Upgrading of District Road D168

(Phase 2) for 7.5 km from the km 15.9

DRAFT Basic Assessment Report

EDTEA REF: DC21/0031/2016

Prepared by

Brousse-James & Associates
Ecological and Environmental Services

This Basic Assessment Report for District Road D168: Phase 2 – km 15.9 to km 23.4, was completed in September 2016, and was produced by:

Brousse-James & Associates: Mr B M James BSc(Hons), MSc, Pr.Sci.Nat., MSAIE&ES, EAPSA and Mrs D B James BA.

In association with:

- **Active Heritage:** Mr Frans Prins MA (Archaeology) – *Contribution to BAR: Heritage Assessment*
- **Council for Geoscience:** Mr M Ncume BSc (Hons), R Singh MSc, N Hicks MSc – *Contribution to BAR: Geology, Soils and Groundwater*
- **Malachite Specialist Services (Pty) Ltd**: Ms R Harrison MSc (Soil Science) Pr.Sci.Nat. and Dr C Widdows Phd (Ecology) – *Contribution to BAR: Wetland Impact Assessment*

Contact details:

Brousse-James & Associates
PO Box 1304, Howick, 3290
Tel: 033-3304984 Fax: 086-2125248
Cell: 082 8954089
Email: brousse@sai.co.za

Active Heritage
PO Box 947, Howick, 3290
Tel: 033-3307729; Cell: 083 4739657
Email: activeheritage@gmail.com

Council for Geoscience
PO Box 900, Pietermaritzburg, 3200
Tel: 033-3456265; Fax 033-3949342
Email: rgrow@geoscience.org.za

Malachite Specialist Services
6 Wills Close, Hilton, 3245
Cell: Rowena Harrison 078 023 0532; Craig Widdows 083 7818725
Email: rowena@malachitesa.co.za; craig@malachitesa.co.za

EXECUTIVE SUMMARY

District Road D168 is one of the roads in the process of being upgraded under the KwaZulu-Natal African Renaissance Roads Programme (Ndebele, 2001). The African Renaissance Roads Programme, which was officially launched in June 2001, concerns itself with the upgrading and blacktopping of major transport routes throughout the province of KwaZulu-Natal. The purpose of this programme is to improve the transport infrastructure and stimulate the economies of impoverished regions in the Province.

The upgrade of the first 10 km section (Phase 1) of District Road D168 commenced in 2006. Environmental Authorisation (EIA/6683) was given for the blacktopping of 13.4 km of that road, starting from the intersection of this road with the Highflats to St Faiths Road (P68-1) and heading in an easterly direction. Emzansi Engineering Consultants were appointed by the Department of Transport as the consulting engineers for this section of road.

Up until 2016, 11.4 km of Phase 1 was complete and the last 2 km was in the process of being completed. Now there are plans to blacktop the next 10 km, with the contract for the first 2.5 km being put out to tender in late 2016 and the remainder to be completed in sections. Given that the first 2.5 km was due to start as soon as possible, the route and the nature of the upgrade for the first 2.5 km was examined and it was shown that there are no activities that would trigger an environmental impact assessment process for that section, because it would simply be blacktopped, with no significant horizontal or vertical realignment and it is not within 32 m of a watercourse. Upgrading of the next 7.5 km, however, will include horizontal and vertical realignment, as well as work within 32 m of a watercourse and the activities required to undertake the upgrade therefore requires a Basic Assessment Report. This BAR therefore concerns itself with the latter 7.5 km, that is, with km 15.9 to km 23.4 and excludes km 13.4 to km 15.9.

Upgrading of the District Road D168 will have a number of benefits for the residents of the area, primarily improved road quality and thus safer driving. For those living close to the road, the reduction in the dust levels will be significant.

In addition to benefits to residents, in spite of there being some negative environmental impacts in the short term, there are environmental benefits in the long term. Gravel roads require constant resurfacing and grading and this requires access to borrow pits at all times. Blacktopping of the road will reduce this requirement to keep the borrow pits open. The road upgrade will also result in improvement to current drainage from the road and repair/rehabilitation of erosion nick points arising from drainage from the current road.

In addition to the direct benefits that accrue from improved transport infrastructure, the bulk of the actual contracts for the construction of the roads are to be given to emerging contractors from previously disadvantage communities. These contractors will work under the guidance of established contractors.

