 12 - Moist Tall Grassland

- **BRG Subgroup** 12.7a
- **Vegetation pattern** Grassland, Wooded Grassland, Bushland, Bushland Thicket
- **Indicator Species** *Acacia karroo, Acacia mearnsii, Acacia nilotica, Acacia sieberiana, Aristida congesta, Diospyros scrub, Hyparrhenia hirta, Ziziphus mucronata*

The rainfall average is 779 mm of rainfall. The mean temperature is 16.8 ^{0}C and the climate rating is C5, which has a moderate to severe limitation on crop growing. There is a severe frost hazard and the erosion rating for the site is 4.2, which translates to a high risk of erosion.

There are 7 perennial, and 2 annual rivers identified for this BRU. Please note there are a number of drainage lines, non-perennial streams and wetlands that are not captured at the coarse level at which this data has been defined.

	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RAINFALL													
Median rainfall (mm)		137	113	92	36	7	0	1	6	24	60	91	117
Mean rainfall (mm)	779	140	116	92	49	19	9	11	19	37	67	98	122
TEMPERATURE													
Mean (^{0}C)	16.8	21.4	21	19.7	16.9	13.7	10.8	10.9	13.1	16	17.8	19.1	20.7
Maximum (^{0}C)	23.8	27.6	27.1	26	23.7	21.3	18.8	19	21.1	23.5	24.6	25.5	27.2
Minimum (^{0}C)	9.8	15.2	15	13.5	10.1	6.1	2.9	2.7	5.2	8.6	11	12.8	14.3
EVAPORATION													
A-pan (mm)	1881	205	172	161	130	114	98	109	138	166	187	190	211
SUNSHINE													
Hours/day (Oct-Mar)	6.9												
Mean annual (hours)	7.3												

6.2.2. TuC5a.

Bioresource Group 18 – Mixed Thornveld

- **BRG Subgroup** 18.1a
- **Vegetation pattern** Grassland, Wooded Grassland, Bushland
- **Indicator Species** *Acacia karroo, Acacia nilotica, Acacia robusta, Acacia sieberiana, Acacia tortilis, Aristida congesta, Bothriochloa insculpta, Eragrostis superba, Euclea spp., Euphorbia ingens, Hyparrhenia hirta, Panicum maximum, Schotia brachypetala, Ziziphus mucronata*

The rainfall average is 707 mm of rainfall. The mean temperature is 17.3 ^{0}C and the climate rating is C5, which has a moderate to severe limitation on crop growing. There is a moderate frost hazard and the erosion rating for the site is 4, which translates to a very high risk of erosion.

There are 2 perennial, and 1 annual rivers identified for this BRU. Please note there are a number of drainage lines, non-perennial streams and wetlands that are not captured at the coarse level at which this data has been defined.

	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RAINFALL													
Median rainfall (mm)		124	98	84	32	7	0	0	6	21	55	86	105
Mean rainfall (mm)	707	133	105	81	49	17	6	7	21	40	66	81	101
TEMPERATURE													
Mean (^{0}C)	17.3	21.7	21.4	20.3	17.5	14.4	11.6	11.6	13.7	16.5	18.2	19.5	21.1
Maximum (^{0}C)	24.2	27.9	27.4	26.4	24.2	21.8	19.3	19.5	21.5	23.8	24.9	25.7	27.4
Minimum (^{0}C)	10.5	15.7	15.5	14.1	10.9	7	3.8	3.7	6	9.2	11.5	13.2	14.8
EVAPORATION													
A-pan (mm)	1880	207	174	163	130	114	97	108	137	164	185	190	211
SUNSHINE													
Hours/day (Oct-Mar)	7.4												
Mean annual (hours)	7.8												

6.2.3. UVc4.

	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RAINFALL													
Median rainfall (mm)		141	104	87	34	6	1	0	5	23	62	98	111
Mean rainfall (mm)	778	154	118	85	44	15	9	10	20	33	73	103	114
TEMPERATURE													
Mean (^{0}C)	17	21.4	21.1	19.9	17.2	14.1	11.2	11.3	13.5	16.3	17.9	19.2	20.8
Maximum (^{0}C)	23.9	27.5	27.1	26	23.9	21.6	19.2	19.4	21.3	23.6	24.6	25.4	27.1
Minimum (^{0}C)	10.1	15.4	15.2	13.8	10.5	6.6	3.4	3.3	5.7	9	11.3	13	14.5
EVAPORATION													
A-pan (mm)	1867	202	170	161	131	115	98	110	138	164	184	186	208
SUNSHINE													
Hours/day (Oct-Mar)	6.8												
Mean annual (hours)	7.2												

Bioresource Group 14 – Sour Sandveld

- **BRG Subgroup** 14.2
- **Vegetation pattern** Grassland, Wooded Grassland, Bushland
- **Indicator Species** *Acacia karroo, Acacia sieberiana, Aristida congesta, Aristida junciformis, Digitaria tricholaenoides, Eragrostis gummiflua, Hyparrhenia hirta, Sporobolus pyramidalis*

The rainfall average is 778 mm of rainfall. The mean temperature is 17.0 ^{0}C and the climate rating is C5, which has a moderate to severe limitation on crop growing. There is a moderate frost hazard and the erosion rating for the site is 3.8, which translates to a very high risk of erosion.

There are 3 perennial, and no annual rivers identified for this BRU. Please note there are a number of drainage lines, non-perennial streams and wetlands that are not captured at the coarse level at which this data has been defined.

6.3 Environmental Potential Atlas

The following is referenced from the Department of Environmental Affairs and Tourism (2007): The Environmental Potential Atlas (ENPAT) developed from a single map of Gauteng to a complete spatial data set of the entire South Africa.

ENPAT was updated in July 2001 and is used by the National Department of Environmental Affairs and Tourism and various provincial environmental management departments as a decision-making tool in the process of environmental impact assessments. ENPAT includes the decision-making parameters such as: high-risk development category indications and potential impacts are linked to the 1:250 000 spatial databases on national and provincial level.

The main purpose of ENPAT is to proactively indicate potential conflicts between development proposals and critical or sensitive environments. ENPAT can also be used for development planning since it indicates the environment's potential for development.

ENPAT consists of two distinct, parallel sets of information: natural or environmental characteristics, and social-economic factors. The environmental character maps depict geology, land types, soils, vegetation, and hydrology. The socio-economic factors consist of land cover, cadastral aspects and infrastructure, land use and culture.

These two sets of information are combined and assessed in terms of their potential or latent environmental sensitivity. Sensitivity is assigned based on the ability of a resource to absorb change

or impact. A value of **0** indicates a **low sensitivity** - thus a high ability to accept change, and a value of **1** indicates a **high sensitivity**, or a low ability to accept change. Areas of low sensitivity are thus available or suitable for development.

The ENPAT data provides the following information about the site:

6.3.1 Soils and Geology

The geology of the site is comprised of Arenite, and Shale, with small areas of Dolerite intrusion. Arenite and Dolerite are extremely sensitive to disturbance and development, while Shale is not sensitive to disturbance and development. The soils on the site are dominated by Glenrosa and or Mispah Forms in the southern portions of the site, while plinthic catenas dominate the northern areas of the pipeline. Plinthic catena soils have a low sensitivity to disturbance, and can accept development well. While Glenrosa and Mispah forms are more sensitive, and cannot accept change as well.

6.4 Mucina and Rutherford's Vegetation Assessment

KwaZulu-Natal (KZN) province is rich in natural diversity. In terms of vegetation the pipeline route falls within the Sub-Escarpment Grassland Bioregion.

In terms of the vegetation on site the general classification is made at a very coarse scale, i.e. low resolution and falls within the four vegetation types listed below:

6.4.1. Gs 4 Northern KwaZulu-Natal Moist Grassland

6.4.1.1. Distribution

Northern KwaZulu-Natal Moist Grassland is distributed in the Northern and northwestern regions of the Province, where it forms a discontinuous rim around the upper Thukela Basin and is situated almost entirely within the catchment of the Thukela River. It lies between the drier Gs 6 KwaZulu-Natal Highland Thornveld and the moist upland vegetation of mainly Gs 3 Low Escarpment Moist Grassland to the north and Gs 10 Drakensberg Foothill Moist Grassland to the west. The most extensive areas are in the vicinity of Winterton, Bergville, Fort Mistake, Dannhauser, Dundee, north of Ladysmith and west of Newcastle. At higher altitudes this unit is usually surrounded by Gs 3 Low Escarpment Moist Grassland in the north and Gs 10 Drakensberg Foothill Moist Grassland in the west and south. At lower altitudes Gs 6 KwaZulu-Natal Highland Thornveld and SVs 2 Thukela Thornveld usually occur to the east. Altitude ranges from about 1040–1440 m.

6.4.1.2. Conservation

It is considered vulnerable, with a conservation target of 24%. Only about 2% statutorily conserved in the uKhahlamba Drakensberg Park as well as in the Chelmsford, Spioenkop, Moor Park, Wagendrift, Ncandu Nature Reserves.

6.4.1.3. Threats

More than a quarter has already been transformed either for cultivation, plantations and urban sprawl or by building of dams (Chelmsford, Driel, Kilburn, Mtoti, Wagendrift, Windsor and Woodstock). Alien *Acacia dealbata*, *Rubus*, *Eucalyptus* and *Populus* are invasive in places. Bush encroachment is common. Erosion very low (53%), low (2%) and moderate (20%).

6.4.1.4. Indicative Plant Species

Important Taxa Small Trees: *Acacia caffra* **(d)**, *Acacia natalitia* **(d)**, *Acacia sieberiana* var. *woodii, Cussonia paniculata, Euclea crispa* subsp. *crispa, Heteromorpha arborescens* var. *abyssinica, Hippobromus pauciflorus, Scutia myrtina, Ziziphus mucronata.* **Tall Shrubs:** *Diospyros lycioides* subsp. *lycioides* **(d)**, *Searsia rehmanniana* var. *rehmanniana* **(d)**, *Acokanthera oppositifolia,*

Asparagus setaceus, Canthium mundianum, Cephalanthus natalensis, Clerodendrum glabrum, Diospyros whyteana, Euclea natalensis subsp. *angustifolia, Leonotis leonurus, Lippia javanica, Pavetta gardeniifolia* var. *gardeniifolia, Searsia dentata, Searsia lucida, Searsia pentheri, Searsia pyroides, Scolopia zeyheri.* **Woody Climbers:** *Clematis brachiata, Dalbergia obovata, Dioscorea sylvatica, Jasminum breviflorum, Rhoicissus tridentata.* **Succulent Woody Climber:** *Sarcostemma viminale*. **Low Shrubs:** *Barleria obtusa* **(d)**, *Anthospermum rigidum* subsp. *pumilum, Artemisia afra, Chaetacanthus burchellii, Euryops pedunculatus, Grewia hispida, Phyllanthus glaucophyllus, Pygmaeothamnus chamaedendrum.* **Succulent Shrub:** *Euphorbia clavarioides* var. *clavarioides.*
Graminoids: *Cymbopogon caesius* **(d)**, *Eragrostis racemosa* **(d)**, *Hyparrhenia hirta* **(d)**, *Themeda triandra* **(d)**, *Bothriochloa insculpta*, *Cymbopogon nardus, Eragrostis curvula, E. plana, Hyparrhenia dregeana* and *Setaria sphacelata*. **Herbs:** *Acalypha caperonioides, Acalypha punctata, Aster bakerianus, Commelina africana, Conyza obscura, Corchorus confusus, Crabbea angustifolia, Dicoma anomala, Eriosema cordatum, Helichrysum rugulosum, Ipomoea oblongata, Monsonia angustifolia, Selago densiflora* and *Stachys natalensis.* **Geophytic Herbs:** *Cheilanthes hirta, Cheilanthes quadripinnata, Hypoxis rigidula* var. *pilosissima, Ledebouria ovatifolia, Oxalis obliquifolia, Pellaea calomelanos* and *Raphionacme hirsuta.* **Succulent Herbs:** *Aloe maculata, Crassula alba.*

Biogeographically important Taxon (endemic to northern KwaZulu-Natal):
Herb*:* *Cissus cussonioides.*
Endemic Taxon:
Tall Shrub: *Calpurnia woodii.*

6.4.2. Gs 5 Northern KwaZulu-Natal Shrubland

6.4.2.1. Distribution

Northern KwaZulu-Natal Shrubland as a widely scattered group of patches. Embedded within Sub-Escarpment Grassland units of Gs 4, Gs 6 and Gs 7, from Ladysmith in the west to Vryheid in the northeast. Large portions of this unit are found in the surrounds of Newcastle. Altitude ranges from about 1100–1540 m.

6.4.2.2. Conservation

It is considered least threatened, with a conservation target of 23%. Less than 1% statutorily conserved in the Spioenkop Nature Reserve.

6.4.2.3. Threats

About 3% transformed by cultivation. Erosion very low (35%), moderate (29%), low (22%) and high (10%).

6.4.2.4. Indicative Plant Species

Graminoids: *Alloteropsis semialata* subsp. *eckloniana* **(d)**, *Aristida congesta* **(d)**, *Cynodon dactylon* **(d)**, *Digitaria tricholaenoides* **(d)**, *Elionurus muticus* **(d)**, *Eragrostis patentissima* **(d)**, *Eragrostis racemosa* **(d)**, *Harpochloa falx* **(d)**, *Hyparrhenia hirta* **(d)**, *Themeda triandra* **(d)**, *Tristachya leucothrix* **(d),** *Abildgaardia ovata, Andropogon appendiculatus, Andropogon eucomus, Andropogon schirensis, Aristida junciformis* subsp. *galpinii, Brachiaria serrata, Cymbopogon caesius, Cymbopogon pospischilii, Cynodon incompletus, Digitaria monodactyla, Digitaria sanguinalis, Diheteropogon amplectens, Diheteropogon filifolius, Eragrostis, chloromelas, Eragrostis plana, Eragrostis planiculmis, Eragrostis sclerantha, Festuca scabra, Heteropogon contortus, Hyparrhenia dregeana, Melinis nerviglumis, Microchloa caffra, Panicum natalense, Paspalum scrobiculatum, Setaria nigrirostris* and *Sporobolus africanus.* **Herbs:** *Acanthospermum australe* **(d)**, *Argyrolobium speciosum* **(d***), Eriosema kraussianum* **(d)**, *Geranium wakkerstroomianum* **(d)**, *Pelargonium luridum* **(d)**, *Acalypha peduncularis*, *Chamaecrista mimosoides*, *Dicoma anomala, Euryops transvaalensis* subsp. *setilobus, Helichrysum caespititium, H. rugulosum, Hermannia depressa, Ipomoea crassipes, Pearsonia grandifolia, Pentanisia prunelloides* subsp. *latifolia, Sebaea grandis, Senecio inornatus, Thunbergia atriplicifolia* and *Zaluzianskya microsiphon*. **Geophytic Herbs:** *Chlorophytum haygarthii*

(d), *Gladiolus aurantiacus* **(d)**, *Asclepias aurea, Cyrtanthus tuckii* var. *transvaalensis, Gladiolus crassifolius, Hypoxis colchicifolia, Hypoxis multiceps, Moraea brevistyla, Zantedeschia rehmannii.* **Succulent Herbs:** *Aloe ecklonis* and *Lopholaena segmentata.* **Low Shrubs**: *Anthospermum rigidum* subsp. *pumilum, Erica oatesii* and *Hermannia geniculata*. **Succulent Shrub:** *Euphorbia pulvinata*.

Biogeographically important Taxa (both Low Escarpment endemics):
Succulent Herb: *Aloe modesta*.
Low Shrub: *Bowkeria citrina*.

6.4.3. Gs 7 Income Sandy Grassland

6.4.3.1. Distribution

Income Sandy Grassland is distributed in a large triangle between Newcastle, Vryheid and Dundee and a larger polygon in the Wasbank area in northern KwaZulu-Natal.

6.4.3.2. Conservation

It is considered vulnerable, with a conservation target of 23%. None conserved in statutory conservation areas.

6.4.3.3. Threats

Some 27% has been transformed for cultivation, plantations and by urban sprawl. Small portion of the area has been lost to the building of dams (Klipfontein, Mvunyane). No serious invasions of aliens have been observed (probably due to low nutrient status of soils). Erosion moderate (38%), high (30%) and low (15%).

6.4.3.4. Indicative Plant Species

Graminoids: *Alloteropsis semialata* subsp. *eckloniana, Andropogon appendiculatus, Andropogon eucomus, Andropogon schirensis, Aristida congesta, Aristida junciformis* subsp. *galpinii, Brachiaria serrata, Cymbopogon caesius, Cynodon dactylon, Digitaria monodactyla, Digitaria tricholaenoides, Diheteropogon amplectens, Diheteropogon filifolius, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis curvula, Eragrostis gummiflua, Eragrostis plana, Eragrostis planiculmis, Eragrostis racemosa, Eragrostis sclerantha, Harpochloa falx, Heteropogon contortus, Hyparrhenia hirta, Loudetia simplex, Melinis repens* subsp. *repens, Microchloa caffra, Monocymbium ceresiiforme, Panicum natalense, Paspalum scrobiculatum, Perotis patens, Pogonarthria squarrosa, Setaria nigrirostris, Sporobolus africanus, Stiburus conrathii, Themeda triandra, Trichoneura grandiglumis* and *Tristachya leucothrix.* **Herbs:** *Berkheya onopordifolia* var. *glabra, Berkheya setifera, Chamaecrista mimosoides, Dicoma anomala, Euryops transvaalensis* subsp. *setilobus, Helichrysum caespititium, Helichrysum cephaloideum, Helichrysum rugulosum, Helichrysum simillimum, Hermannia depressa, Hermannia transvaalensis, Kohautia amatymbica, Kohautia virgata, Macledium zeyheri* subsp. *argyrophyllum, Pentanisia prunelloides* subsp. *latifolia, Senecio coronatus* and *Zornia capensis.* **Herbaceous Climbers:** *Anthospermum rigidum* subsp. *pumilum* **Geophytic Herbs:** *Hypoxis rigidula* var. *pilosissima* **Low Shrubs:** *Rhynchosia totta* and *Stoebe plumosa*

6.4.4. SVs 2 Thukela Thornveld

6.4.4.1. Distribution

Thukela Thornveld is distributed in the Upper Thukela River basin fringing the SVs 1 Thukela Valley Bushveld on its upper border in a series of discontinuous patches. Largest area east of Estcourt–Colenso and including Ladysmith. Also some outliers on slopes south of Dundee. Altitude ranges from about 900–1300 m.

6.4.4.2. Conservation

It is considered least threatened, with a conservation target of 25%. Statutorily conserved (less than 1 500 ha) in Weenen Game Reserve and Isandlwana Nature Reserve.

6.4.4.3. Threats

About 5% already transformed, mainly by cultivation. Erosion somewhat less than in SVs1 Thukela Valley Bushveld.

6.4.4.4. Indicative Plant Species

Small Trees: *Acacia natalitia* **(d),** *A. nilotica* **(d),** *Acacia sieberiana* var. *woodii*, *Acacia tortilis* subsp. *heteracantha***,** *Allophylus melanocarpus***,** *Boscia albitrunca***,** *Clausena anisata***,** *Cussonia spicata***,** *Dais cotinifolia***,** *Ziziphus mucronata.* **Tall Shrubs:** *Coddia rudis* **(d),** *Buddleja saligna, Clerodendrum glabrum, Euclea crispa* **subsp.** *crispa, Heteromorpha arborescens* **var.** *abyssinica, Hibiscus calyphyllus, Lippia javanica, Pachystigma macrocalyx, Searsia pentheri* and *Searsia rehmanniana.*
Low Shrubs: *Barleria obtusa* and *Justicia flava.* **Soft Shrub:** *Peristrophe cernua.* **Woody Succulent Climber:** *Senecio brachypodus.* **Graminoids:** *Eragrostis curvula* **(d),** *Hyparrhenia hirta* **(d),** *Melinis repens* **(d),** *Panicum maximum* **(d),** *Themeda triandra* **(d),** *Tristachya leucothrix* **(d),** *Aristida congesta, Digitaria eriantha* subsp. *eriantha, Elionurus muticus, Eragrostis chloromelas, Eragrostis superba, Heteropogon contortus, Setaria sphacelata, Sporobolus pyramidalis.* **Herb:** *Osteospermum muricatum.* **Geophytic Herb:** *Sansevieria hyacinthoides.* **Succulent Herb:** *Aloe mudenensis.*

Biogeographically important Taxa (Thukela Basin endemics)
Small Tree: *Vitellariopsis dispar.*
Succulent Herbs: *Aloe prinslooi* and *Orbea woodii.*

Endemic Taxon:
Small Tree: *Encephalartos msinganus.*

7. VEGETATION ON SITE

In terms of the pipe line routing there are three potential categorisations that the vegetation may be placed into in terms of its current status. There are areas, in particular close to Ladysmith and extending as far as the Driefontein Road, in the vicinity of Alan Gray's Farm and Longfields Farm (Tony Porrill), which would be considered as bushed thicket, with the dominant plant species being woody in nature.

The most commonly occurring species is *Acacia nilotica,* which comprises a nearly monotypic stand. This species is common and resistant to over-burning and grazing, and which consequently may over-express where this is the case. There are other tree species that occur however, they are represented within the species assemblage at significantly lower abundances. The other species are; *Euclea crispa, Aloe marlothii, Cussonia paniculata, Gymnosporia buxifolia, Searsia rehmanniana* subsp. *rehmanniana, Searsia pentheri, Ziziphus mucronata* and *Diospyros lycioides.*

Further the graminoid assemblage in these bushed lands is dominated by species such as, *Chloris guyana, Cymbopogon plurinodis, Digitaria eriantha, Cynodon dactylon, Chloris pycnothrix* and *Bothriochloa insculpta.* To a lesser extent there are a number of other species, which were less prevalent, with the exception of *Themeda triandra* which when it was present dominated the species assemblage. The other less common species were *Imperata cylindrica, Paspalum scrobiculatum, Hyparrhenia hirta* and *Eragrostis curvula.* Given the relatively high incidence of disturbance, through anthropogenic influences and the on-going utilisation of the road and the impacts of dust landing on the vegetation along the road ways the number of forbaceous and geophytic species has been significantly reduced.

Many of the Forbaceous and Geophytic species have succumbed to historic land practices as well as the ongoing disturbance that they are exposed to as a simple factor of their position within the landscape, i.e. their proximity to the road. The species that do remain within these areas are considered for the most part to be hardy species, which for the most part become weedy and invasive in disturbance situations. These species are typically referred to as ruderal[2] or pioneer[3] species.

The second classification or category would be grasslands with limited woody vegetation. The woody vegetation is typically agglomerated into clumps and results from one of or a combination of the following landscape features, soil features and micro-climate.

- Deeper soils
- Elevated soil moisture
- Burning regime
- Rock presence at surface and sub-surface
- Sheltering (within incised valleys)
- Shade and Aspect

In areas where the growth of woody vegetation is favoured these areas for the most part are dominated by species such as *Acacia sieberiana* and *Ziziphus mucronata.* In areas where the natural equilibrium has been altered through external pressures, species such as *Acacia nilotica* have become more prevalent within the grassland situation, and this is commonly referred to as bush encroachment, and has a significant detrimental effect on the grazing capacity of the land as well as its utilisation.

There are portions of the proposed pipe line alignment where bush encroachment is occurring, and as this process is human induced the removal of the trees from within the pipe line servitude will be beneficial to the land owner(s), and mimic the natural situation prior to human interventions and farming methods.

The third categorisation is open grassland and occurs along large portions of the proposed pipe line alignment. These open grassland areas, for the most part, are dominated by species such as *Hyparrhenia hirta, Eragrostis* spp., *Andropogon* spp., *Diheteropogon amplectens, Cymbopogon* spp., *Aristida junciformis, Melinis repens* and *Panicum natalense.* The most dominant species that was evident during our field survey was *Hyparrhenia hirta*, which is a tall grass species that responds well to grazing pressure, has relatively low nutritional value and therefore is often one of the last species to be utilised by large herbivores such as cattle.

Given the height of the grass sward and the historical impacts and pressure that have been imparted on the receiving environment the presence and abundance of forbaceous and geophytic species is low. Coupled with this is the fact that when a comparison between these grasslands and grasslands in the Midlands, for example, the average forbaceous content is six (6) forbs per square metre (m^2) as opposed to 17-20 m^2 for the Midlands Mistbelt grasslands.

Grassland and bushed ecosystems experiencing poor management, such as that which occurs through inappropriate burning, overgrazing and or long term anthropogenic disturbance undergoes a two-track process of species-loss.

[2] A ruderal species is a plant species that is first to colonise disturbed lands. The disturbance may be natural (e.g., wildfires), or due to human influence - constructional (e.g., road construction, building construction or mining), or agricultural (e.g., abandoned farming fields or abandoned irrigation ditches). Ruderal species typically dominate the disturbed area for a few years, gradually losing the competition to other native species.

[3] Pioneer species are species which colonize previously un-colonized land or disturbed land, usually leading to ecological succession. Since un-colonized land usually has thin, poor quality soils with few nutrients, pioneer species are typically very hardy plants with adaptations such as long roots, root nodes containing nitrogen-fixing bacteria, and leaves that employ transpiration. The plants, or anything that has the system of a plant, will be specially adapted to the extremes that may be experienced, and once they have modified the environment may be out-competed by less specific plants, eventually leading to a climax community. Pioneer species can also be found in secondary succession (an established ecosystem being reduced by an event such as a forest fire or a clearing), colonizing newly created open spaces quickly.

First, there is quantitative loss when particular species diminish to persist in smaller numbers. Second there is qualitative loss that occurs when species disappear entirely. This latter kind of loss tends to become evident at a later stage after significant sustained negative impacts and is more serious as it is difficult and often impossible to reverse.

The grassland areas that were visited show signs of both severe quantitative and qualitative loss. It can be described as nearly secondary grassland, and should be described as such without reservation except that there are very small number of forbs and geophytes still present, not all of which are ruderals or weeds of disturbance. It is also possible there could be a small seed bank or residue of underground organs on the site which could lead to a better than expected recovery if all impacts were removed, however this is unlikely and therefore it is envisaged that the sustained pressure will result in a further decline in habitat integrity or in the *status quo* remaining the same.

Fire-management is usually regarded as essential for maintaining grassland health and retaining or improving its species diversity. As the bulk of the infrastructure, with the exception of the air valve chambers will be placed underground, natural processes such as burning will still be able to take place. In areas where there are heavy infestations of woody material, in particular *A. nilotica* we would suggest that there removal along the proposed pipe line alignment may be beneficial, as it will provide an opportunity for graminoid species to proliferate post grass seeding and hopefully prevent these species from recurring. We would suggest that a burning regime be utilised every two to three years and that where possible a reduction in grazing intensity occur to prevent the re-establishment of these woody species.

In terms of the vegetation that was recorded (plant species list appended at **Appendix 2**) the majority of the species are common species. However, it is important to mention that within the vicinity of the pipe line alignment there were species that were recorded that may occur within the proposed working servitude. However, due to time constraints and the sampling methodology may have been overlooked during our field survey. Therefore, due consideration for these species and the potential for their presence must be noted. These species even though not protected are considered to be unusual species, which are not well known in the botanical world. Given their size and relatively non-descript nature they may have been overlooked historically (i.e. these species are not charismatic or flamboyant, but cryptic) and could potentially be more common than is currently assumed.

The species are as follows;

Elephantorrhiza woodii	This rare species is currently Red Listed as Data Deficient – Threatened. This listing is provided for a species that is believed to be threatened but insufficient information is available to allocate it to a more resolved category. This species is known from only a few collections in KwaZulu-Natal.
Jatropha woodii	Only one occurrence was found, but the same comments apply.
Ipomoea cf. *bathycolpos*	This species, which was collected has been compared with numerous herbarium specimens and, most closely resembles *I. bathycolpos* however, there are some significant morphological differences and this leads the authors to believe that as *I. bathycolpos* has not been recorded in KZN that this maybe in fact a new species. This species was restricted to extremely dry and exposed rocky crests of hills in the vicinity of the Saders and Hobsland Farms. It appears to be able to withstand relatively high disturbance given its growth form, which has an extremely large underground tuber.

Crinum bulbispermum, Ledebouria sp. (three species) and *Cyrtanthus stenophylla* (seen outside of the servitude but will occur within it) will require special attention and will need to be relocated outside of the servitude, should the trenches remain open for extended periods of time.

These protected plants and conservation-significant plants could be relocated where they fall within the proposed construction servitude. They would need to be replanted in positions where they would still receive a good amount of sun (i.e. not where they would be in shade for much of the day, due to overshadowing infrastructure, i.e. air valve chambers or booster pump stations).

Relocation should occur during the summer months and with due care, preferably by a qualified botanist or similarly qualified individual, into good-sized holes that are at least twice the size of underground organs. It is very important for survival for underground organs not to be damaged and for plants to be watered for a period of time. Except for *Ledebouria ovatifolia* subsp. *scabrifolia*, this is recommended as every second day for a month, but would need to increase if underground organs are damaged. *Ledebouria ovatifolia* subsp. *scabrifolia* would not need to be maintained, as the bulb will ensure persistence until rains fall.

The above proposed methodology may not be an ideal or implementable option for this proposed pipe line and therefore the following options, utilised historically on other projects have been identified as alternatives. Relocation of certain plant species is recommended, however, in many instances this proposed approach is not a practical or workable solution.

In the case of *Elephantorrhiza woodii* this species is renowned for having an extremely large Suffrutex which will preclude it from being transplanted, however, it may be a recommendation that seed be collected of this species, propagated off site, and re-established once the pipe line has been completed and the saplings are able to withstand the natural environment.

In terms of the geophytes, for example the *Ledebouria* genus these individuals bulbs are usually quite small and will be able to withstand a relatively high level of disturbance, given their survival strategy of storing the required reserve resources in the bulb. These species will likely be able to re-generate following the excavation and replacement of the soils.

Species like the *Crinum bulbispermum* are large bulbed species which tend to grow in deep soils so their safe removal will pose greater difficulty. In the instance of this species we would propose that seed is collected and germinated and replanted post-construction. Alternatively these species are freely available and could be bought and replanted in an effort to restore the *status quo*.

Therefore in summary the vegetation that potentially may be impacted upon is not considered;

- Vulnerable;
- The vegetation is relatively homogenous at the landscape level;
- The vegetation is considered to be degraded and in some areas seriously degraded;
- Very few protected plant species were identified;
- It is unlikely that management of the grasslands will change significantly and therefore the *status quo* of the grasslands will remain, and;
- Good housekeeping and management of the construction impacts will see no or very limited impact on the receiving environment.

8. CURRENT IMPACTS

8.1. Livestock grazing

The most significant grazing pressure that we noted and would potentially present the current degraded nature of the receiving environment, p-particularly in areas around the Saders Farm, Hobsland and Ekuvukheni is caused by goats, which are highly deleterious to the vegetation component of any landscape.

This species is able to access all landscape features, is usually present in significant numbers (over-stocking) and is not very specific when feeding. The result being that as soon as one food resource is unavailable the goats will simply switch there feeding strategy. In essence goats unlike cattle are not mega-herbivores and will switch from grass and forb based grazing to browsing of trees.

8.2. Urban Sprawl

In the vicinity of all the established areas, both formal and informal settlements, the vegetation is considered transformed. The reason being that the Open Space Areas adjoining the development zones are utilised by the community at large and therefore many of the impacts result from the communities' actions.

It was noted that in many of these areas numerous vehicle tracks and footpaths have been created. These movement corridors have presented the ideal place for the commencement of erosion and have resulted in the establishment of large erosion gulley's and in certain areas erosion dongas. In these areas the vegetation is extremely denuded and the soils are exposed and prone to water as well as wind erosion. Further many of the soils are extremely rocky and inhospitable to plant species other than alien invasive species and pioneer species which are traditionally annual species. This makes for the re-establishment of vegetation near impossible and with the additional grazing pressure that will be imparted likely impossible that any rehabilitation will be successful.

In addition to the impacts of paths and grazing, the issue of waste disposal is also quite significant with many areas being exposed to regular dumping. These areas present an opportunity for alien invasive vegetation to establish, which results in further degradation of the landscape and vegetation communities.

8.3. Alien Invasive Vegetation

Due to the high abundance of alien species in the surrounding areas, their competitive advantage, resulting from their primary ecological strategy, these species are able to colonise new areas rapidly and out-compete existing indigenous vegetation.

Plants can be classified according to their primary ecological strategies. Alien plant species are **r-selected** plant species, with the following characteristics distinguishing them from **k-selected** plants.

r-selected plants are those that maximize their intrinsic rate of reproductive increase. This is done through high seed production, and minimizing costs for maintenance. They generally grow in highly unpredictable climates or habitats, have low long term survivorship, are poor competitors, short development times, short life-span, strong reproductive focus with a monocarpic reproductive effort (MacArthur and Wilson 1967).

K-selected species tend to grow in more predictable climates. Mortality is density dependent, They have Type I or II survivorship. The population is near constant, near the carrying capacity. They are strongly affected by competition. They have a long development time, long life span, and generally a small seed bank. Allocation is to survivorship and delayed reproduction, which is typically polycarpic (MacArthur and Wilson 1967).

A caveat here is that not all r-selected plants are alien invader species, many plants that are the first plants to colonise disturbed areas are r-selected plants. However, the majority of invader species exhibit all or most of the following characteristics;

- Fast growth
- Rapid reproduction
- High dispersal ability
- Phenotypic plasticity (the ability to alter growth form to suit current conditions)
- Tolerance of a wide range of environmental conditions (Ecological competence)
- Ability to live off of a wide range of food types (generalist)
- Association with humans
- Prior successful invasions

Bearing this in mind there are a number of considerations that will be required when undertaking the construction and thereafter the rehabilitation of the pipe line excavations. These considerations will

ensure that the current value of the land is not adversely impacted upon and that the land use may continue following rehabilitation.

9. BIODIVERSITY ASSESSMENT

In terms of assessing the impacts of a proposed development on the receiving environment it is imperative that the current state of the environment is assessed and the level at which it contributes is considered and recorded.

It is bearing this in mind that we have developed an assessment matrix which will assist in determining the current biodiversity and conservation value of the various landscape (vegetation types) that were encountered during the field survey. Please note that because of the linear nature of this project that a number of vegetation types have been encountered and we have therefore assessed the pipe line alignment at a broad level to comply with the **Mucina & Rutherford, 2006** vegetation classifications. In addition we need to consider the biodiversity noteworthiness of the receiving environment (i.e. does the environment hold any rare species, protected species and unique landscape features) as well as the functional integrity and future sustainability of the vegetation types in the immediate vicinity of the pipe line.

9.1. Biodiversity noteworthiness

In terms of the vegetation classifications that were identified from the aerial photography and ground truthed on site, the following assessment was made in terms of the noteworthiness of the vegetation that would be immediately impacted upon by the proposed pipe line arrangement.

9.1.1. Income Sandy Grassland

Table 4. Biodiversity noteworthiness for the Income Sandy Grassland portions of the pipe line alignment

	Scores				
Biodiversity Noteworthiness	**0**	**1**	**2**	**3**	**4**
Diversity	✓				
Rarity	✓				
Conservation Status			✓		
Red Data Species					✓
Uniqueness / Special features	✓				
OVERALL VALUE	Total Score/number of categories is 6 / 5= **1.2**				

9.1.2. Thukela Thornveld

Table 5. Biodiversity noteworthiness for the Thukela Thornveld portions of the pipe line alignment

	Scores				
Biodiversity Noteworthiness	**0**	**1**	**2**	**3**	**4**
Diversity	✓				
Rarity	✓				
Conservation Status	✓				
Red Data					✓
Uniqueness / Special features	✓				
OVERALL VALUE	Total Score/number of categories is 4 / 5= **0.8**				

9.1.3. Northern KwaZulu-Natal Shrubland

Table 6. Biodiversity noteworthiness for the Northern KwaZulu-Natal Shrubland portions of the pipe line alignment

	Scores				
Biodiversity Noteworthiness	**0**	**1**	**2**	**3**	**4**
Diversity	✓				
Rarity	✓				
Conservation Status	✓				
Red Data					✓
Uniqueness / Special features	✓				
OVERALL VALUE	Total Score/number of categories is 4 / 5= **0.8**				

9.1.4. Northern KwaZulu-Natal Moist Grassland

Table 7. Biodiversity noteworthiness for Northern KwaZulu-Natal Moist Grassland portions of the pipe line alignment

	Scores				
Biodiversity Noteworthiness	**0**	**1**	**2**	**3**	**4**
Diversity	✓				
Rarity	✓				
Conservation Status			✓		
Red Data					✓
Uniqueness / Special features	✓				
OVERALL VALUE	Total Score/number of categories is 6 / 5= **1.2**				

9.2. Functional Integrity and Sustainability

The functional Integrity and sustainability speaks to the impact of the proposed activity on the receiving environment and the likelihood that it will be of significance and whether there are significant mitigation and or amelioration measures that are required to be put in place to ensure that the impacts are manageable and will not prove deleterious to the vegetation type as a whole, which falls within the current proposed area of disturbance.

9.2.1. Income Sandy Grassland

Table 8. Future Integrity and viability of the Income Sandy Grassland portions of the pipe line

	Scores				
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer		✓			
Connectivity		✓			
Alteration		✓			
Invasive/pioneers	✓				
Size	✓				
OVERALL VALUE	Total Score/number of categories is3 / 5= **0.6**				

9.2.2. Thukela Thornveld

Table 9. Future Integrity and viability of the Thukela Thornveld portions of the pipe line

	Scores				
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer			✓		
Connectivity				✓	
Alteration			✓		
Invasive/pioneers			✓		
Size	✓				
OVERALL VALUE	Total Score/number of categories is 9 / 5= **1.8**				

9.2.3. Northern KwaZulu-Natal Shrubland

Table 10. Future Integrity and viability of the Northern KwaZulu-Natal Shrubland portions of the pipe line

	Scores				
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer			✓		
Connectivity				✓	
Alteration			✓		
Invasive/pioneers			✓		
Size	✓				
OVERALL VALUE	Total Score/number of categories is 9 / 5= **1.8**				

9.2.4. Northern KwaZulu-Natal Moist Grassland

Table 11. Future Integrity and viability of the Northern KwaZulu-Natal Moist Grassland portions of the pipe line

	Scores				
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer			✓		
Connectivity				✓	
Alteration			✓		
Invasive/pioneers			✓		
Size	✓				
OVERALL VALUE	Total Score/number of categories is 9 / 5= **1.8**				

In terms of the overall value that has been obtained from the above mentioned matrix that has been compiled for each of the vegetation units, the most significant values are returned by portions of the pipe line falls within the **Northern KwaZulu-Natal Moist Grassland** vegetation unit. The entire proposed pipe line routing falls within the Moderately Low category in terms of biodiversity maintenance. The interpretation therefore is such that the entire pipe line alignment should accept change relatively well. Further the construction of the pipe line will not have any lasting significant impacts associated therewith.

10. RECOMMENDATIONS

Following the assessment that was undertaken for the proposed construction of a pipe line with ancillary infrastructure namely;

- Air Valve Chambers,
- Scour Valve Chambers, and;
- Booster Pump Stations

The following recommendations can be made and the appointed ECO should ensure that the following is undertaken and that the outcomes of the project ensure no nett loss of land value from a conservation and agricultural use perspective.

1. The top soil, nominally 250 mm, should be cleared and stockpiled separately. The sub-soil and topsoil should be stock piled on opposite sides of the trench so as to prevent the incorrect sequence of back filling of the soils and the resultant loss of soil profile and integrity.
2. The entire working servitude width is to be determined in conjunction with the Engineer and the Environmental Control Officer, however, our recommendation is that should the use of OPVC be accepted then the servitude width should not exceed 8 (eight) metres. In difficult areas and steep portions of the proposed pipe line alignment we would suggest reducing the width to the minimal acceptable width, which would allow for the pipe sections to be walked in and placed in the trench, i.e. reduce the width to 6 (six) metres.
3. Sub-soil must be well compacted around the pipe once the pipe has been bedded on the correctly sourced bedding material, traditionally an evenly graded sandy material with a very low clay content.
4. The area of excavation should not precede the laying of the pipe line by more than a single working week;
5. Once the pipe line excavation has been backfilled the top soil should be placed and lightly compacted;
6. Thereafter a light watering of the replaced soil will be essential. It is also advised that the topsoil which has been excavated is lightly watered every second day while outside of the trench however, this may pose a significant issue and may not be possible.
7. In steep areas, it is essential that cross berms, or some erosion control mechanisms are put in place to ensure that the pipe line is protected as well as the rehabilitation efforts are afforded an opportunity to succeed;
8. This will be required, particularly in areas on Saders Farm, Hobsland and on portions of the two adjoining farms where the pipe line is proposed to traverse steep slopes. Other areas that will require similar measures are the ingress to the reservoir at Jonono's Kop and the ingress to the reservoir in Wasbank and Ekuvhukeni.
9. Given the high volume of rock in these areas we would propose that this rock is utilised at intervals of approximately 2 metres on slopes greater than 12^0, or where its lowest outfall point will coincide with well established vegetation. These rock berms are to be put in place to check storm water velocity, reduce the scour potential of storm water and prevent all the valuable topsoil from being gathered up and displaced at the bottom of the excavation.
10. The rapid excavation and replacement of the soils should result in the current seed bank within the soils being impacted upon only a very low level;
11. The seed bank will thus supplement the proposed re-seeding that must take place, utilising the standard NPA mix;
12. Regular watering will be required of the seeded areas, unless hydro-seeding is utilised which will have significantly higher initial input costs, however, the results and coverage will reduce the ongoing input costs;
13. The regular control and management of alien invasive species will be required. It is our recommendation that every 3 months for a year post construction, the pipe line servitude is revisited and the alien vegetation removed, either through hand-pulling. Where this is not possible or appropriate the very carefully monitored application of chemical herbicides.

11. CONCLUSIONS

Having undertaken a detailed vegetation assessment of the proposed pipe line our assessment is that the proposed activity, if undertaken in accordance with the above mentioned mitigation measures (recommendations) and detailed Environmental Management Programme will have limited significance. It is envisaged that the rehabilitation of the working servitude will result in the disturbed area being returned to grassland that will not significantly reduce the grazing value of the area in the short term and in the long term it is envisaged that value of the disturbed area will mirror the surrounding areas.

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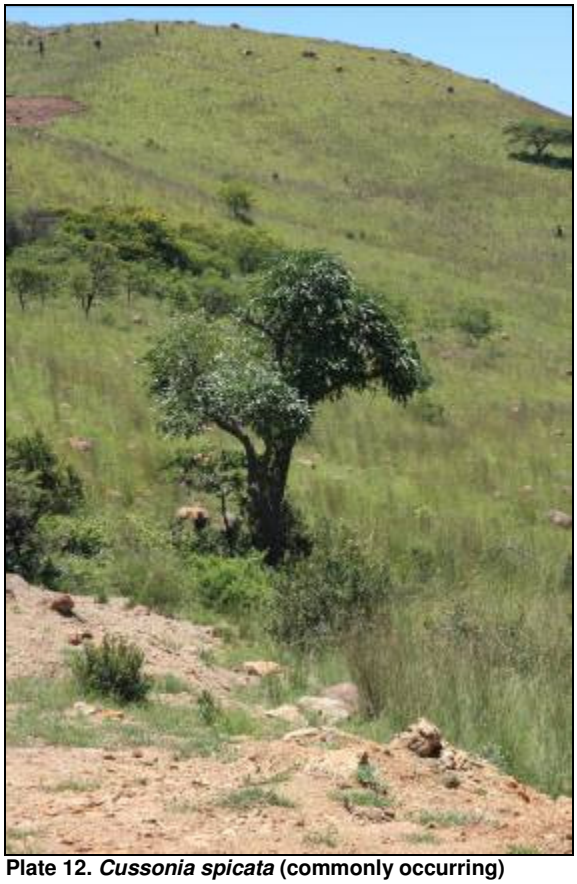

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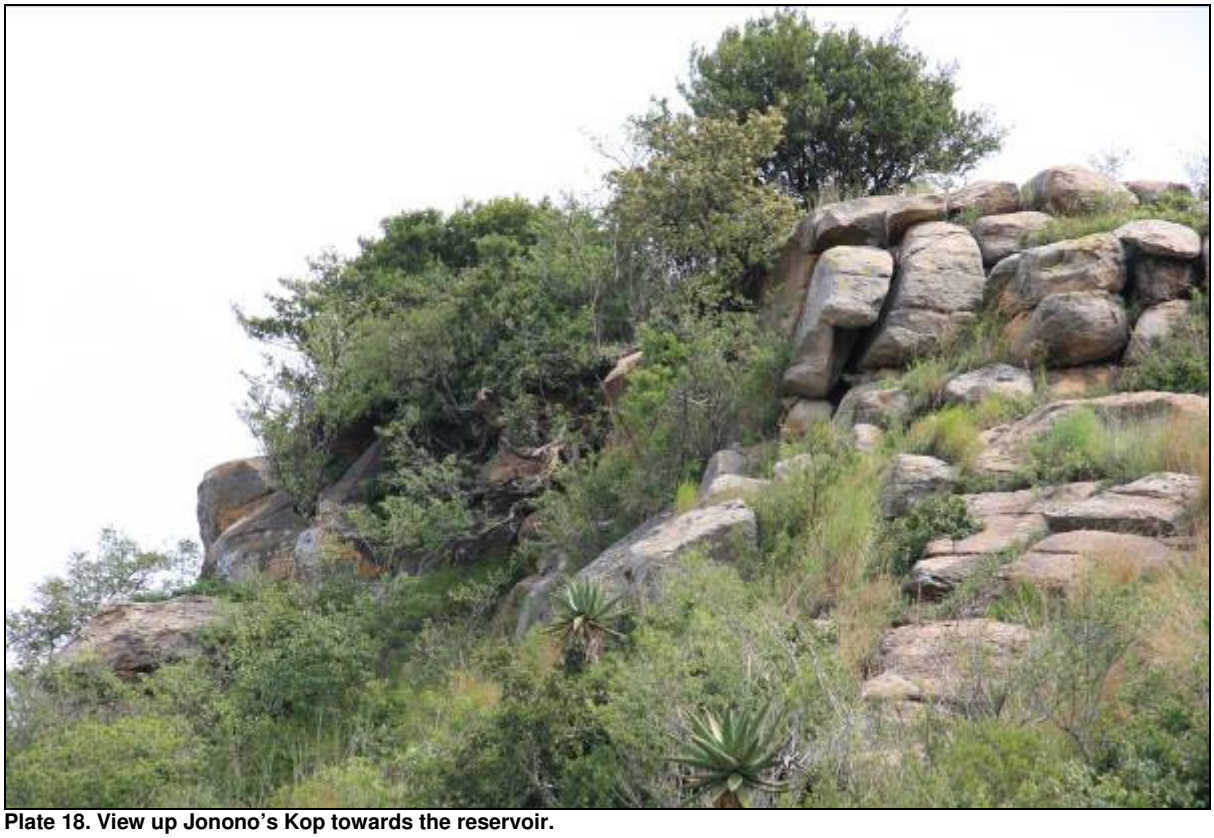