ACRONYMS AND ABBREVIATIONS

EDTEA	Department of Economic Development, Tourism and Environmental Affairs (KZN)
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
ESO	Environmental Site Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
HGM	Hydrogeomorphic Unit
I&AP	Interested and Affected Parties
IDP	Integrated Development Plan
WULA	Water Use License Application
KZN	KwaZulu-Natal
NEMA	National Environmental Management Act (107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act (No 36 of 1998)
PES	Present Ecological State
PPP	Public Participation Process
SABS	South African Bureau of Standards
SANS	South African National Standards
SDF	Spatial Development Framework
SMP	Stormwater Management Plan
SUDS	Sustainable Urban Drainage Systems

Table of Contents

List of Maps in Appendix 1

List of Photographs in Appendix 2

List of Figures in Main document

List of Figures in Appendix 3: Public Participation

1 PROJECT BACKGROUND AND LOCATION

District Road D168 (Appendix 1, Map 1) is one of the roads in the process of being upgraded under the KwaZulu-Natal African Renaissance Roads Programme (Ndebele, 2001). The African Renaissance Roads Programme, which was officially launched in June 2001, concerns itself with the upgrading and blacktopping of major transport routes throughout the province of KwaZulu-Natal. The purpose of this programme is to improve the transport infrastructure and stimulate the economies of impoverished regions in the Province.

In addition to the direct benefits that accrue from improved transport infrastructure, the bulk of the actual contracts for the construction of the roads are to be given to emerging contractors from previously disadvantage communities. These contractors will work under the guidance of established contractors.

The upgrade of the first 10 km section (Phase 1) of District Road D168 started in 2006 (EIA/6683). Environmental Authorisation was given for the blacktopping of 13.4 km of that road, starting from the intersection of this road with the Highflats to St Faiths Road (P68-1) and heading in an easterly direction. Emzansi Engineering Consultants were appointed by the Department of Transport as the consulting engineers for this section of road.

A large part of the work, wherever feasible, has been done by means of manual labour and, where possible, locally owned plant has been used. Because of the labour intensive method used, the duration of construction has been longer than normal and the last 2 km section of that first 13.4 km is in the process of being completed (Map 1 in Appendix 1).

Emzansi have now been appointed to oversee the next 10 km of that road, from km 13.4 to km 23.4, starting at 30°26’41.67” S, 30°12’14.41” E and ending at 30°24’18.21” S, 30°15’39.67” E. The first 2.5 km of this new section is to be put out to tender in late 2016. Since the original Environmental Authorisation for the first 13.4 km was issued, there have been changes in the EIA Regulations, which means that the proposed upgrade of the first 2.5 km does not trigger any listed activities in the 2014 Regulations. However, the sections after that first 2.5 km, starting at km 15.9, have wetlands within 32 m of the road and the road crosses a small stream and the Mzumbe River at different points, whilst running very close to the river along a short section.

For these reasons, this BAR concerns itself with km 15.9 to km 23.4 and excludes km 13.4 to km 15.9.

2 DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

Brousse-James & Associates is a Close Corporation, registered in 1997 (CK97/57246/23), and jointly owned by Mr Barry Mark James and Mrs Danielle Brousse James. All professional work is conducted by Barry James, with Danielle James assisting with administration, editing of documents and field work. When required, other specialist sub-consultants are subcontracted. Since 1997, the business has been involved in a variety of projects, ranging from wildlife management plans, environmental journalism, specialised computer programming for biological and conservation applications, environmental impact assessments, specialist biodiversity assessments, writing of rehabilitation plans and environmental management programmes, and Barry James has also acted as environmental control officer for a number of projects.