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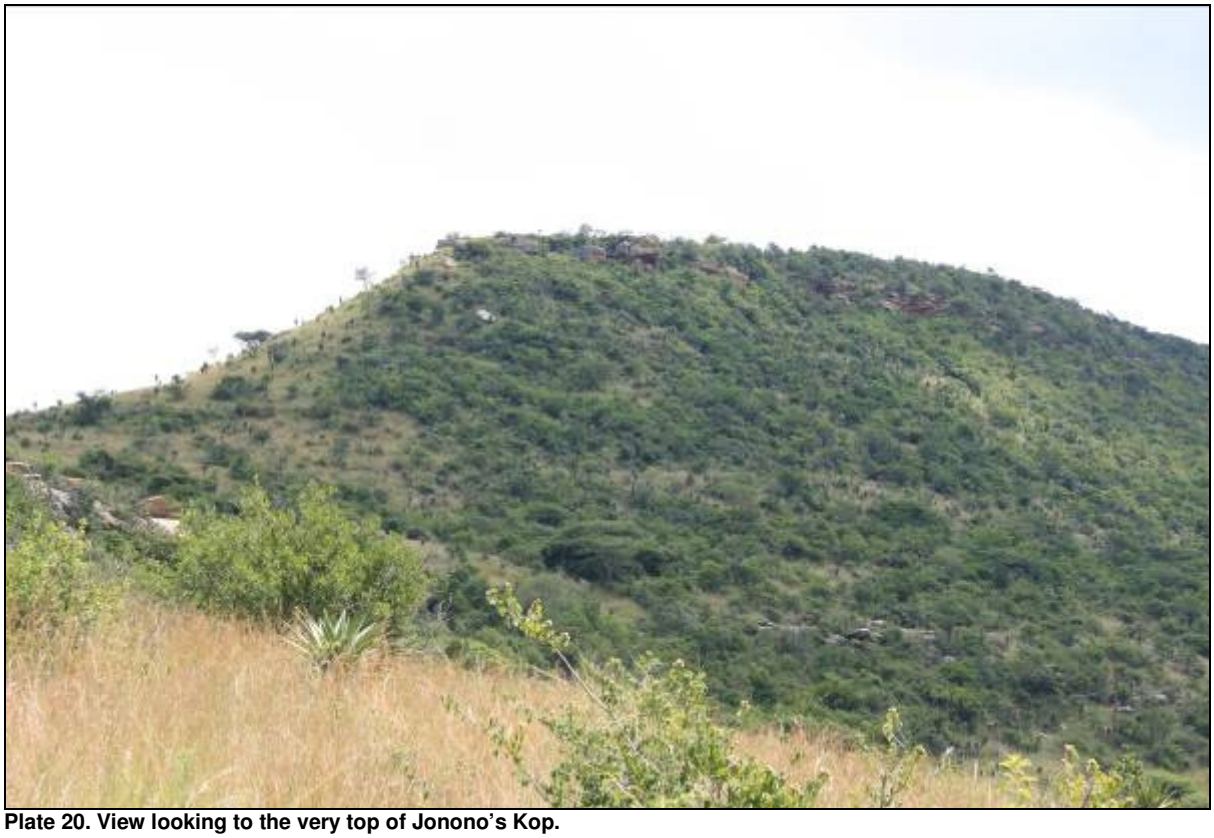

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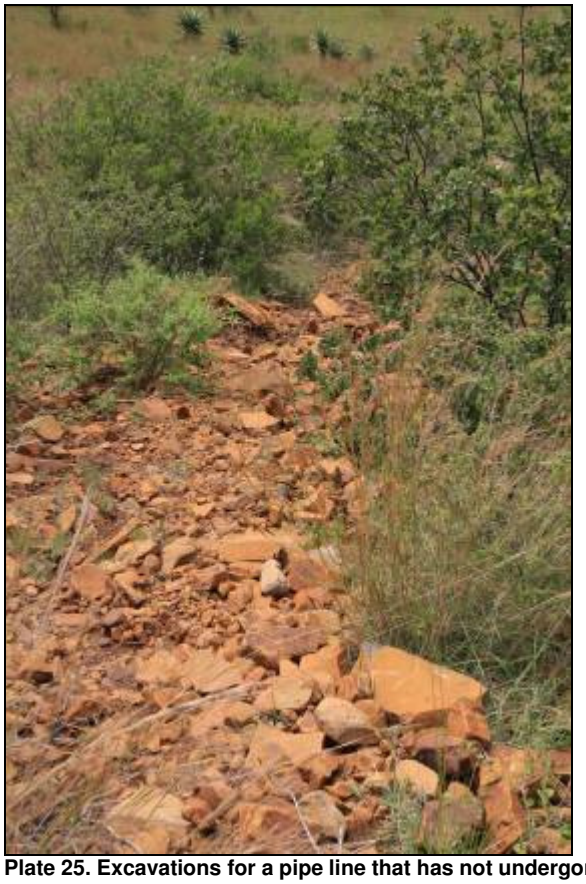

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DRIEFONTEIN PIPE LINE: ADDENDUM VEGETATION ASSESSMENT OF THE PROPOSED ALIGNMENT BETWEEN ELANDSLAAGTE AND EKUVHUKENI

ADDENDUM REPORT

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REVISION NO.: 1
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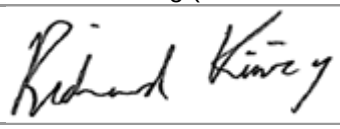
Date:	October 2013
Document Title:	Driefontein Pipe Line: Addendum Vegetation Assessment Proposed Alignment between Elandslaagte and Ekuvhukeni: Addendum Report
Author:	Dr. R.G. Kinvig (*Pr. Sci. Nat.*)
Signature:	
Revision Number:	1
Checked by:	Kurt Barichievy (*Pr. Sci. Nat.*)
Approved:	Kurt Barichievy (*Pr. Sci. Nat.*)
Signature:	
For:	SiVEST Environmental Division
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Declaration

I, Dr. Richard Grant Kinvig and David Styles, **declare that I** –

- act as independent consultants in the field of Ecology and Botany and have undertaken the **Addendum Vegetation Assessment** for the site identified for assessment for the proposed development known as the Driefontein Pipe Line in the **Uthukela District Municipality**;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not

DRIEFONTEIN PIPE LINE: ADDENDUM VEGETATION ASSESSMENT PROPOSED ALIGNMENT BETWEEN ELANDSLAAGTE AND EKUVHUKENI: ADDENDUM REPORT

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DRIEFONTEIN PIPE LINE: ADDENDUM VEGETATION ASSESSMENT PROPOSED ALIGNMENT BETWEEN ELANDSLAAGTE AND EKUVHUKENI: ADDENDUM REPORT

1. BACKGROUND

In light of the numerous re-alignments that have been proposed and identified during the field survey component of the project, an additional vegetation assessment of the new alignment options has been compiled in order to ensure that the information provided to the Department is correct and accurate.

It must be clearly stated that the overarching vegetation components that will be traversed by the proposed pipe line and its re-alignments have not changed to the extent that any new vegetation types will be crossed and therefore the addendum report will cover the specific areas where re-alignments have been proposed and the resultant impacts that will be imparted on the receiving environment assessed. Further the vegetation that occurs along the pipeline will be briefly described, in terms of the predominant species encountered as well as species that may potentially occur.

2. RE-ALIGNMENT ASSESSMENTS

2.1. R 602 to the Transnet Railway line (Commercial Farmland)

This portion of the proposed alignment will run approximately 70 metres away from the Sundays River. It is proposed that there will be a single crossing of the Sundays River. The proposed crossing position is in an area where the river is extremely narrow with steeply incised banks. The vegetation is dominated by graminoid species and there are a few trees growing in close proximity to the crossing point, however, no trees will be impacted upon by the construction activities in and around the river crossing. In addition, the tree species were alien species, most notably *Melia azedarach* and individuals belonging to the Poplar family. The river crossing and the associated impacts will be expanded upon in the wetland report which must be read in conjunction with the Final Basic Assessment Report. The methodology for the crossing of the Sundays River will also be detailed.

Areas that are removed from the river banks are grassland areas, which have been exposed to relatively high levels of grazing pressure and thus do not reflect the typical vegetative structure that would have occurred historically prior to the presence of elevated levels of livestock.

Within the grassland areas, woody vegetation is extremely sparse. This is as a result of the management of the grasslands, utilising fire as a maintenance tool. Woody vegetation therefore is restricted predominantly to areas where agricultural infrastructure exists, such as fence lines and road verges. Other areas where woody vegetation has been able to gain a foothold are the areas which are more rocky (surface rock is prevalent) and in areas where dongas have formed or along non-perennial drainage lines. In these areas, species such as *Acacia sieberiana* and *Searsia dentata* are relatively common.

In terms of the graminoid species assemblage, it is considered to be highly modified, in the most part due to the dominance of the grass sward by *Hyparrhenia hirta* (**Plate 4**). To a lesser degree species such as *Aristida junciformis* (particularly in areas where erosion was evidenced and the soils shallow).

Other more common species which were recorded were *Melinis repens, Cymbopogon* spp. and *Bothriochloa insculpta*. The Decreaser species, which are the more desirable species due to their palatability and their high protein content, have been selectively grazed and are not prevalent within the grass sward assemblage. The result of the removal of these species is that a relatively homogenous grass sward assemblage of limited nutritional value, particularly later in the season has

been created. *H. hirta* is commonly referred to as thatching grass, with this description alluding to the fibrous and hard culms that it produces.

In addition to the homogenous grass sward, one needs to appreciate the change is the grass sward architecture. The change is reflected in the average height and density of the grass sward changing resulting in impacts being imparted on the herbaceous and geophytic plant species composition of the grasslands.

The major driver is the change in the relative grass heights which results in higher levels of shading taking place and thus reducing many of the herbaceous species ability to vigorously compete, and thus over time they will fall out of the species assemblage. In addition, many herbaceous species are often relatively palatable and are the first food source to produce green material following winter, and thus they are sort out by livestock and heavily utilised. The result is that the herbaceous content and thus the diversity contained within these grassland areas is highly depauperate with a number of species occurring that appear to benefit from the grazing pressure as well as the on-going disturbance.

The most notable species that were commonly occurring within the grassland components were as follows: *Ledebouria ovatifolia* subsp. *scabrifolia, Lobelia flaccida, Oxalis obliquifolia, Rhynchosia totta, Stoebe plumosa, Chamaecrista mimosoides, Helichrysum caespititium, Helichrysum cephaloideum, Hermannia depressa, Lotononis solitudinis*[1](**Plate 5**)*, Helichrysum pilosellum* and *Helichrysum nudifolium.*

In terms of the herbaceous plants present, a number of assumptions regarding the current utilisation of the grasslands may be made. Further, numerous of these species are indicative of management practices, and soil type. Species such as *Ledebouria ovatifolia* subsp. *scabrifolia* is, due to its growth form able to withstand and in many instances evade grazing pressure, as it grows so close to the ground, i.e. it produces leaves which lie prostrate on the ground, and therefore make grazing thereof difficult. Many of the other herbaceous plant species only flower and produce green photosynthetic material slightly later in the spring and thus are not as heavily grazed as they are able to avoid the grazing pressure, as a result of the significant amounts of green grass available.

2.2. Transnet Railway line (Tribal Grazing Areas)

Species such as *Stoebe plumosa* are commonly known to increase in abundance in the presence of high grazing pressure. This species was more evident in the grassland areas which fell within the grazing lands that are under tribal ownership. In these areas it was evident that the grazing potential was significantly lower, both as a result of the lack of management, which allows the grazing livestock to simply utilise any and all resources, on an on-going basis, with no rest and or rotation of the grazing areas.

Further, the vegetation as one approaches the escarpment starts to transform to a more woody dominated species assemblage. Where the pipe line is proposed to cross steeper slopes the vegetation within these areas are dominated by woody species and succulents such as *Aloe ferox*(**Plate 6 & 7**). The most common woody species that were recorded during the ground-truthing exercise on the steeper slopes were; *Dombeya rotundifolia, Dais cotinifolia, Heteromorpha arborescens* **var.** *abyssinica, Cussonia paniculata, Acacia nilotica, Acacia caffra, Acacia robusta,* and *Ziziphus mucronata.* In the flatter areas lower down in the valley lines the most abundant woody species were *Acacia natalitia, Acacia nilotica, Dichrostachys cinerea, Gymnosporia glaucophylla, Searsia pentheri, Lippia javanica, Coddia rudis, Acacia tortilis,* and *Euclea crispa* subsp. *crispa.*

In areas where the slopes were less steep and the soil profile deeper, the vegetation was more of a mixed community with Graminoids dominating the species assemblage and numerous tree species

[1] **Considered to be a rare and relatively poorly documented species, which has a limited distribution. It was commonly occurring along numerous parts of the pipe line section running between the R 602 and the railway line. This species should be conserved by the removal of the topsoil and replacement thereof once construction is complete. It is therefore our opinion that no special measures need to be taken to conserve this species, which is a small prostrate herbaceous species.**

perforating the grassland areas. Some areas which have been exposed to excessive and unmanaged grazing are dominated by *Acacia natalitia* and *Acacia nilotica* (**Plate 10**). In areas close to erosion gulleys (**Plate 8 & 9**) and along numerous of the cattle paths *Dichrostachys cinerea* is starting to encroach onto the grazing land areas.

The pipe line for a long section, after the re-alignment off the steeper slopes runs long a newly erected fence line, which appears to be a game fence (**Plate 8 & 12**) as opposed to a livestock fence. The fence is approximately 2.4 metres in height and is well constructed. As a result of the fence construction, much of the woody vegetation in close proximity to the fence line and the road way, which runs along it has been cleared.

The presence of the fence line is such that it is enclosing an area through which the pipe line is proposed to traverse and therefore, consideration of the fence line and managing the construction within this area will need to be taken.

2.3. In close proximity to Ekuvhukeni.

This area has been identified, at a course scale, to be Income Sandy Grassland, as per the **Mucina & Rutherford 2006** classification. However, during the field survey and having followed the pipe line for its entire extent the vegetation in proximity to the pipe line is dominated by woody vegetation. Thus the vegetation cannot be described as Income Sandy Grassland, and given the species assemblage we would postulate that the vegetation type mimics the Tugela Thornveld vegetation type. We would also suggest that in large parts of this portion of the pipe line the vegetation type would never have been grassland.

The most common species of tree encountered were: *Euclea crispa* subsp. *crispa, Acacia natalitia***,** *Coddia rudis***,** *Buddleja saligna, Searsia rehmanniana, Ziziphus mucronata, Lippia javanica, Searsia pentheri* and *Gymnosporia glaucophylla.* In terms of the herbaceous and graminoid assemblage, it is dominated by increaser graminoid species and the herbaceous content is dominated by small scandent species of creeper that are able to survive the impacts and effects of the continual and unmanaged livestock grazing, particularly, in and around Ekuvhukeni. The most common species of creeper, was *Rhynchosia totta.* Other herbaceous species that were encountered during the field survey, but in limited abundances and in areas, quite well protected from the effects of livestock grazing were; *Justicia flava, Stoebe plumosa, Perotis patens, Hermannia depressa, Pentanisia prunelloides* subsp. *latifolia* and *Chamaecrista mimosoides.*

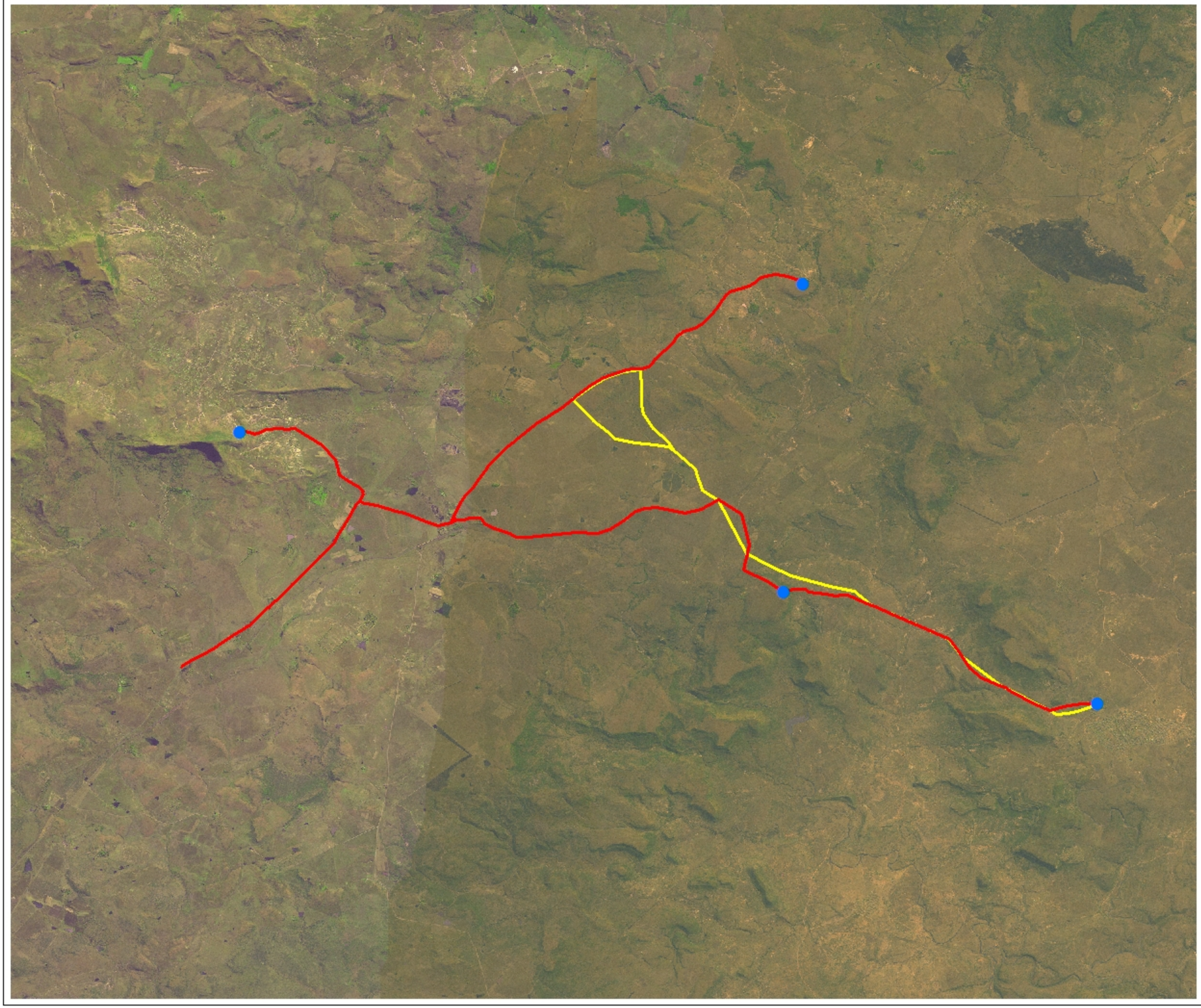
3. CONCLUSIONS

Following the assessment of the proposed alignment and having assessed the re-alignment options that will result in reducing the impact on the receiving environment as well as making the construction of the pipe line easier and less invasive and thus lowering the significance thereof, we would suggest that the pipe line be re-aligned as per our recommendations.

The overall impact on the receiving environment of the pipe line is going to be low given the relatively transformed nature of the pipe line through the commercial farming areas and the highly transformed nature of the receiving environment in close proximity to the Ekuvhukeni Reservoir.

Appendix 1

MAPPING



DRIEFONTEIN PIPELINE

VEGETATION STUDY
PROPOSED REALIGNMENTS

Legend

- Proposed Pipeline Route
- Pipeline re-alignments proposed by vegetation study
- Reservoirs

SOURCE : Chief Directorate of Survey & Mapping

N

0 1 2

Kilometers

SiVEST

ENVIRONMENTAL DIVISION
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Project No	Map Ref No	Prepared By	Date
11767	11767/03/02	SLB	30/10/2012

THIS MAP HAS BEEN PREPARED UNDER THE CONTROLS ESTABLISHED BY THE SIVEST QUALITY MANAGEMENT SYSTEM AND MEETS THE REQUIREMENTS OF THE SETA QUALITY GRADING SYSTEM THAT IS ISO COMPLIANT

Appendix 2

PLATES

Plate 1. Feeder wetland systems leading into the Sunday's River. These systems are highy degraded and eroded.

Plate 2. *Arundinella nepalensis* and *Typha capensis* growing in the feeder wetland system adjacent the Sundays River.

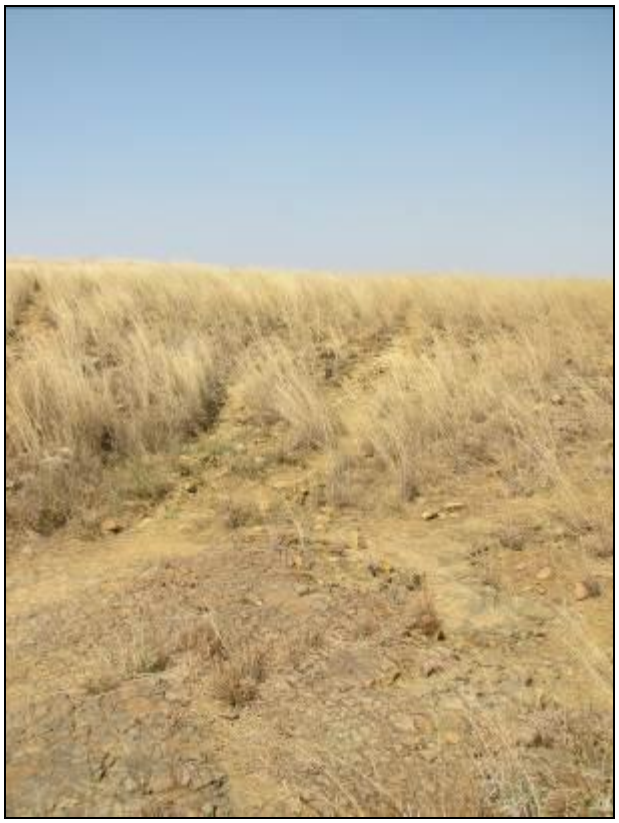

Plate 3. Eroded grassland areas

Plate 4. Typical grassland areas within the commercial farms

Plate 5. *Lotononis solitudinis* considered to be relatively rare and recorded from a few localities.

Plate 6. Rocky areas to be avoided through the re-alignment of the pipe line

Plate 7. Steep sided escarpment to be avoided through the re-alignment of the pipe line, resulting in lower impacts.

Plate 8. Pipe line to run through the woody grassland. Note the significant erosion and the cleared fence line area.