Expertise to undertake Environmental Assessment Process
Qualifications and memberships:

- **PhD (Da Vinci Institute)** Currently registered for a PhD, looking at sustainable utilisation of indigenous Southern African wood.
- **MSc** (Natal University - 1998); Project Title - Succession and soil properties following the removal of pine plantations on the Eastern Shores of Lake St Lucia, South Africa.
- **BSc (Hons)** (Potchefstroom University - 1995); Stress Physiology (Distinction); Soil Degradation (Distinction) Plant Ecology and Management; Analytical Procedures in Ecology; Reclamation Ecology; Soil Classification; Taxonomy; Modern Systematics; Statistics (Distinction). Project Title - Numerical analysis of the vegetation, its distribution and relation to major environmental gradients in the south-western portion of Umfolozi Game Reserve.
- **BSc** (UNISA - 1994); Majors: Zoology and Botany. Distinctions in Plant Ecology and Animal Physiology.
- **Pr.Sci.Nat.** - Registered with the South African Council for Natural Scientific Professions in the field of Ecological Science (Registration No. 400263/06).
- **MSAIE&ES** - Professional member of the Southern African Institute of Ecologists and Environmental Scientists.
- **EAPSA** - Certified Environmental Assessment Practitioner with Interim Certification Board.
- **Numerous Natal Parks Board In-Service Courses**
- **Short Courses of relevance to the EIA Process:**
    - Geographic Information Systems (GIS) - (Natal University, 1998)
    - Integrated Environmental Management (IEM) - (Natal University, 1998)
    - Crash course in Environmental Auditing - (Eagle Environmental, 1999)
    - Soil Classification and Land Capability - (Cedara, 1999)
    - Environmental Impact Assessment - (Rhodes University, 2006)

Applicable Experience:
A comprehensive list of projects undertaken by Brousse-James & Associates is available as required.

3 POLICY AND LEGISLATIVE CONTEXT

The blacktopping of the road will include some horizontal and vertical realignment, which means that some cutting and filling will take place to "soften" dramatic changes in direction and height of the road.

Legislation relevant to this activity includes:

LEGISLATION	ADMINISTERING AUTHORITY	DATE
1. Constitution of SA 1996.	1. National Government	1996
2. NEMA – Biodiversity Act & Protected Areas Act.	2. DEA	1984
3. National Environmental Management Act (Act No. 107 of 1998) (NEMA) & Regulations in terms of Chapter 5.	3. Department of Environmental Affairs	1998
4. Heritage Resources Act (Act No. 25 of 1999).	4. Amafa	1999
5. KwaZulu-Natal Heritage Act (Act No. 4 of 2008).	5. Amafa	2008
6. KwaZulu Nature Conservation Act (Act No. 29 of 1992).	6. Ezemvelo KZN Wildlife	1992
7. Natal Nature Conservation Ordinance (Act No. 15 of 1974).	7. Ezemvelo KZN Wildlife	1974
8. National Forest Act (Act No. 84 1998).	8. Department of Agriculture, Forestry & Fisheries	1998

A Basic Assessment process must be undertaken in accordance with the 2014 EIA regulations promulgated through the provisions of the National Environmental Management Act 107 of 1998 (Act 107 of 1998). The relevant listed activities in this instance are the following. [EAP comments in square brackets]:

Listing Notice 1 – Notice R.983 of 2014 (Basic Assessment Required).
Activity 12: *The development of-*
(iii) bridges exceeding 100 square metres in size;
(xii) infrastructure or structures with a physical footprint of 100 square metres or more:

Where such development occurs-
(a) within a watercourse;
(b) in front of a development setback; or
(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of the watercourse.

[This covers any work that will take place in and around wetlands – cutting, filling, culverts and the bridge.]

Activity 19:
The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-
(i) a watercourse;
(ii) the seashore; or
(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater-

but excluding where such infilling, depositing , dredging, excavation, removal or moving-
(a) will occur behind a development setback;
(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or
(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.

[This is related to cutting and filling in and around wetlands and drainage lines during the road re-alignment.]

Activity 24:
The development of-
(i) a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or
(ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;

but excluding-
(a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or
(b) roads where the entire road falls within an urban area.

[This will cover any new sections of road where it will be horizontally re-aligned.]

In addition to obtaining environmental authorisation from the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs, a Water Use Licence must be approved in terms of Section 21 of the National Water Act (Act No. 36 of 1998), as amended by the Department of Water and Sanitation.

The road upgrade forms part of the KwaZulu-Natal African Renaissance Roads Programme, which continues with the 2015/16 KwaZulu-Natal Provincial Budget.

4 NEED AND DESIRABILITY

There is no doubt that upgrading of the District Road D168 will have a number of benefits for the residents of the area, primarily improved road quality and thus safer driving. For those living close to the road, the reduction in the dust levels will be significant.

In addition to benefits to residents, in spite of there being some negative environmental impacts in the short term, there are environmental benefits in the long term. Gravel roads require constant resurfacing and grading and this requires access to borrow pits at all times. Blacktopping of the road will reduce this requirement to keep the borrow pits open. The road upgrade will also result in improvement to current drainage from the road and repair/rehabilitation of erosion nick points arising from drainage from the current road.

In addition to the direct benefits that accrue from improved transport infrastructure, the bulk of the actual contracts for the construction of the roads are to be given to emerging contractors from previously disadvantage communities. These contractors will work under the guidance of established contractors. A large part of the work, where feasible, will be done by means of manual labour and, where possible, locally owned plant will be used. Because of the labour intensive method to be used, the duration of construction will be longer than normal. This means that the construction will result in local employment and skills transfer to local residents.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Climate

The Umzumbe area is characterised by a summer rainfall pattern with intermitted rainfall events in the winter months. The mean annual precipitation is approximately 700 mm, with 73 % occurring between November and March. These high intensity rainfall conditions are conducive to high levels of surface runoff and subsequent erosion where soils are shallow, occur on steep slopes or are overgrazed. Erosion often occurs in the area due to a combination of the factors listed above. Frost is generally infrequent and occurs in low-lying valleys (Mucina and Rutherford, 2006).

The wettest time of the year is December, with an average of 108 mm, and the driest is June, with 5 mm. The seasonality of precipitation is a driving factor behind the hydrological cycles of rivers and drainage lines within the area. Typically rivers and drainage lines have a higher flow rate during the summer months.

Temperatures are also relatively high, with maximum temperatures ranging from 18.80° C in June to 25.30° C in February. The region is coldest in July with minimum temperatures of 4.50° C on average (Mucina and Rutherford, 2006).

5.2 Terrain morphology and drainage

To put the terrain in context, it has been described for both the nearly completed first phase and the second phase of the upgrade.

The D168 route traverses an area broadly classified as closed hills and mountains with moderate to high relief (Kruger, 1983) (Appendix 1, Map 3; Appendix 2, Photos 1&18). The terrain comprises low mountains with convex/concave/straight slopes and relief of 420-1000 m. The percentage of areas with slopes less than 5 % is less than 20 %. The route traverses a narrow interfluve, created by the headwaters of numerous tributaries of the Mhlabatashane and Mzumbe Rivers, within the Quaternary subcatchment U80B (Midgley *et al.*, 1994a). Drainage densities are medium, from 0.5 to 2 km/km^2, and stream frequency is medium to high, from 1.5 to 10.5 streams/km^2.

The first 13.4 km section of the route (Phase 1) begins at an elevation of 975 m above sea level (asl) and then gradually descends to an elevation of 910-915 m asl around the Springfield area, and maintains this elevation for 2 km. The route drops into a valley at Ivanhoe, reaching an elevation of 810 m. Further south, at ~ km 5, the route climbs up to an elevation of 855 m asl. At ~ km 6.7, the route continues to drop to an elevation of 780 m asl. The route reaches an elevation of 795 m asl around Radley, and maintains this elevation along the interfluve between the Madodobela and Mzumbe River tributaries' headwaters. The route then gradually decreases to an elevation of 700-720 m asl around Ntabakucasha.

The second 10 km section of the route (Phase 2) starts at Ntabakucasha at an elevation of 720 m and, mostly following the interfluves over a distance of 3 km, drops down to 416 m and runs close to the Mzumbe River for a distance of 1 km before it crosses the river at a relatively new low-level bridge (Appendix 2, Photo 13), which will probably not need to be upgraded. There is a small stream 150 m along where the road runs adjacent to the river and that stream runs through a pipe under the road into the river (Appendix 2, Photos 14&15). Just after where the stream runs into the river, there is a steep and unstable borrow area, cut into the side of the hill, that will need attention (Appendix 2, Photo 14). About 200 m after the low-level bridge, the road heads east-north-east and steadily climbs the interfluve to an elevation of 745 m at Mpongozini and then continues along the ridge up to 820 m, just before Kagoleta.

5.3 Geology

The regional geological context of the proposed road upgrading is outlined, as this influences the terrain morphology, drainage network and soil types along the route. The geological information discussed is based on the published 1:250 000 Port Shepstone (3030) geological map (Geological Survey, 1988).