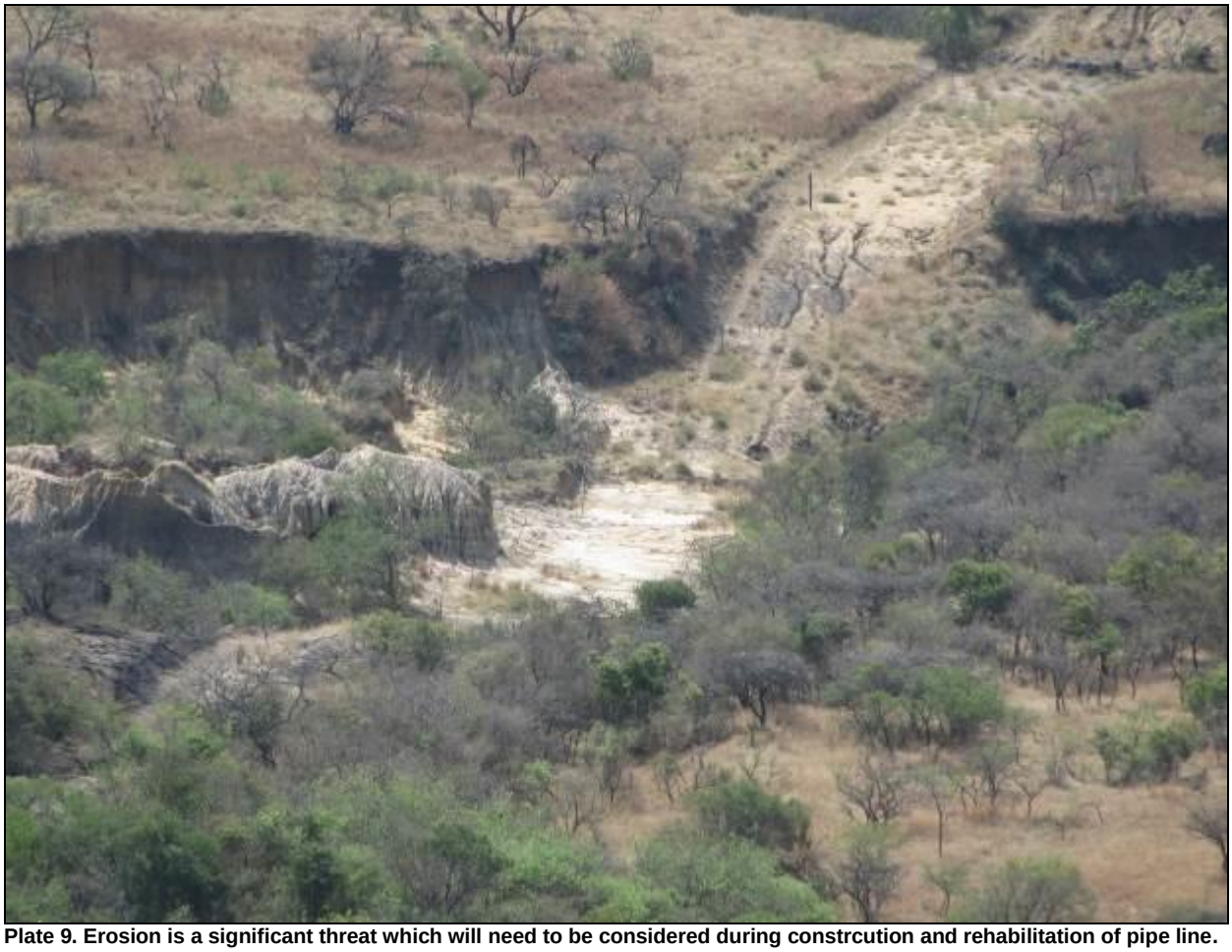

Plate 9. Erosion is a significant threat which will need to be considered during constrcution and rehabilitation of pipe line.

Plate 10. *Acacia nilotica* and *A. natalitia* encroaching into the grassland areas as a result of over-grazing.

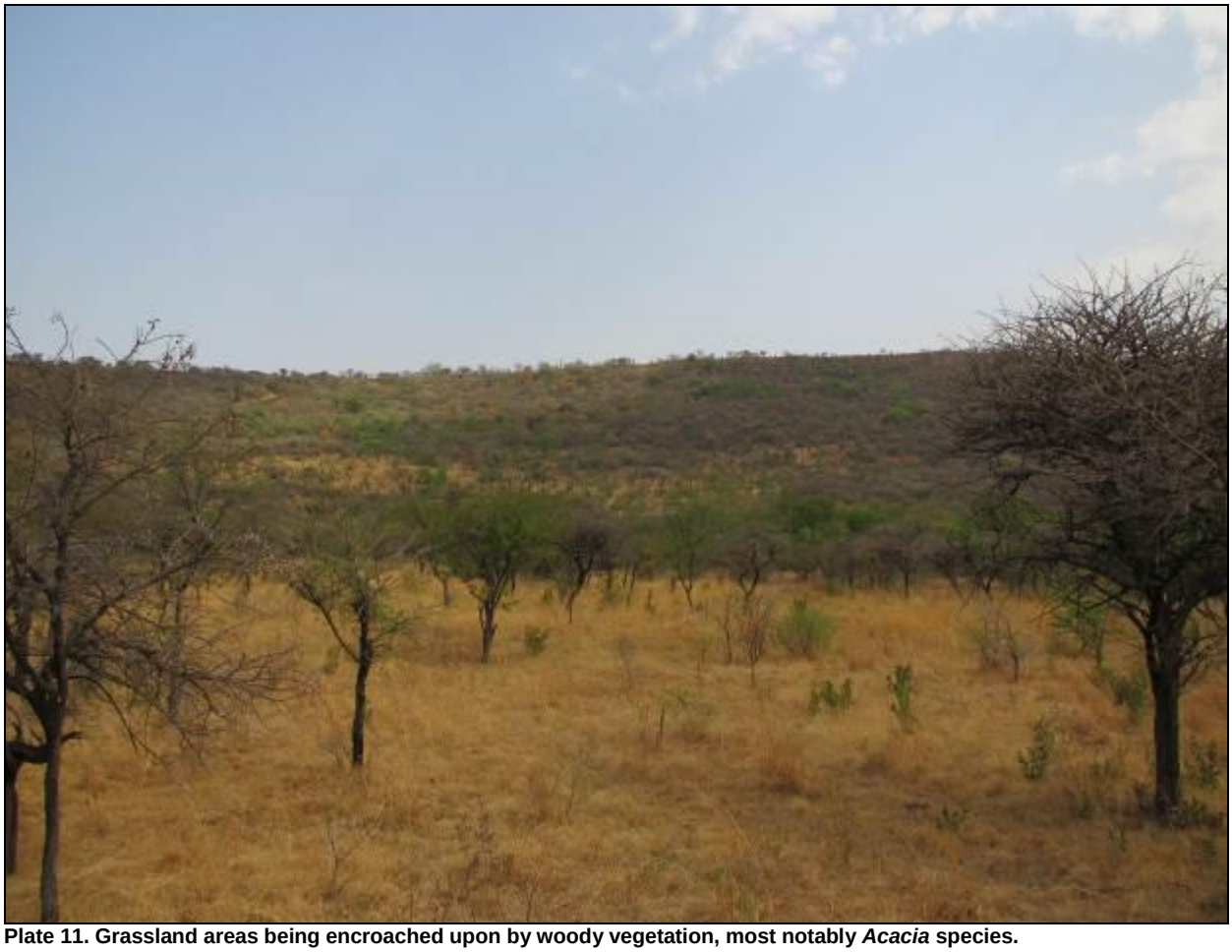

Plate 11. Grassland areas being encroached upon by woody vegetation, most notably *Acacia* species.

Plate 12. Fence line along which the pipe line runsfor a relatievly long portion, note the paths and associated disturbance

Plate 13. River crossing close to the end of the fence line nearing Ekuvhukeni.

Willcocks, Reed and Kotze cc

Proposed Driefontein Water Pipe Line from Ladysmith to Ekuvukheni

Phase 2: Wetland Assessment Report

Issue date: 07 November 2013
Revision No.: 2.0
Project No.: 11884

SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of Section 32 of Government Notice No. R. 543 dated 18 June 2010 (Environmental Impact Assessment Regulations) under sections 24(5), 24M and 44 of the National Environmental Management Act, 1998 (Act 107 of 1998).

I, **Stephen Burton,** declare that this report has been prepared independently of any influence or prejudice as may be specified by the Department of Agriculture and Environmental Affairs (DAEA).

Signed:  Date: 07/11/2013

Date:	07th November 2013
Document Title:	Proposed Driefontein water pipe line and ancillary infrastructure, from Ladysmith to Ekuvukheni, KwaZulu-Natal: Phase 2 Wetland Assessment Report
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Revision Number:	# 2.0
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PROPOSED DRIEFONTEIN WATER PIPE LINE

PHASE 2 WETLAND ASSESSMENT REPORT

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PROPOSED DRIEFONTEIN WATER PIPE LINE

PHASE 2 WETLAND ASSESSMENT REPORT

1 INTRODUCTION

SiVEST SA (Pty) Ltd (**SiVEST**) was appointed by Willcocks, Reed and Kotze to undertake a specialist wetland assessment for the proposed Driefontein water pipe line and ancillary infrastructure project. The proposed pipe line will extend from Ladysmith to Ekuvukheni in the KwaZulu-Natal Province.

2 PROJECT DESCRIPTION & MOTIVATION

Uthukela District Municipality proposes to construct approximately 56 kilometres of potable bulk water pipe mains ranging between 500 & 600 mm Ø from the existing Observation Hill reservoir site in Ladysmith to Hobsland in the Driefontein Complex, from where it will extend further to the existing Zandbult Reservoir at Ekuvukheni. This project includes the construction of a new 5 mega litre (Ml) reservoir along the pipe route to act as a balancing and storage structure (**Figure 1**).

The proposed pipe line forms part of a larger project, which aims to upgrade infrastructure and supply potable water to the greater part of the uThukela District Municipality area. This pipe line will provide potable water to a number of communities in the greater Emnambithi and Indaka Local Municipality areas. This project will improve the infrastructure and services in the area, as well as to improve the lifestyle of the communities (**SiVEST, 2013**).

Due to the extensive nature of the project a Phased approach has been adopted. This document reports solely on Phase 2 of the Driefontein Pipe Line Project (**Figure 2**).

The primary activity associated with Phase 2 of the Driefontein project will include the laying of approximately 50 km of new pipe line. Phase 2 extends from the end of Phase 1 (along the N11) north east to the Wasbank turn-off from the N11. The pipeline route then splits, and one route follows the road to Matiwane, while the other route runs in an easterly direction to Elandslaagte, and then north east towards Wasbank, before splitting just before the Sundays River, with one branch continuing towards Wasbank, and the other route running south east to Ekuvukeni (**Figure 2**).

Originally, the proposed pipeline route split at Elandslaagte, and the one leg ran adjacent to the railway line towards Ekuvukeni, while the other leg followed the existing route towards Wasbank. However, access to this alignment was difficult, and the pipeline routing would have required six wetland crossings more than the current alignment. After field verification of the pipeline route by the wetland and vegetation specialists, and following discussions with the landowners in the area, an alternative pipeline routing was determined by the specialists. This alternative alignment was presented as an option to the engineers, as a way to reduce wetland and vegetation impacts, and allow easier access for construction. The engineers have adopted the proposed alignment changes, and this is the route assessed in this report. *For further details regarding the changes to the pipeline route, please see the Vegetation Assessment undertaken by Dr. Richard Kinvig, which includes a map of the original routing, and the alternatives proposed.*

3 TERMS OF REFERENCE

The scope of works for proposed Phase 2 study is to:

- Undertake a desktop wetland assessment for the Phase 2 routing;
- Delineate the outer temporary boundary of pertinent wetland units and river crossings as identified in the desktop assessment;
- Provide a general description of the state of important wetland units delineated as above;
- Identify potential impacts of the proposed development on the integrity of the wetland areas delineated; and
- Provide mitigation and management measures to minimise the severity/magnitude of the impacts on the wetlands delineated. This will include generic wetland and river crossing methodologies.

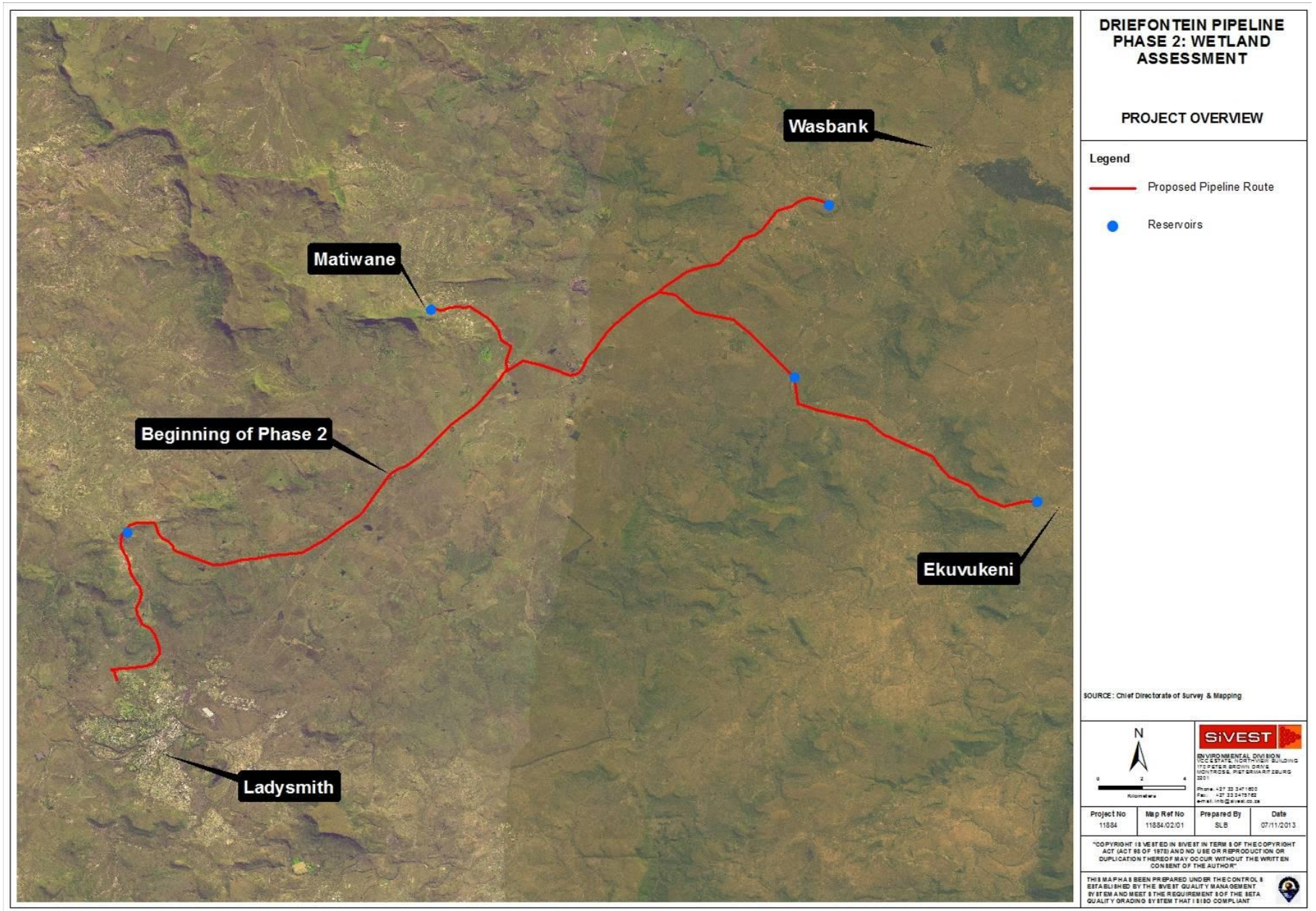

Figure 1: Project overview map

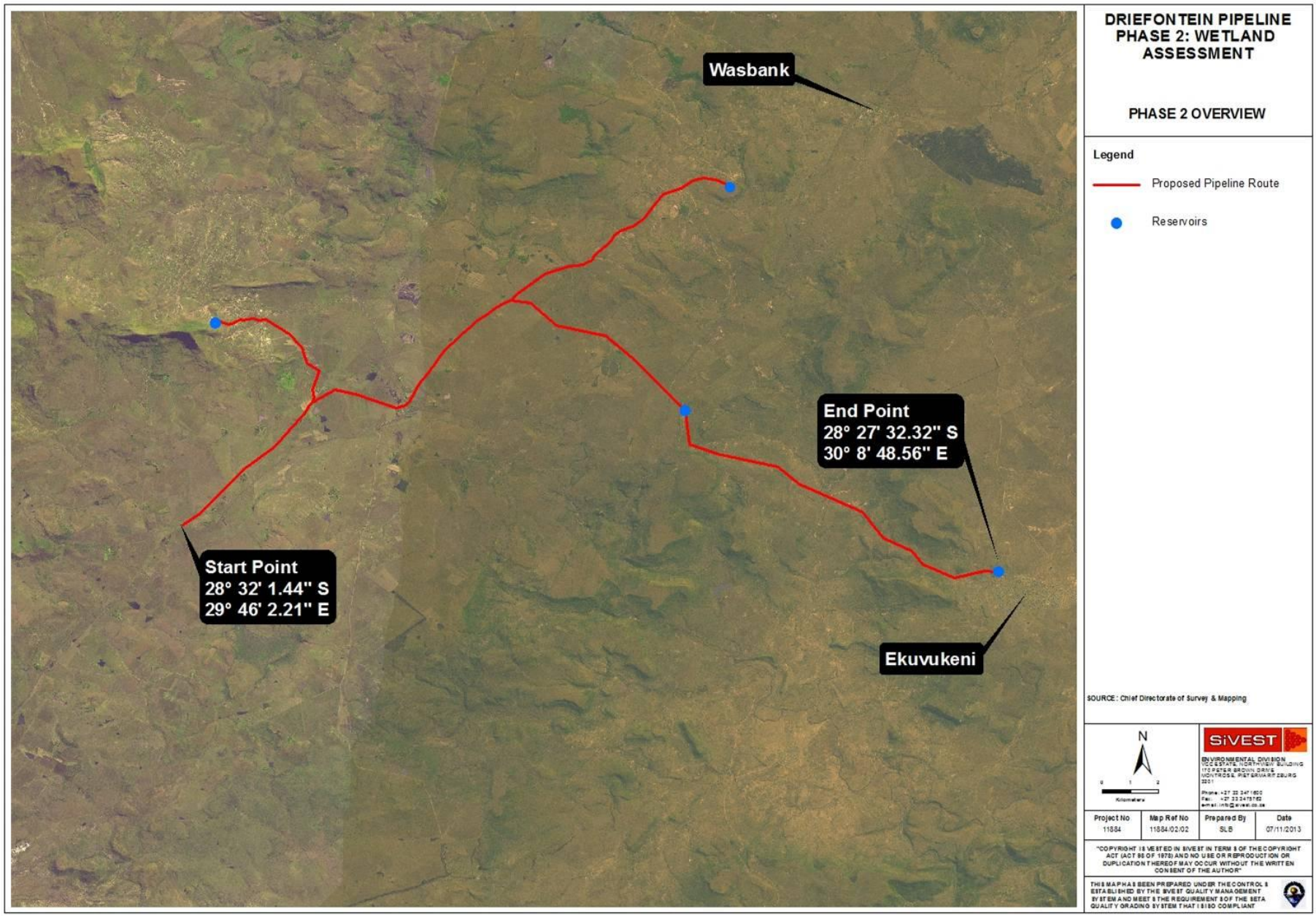

Figure 2: Phase 2 overview

4 PHASE 2: AREA OVERVIEW

Existing high level data was sourced from National GIS Datasets as well as the Environmental Potential Atlas for South Africa (ENPAT) Database for the KwaZulu-Natal Province of South Africa, compiled by the Department of Environmental Affairs and Tourism (**DEAT, 2001**).

The main purpose of ENPAT is to proactively indicate potential conflicts between development plans and critical, endangered or sensitive environments. By combining the aforementioned data resources, one is able to broadly assess the PDA, and its ability to accept change, in the form of development.

4.1 Climate

The study area has subtropical highland climate and is associated with warm summers and cool dry winters. The mean annual precipitation is approximately 750 mm with the majority of this falling between October and March. According to the Bio-Resource Unit information the overarching climate rating is C5 with moderate to severe limitations to cultivation due to seasonal rainfall and a moderate frost risk (**Camp, 1995**).

4.2 Geology and Soils

The Phase 2 pipe line route crosses land which is underlain by Arenite for the majority of the route. There is a small area near Matiwane that is underlain by shale, and a small area of dolerite intrusion near Elandslaagte.

According to ENPAT the soils are a mix of plinthic catena's, and rocky Glenrosa and/or Mispah forms. A catena is defined as a sequence of soils of similar age, derived from similar parent material but having different characteristics due to variation in topography and drainage (**Soil Classification Working Group, 1991**). Soils in a catena sequence will typically range from well drained (e.g. Hutton Soil Form) near the hilltop, grading via yellow soils on the mid-slopes to poorly drained grey soils in the valley bottoms. Typically a plinthic horizon is found in profiles of the yellow and grey members of this sequence (**Fey, 2010**).

4.3 Vegetation and Land Use

According to Mucina and Rutherford (**2006**), the southern portion of the Phase 2 route is classified as Northern KwaZulu-Natal Moist Grassland (Grassland biome), while the pipe line route crosses Thukela Thornveld (Savanna Biome) as it moves east towards Ekuvukeni, and finally crosses Income Sandy Grassland (Grassland biome) near Wasbank and Ekuvukeni According to the ENPAT Database and 2010 land cover data the study area is dominated by veld and unimproved grassland which is used as grazing land for sheep, goats and cattle. Small, formalised pockets of cultivation do also exist.

5 CONCEPTUAL FRAMEWORK

5.1 Wetland Delineation

Wetlands are defined as those areas that have water on the surface or within the root zone for long enough periods throughout the year to allow for the development of anaerobic soil conditions that favour the growth and regeneration of hydrophytic vegetation (plants adapted to saturated and anaerobic soil conditions).

In terms of Section 1 of the National Water Act (Act No. 36 of 1998), wetlands are legally defined as:

(1)…land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which

land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Soils characterised by prolonged anaerobic soil conditions are referred to as hydric or hydromorphic soils. Hydric soils develop and occur under anaerobic conditions and are characterised by the chemical reduction of common soil minerals (e.g. iron and manganese) under saturated conditions that results in the gleying (loss of mineral colours) of the soil matrix and under temporarily and seasonally saturated conditions, the formation of mottles, which are mineral oxide precipitates of formerly reduced minerals that precipitate out of solution during the drying of the soil in the dry season. These soil wetness features are referred to as redoximorphic features. Wetland delineations are based primarily on the presence of soil wetness indicators/redoximorphic features. These features must occur within 50 cm of the surface soil profile for an area to be considered a wetland (**Collins, 2005**).