This 10 km long portion of District Road D168 traverses areas associated with rocks of the Namaqua-Natal Metamorphic Province, Natal Group, Karoo Supergroup and Quaternary alluvium (Appendix 1, Map 4).

The Meso-Proterozoic Namaqua-Natal Metamorphic Province forms the basement to the region, with gneisses of the Mzumbe Suite dominant. In adjacent areas, the Mzumbe Suite intrudes older amphibolitic units of the Quha Formation (Cornell *et al*., 2006). The gneisses of the Mzumbe Suite cover a large extent of the route, forming the base lithology for two stretches of road, between ~1.2 to ~2.5 km, and ~3.3 to ~6.0 km from the beginning of the upgrade zone. The Mzumbe Suite is locally intruded by late Meso-Proterozoic granites and charnokites of the Oribi Gorge Suite (Cornell *et al*., 2006), which form large batholitic intrusions to the east of the study area. Although voluminous in neighbouring areas, the coarse-grained granites and charnokites of the Oribi Gorge Suite underlie a small section along the proposed road upgrade section underlying a 700 m section between ~ 2.5 to ~ 3.2 km from the start of the upgrade. The rocks of the Oribi Gorge Suite are non-conformably overlain by sedimentary rocks of the Ordovician Natal Group (Thomas *et al*., 1992). According to Thomas (1988), in the Port Shepstone region the Natal Group comprises red-brown, coarse-to-fine grained arkose to subarkose, light-grey quartzarenite, micaceous sandstone, grit, conglomerate, subordinate siltstone and mudstone. A small outcrop of Natal Group occurs at approximately 1.0 to 1.3 km along the route. The initial section of the road proposed for upgrade is underlain by tillite of the Dwyka Group, which unconformably overlies the Natal Group. The Dwyka Group characterises about 1 km from the start point of the route. A small section along the route is associated with alluvium in low-lying sections.

Numerous faults and faulted contacts occur, displacing rocks of the Mzumbe and Oribi Gorge Suites, Natal Group and Dwyka Group. Two faults are intersected by the route, a northeastsouthwest trending fault intersected at ~ 1.25 km and a relatively north-south trending fault at ~ 1.55 km.

5.4 Land Type and Soils

The relationship between geology, slopes and soils is effectively communicated by the land type approach to soil mapping, where the landscape is subdivided on the basis of similar geology, soil patterns, microclimate and terrain forms (Soil and Irrigation Research Institute, Agricultural Geo-referenced Information System; http://www.agis.agric.za). Appendix 1: Map 5 indicates that the proposed road upgrade route traverses four land types. The Ab153, Fa575, Fa574 and Ac261 land type description given below is based on descriptions done by the Soil and Irrigation Research Institute (Agricultural Geo-referenced Information System; http://www.agis.agric.za) and Fey (2010).

5.4.1 Ab153

The topography of the Ab153 land type is characterised by crests (10%), scarps (8%), middle slopes (70%) and valley bottoms (12%). Middle slopes dominate this land type and are associated with slopes of 10-50%. This land type is dominated by freely draining, oxidic soils of the Hutton Form and shallow lithic soils of the Glenrosa Form in crests and middle slope positions. The average thickness of Hutton soils is 400-800 mm and that of the Glenrosa soils is 200-600 mm. These soil forms have a clay content that ranges between 15-40%. The scarp regions are associated with 80% rock exposures whilst the valley bottoms are dominated by poorly drained, gleyic soils of the Katspruit Form, lithic Glenrosa soils and stream bed material (Appendix 1a).

a. Fa575

The Fa575 land type comprises middle slopes (60%) and valley bottoms (40%). In the middle slope areas, slopes are between 3-7% and shallow lithic soils of Glenrosa and Mispah Forms dominate. The Glenrosa and Mispah soil forms are associated with an average soil thickness of 100-400 mm and have a clay content that ranges between 5-20 %. Valley bottoms are characterised by cumulic soils of the Dundee and Oakleaf Forms developed in alluvial sediment as well as stream beds (Appendix 1b).

b. Fa574

The topography of the Fa574 land type comprises crests (5%), scarps (2%), middle slopes (70%), foot slopes (3%) and valley bottoms (20%). Middle slope areas dominate this land type and are associated with slope gradients of 10-50%. The crests and middle slope areas are dominated by freely draining Hutton Form soil profiles and shallow lithic soils of the Glenrosa Form. Average thickness for Hutton soils is 450-1200 mm with a clay content of 35-65%. Glenrosa soils are 200-400 mm thick and have a clay content of 10-30%. The steep scarp regions are dominated by rock exposures whilst deeper soils of the Hutton and Oakleaf Forms dominate the foot slopes. Stream bed material and soils of the Dundee and Katspruit Forms predominate the valley bottom areas (Appendix 1c).

c. Ac261

The Ac261 land type is characterised by crests (50%), middle slopes (25%) and valley bottoms (25%). Convex crests dominate this land type and are associated with slopes of 1-8%.

The crest areas are dominated by humic Kranskop soils and oxidic soils of Hutton and Griffin Forms. The soils of the Kranskop Form have an average depth of >1200 mm and a clay content of 35-45% whilst the oxidic Hutton and Griffin soils have average depths of between 1000-2000 mm and a clay content of 30-60%. The subordinate soil over the rest of the landform comprise lithic soils of the Cartref and Glenrosa Forms, humic Inanda soils, gleyic Katspruit soils, plinthic Westleigh soils, cumulic Oakleaf soils and oxidic Clovelly soils. The middle slope areas are predominantly associated with soils of the Hutton, Cartref, Glenrosa and Griffin Forms. The gleyic soils of Katspruit Forms and streambed material dominate valley bottom areas (Appendix 1d).

<u>Anticipated environmental impacts, mitigation and management</u>

Apart from minimal negative impact on agricultural production, the most probable impact on soils by the road upgrade is related to the erodibility and dispersivity of disturbed soils. The Highflats area receives 800-1000 mm mean annual rainfall and is characterised by rainfall erodibility index values (EI_{30} values) ranging between 401-500 (Middleton and Bailey, 2005; Rooseboom et al., 1992). According to the revised sediment yield map of Southern Africa which provides estimates of catchment sediment yields and relative erodibility of soils, the Highflats area has a high erodibility index of 3 (Msadala et al., 2010).

Dominant slope facets (crests and middle slope) along the route are mainly characterised by red-yellow-brown apedal and shallow lithic soils (Fig 2). The red-yellow-brown apedal soils on steep or sloping ground are classified in the “High” sediment yield delivery potential class (Rooseboom et al., 1992). Lithocutanic profiles exist, and these structured soils may be more prone to erosion as soil peds/blocks may be readily eroded by water as opposed to grain by grain removal.

The route crosses a river (Fig 2.) where the potential for surface water contamination by accidental spillages and uncontrolled water run-off possess a high risk during the construction phase. Proper containment and control of spillages is necessary. Although no significant erosional dongas or gullies were evident along the route, storm water runoff must be controlled, as concentrated runoff could lead to the development of gullies which could expand laterally.

5.5 Groundwater

The lithologies occurring along the route are classified as secondary aquifers since their groundwater bearing properties depend on secondary openings formed as a result of either tectonic deformation, weathering processes, unloading by erosion or a combination of these processes (Department of Water Affairs and Forestry, 1995). Along the route alignment, limited alluvium within the valley bottoms represents a low volume primary aquifer (Department of Water Affairs and Forestry, 1995). The two faults traversed by the road route represent secondary aquifers (Department of Water Affairs and Forestry, 1995). Fault zones often act as conduits, some of which extend to great depths and higher groundwater transmissivity rates can therefore be expected in such areas (Department of Water Affairs and Forestry, 1995).

The Mzumbe and Oribi Gorge Suites are classified as “Weathered and Fractured Aquifer” mainly because water bearing properties in these rocks are a result of fracturing at depths and near surface weathering processes (Department of Water Affairs and Forestry, 1995). Groundwater flows mainly occur within fractures and storage of groundwater contained in saturated zones within openings of the weathered rock. Groundwater yields from boreholes drilled within these rocks are derived mainly in saturated transition zones that exist between completely weathered rock (or regolith) and fractured unweathered rock (Department of Water Affairs and Forestry, 1995). Borehole yields expected for the Mzumbe and Oribi Gorge Suites range from poor (> 0.1-0.5 l/s) to marginal (>0-0.1 l/s) respectively (Department of Water Affairs and Forestry, 1995).