Typical redoximorphic features are (**Collins, 2005**):

- A reduced matrix - occurs when the iron and manganese in soils are reduced and the soils appears grey/pale (colour appears washed out).
- Redox depletions - the "grey" (low chroma) bodies within the soil where Fe-Mn oxides have been stripped out, or where both Fe-Mn oxides and clay have been stripped. Iron depletions and clay depletions can occur. These can occur as:
  - Iron depletions - low chroma bodies with clay contents similar to that of the adjacent matrix. Iron depletions are often referred to as grey mottles.
  - Clay depletions - low chroma bodies containing less iron, manganese and clay than the adjacent soil matrix.
- Redox concentrations - Accumulation of iron and manganese oxides. These can occur as:
  - Nodules - firm, irregular shaped bodies that are uniform when broken.
  - Concretions - harder, regular shaped bodies;
  - Mottles - soft bodies of varying size, mostly within the matrix, with variable shape appearing as blotches or spots of high chroma colours;
  - Pore linings - zones of accumulation that may be either coatings on a pore surface, or impregnations of the matrix adjacent to the pore. They are recognized as high chroma colours that follow the route of plant roots, and are also referred to as oxidised rhizospheres.

It is important to note that there are normally three wetness or saturation zones to every wetland namely, the permanent zone, the seasonal zone and the temporary zone. Each zone is based on the degree and duration of inundation and saturation of the soils. The permanent zone usually reflects soils that indicate inundation and/or saturation cycles that last more or less throughout the year, whilst the seasonal zone may only reflect soils that indicate inundation and/or saturation cycles for a significant period during the rainy season. The temporary zone reflects soils that indicate the shortest period(s) of inundation/saturation that are long enough, under normal circumstances, for the formation of hydromorphic soils and the growth of wetland vegetation (**DWAF, 2005**). The diagnostic criteria for the identification of the three wetness zones are summarised in **Table 1** below.

Table 1: Relationship between degree of wetness (wetland zone), soil-physio-chemistry and vegetation (***after*** **Kotze *et al*, 1994**)

	Degree of wetness		
	Temporary	**Seasonal**	**Permanent / Semi-permanent**
Soil Depth (0cm – 10cm)	Matrix chroma: 1-3 Few / no mottles Low / intermediate OM Non-sulphuric	Matrix chroma: 0-2 Many mottles Intermediate OM Seldom sulphuric	Matrix chroma: 0-1 Few / no mottles High OM Often sulphuric
Soil Depth (40cm – 50cm)	Few / many mottles Matrix chroma: 0-2	Many mottles Matrix chroma: 0-2	No / few mottles Matrix chroma: 0-1
Vegetation	Predominantly grass species	Predominantly sedges and grasses	Predominantly reeds and sedges

Vegetation distribution within wetlands is very closely linked to the flooding regime. Terrestrial plants are not tolerant of flooding and saturation within the root zone for periods long enough to cause anaerobic conditions, and are thus found on higher ground. The distribution of wetland plants is related to their tolerance of different flooding conditions, and their distribution within a system can be used as an indication of the wetness of an area.

Wetland plants are divided into 5 categories based on their expected frequency of occurrence in wetlands. These groups are:

- **Obligate Wetland Plants** - occur almost always in wetlands under natural conditions (>99% of occurrences);
- **Facultative Wetland Plants** - usually occur in wetlands but can occasionally be found on dry land (67-99% of occurrences);
- **Facultative Plants** - equally likely to grow in wetlands and non-wetlands (34-66% of occurrences);
- **Facultative Upland/Dry-land Plants** - usually occur outside of wetlands but occasionally found in wetlands (1-34% of occurrences); and
- **Obligate Upland/Dry-land Plants** - occur almost always outside of wetlands under natural conditions (<1% of occurrences).

Typically, indicators of soil wetness based on soil morphology correspond closely with vegetation distribution, since hydrology affects soils and vegetation in systematic and predictable ways. However, in systems where the hydrological regime has been modified due to human activities, vegetation distribution will not vary systematically with soil morphology. The response of vegetation to alteration of hydrological conditions is rapid (months/years), whereas the response of soil morphology to such alteration is slow (centuries). Therefore, the lowering of the water table or reduction of surface flows, may lead to rapid establishment of terrestrial vegetation, whereas the soil morphology will retain indicators of wetness for a lengthy period.

For this reason, soil morphology forms the basis of wetland delineation nationally, following international protocols, mainly because it provides a long-term indication of the “natural” hydrological regime. However, it is important to note that where soil wetness indicators cannot be used to identify the current hydrological conditions either through extensive disturbance or through certain soil types that do not retain clear redoximorphic features, the terrain and vegetation indicators will have to be used.

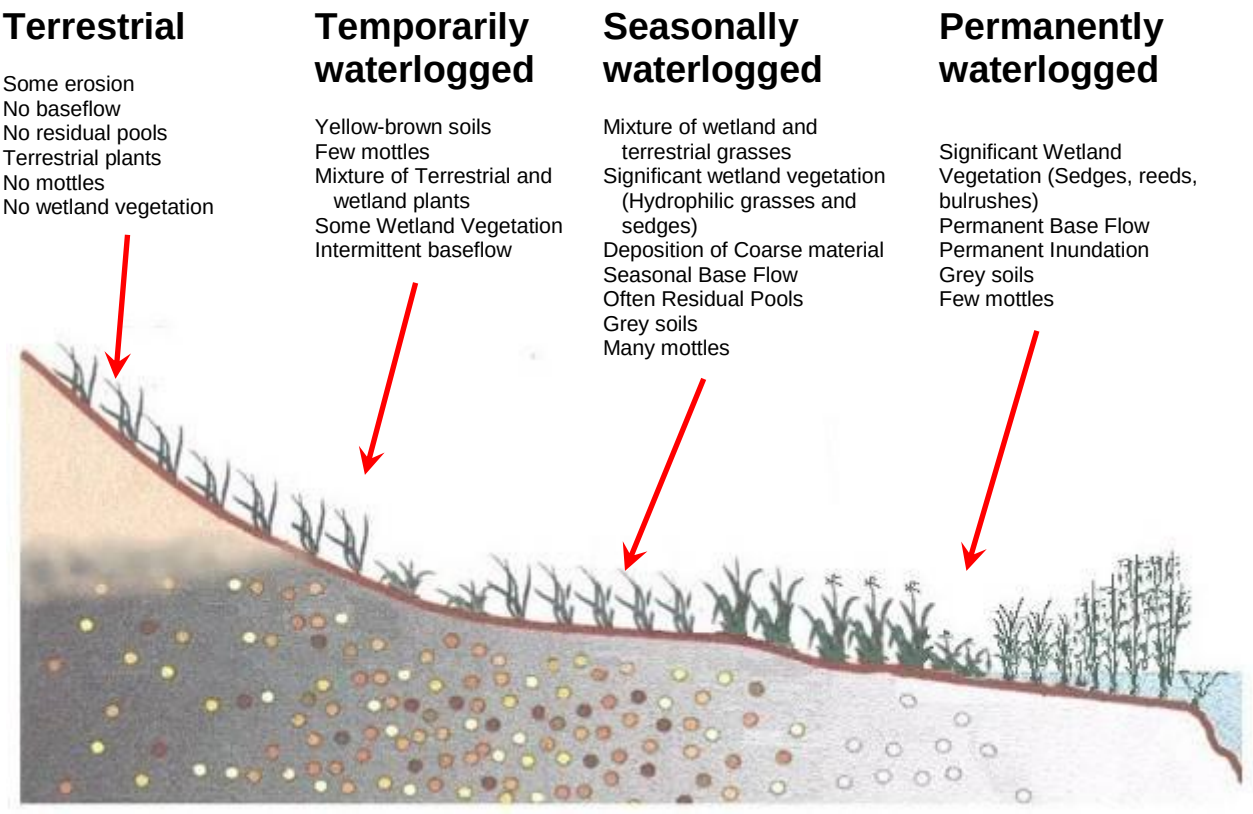

Figure 3: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change along a gradient of decreasing wetness, from the middle to the edge of the wetland. (**Reproduced from Kotze (1996), DWAF Guidelines**)

5.2 Wetland Classification

Central to the assessment of the health and ecosystem services value of wetlands is the characterisation of wetland hydro-geomorphic types which are defined based on the geomorphic setting of the wetland in the landscape, water source, how water flows through the wetland and how water exits the wetland (**Kotze *et al.*, 2009**). In this regard, a proposed National Wetland Classification System has been developed by the South African National Biodiversity Institute (SANBI). The classification system identifies eleven broad hydro-geomorphic units:

1. Channel
2. Channelled valley bottom wetland
3. Un-channelled valley bottom wetland
4. Floodplain wetland
5. Exhorheic depression with channelled inflow
6. Exhorheic depression without channelled inflow
7. Endorheic depression with channelled inflow
8. Endorheic depression without channelled inflow
9. Flat
10. Hillslope seep with channelled outflow
11. Hillslope seep without channelled outflow
12. Valley head seep

A brief description of the key elements of each HGM type is provided below in **Table 2** below.

Table 2: Characteristics of different hydro-geomorphic (HGM) types included in the proposed National Wetland Classification System (**SANBI, 2009**)

HGM Type	Landscape Setting	Hydrological Characteristics		
		Inputs	**Throughputs**	**Outputs**
1. Channel	Slope / Valley floor / Plain	• Overland flow from catchment runoff, • Concentrated surface flow from upstream channels and tributaries • Diffuse surface flow from an unchannelled upstream drainage line • Seepage	• Concentrated surface flow	• Concentrated surface flow, generally, but can be diffuse surface flow
2. Channelled Valley Bottom Wetland	Valley floor	• Overland flow from adjacent valley-side slopes • Lateral seepage from adjacent hillslope seeps • Channel overspill during flooding	• Diffuse surface flow • Temporary storage in depressions • Short-lived concentrated flows during flood events	• Diffuse surface flow and interflow into adjacent channel • Infiltration and evaporation
3. Un-channelled Valley Bottom Wetland	Valley floor / plain	• Concentrated or diffuse surface flow from upstream • Channels and tributaries • Overland flow from adjacent valley-side slopes • Lateral seepage from adjacent hillslope seeps • Groundwater	• Diffuse surface flow, • interflow, temporary storage of water in depressions, • Possible short-lived concentrated flows during high-flow events	• Diffuse or concentrated surface flow, • Infiltration and evaporation (particularly from depressional areas)
4. Floodplain Wetland	Valley floor / plain	• Channel overspill during flooding (predominantly) • Some overland flow from adjacent valley-side slopes (if present) • Lateral seepage from adjacent hillslope seeps (if present)	• Diffuse surface flow • interflow temporary storage of water in depressions • possible short-lived concentrated flows during flooding events	• Diffuse surface flow and interflow into adjacent channel • Infiltration and evaporation (particularly from depressional areas)
5. Exorheic Depression with channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Concentrated and (possibly) diffuse surface flow • Interflow • Groundwater	• Storage of water • Slow through-flow	• Concentrated surface flow
6. Exorheic Depression without channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Diffuse surface flow • Interflow • Groundwater	• Storage of water • Slow through-flow	• Concentrated surface flow
7. Endorheic Depression with channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Concentrated and (possibly) diffuse surface flow • Interflow • Groundwater	• Containment and storage of water	• Evaporation • Infiltration
8. Endorheic Depression without channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Diffuse surface flow • Interflow • Groundwater	• Containment and storage of water	• Evaporation • Infiltration
9. Flat	Plain / bench	• Precipitation • Groundwater	• Containment of water • Some diffuse surface flow and/or interflow	• Evaporation • infiltration
10. Hillslope Seep with	Slope	• Groundwater	• Diffuse surface flow	• Concentrated surface

HGM Type	Landscape Setting	Hydrological Characteristics		
		Inputs	Throughputs	Outputs
channelled outflow		• Precipitation (perched)	• Interflow	flow
11. Hillslope Seep without channelled outflow	Slope	• Groundwater • Precipitation (perched)	• Diffuse surface flow • Interflow	• Diffuse surface flow • Interflow • Evaporation • Infiltration
12. Valley Head Seep	Valley floor	• Groundwater • Diffuse surface flow • Precipitation	• Diffuse surface flow • Interflow	• Concentrated surface flow

6 METHODS

6.1 Wetland Delineation

The outer temporary boundaries of the wetlands onsite were delineated using the method contained within the DWAF guideline 'A practical field procedure for the identification and delineation of wetlands and riparian areas' (**DWAF, 2005**). This guideline document stipulates that consideration be given to four specific wetland indicators required to determine the outer edge of the temporary boundary of a wetland.

These indicators are:

- **Terrain Unit** - identify those parts of the landscape where wetlands are most likely to occur e.g. valley bottoms and low lying areas.
- **Soil Form** - identify the soil forms associated with prolonged and frequent saturation.
- **Soil Wetness** - identify the soil morphological "signatures" that develop in soils characterised by prolonged and frequent saturation.
- **Vegetation** - indentify the presence of 'hydrophylic and hydrophytic vegetation associated with frequently saturated soils.

In practice, the soil wetness indicator is the most important indicator for determining the outer boundary of wetlands and the other three indicators are better used in a confirmatory role. This is mainly due to the fact that soil wetness indicators remain in wetland soils, even if they are degraded or desiccated, thereby providing an indication of the natural extent of wetlands.

In this study the presence of soil wetness indicators within the top 50 cm of the soil profile were utilised to delineate the outer temporary wetland boundary. The vegetation indicator was used in to supplement the findings.

Soil sampling was carried out along transects across the valley bottom and low-lying areas onsite. At each sample point, soil was sampled at 0-10 cm and 40-50 cm. The value and chroma were recorded for each sample according to the 7.5YR Munsell Soil Colour Chart, as well as the degree and colour of mottling. Vegetation sampling was carried out in a 5m radius surrounding each of the soil sample sites.

A conventional handheld Global Positioning System (GPS) was used to record the location of the soil sampling points along each transect. The GPS points were then imported into ArcGIS 10 and the outer temporary wetland boundary along each transect determined. The boundary points were then combined to form a single continuous boundary using contour information, aerial photography and knowledge on the hydraulic conductivity of the soils. The GPS is expected to be accurate up to 3 metres.

6.2 Wetland Classification

The wetlands identified onsite were classified into individual hydro-geomorphic (HGM) units as per the proposed National Wetland Classification System developed by **SANBI (2009)**. This was achieved by observing the topographical and geomorphic setting, and the general hydrology of the wetland units.

7 WETLAND DESKTOP ASSESSMENT

A desktop wetland assessment was undertaken for Phase 2 of the Driefontein Pipe Line Project. The objective of this study is to identify wetland features in the broad study area. In order to achieve this objective the National Freshwater Ecosystem Priority Areas database was used in combination with the 1: 50 000 map sheets to identify spatially prominent wetland features.

The National Freshwater Ecosystem Priority Areas (NFEPA) is a product of a multi-partner project, completed in 2011, between the CSIR, Water Research Commission, South African National Biodiversity Institute, Department of Water and Environmental Affairs, South African Institute of Aquatic Biodiversity and South African National Parks. By interrogating this database one is able to identify wetlands and other sensitive aquatic features. Identified surface water features from the database within close proximity to the pipeline route will provide the basis for the in-field detailed assessment.

7.1 Assumptions and Limitations

The desktop portion of this report is used to identify major wetland systems and important freshwater resources. It should be clearly noted that, since the spatial information used in portions of this assessment is of a reconnaissance nature, only broad/large scale information is provided. This study has focused on the delineation of wetlands and wetland boundaries for the pipe line route / corridor. A full delineation and mapping of all wetlands in the wider area has thus not been undertaken.

7.2 Results

The results from the desktop assessment are shown in **Figures 4, 5 and 6**.

Figure 4, assesses the pipe line route which runs from the N11 to the existing Matiwane Reservoir to the north. The primary hydrological feature of this area is the Modderspruit which runs in a southerly direction and crosses the pipe line route near its southern extent. The proposed pipe line route impacts a small number of valley bottom wetlands but mainly influences a number of drainage lines which ultimately supplement the Modderspruit to the east.

Figure 5, assesses the section of pipe line running from the N11, north east to Wasbank. A large channelled valley bottom wetland system, associated with the Sundays River, dominates this portion of the pipe line route. The proposed pipe line route impacts a small number of valley bottom wetlands but mainly influences a number of drainage lines which ultimately supplement the Sundays River to the south.

Figure 6, assesses the remainder of Phase 2 from the Sundays River split to Ekuvukeni in the southeast. The pipe line route is dominated by a number of small drainage systems, all of which drain eventually into the Sundays River system east and south of the pipe line route. The remainder of the route crosses a number of smaller drainage systems which drain into the abovementioned tributaries of the Sundays River.

After examining the aerial photos and GIS data it is clear that the NFEPA Database has not captured all the wetlands present within the project area. Owing to this, field verification was undertaken to refine and ground-truth the features displayed in this wetland assessment.