The Natal Group sandstone is characterised as a “Fractured Aquifer” as groundwater flow occurs principally within secondary openings and discontinuities. Groundwater storage in this lithology is governed by the frequency of rock discontinuities, as well as topographic distribution (Department of Water Affairs and Forestry, 1995). In highly dissected areas, springs and surface seepages occur in valley head areas. The rocks of the Natal Group are associated with marginal to moderate borehole yields (> 0.0-3.0 l/s) (Department of Water Affairs and Forestry, 1995).

The Dwyka Group tillite is characterised as a “Fractured Aquifer” as groundwater is confined within narrow discontinuities, joints, fractures and faults (Department of Water Affairs and Forestry, 1995). Jointing within the Dwyka often results in elongated zones of preferential weathering, and such structures act as conduits for groundwater movement (Department of Water Affairs and Forestry, 1995). The Dwyka Group tillite is one of the poorest yielding rocks with marginal borehole yields of >0-0.1 l/s (Department of Water Affairs and Forestry, 1995).

Alluvium is characterised as an “Inter-granular Aquifer” since groundwater flow depends on the permeability and porosity of the sediments (Department of Water Affairs and Forestry, 1995). Alluvium is associated with good borehole yields (>3.0 l/s) (Department of Water Affairs and Forestry, 1995).

In the Highflats area the mean depth to groundwater level is 20-30 m below surface and the range by which the groundwater level fluctuates about the mean is 15-25 m (Vegter, 1995). The typical groundwater chemical character is Type D, with dominant cations Na+ and or K+ and dominant anions Cl- and or SO42- (Vegter, 1995; Department of Water Affairs and Forestry , 1995). The amount of total dissolved solids (TDS) associated with the groundwater for these lithologies are <300 mg/l (lower standard deviation) to <500 mg/l (upper standard deviation) (Vegter, 1995). Department of Water Affairs and Forestry (1995) has characterised the groundwater typical of the lithologies associated with the route:

1. Dwyka tillites: Sodium bicarbonate
2. Natal sandstones: Sodium chloride
3. Granite and gneisses: Sodium bicarbonate/ Sodium chloride

Anticipated environmental impacts, mitigation and management

In general, the route traverses lithologies associated with marginal to poor groundwater aquifer potential so the impact of road construction activities is anticipated to be low. Earthworks associated with the road upgrading activities do not pose a significant risk. However, localised risks in the form of shallow groundwater contamination from construction vehicle maintenance, fuel storage and inadequate toilet facilities will occur. Accidental spillages could contaminate porous soil and may enter adjacent stream channels. Along the route, higher transmissivity rates are associated with fault zones whilst areas of alluvium are characterised as having good aquifer potentials. Therefore, a high risk of groundwater contamination exists in areas associated with faulting and/or alluvium.

5.6 Catchment characteristics and watercourses

The proposed project falls within the quaternary catchment U80B, which is part of the Coastal Mvoti Sub Water Management Area and the Mvoti to Umzimkhulu Water Management Area. The major rivers within the catchment are the Umgeni, Mvoti, Umkomazi and Umzimkhulu Rivers. These rivers experience significant levels of high water demand related stress, particularly during drought seasons. Many of these surrounding communities rely on fresh water from these rivers throughout the year (DWAF, 2004).

Land use within the U80B quaternary catchment is generally associated with transformation through urban sprawl, road networks and residential housing, as well as subsistence agriculture, Eucalyptus plantations and livestock grazing. Livestock overgrazing and lack of stormwater control are two major contributors to soil erosion within the catchment. The Mzumbe River (bisects the road upgrade route), Quha River (a tributary of the Mtwalume River) and Mhlabatshane River are the main watercourses within the larger study area and are located approximately 260 m east and 1.38 km west of the proposed development site respectively. These rivers experience significant levels of high water demand related stress, particularly during drought seasons. Many of these surrounding communities rely on fresh water from these rivers throughout the year.

The National Freshwater Ecosystem Priority Areas (NFEPA) is a project that was developed to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs (Driver *et al*., 2011).

No FEPA wetlands were identified within a 500 m buffer around the existing road.

5.7 Vegetation

Most of the route passes through Moist Coast Hinterland Grassland (Gs 20), except where it descends to the Mzumbe River valley (Appendix 2, Map 2). In the upper parts of the valley the vegetation type changes to Dry Coast Hinterland Grassland (Gs 19) and then, in the lower parts of the valley, KwaZulu-Natal Highland Thornveld (Gs 6) (Appendix 2, Map 2).