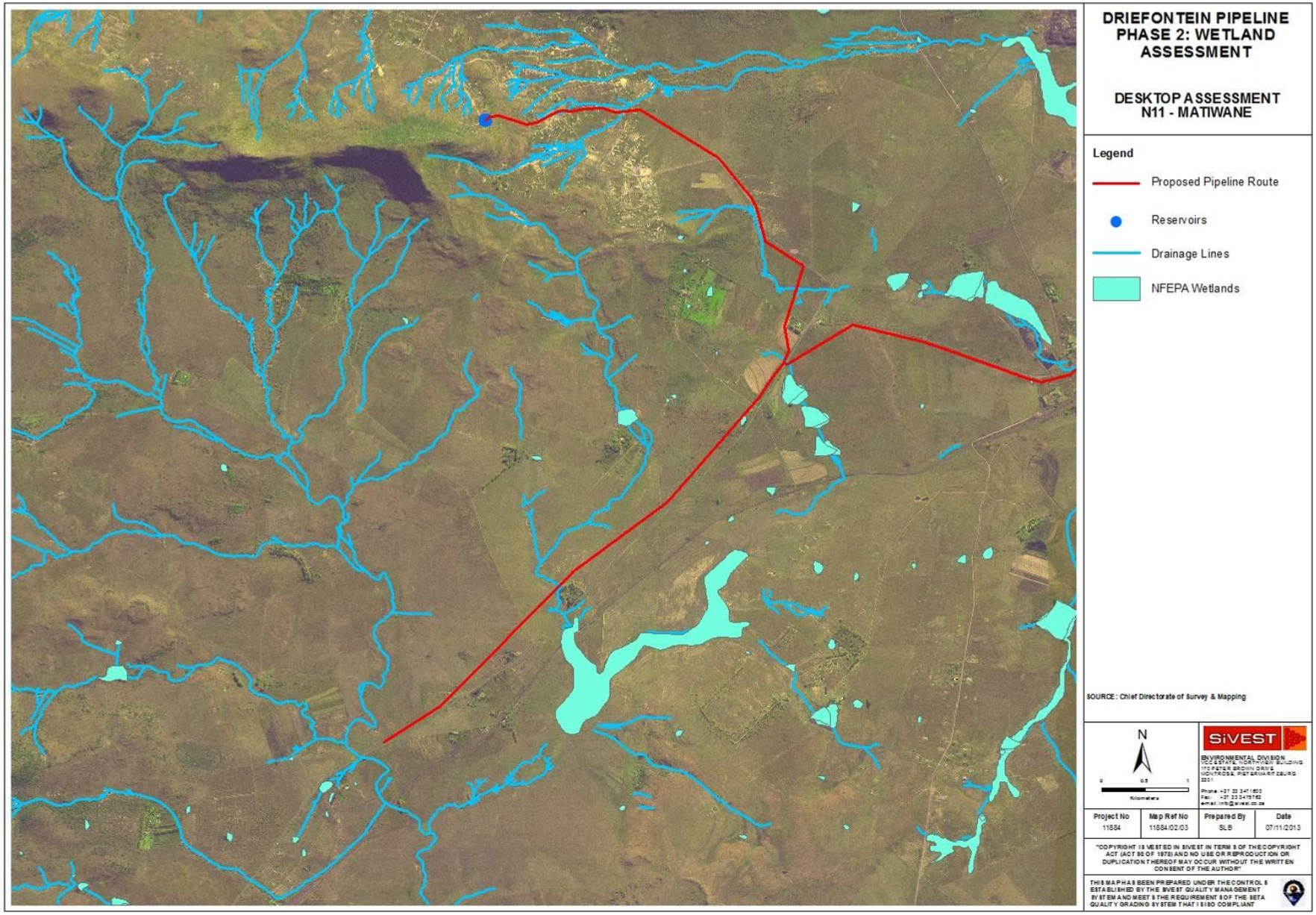

Figure 4: Phase 2 Desktop Wetland Assessment N11 - Matiwane Pipe Line

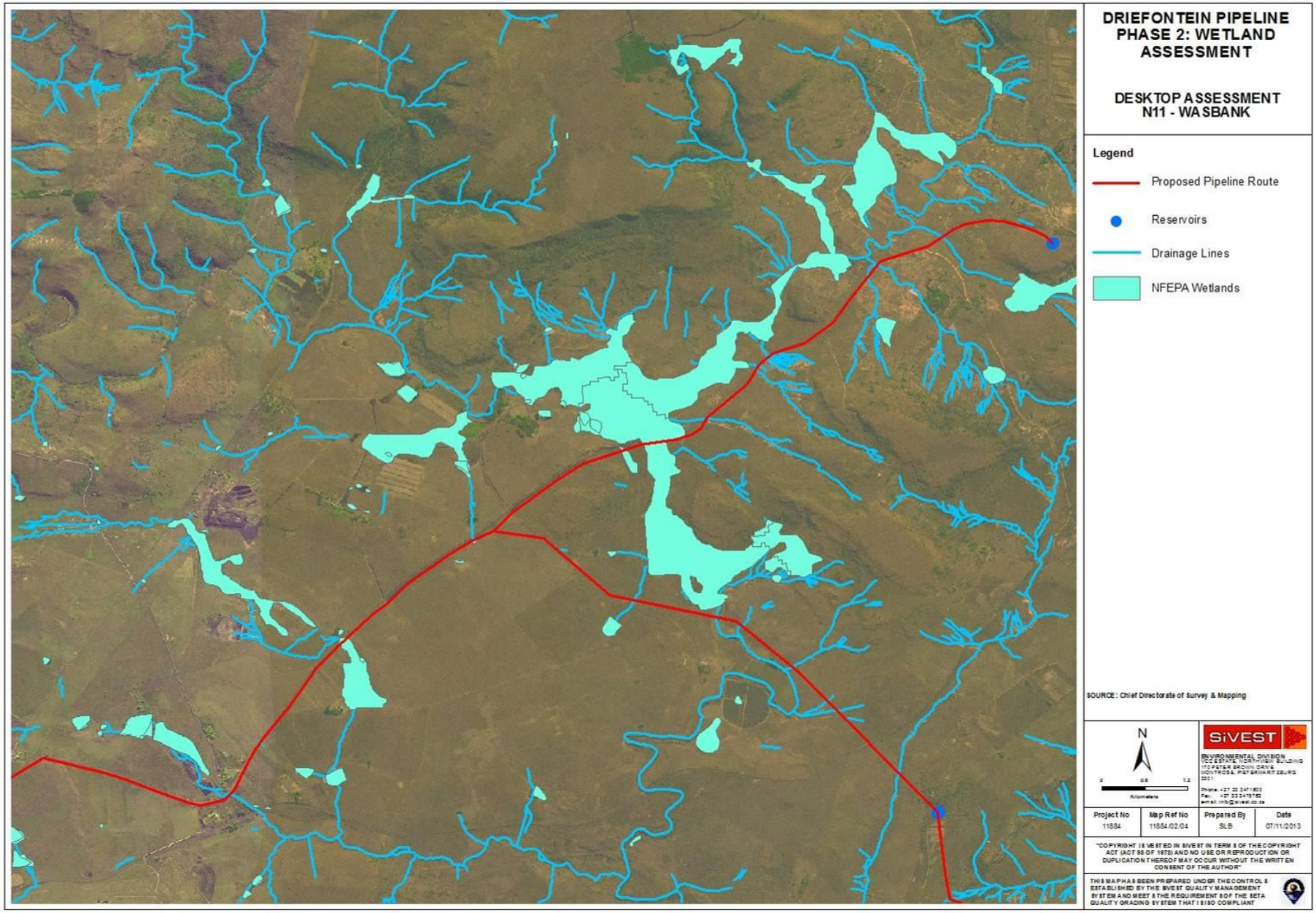

Figure 5: Phase 2 Desktop wetland assessment N11 - Wasbank

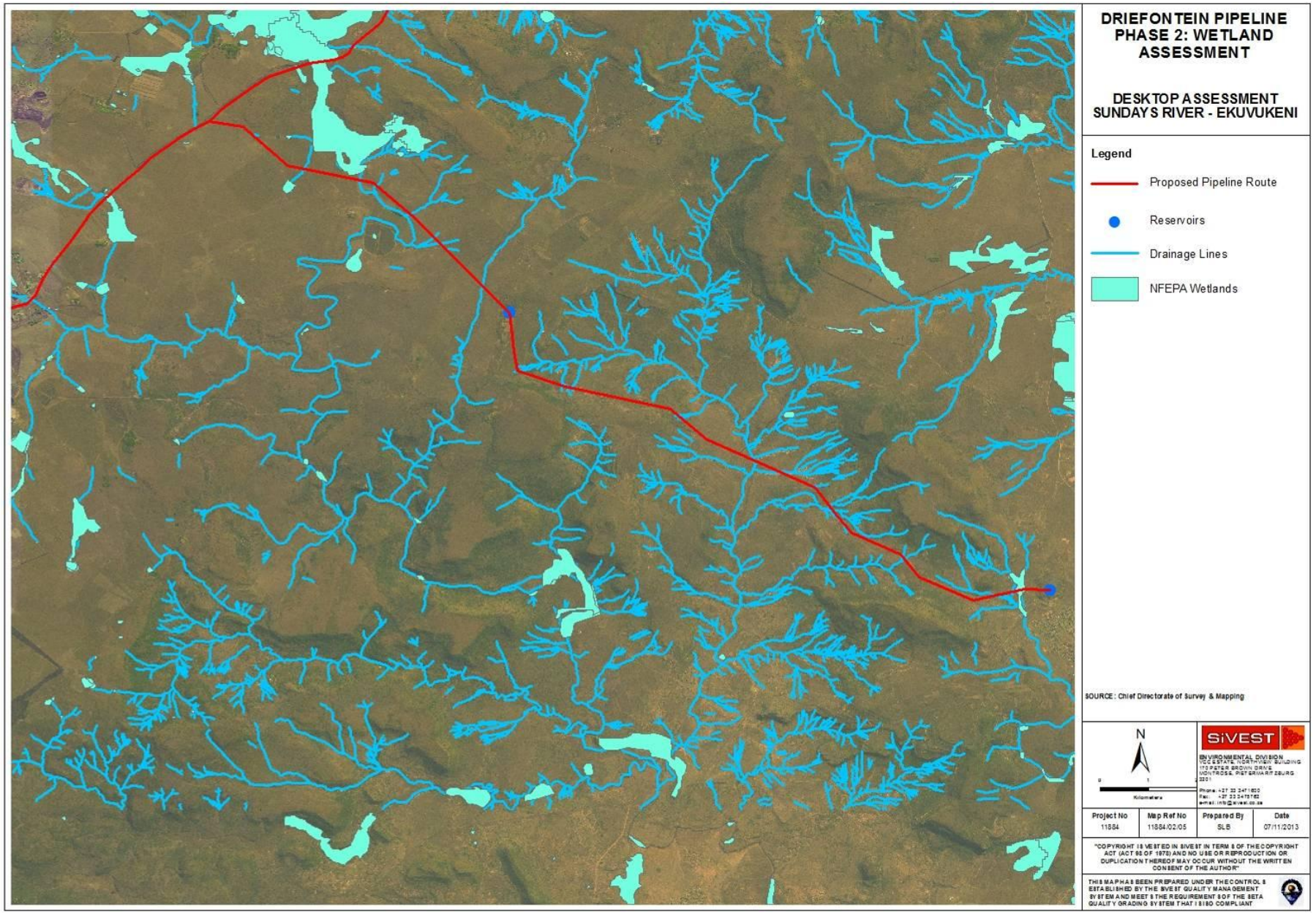

Figure 6: Phase 2 desktop wetland assessment Sundays River - Ekuvukeni

8 IN-FIELD WETLAND DELINEATION RESULTS AND DISCUSSION

Field verification for Phase 2 took place on the 31st of January, 22nd of May and 31st of July 2013. This study has focused on the delineation of wetlands and wetland boundaries influenced by the proposed pipe line alignment. A full delineation and mapping of all wetlands in the wider area has thus not been undertaken. For ease of assessment Phase 2 of the project was broken into three focus areas. These focus areas were subjected to detailed assessment and are summarised in **Sections 8.1** through **8.3**.

8.1 Wetland Delineation Results: N11 - Matiwane Focus Area

The N11 - Matiwane focus area incorporates the area along the N11, and along the road to Matiwane (**Figure 7**). The pipe line route follows the N11 in a north easterly direction towards the Wasbank turn-off. This part of the route influences four small wetland units, which have already been disturbed by previous activities associated with the development of the road.

The pipe line crosses under the N11 and immediately turns west along existing road that runs to Matiwane. This section of the route affects three small sections of wetland, two of which have existing disturbance, and one of which is currently being eroded through degradation of the vegetation within a communal grazing area.

If the proposed route is authorised trenching within wetlands will be required. Negative impacts to the wetland will need to be mitigated (**Section 9**).

8.2 Wetland Delineation Results: N11 - Wasbank Focus Area

The N11 - Wasbank focus area runs between the N11 Wasbank turn-off, and Wasbank town (**Figure 8**). This focus area comprises seven small wetland and drainage crossings, as well as two large wetland crossings, one of which is the Sundays River and associated floodplain. Signs of land degradation and erosion are common along this portion of the route with most drainage lines showing disturbance and associated erosion. The area is characterised by undulating topography with seasonal, incised and rocky channels. The drainage lines and associated aquatic habitats have been degraded and normal functioning has been severely compromised.

In most instances the channels have virtually eroded onto bed rock and blasting will be required to ensure that the pipe is correctly bedded and afforded the necessary protection. The issue with crossing and re-instating these channels is that they are generally a high energy environment in the rainy season. The fill material (usually a mix of in-situ rock and soil) will quickly become the preferential flow path for storm water runoff resulting in rapid scouring and exposure of the pipe to the impacts of the river when in spuit. The option of concrete capping of the pipe line trench or an installation of a gabion mattress may need to be explored as a mitigation measure in these areas.

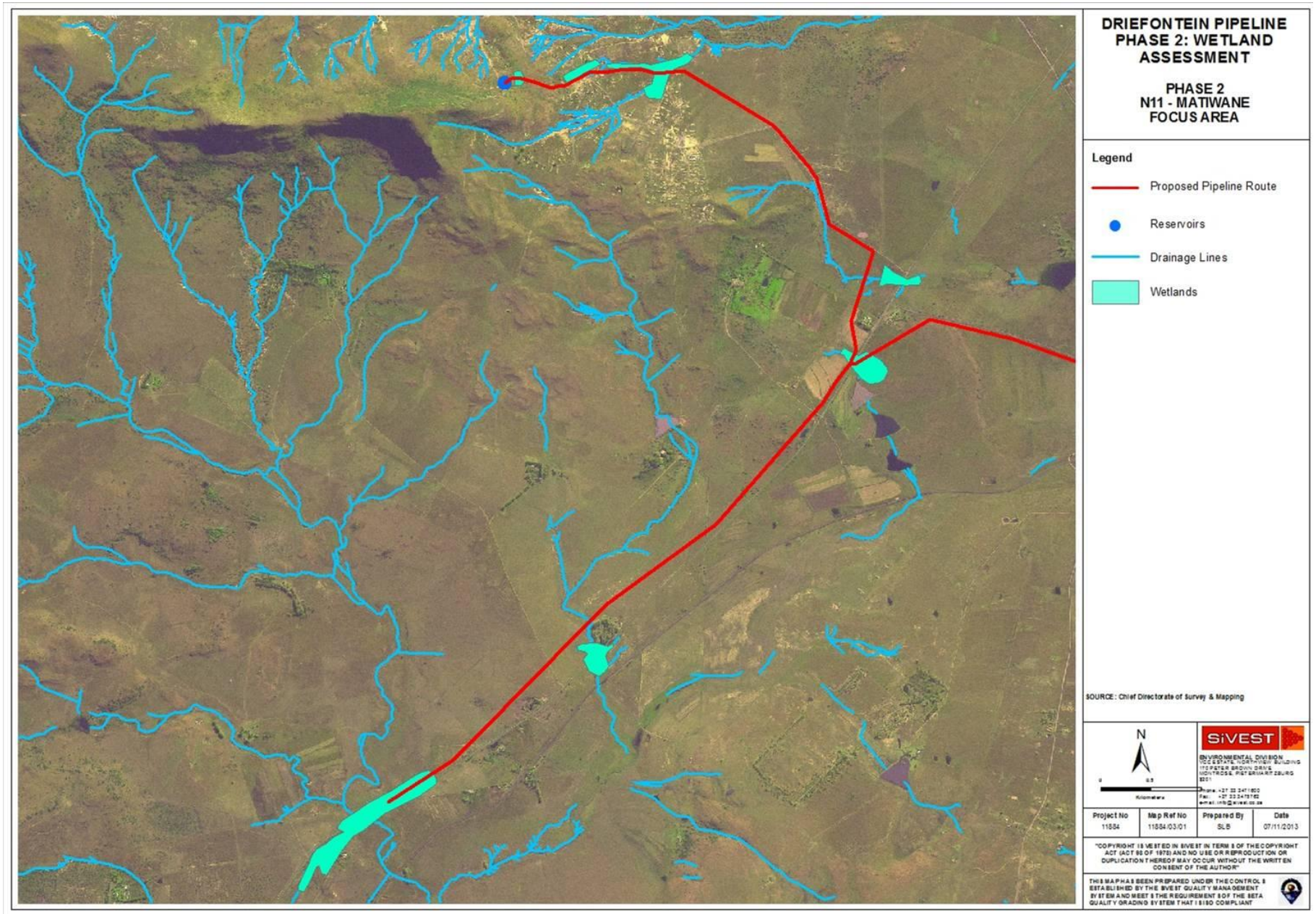

Figure 7: N11 - Matiwane Focus Area: wetland delineation map.

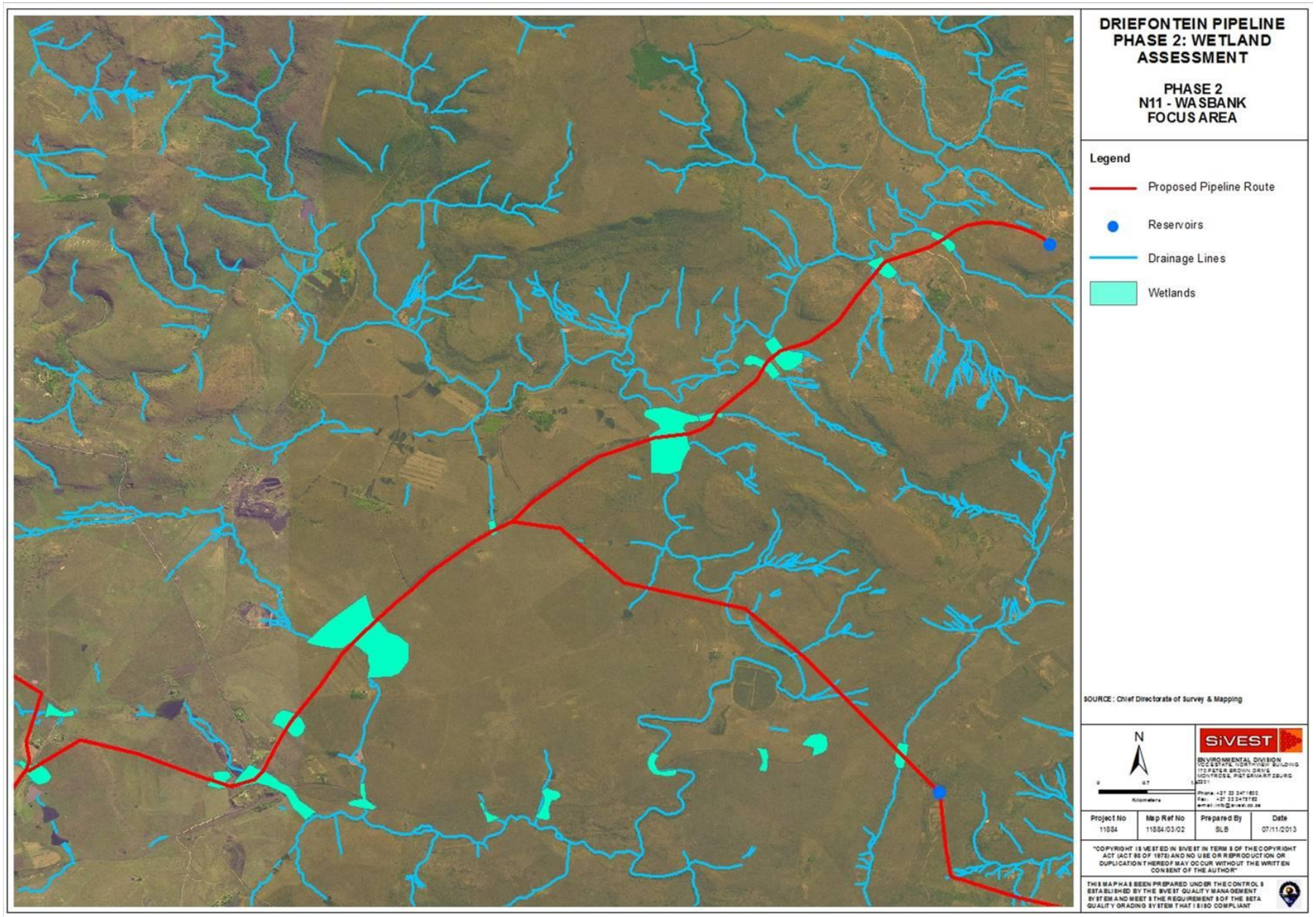

Figure 8: N11 - Wasbank Focus Area: wetland delineation map.

8.3 Wetland Delineation Results: Sundays River - Ekuvukeni Focus Area

The Sundays River - Ekuvukeni focus area incorporates the area from the pipeline split near the Sundays River to Ekuvukeni (**Figure 9**). The majority of this route crosses range land used for the grazing of cattle, and incorporates eleven small drainage line and wetland crossings. There is one larger system to be crossed, namely the Sundays River, which at the crossing point is an incised river valley with no real floodplain. The area is characterised by undulating topography with seasonal, incised and rocky channels. The drainage lines and associated aquatic habitats have been degraded and normal functioning has been severely compromised.

In most instances the channels have virtually eroded onto bed rock and blasting will be required to ensure that the pipe is correctly bedded and afforded the necessary protection. The issue with crossing and re-instating these channels is that they are generally a high energy environment in the rainy season. The fill material (usually a mix of in-situ rock and soil) will quickly become the preferential flow path for storm water runoff resulting in rapid scouring and exposure of the pipe to the impacts of the river when in spuit. The option of concrete capping of the pipe line trench or an installation of a gabion mattress may need to be explored as a mitigation measure in these areas.

If the proposed route is authorised trenching within wetlands will be required. Negative impacts to the wetland will need to be mitigated (**Section 9**).

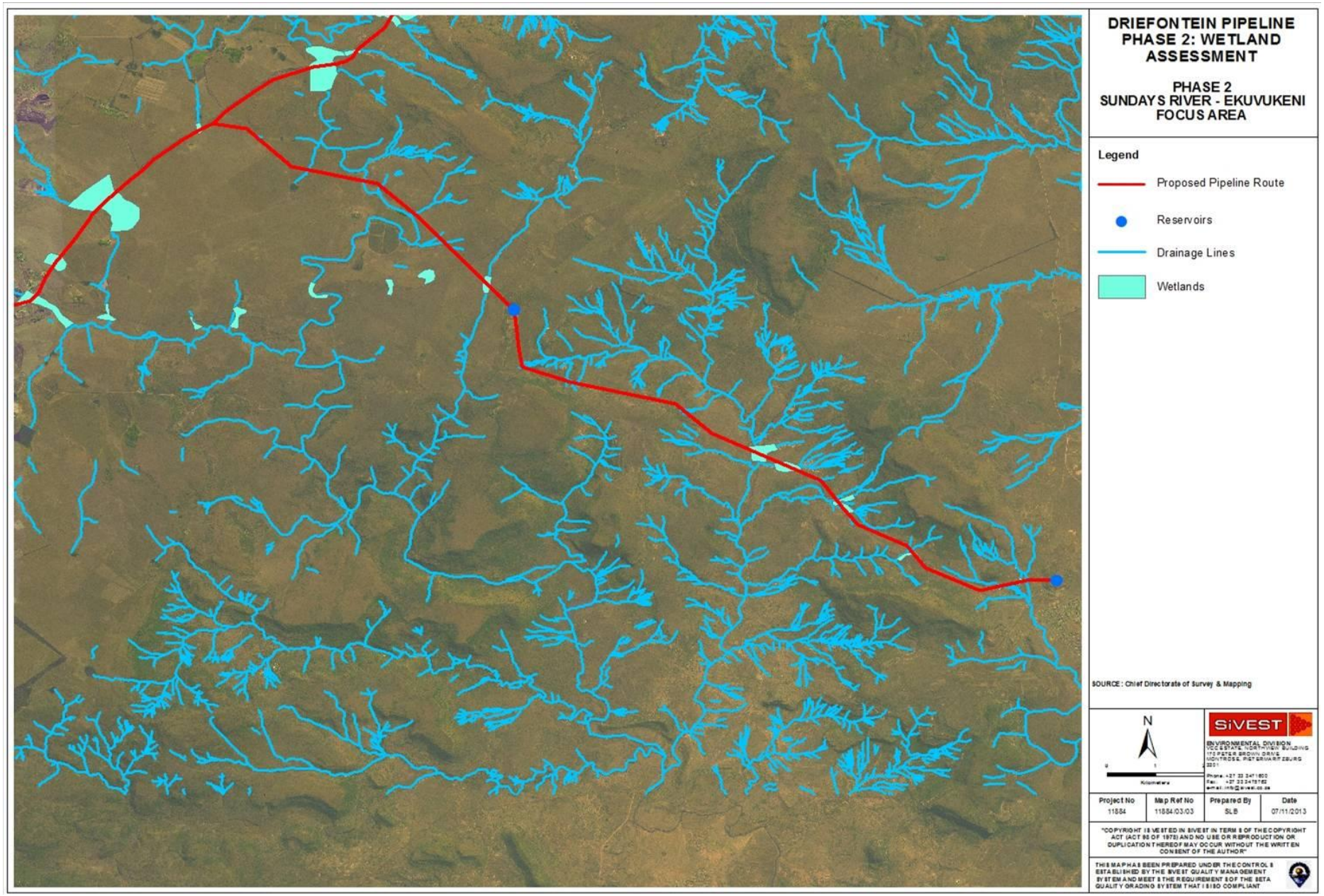

Figure 9: Sundays River - Ekuvukeni Focus Area: wetland delineation map.

9 POTENTIAL IMPACTS AND MITIGATION MEASURES

9.1 Water Pipe Crossing Impacts

Due to the extent of the proposed development the crossing of wetland and water courses is inevitable.

Due to the diameter and weight of the pipe line, wetland crossings will be underground (buried). Direct disturbances to the wetlands associated with the construction of underground water pipes include the excavation of a trench within the wetland and the compaction of the wetland vegetation and soils by heavy vehicles involved in the excavations and the laying of the pipes. Indirect disturbances arising from these direct impacts include erosion, sedimentation and alien plant encroachment.

Recommended mitigation measures:

Approvals:
The Department of Water Affairs must be consulted with if any approvals are required.

Design & routing:
- Wetland and stream pipe crossings should ideally be located within already disturbed areas like existing road crossings and located across the narrowest portions of the wetland.
- The pipe must be routed so that the wetland is crossed at right angles to the direction of flow.

Site setup and construction phase:
- Ideally, construction should be undertaken between the months of April and August.
- The wetland and riparian zone boundaries either side of the crossing must be demarcated using shade cloth or snow fencing prior to the construction commencing.
- Disturbance to the wetland and riparian zone soils along the crossing should be restricted to an established construction right-of-way (ROW) corridor.
- The ROW corridor within the wetlands and riparian zones should be as narrow as practically possible and should be demarcated and fenced off during the site setup phase to the satisfaction of the ECO.
- The construction ROW should comprise the trench area and a narrow one-way running track only.
- No refuelling must be done in the designated wetland areas.
- Indigenous wetland and riparian vegetation and topsoil along the running track and ROW must be turfed and stored outside of the wetland. These turfed stockpiles must be regularly wetted to ensure that the wetland plants do not die out and the clayey soils remain moist. The location of these wetland and riparian vegetation/topsoil stockpile area must be agreed upon by the ECO prior to construction commencing.
- Once the running track is turfed, Geotextile / geofabric / bog mats must be laid down along the running track within the wet areas.
- Geotextile / geofabric must be laid down along the sub-soil stockpile corridors to ensure that the stockpiled soils do not mix with the existing wetland soils.
- The subsoils and topsoils must be reinstated in the proper order that they were excavated.
- After the trench soils are re-instated, the geotextile fabric along the soil stockpile corridors should be lifted by hand.
- Excavated soil must not be stockpiled within the wetland or riparian zones.
- All wetland areas outside of the demarcated ROW must be considered no-go areas.

Rehabilitation and monitoring:

- Compacted wetland and riparian soils along the running track must be ripped to a depth of 20-30 cm. Thereafter, the turfed topsoil and vegetation must be reinstated within the wetland and riparian areas along the running track by hand to the satisfaction of the ECO.
- Where no indigenous vegetation is present, the compacted areas must be ripped and seeded immediately. A deep rooting indigenous plant seed mix should be used as recommended by a wetland specialist.
- The disturbed area should be monitored for erosion once a month during the first wet season after construction.
- The re-instated wetland and riparian areas must be monitored for a year post-construction by a suitably qualified wetland specialist on a bi-monthly basis. During this time, the measures to manage and control alien vegetation in the wetland rehabilitation and management plan must be applied to the re-instated ROW.
- Method statements for all activities within the wetlands and riparian zones must be submitted to the ECO for approval prior to construction commencing.

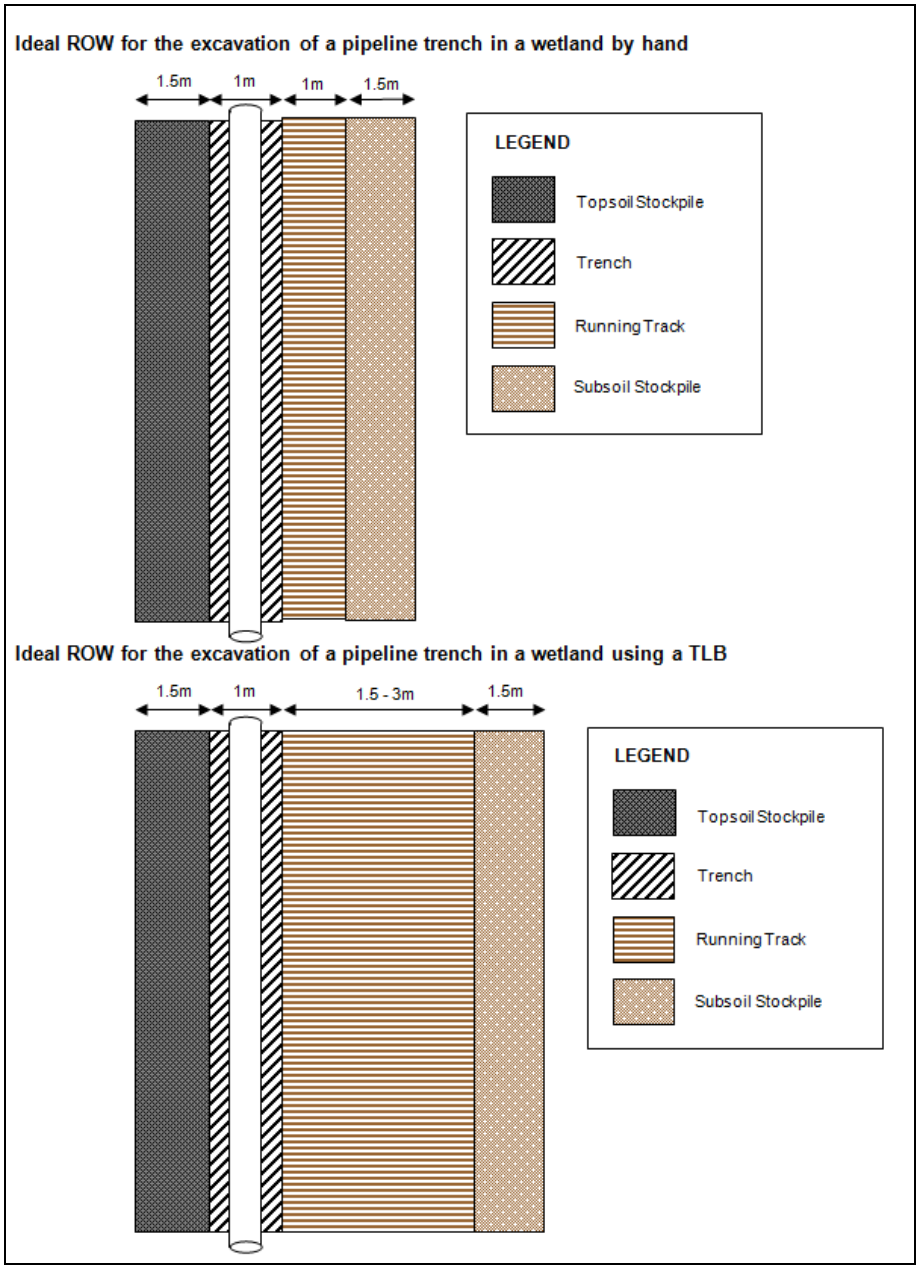

Figure 10: Recommended trenching diagrams

9.2 Erosion and Disturbance Related Impacts

If storm water, vegetation clearance and soil disturbance is not managed during the construction phase, the wetland units below the construction site will be at risk from both erosion and sedimentation. The erosion and/or sedimentation of the wetlands below the construction site will result in the disturbance to the natural wetland vegetation communities, the canalisation of flow where erosion occurs and the opening up of the wetland communities to alien invasive plants that are better equipped to colonise bare and disturbed wetland soils. These impacts ultimately result in a reduction in the level of ecosystem services provided by the wetland.

Recommended mitigation measures:

- Silt fences and sandbags should be established down-slope of the construction site to protect the downstream slopes from erosion and sedimentation.
- De-watering must be done in a controlled manor. De-watering should discharge into silt traps / lagoons in order reduce sediment and runoff velocities.
- The in-stream silt fences should be erected downstream before activities are initiated.
- The fluming of the stream was undertaken quickly and efficiently resulting in as little silt kick-up as possible.
- All bare surfaces and slopes must be re-vegetated immediately on completion of platform and embankment shaping with an indigenous grass mix suitable for the area.
- The crossings must be checked for erosion rills and gullies after rainfall events and erosion rills and gullies must be rehabilitated immediately.
- Additional silt fences and sandbags must be used to control and manage runoff along erosion scars and preferential flow paths onsite if necessary.

10 SUMMARY AND RECOMMENDATIONS

SiVEST were appointed to undertake a specialist wetland assessment for the proposed Driefontein water pipe line and ancillary infrastructure project. The proposed pipe line will extend from Ladysmith to Ekuvukheni in the KwaZulu-Natal Province.

Due to the extensive nature of the project a phased approach has been adopted. This document reports solely on Phase 2 of the Driefontein Pipe Line Project. The primary activity associated with Phase 2 of the Driefontein project will include the laying of approximately 50 km of new pipe line. Phase 2 extends from the end of Phase 1 (along the N11) north east to the Wasbank turn-off from the N11. The pipeline route then splits, and one route follows the road to Matiwane, while the other route runs in an easterly direction to Elandslaagte, and then north east towards Wasbank, before splitting just before the Sundays River, with one branch continuing towards Wasbank, and the other route running south east to Ekuvukeni.

The pipe line route will need to cross a number of streams and wetland areas. If not managed correctly the proposed activities could have a negative impact on the delineated surface water resources and their associated functioning. In order to assess these wetlands and mitigate the potential impacts a desktop wetland assessment was undertaken for Phase 2 of the Driefontein Pipe Line Project. The objective of this study is to identify wetland features in the broad study area using the National Freshwater Ecosystem Priority Areas. The results of this desktop study indicated that the NFEPA Database has not captured all the wetlands present within the project area. Owing to this, field verification was undertaken to refine and ground-truth the pertinent wetland features.

Field verification for Phase 2 took place on the 31st of January, 22nd of May and 31st of July 2013. For ease of assessment Phase 2 of the project was broken into three focus areas and were subsequently subjected to detailed assessment. Following the field verification, a number of alternative options were presented to the engineers to minimise the impact of the proposed pipeline route on wetland systems, and the vegetation communities in the area. The

proposed realignments were subsequently adopted as the preferred route, and this alignment was assessed further.

The current alignment reduces the impact of the pipeline on wetland systems in the area, and it is felt that this alignment is the most suitable proposal for the construction of the required pipelines. Finally generic crossing methods and mitigation measures were provided as well as erosion control measures. It is hoped the final low impact route and associated mitigatory measures are implemented in order to reduce the impacts on the identified wetland units.

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CULTURAL HERITAGE IMPACT ASSESSMENT OF THE PROPOSED DRIEFONTEIN PIPELINE DEVELOPMENT, EMNAMBITHI/LADYSMITH LOCAL MUNICIPALITY

ACTIVE HERITAGE CC.

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LIST OF ABBREVIATIONS AND ACRONYMS

EIA	Early Iron Age
ESA	Early Stone Age
HISTORIC PERIOD	Since the arrival of the white settlers - c. AD 1836 in this part of the country
IRON AGE	Early Iron Age AD 200 - AD 1000 Late Iron Age AD 1000 - AD 1830
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998 and associated regulations (2010).
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations (2008)
SAHRA	South African Heritage Resources Agency
STONE AGE	Early Stone Age 2 000 000 - 250 000 BP Middle Stone Age 250 000 - 25 000 BP Late Stone Age 30 000 - until c. AD 200

EXECUTIVE SUMMARY

A cultural heritage ground survey of the proposed Driefontein Water Pipeline near Ladysmith identified five heritage sites in the general study area. However, all these sites are situated more than 100m from the proposed pipeline route. It would therefore be possible to maintain a buffer zone of at least 20m around each of these sites without altering the preferred route. Alternatively, mitigation will be necessary and an archaeological rescue excavation may need to be conducted before any site may be destroyed or altered. Attention is drawn to the South African National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu-Natal Heritage Act (Act No. 4 of 2008) which requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

1 BACKGROUND INFORMATION ON THE PROJECT

The consultants were approached by Sivest to conduct a heritage impact assessment (HIA) of the study area.

According to the National Heritage Resources Act, 1999 (NHRA) (Act No. 25 of 1999), the heritage resources of South Africa include:

a. places, buildings, structures and equipment of cultural significance;
b. places to which oral traditions are attached or which are associated with living heritage;
c. historical settlements and townscapes;
d. landscapes and natural features of cultural significance;
e. geological sites of scientific or cultural importance;
f. archaeological and palaeontological sites;
g. graves and burial grounds, including-
i. ancestral graves;
ii. royal graves and graves of traditional leaders;
iii. graves of victims of conflict;
iv. graves of individuals designated by the Minister by notice in the Gazette;
v. historical graves and cemeteries; and

vi. other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
h. sites of significance relating to the history of slavery in South Africa;
i. movable objects, including-
i. objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
ii. objects to which oral traditions are attached or which are associated with living heritage;
iii. ethnographic art and objects;
iv. military objects;
v. objects of decorative or fine art;
vi. objects of scientific or technological interest; and
vii. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

The newly promulgated KwaZulu-Natal Heritage Act (Act No. 4 of 2008) also makes specific mention to rock art and archaeological sites.

It is furthermore stated that:

—(1) No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the KwaZulu-Natal Heritage Council.
(2) Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
(3) The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
(4) No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification,

meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.

(5) No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.

(6) (*a*) The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.

(*b*) The Council may establish and maintain a provincial repository or repositories for the safekeeping or display of—

(i)

archaeological objects;

(ii)

palaeontological material;

(iii)

ecofacts;

(iv)

objects related to battlefield sites;

(v)

material cultural artefacts; or

(vi)

meteorites.

(7) The Council may, subject to such conditions as the Council may determine, loan any object or material referred to in subsection (6) to a national or provincial museum or institution.

(8) No person may, without the prior written approval of the Council having been obtained on written application to the Council, trade in, export or attempt to export from the Province—

(*a*)

any category of archaeological object;

(*b*)

any palaeontological material;

(*c*)
any ecofact;
(*d*)
any object which may reasonably be regarded as having been recovered from a battlefield site;
(*e*)
any material cultural artefact; or
(*f*)
any meteorite.
(9) (*a*) A person or institution in possession of an object or material referred to in paragraphs (*a*) – (*f*) of subsection (8), must submit full particulars of such object or material, including such information as may be prescribed, to the Council.
(*b*) An object or material referred to in paragraph (*a*) must, subject to paragraph (*c*) and the directives of the Council, remain under the control of the person or institution submitting the particulars thereof.
(*c*) The ownership of any object or material referred to in paragraph (*a*) vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.

This study aims to identify and assess the significance of any heritage and archaeological resources occurring on the site. Based on the significance, the impact of the development on the heritage resources would be determined. Then appropriate actions to reduce the impact on the heritage resources would be put forward. In terms of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of:

a. its importance in the community, or pattern of South Africa's history;
b. its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
c. its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
d. its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
e. its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

f. its importance in demonstrating a high degree of creative or technical achievement at a particular period;

g. its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;

h. its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and

i. sites of significance relating to the history of slavery in South Africa.

Table 1. Background information

Consultants:	Frans Prins & Sian Hall (assistant)
Type of development:	Approximately 80 km of pipeline development linking a water reservoir at Ladysmith with those near Wasbank, and Ekuvukeni (Fig 1).
Rezoning or subdivision:	Rezoning
Terms of reference	To carry out a Heritage Impact Assessment
Legislative requirements:	The Heritage Impact Assessment was carried out in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and following the requirements of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu Natal Heritage Act (Act No. 4 of 2008)

1.1. Details of the area surveyed:

Footprint: The proposed footprint can be accessed by travelling north out of Ladysmith on the N11 towards Dundee. Turn right on the R602 in a easterly direction and follow the road towards Ekuvukeni. . The GPS coordinates of the starting point at Ladysmith is 28º 32' 1.44"S 29º 46' 2.21"E and the end point near Ekuvukeni is 28º 27' 32.32" S 30º 8' 48.56"E. Smaller deviations from this route are indicated in Fig 1.

Current land use: The greatest portion of the footprint is bordered onto by commercial farms and some communal land. The Nambiti Private Game Reserve borders onto the proposed pipeline route near the R602. The starting point at Ladysmith and the end point at Ekuvukeni are both urban areas. Other land uses within the study area include agriculture and small villages with scattered dwellings.

2 BACKGROUND TO ARCHAEOLOGICAL HISTORY OF AREA

Portions of the greater Ladysmith area have been systematically surveyed for archaeological heritage sites in the past. These were mostly conducted by archaeologists attached to the Natal Museum as well as by Amafa staff. Sixty one sites are recorded in the data base of the KwaZulu-Natal Museum. These include five Early Stone Age sites, five Middle Stone Age sites, six Later Stone Age sites, three rock art sites (two rock paintings and one rock engraving), and eleven Later Iron Age sites and twenty historical period Nguni homesteads. The majority of the Later Iron Age and historical period Nguni homesteads are demarcated by characteristic stone walling. Stone walling and graves related to the Anglo-Boer War period of 1899-1901 are also abundant in the area. Ten sites are recorded in the KwaZulu-Natal Museum data base but many more sites belonging to this period should occur in the greater Ladysmith area. The project area has not been systematically surveyed in the past but some heritage sites occur close to the proposed pipeline route..

The San were the owners of the land for almost 30 000 years but the local demography started to change soon after 2000 years ago when the first Bantu-speaking farmers crossed the Limpopo River and arrived in South Africa. Around 800 years ago, if not earlier, Bantu-speaking farmers also settled in the greater Ladysmith area. Although some of the sites constructed by these African farmers consisted of stone walling not all of them were made from stone. Sites located elsewhere in the KwaZulu-Natal Midlands show that many settlements just consisted of wattle and daub structures. These Later Iron Age sites were most probably inhabited by Nguni-speaking groups such as the amaBhele and others (Bryant 1965). However, by 1820 the original African farmers were dispersed from this area due to the expansionistic policies of the Zulu Kingdom of King Shaka. Many individuals of former chiefdoms in the area became bandits and oral tradition suggests that cannibalism may also have been practised by some of these groups. African refugee groups and individuals were given permission to settle in the area by the British colonial authorities after 1845 where most of them became farm labourers. After the Anglo-Zulu war of 1879 and the Bambatha Rebellion of 1911 many of the African people in the study area adopted a Zulu ethnic identity.

European settlement of the area started soon after 1838 when the first Voortrekker settlers marked out large farms in the area. However, most of these farms were abandoned in the 1840's when Natal became a British colony only to be reoccupied

again by British immigrants. Nevertheless, a group of Dutch farmers declared an independent republic in 1847 on the banks of the Klip River and called it the Klip River Republic with Andries Spies as commandant. This pocket republic only survived for a few months before British authority over the area was declared. The British planned a town as an administrative centre for the Klip River District, proclaiming it on 20 June 1850 and called it Ladysmith. Ladysmith became world famous during the Anglo-Boer War of 1899-1901 when it was besieged by Boers from 2 November 1899 until 28 February 1900. Ghandi, Smuts and Churchill are figures of international significance who were also present during the siege of Ladysmith. During the 118 day long siege the stone Town Hall sustained considerable damage. It has since been restored to the original vision of the architects. Located next to the Town Hall the building housing the Siege Museum was erected in 1884. It was used as a rations post for civilians. The Museum displays relics from the time of the siege, including documents, uniforms and firearms. Several of the most celebrated battles of the war were fought around Ladysmith. These include the Battles of Elandslaagte, Spionkop, Wagon Hill, Caesars Camp, Lombards Kop and Umbulwana Hill. These battle field sites as well as associated graves and buildings of the era are proclaimed heritage sites and are protected by provincial heritage legislation (Derwent 2006).

3 BACKGROUND INFORMATION OF THE SURVEY

3.1 Methodology

A desktop study was conducted of the SAHRA inventory of heritage sites. Unfortunately this database is incomplete and of only limited use. In addition, the archaeological database of the KwaZulu-Natal Museum was consulted. This data base indicated more than 100 heritage sites in the greater Ladysmith area.

A ground survey of the proposed developments following standard and accepted archaeological procedures was conducted. The ground survey followed the available roads in the project area. However, there are many mountainous areas with no road access that transverse the project area. The ground survey was therefore complimented with a desktop survey of available aerial photographs of the project area. The latter method located almost 40 Iron Age and late historical sites.

3.2 Restrictions encountered during the survey

3.2.1 Visibility

Visibility during the site visit was good.

3.2.2 Disturbance.

No overt disturbance or vandalism of any heritage features or archaeological sites was noted. However, stone robbing of Iron Age walling has taken place where such sites are situated in the close vicinity of contemporary rural settlements.

3.3 Details of equipment used in the survey

GPS: Garmin Etrek
Digital cameras: Canon Powershot A460
All readings were taken using the GPS. Accuracy was to a level of 5 m.

4 DESCRIPTION OF SITES AND MATERIAL OBSERVED

4.1 Locational data

Province: KwaZulu-Natal
Towns: Ladysmith
Municipality: Emnambithi

4.2 Description of the general area surveyed

The proposed water pipeline starts at a reservoir in the northern parts of Ladysmith and then runs roughly parallel to the N11 towards Dundee. However, before it reaches Dundee the route turns right alongside the R602 in an easterly direction and follows the road towards Ekuvukeni. Smaller deviations from this route are indicated in Fig 1.

4.3 Description of sites

Five heritage sites occur in the greater project area. These include two Later Iron Age Stone Circles, a Cemetery, two historical dwellings, and a military grave yard associated with the Anglo-Boer War. A description, GPS coordinates, and

assessment of each site is provided in Table 2. The distribution of these heritage sites is indicated on Figure 2.

Table 2. Heritage sites located during the ground survey in close association with proposed pipe line.

No	Heritage category	Description	Significance	Type of Mitigation	GPS coordinates	Survey method
1	LIA site (Fig 3)	Two single stone walled circles. Situated on the eastern bank of the N11 approximately 100m from the road. Each circle is approximately 20m in diameter.	Medium to high	Not applicable as site is situated more than 100m from proposed pipeline. However, maintain 20m buffer zone around site	S 28º 29'42.68" E 29º 50'27.76 "	Ground survey
2	LIA site (Fig 4)	Single stone walled circle. Approximately 25m diameter. Situated approximately 250m to the north of proposed pipeline.	Medium to high	Not applicable as site is situated more than 100m from proposed pipeline. However maintain 20m buffer zone around site	S 28º 18'52.71" E 30º 3'42.36"	Desktop aerial photograph
3	Historical residential building (Fig 5)	Residential building associated with Elandslaagte Railway Station. Appears to be approximately 80 years old.	Medium to high	Not applicable as site is situated more than 50m from the proposed pipeline. However, maintain	S 28º 24' 26.30" E 29º 57'24.21"	Ground Survey

				20m buffer zone around site		
4	Elandslaagte Battle Site Military Graveyard (Fig 6)	Military Cemetery with the graves and memorial to British soldiers who died at the Battle of Elandslaagte in 1899 (Derwent 2006)	High (with potential Provincial Heritage Site grading)	Not applicable as proposed pipeline is situated more than 100m from this heritage site. However, maintain 20m buffer zone around site	S 28º 24'49.19" E 29º 56'53.43"	Ground survey.
5	Modern Cemetery (Fig 7)	Large Cemetery covering an area of approximately 250m x 220m. The graves are all relatively modern with the vast majority younger than 60 years old. The cemetery is situated on the edge of the Ekuvukeni Township.	Medium	Not applicable as proposed pipeline is situated more than 100m to the north of the cemetery. However, maintain a 20m buffer zone around site	S 28º 27' 53.90" E 30º 08' 21.57"	Desktop study aerial photograph

.

4.4 Summary of findings

Five heritage sites have been located along the trajectory of the proposed pipeline. These include two Later Iron Age sites, one historical residential building, a Boer War era military graveyard, and a modern cemetery. All of these sites are situated more than 80m from the proposed pipeline and none of them are threatened by the development. It would be possible to maintain a buffer zone of at least 20m around each of these sites without altering the preferred route. Alternatively, mitigation will be

necessary and an archaeological rescue excavation may need to be conducted before any site may be destroyed or altered.

5 STATEMENT OF SIGNIFICANCE (HERITAGE VALUE)

The known heritage sites in the general area of the proposed power lines have been rated according to SAHRA standards (Table 3 & Table 4). The majority of these have been rated as high to medium significance. In other words mitigation will be necessary before a site may be altered or destroyed. A second phase heritage impact assessment will be called for and Amafa must issue a permit for any such rescue excavation to take place.

5.1 Field Rating

Table 2 provides a rating for each and every site with reference to the criteria as outlined in Table 3. It is important that the developer takes cognisance of the fact that all these sites are protected by national and provincial heritage legislation and that a buffer of at least 20m diameter must be maintained around each site. No destruction or alteration of any of these sites is allowed.

Table 3. Field rating and recommended grading of sites (SAHRA 2005)

Level	Details	Action
National (Grade I)	The site is considered to be of National Significance	Nominated to be declared by SAHRA
Provincial (Grade II)	This site is considered to be of Provincial significance	Nominated to be declared by Provincial Heritage Authority
Local Grade IIIA	This site is considered to be of HIGH significance locally	The site should be retained as a heritage site
Local Grade IIIB	This site is considered to be of HIGH significance locally	The site should be mitigated, and part retained as a heritage site
Generally Protected A	High to medium significance	Mitigation necessary before destruction
Generally Protected B	Medium significance	The site needs to be recorded before destruction
Generally Protected C	Low significance	No further recording is required before destruction

6 RECOMMENDATIONS

The construction of the proposed water pipelines along the preferred route as identified by the developer may proceed in terms of heritage values as no known heritage sites are in any immediate danger of being damaged or altered. However, the following measures need to be adhered to:

- Avoid all heritage sites; a golden rule is to maintain a buffer zone of at least 20m around identified sites.
- Avoid sandstone outcrops and rock faces, where possible, as these areas may harbour unknown rock art sites and shelters with Later Stone Age archaeological deposits.
- Only use established roads during the construction process. All secondary access roads planned need to be surveyed for heritage sites before construction may commence.
- Should the developer decide to move the proposed pipeline closer than 20m to any of the identified heritage sites then a second phase heritage impact assessment should be initiated. Should any of the colonial-era heritage sites be affected then a built environment heritage specialist consultant should be approached for the second phase heritage impact assessment.
- Should any heritage material or artefacts be located during the construction process then all activities should stop in the immediate vicinity of the site and the local heritage agency Amafa contacted for further evaluation.

7 MAPS AND PHOTOGRAPHS

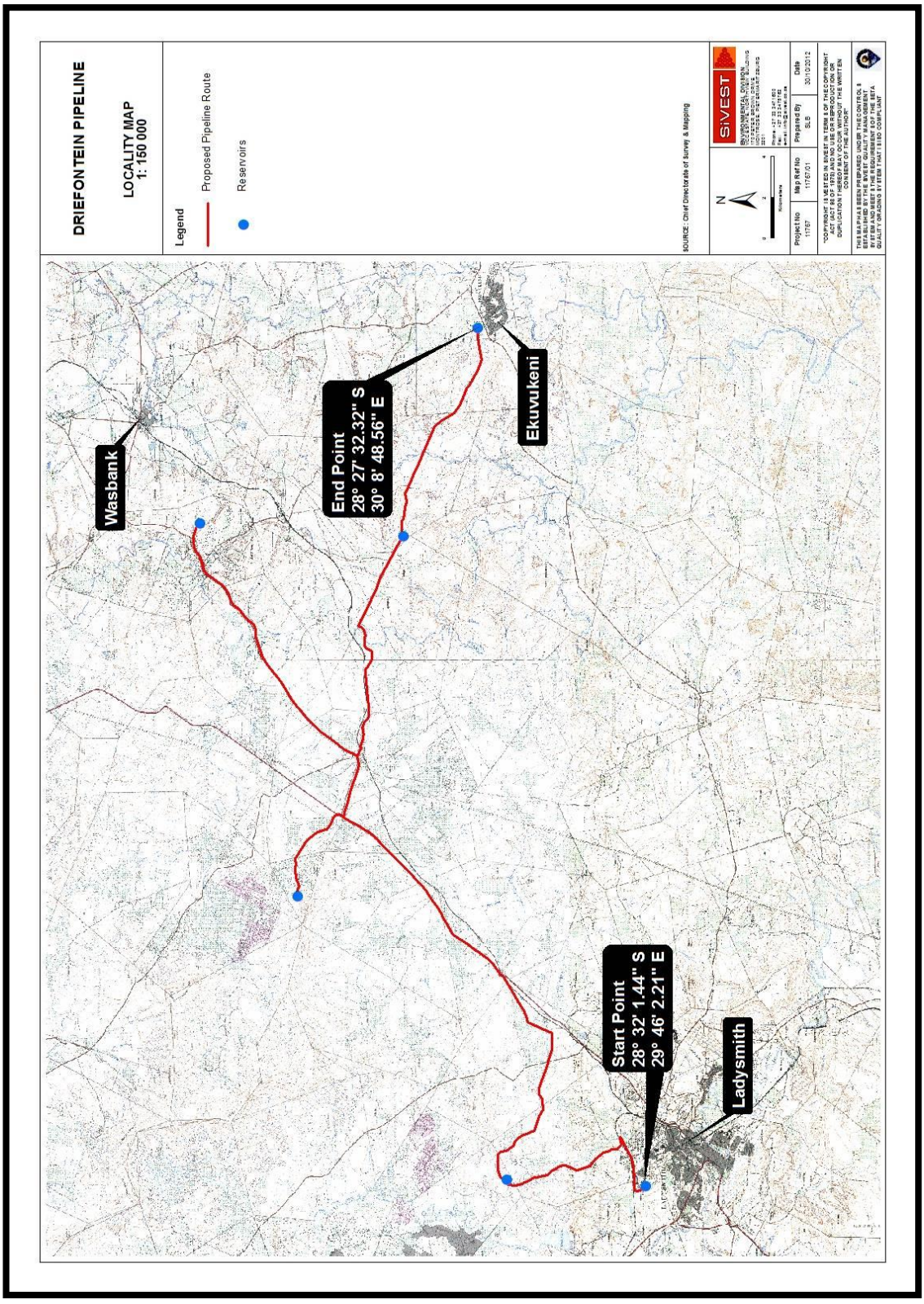

Figure 1. Topographical map showing the location of the proposed Driefontein pipeline.

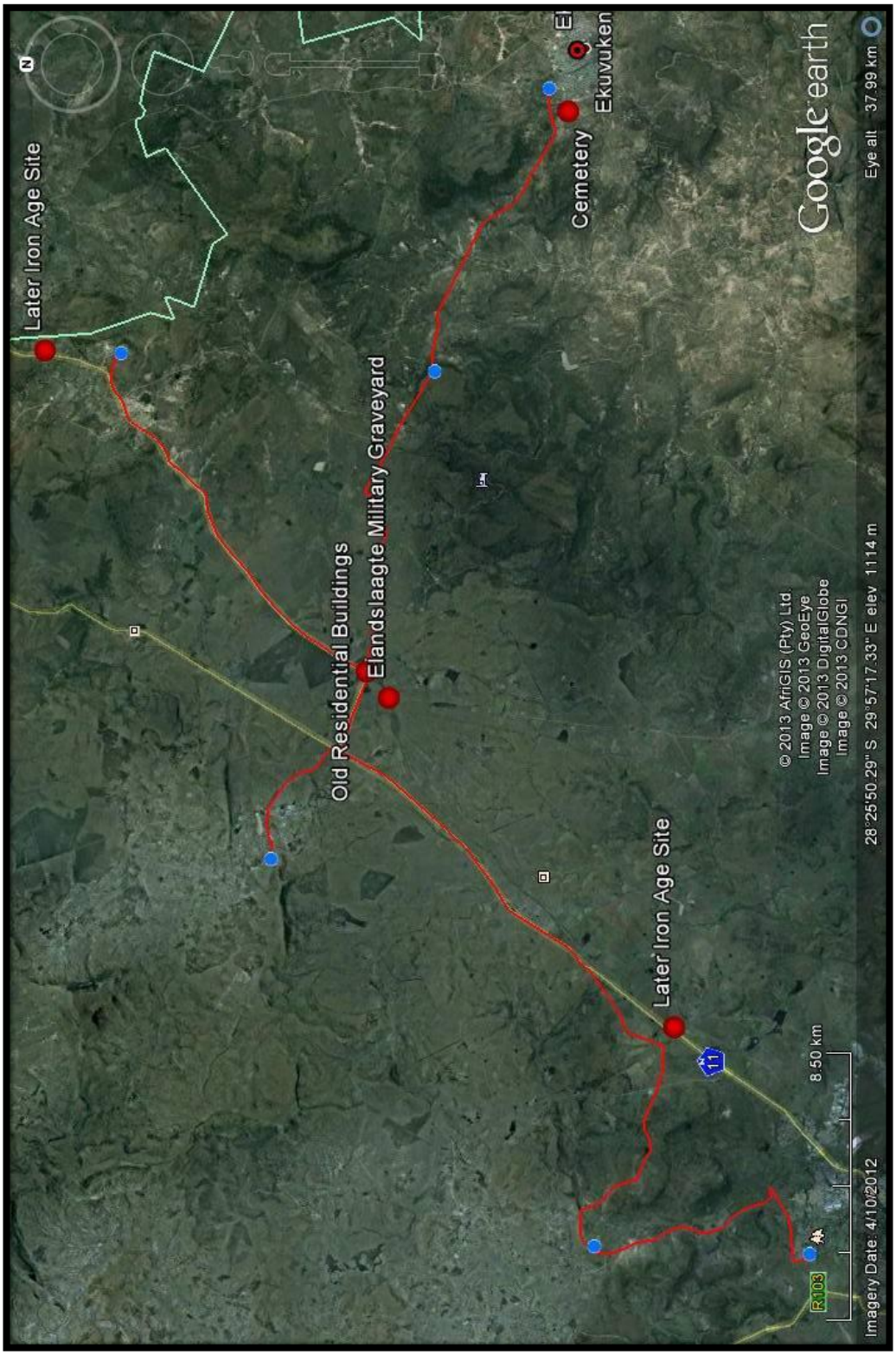

Figure 2. Google aerial photograph showing the distribution of heritage sites in the near locality of the proposed Driefontein pipeline.

***Figure 3. Late Iron Age stone circle ,approximately 100m from the proposed pipeline*.**

***Figure 4. Later Iron Age stone circle, approximately 80m from the proposed pipeline*.**

Figure 5. Historical era residential home.

Figure 6. Modern Cemetery

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CULTURAL HERITAGE IMPACT ASSESSMENT OF THE PROPOSED DRIEFONTEIN PIPELINE DEVELOPMENT PHASE2 INCLUDING THE RECENTLY IDENTIFIED ALTERNATIVE ROUTE, EMNAMBITHI/LADYSMITH LOCAL MUNICIPALITY.

ACTIVE HERITAGE CC.

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LIST OF ABBREVIATIONS AND ACRONYMS

EIA	Early Iron Age
ESA	Early Stone Age
HISTORIC PERIOD	Since the arrival of the white settlers - c. AD 1836 in this part of the country
IRON AGE	Early Iron Age AD 200 - AD 1000 Late Iron Age AD 1000 - AD 1830
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998 and associated regulations (2010).
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations (2008)
SAHRA	South African Heritage Resources Agency
STONE AGE	Early Stone Age 2 000 000 - 250 000 BP Middle Stone Age 250 000 - 25 000 BP Late Stone Age 30 000 - until c. AD 200

EXECUTIVE SUMMARY

A cultural heritage ground survey of the proposed Driefontein Water Pipeline near Ladysmith (phase 2) identified no heritage sites along the alternative route recently identified. However attention is drawn to the South African National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu-Natal Heritage Act (Act No. 4 of 2008) which requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

1 BACKGROUND INFORMATION ON THE PROJECT

The consultants were approached by Sivest to conduct a heritage impact assessment (HIA) of the study area.

According to the National Heritage Resources Act, 1999 (NHRA) (Act No. 25 of 1999), the heritage resources of South Africa include:

a. places, buildings, structures and equipment of cultural significance;
b. places to which oral traditions are attached or which are associated with living heritage;
c. historical settlements and townscapes;
d. landscapes and natural features of cultural significance;
e. geological sites of scientific or cultural importance;
f. archaeological and palaeontological sites;
g. graves and burial grounds, including-
i. ancestral graves;
ii. royal graves and graves of traditional leaders;
iii. graves of victims of conflict;
iv. graves of individuals designated by the Minister by notice in the Gazette;
v. historical graves and cemeteries; and
vi. other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
h. sites of significance relating to the history of slavery in South Africa;
i. movable objects, including-

i. objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
ii. objects to which oral traditions are attached or which are associated with living heritage;
iii. ethnographic art and objects;
iv. military objects;
v. objects of decorative or fine art;
vi. objects of scientific or technological interest; and
vii. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

The newly promulgated KwaZulu-Natal Heritage Act (Act No. 4 of 2008) also makes specific mention to rock art and archaeological sites.

It is furthermore stated that:

—(1) No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the KwaZulu-Natal Heritage Council.
(2) Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
(3) The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
(4) No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
(5) No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or excavation equipment

onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.

(6) (*a*) The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.

(*b*) The Council may establish and maintain a provincial repository or repositories for the safekeeping or display of—

(i)

archaeological objects;

(ii)

palaeontological material;

(iii)

ecofacts;

(iv)

objects related to battlefield sites;

(v)

material cultural artefacts; or

(vi)

meteorites.

(7) The Council may, subject to such conditions as the Council may determine, loan any object or material referred to in subsection (6) to a national or provincial museum or institution.

(8) No person may, without the prior written approval of the Council having been obtained on written application to the Council, trade in, export or attempt to export from the Province—

(*a*)

any category of archaeological object;

(*b*)

any palaeontological material;

(*c*)

any ecofact;

(*d*)

any object which may reasonably be regarded as having been recovered from a battlefield site;

(*e*)

any material cultural artefact; or

(*f*)

any meteorite.

(9) (*a*) A person or institution in possession of an object or material referred to in paragraphs (*a*) – (*f*) of subsection (8), must submit full particulars of such object or material, including such information as may be prescribed, to the Council.

(*b*) An object or material referred to in paragraph (*a*) must, subject to paragraph (*c*) and the directives of the Council, remain under the control of the person or institution submitting the particulars thereof.

(*c*) The ownership of any object or material referred to in paragraph (*a*) vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.

This study aims to identify and assess the significance of any heritage and archaeological resources occurring on the site. Based on the significance, the impact of the development on the heritage resources would be determined. Then appropriate actions to reduce the impact on the heritage resources would be put forward. In terms of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of:

a. its importance in the community, or pattern of South Africa's history;

b. its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

c. its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

d. its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;

e. its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

f. its importance in demonstrating a high degree of creative or technical achievement at a particular period;

g. its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;

h. its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
i. sites of significance relating to the history of slavery in South Africa.

Table 1. Background information

Consultants:	Frans Prins & Sian Hall (assistant) for Sivest
Type of development:	Approximately 80 km of pipeline development linking a water reservoir at Ladysmith with those near Wasbank, and Ekuvukeni. An alternative route (phase 2) has been identified (Fig 1)
Rezoning or subdivision:	Rezoning
Terms of reference	To carry out a Heritage Impact Assessment
Legislative requirements:	The Heritage Impact Assessment was carried out in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and following the requirements of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu Natal Heritage Act (Act No. 4 of 2008)

1.1. Details of the area surveyed:

Footprint: The proposed footprint can be accessed by travelling north out of Ladysmith on the N11 towards Dundee. Turn right on the R602 in a easterly direction and follow the road towards Ekuvukeni. . The GPS coordinates of the starting point at Ladysmith is 28º 32' 1.44"S 29º 46' 2.21"E and the end point near Ekuvukeni is 28º 27' 32.32" S 30º 8' 48.56"E. The alternative route investigated in this phase of the project (phase 2) is presented in Fig 1.

Current land use: The greatest portion of the footprint is bordered onto by commercial farms and some communal land. The Nambiti Private Game Reserve borders onto the proposed pipeline route near the R602. The starting point at Ladysmith and the end point at Ekuvukeni are both urban areas. Other land uses within the study area include agriculture and small villages with scattered dwellings.

2 BACKGROUND TO ARCHAEOLOGICAL HISTORY OF AREA

Portions of the greater Ladysmith area have been systematically surveyed for archaeological heritage sites in the past. These were mostly conducted by archaeologists attached to the Natal Museum as well as by Amafa staff. Sixty one sites

are recorded in the data base of the KwaZulu-Natal Museum. These include five Early Stone Age sites, five Middle Stone Age sites, six Later Stone Age sites, three rock art sites (two rock paintings and one rock engraving), and eleven Later Iron Age sites and twenty historical period Nguni homesteads. The majority of the Later Iron Age and historical period Nguni homesteads are demarcated by characteristic stone walling. Stone walling and graves related to the Anglo-Boer War period of 1899-1901 are also abundant in the area. Ten sites are recorded in the KwaZulu-Natal Museum data base but many more sites belonging to this period should occur in the greater Ladysmith area. The project area has not been systematically surveyed in the past but some heritage sites occur close to the proposed pipeline route..

The San were the owners of the land for almost 30 000 years but the local demography started to change soon after 2000 years ago when the first Bantu-speaking farmers crossed the Limpopo River and arrived in South Africa. Around 800 years ago, if not earlier, Bantu-speaking farmers also settled in the greater Ladysmith area. Although some of the sites constructed by these African farmers consisted of stone walling not all of them were made from stone. Sites located elsewhere in the KwaZulu-Natal Midlands show that many settlements just consisted of wattle and daub structures. These Later Iron Age sites were most probably inhabited by Nguni-speaking groups such as the amaBhele and others (Bryant 1965). However, by 1820 the original African farmers were dispersed from this area due to the expansionistic policies of the Zulu Kingdom of King Shaka. Many individuals of former chiefdoms in the area became bandits and oral tradition suggests that cannibalism may also have been practised by some of these groups. African refugee groups and individuals were given permission to settle in the area by the British colonial authorities after 1845 where most of them became farm labourers. After the Anglo-Zulu war of 1879 and the Bambatha Rebellion of 1911 many of the African people in the study area adopted a Zulu ethnic identity.

European settlement of the area started soon after 1838 when the first Voortrekker settlers marked out large farms in the area. However, most of these farms were abandoned in the 1840's when Natal became a British colony only to be reoccupied again by British immigrants. Nevertheless, a group of Dutch farmers declared an independent republic in 1847 on the banks of the Klip River and called it the Klip River Republic with Andries Spies as commandant. This pocket republic only survived for a few months before British authority over the area was declared. The British planned a

town as an administrative centre for the Klip River District, proclaiming it on 20 June 1850 and called it Ladysmith. Ladysmith became world famous during the Anglo-Boer War of 1899-1901 when it was besieged by Boers from 2 November 1899 until 28 February 1900. Ghandi, Smuts and Churchill are figures of international significance who were also present during the siege of Ladysmith. During the 118 day long siege the stone Town Hall sustained considerable damage. It has since been restored to the original vision of the architects. Located next to the Town Hall the building housing the Siege Museum was erected in 1884. It was used as a rations post for civilians. The Museum displays relics from the time of the siege, including documents, uniforms and firearms. Several of the most celebrated battles of the war were fought around Ladysmith. These include the Battles of Elandslaagte, Spionkop, Wagon Hill, Caesars Camp, Lombards Kop and Umbulwana Hill. These battle field sites as well as associated graves and buildings of the era are proclaimed heritage sites and are protected by provincial heritage legislation (Derwent 2006).

3 BACKGROUND INFORMATION OF THE SURVEY

3.1 Methodology

A desktop study was conducted of the SAHRA inventory of heritage sites. Unfortunately this database is incomplete and of only limited use. In addition, the archaeological database of the KwaZulu-Natal Museum was consulted. The SAHRIS website was also consulted to investigate previous heritage impact assessments in the area. The desktop study indicated more than 100 heritage sites in the greater Ladysmith area.

A ground survey of the proposed developments following standard and accepted archaeological procedures was conducted. The ground survey followed the available roads in the project area. However, there are many mountainous areas with no road access that transverse the project area. The ground survey was therefore complimented with a desktop survey of available aerial photographs of the project area. The latter method located almost 40 Iron Age and late historical sites.

3.2 Restrictions encountered during the survey

3.2.1 Visibility

Visibility during the site visit was good.

3.2.2 Disturbance.

No overt disturbance or vandalism of any heritage features or archaeological sites was noted. However, stone robbing of Iron Age walling has taken place where such sites are situated in the close vicinity of contemporary rural settlements.

3.3 Details of equipment used in the survey

GPS: Garmin Etrek
Digital cameras: Canon Powershot A460
All readings were taken using the GPS. Accuracy was to a level of 5 m.

4 DESCRIPTION OF SITES AND MATERIAL OBSERVED

4.1 Locational data

Province: KwaZulu-Natal
Towns: Ladysmith
Municipality: Emnambithi

4.2 Description of the general area surveyed

The proposed water pipeline starts at a reservoir in the northern parts of Ladysmith and then runs roughly parallel to the N11 towards Dundee. However, before it reaches Dundee the route turns right alongside the R602 in an easterly direction and follows the road towards Ekuvukeni. The recently alternative route identified is presented in Fig 1. No heritage sites were observed along this alternative route.

5 STATEMENT OF SIGNIFICANCE (HERITAGE VALUE)

As no heritage sites were located along the alternative route no heritage values could be ascribed.

5.1 Field Rating

Not applicable as no heritage sites were located along the alternative route.

Table 3. Field rating and recommended grading of sites (SAHRA 2005)

Level	Details	Action
National (Grade I)	The site is considered to be of National Significance	Nominated to be declared by SAHRA
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6 RECOMMENDATIONS

The construction of the proposed water pipelines along the preferred route as identified by the developer may proceed in terms of heritage values as no known heritage sites are in any immediate danger of being damaged or altered. However, the following measures need to be adhered to:

- Avoid all heritage sites; a golden rule is to maintain a buffer zone of at least 20m around identified sites.
- Avoid sandstone outcrops and rock faces, where possible, as these areas may harbour unknown rock art sites and shelters with Later Stone Age archaeological deposits.
- Only use established roads during the construction process. All secondary access roads planned need to be surveyed for heritage sites before construction may commence.
- Should any heritage material or artefacts be located during the construction process then all activities should stop in the immediate vicinity of the site and the local heritage agency Amafa contacted for further evaluation.

7 MAPS AND PHOTOGRAPHS

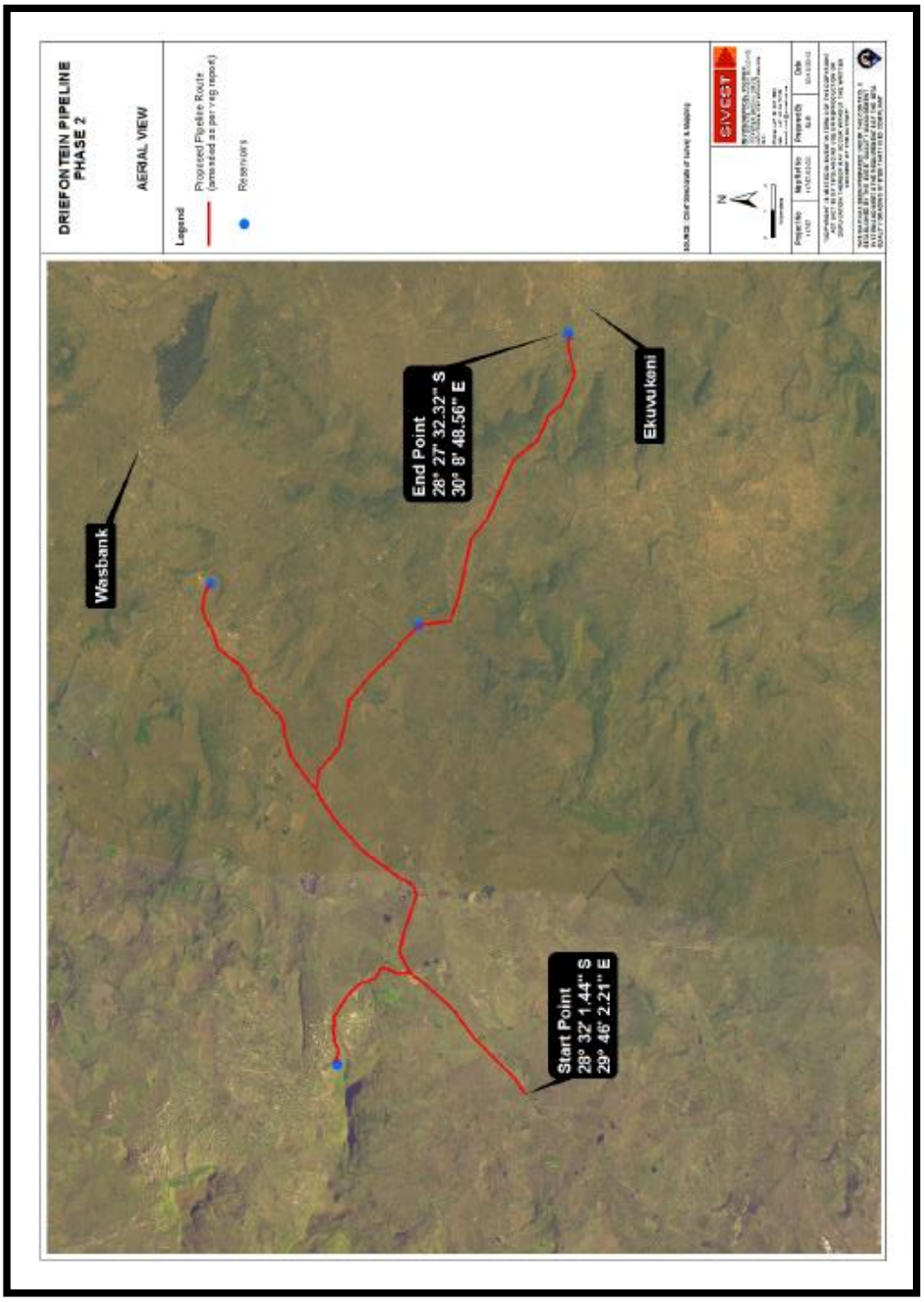

Figure 1. Aerial photograph showing the location of the alternative route identified for the proposed Driefontein pipeline (Source: Sivest)

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