Mucina and Rutherford (2006) describe the properties of Moist Coast Hinterland Grassland and Dry Coast Hinterland Grassland under a combined single vegetation type, SVs 4 – Ngongoni Veld, but Ezemvelo KZN Wildlife have refined the description and separated it into the two further vegetation types whose descriptions will follow (Scott-Shaw & Escott, 2011).

Dry Coast Hinterland Grassland (Gs 19) is found in KwaZulu-Natal and the Eastern Cape Provinces, generally occurring above SVs 3 KwaZulu-Natal Hinterland Thornveld, SVs 7 Bisho Thornveld and the SVs 6 Eastern Valley Bushveld at an altitude of 450 - 900 m. It is found on undulating plains and hilly landscapes mainly associated with drier coast hinterland valleys in the rain-shadow of the rain-bearing frontal weather systems from the east coast. This vegetation consists of sour sparse wiry grassland dominated by unpalatable Ngongoni grass (*Aristida junciformis*), with this monodominance associated with low species diversity. In good condition, it is dominated by *Themeda triandra* and *Tristachya leucothrix*. Wooded areas are found in valleys at lower altitudes, where, in this instance, it grades into SVs 3 KwaZulu-Natal Hinterland Thornveld. The herbaceous species richness is lower than in Moist Coast Hinterland Grassland. The conservation status of Dry Coast Hinterland Grassland is Vulnerable. It is 53.7 % transformed and only 0.7 % is statutorily conserved in the province in Oribi Gorge Nature Reserve. The conservation target is 25 %.

Moist Coast Hinterland Grassland (Gs 20) is found in KwaZulu-Natal and Eastern Cape Provinces, generally occurring below Gs 9 Midlands Mistbelt Grassland in a rolling and hilly landscape. The vegetation consists of dense tall sour grassland dominated by unpalatable Ngongoni grass (*Aristida junciformis*), with this mono-dominance associated with low species diversity. In good condition, it is dominated *Themeda triandra* and *Tristachya leucothrix*. The conservation status of Moist Coast Hinterland Grassland is Endangered. It is 63.4 % transformed and only 0.2 % conserved in Vernon Crookes and Entumeni Nature Reserves. The conservation target is 25 %.

KwaZulu-Natal Highland Thornveld (Gs 6) consists of a series of several patches in the central and northern regions of KwaZulu-Natal, where it occurs in both dry valleys and moist upland. The landscape in which this vegetation type is found is hilly and undulating with broad valleys. It supports tall tussock grassland with occasional savannoid woodlands with scattered *Vachellia* (*Acacia*) *sieberiana* var *woodii* and, in small pockets, also with *V.* (*A.*) *karroo* and *V.* (*A.*) *nilotica*. The conservation status of KwaZulu-Natal Highland Thornveld is Least Threatened, with 37.3 % transformed to cultivation, urban sprawl and dams, but probably the greatest threat to this unit is bush encroachment. The conservation target is 23 % in KwaZulu-Natal, but only about 2 % is statutorily conserved in the province.

Alien invasive and exotic species identified along the route included *Acacia mearnsii* (Black Wattle), *Ageratum conyzoides* (Invading Ageratum), *Bidens pilosa* (Common Black Jack), *Chromolaena odorata* (Triffid Weed), *Eucalyptus* spp. (Gum), *Jacaranda mimosifolia* (Jacaranda), *Lantana camara* (Tickberry), Melia *azedarach* (Syringa), *Phytolacca dioica* (Belhambra), *Psidium guajava* (Guava), *Ricinus communis* (Castor Oil), *Senna didymobotrya* (Peanut Butter Cassia), *Tagetes minuta* (Tall Khaki Weed) and *Solanum mauritianum* (Bugweed) (Appendix 2, Photos 7&15). Further to this, various parts of the surrounding landscape have been transformed by subsistence farming and rural housing developments (Photos 4&5, 8&9 and 12&17**)**. Vegetation units surrounding the rural development were disturbed and the vegetation structure has been further impacted by overgrazing and alien invasive species. Away from the homesteads, grass basal cover is good (Appendix 2, Photo 3).

Grass species identified include *Aristida junciformis, Eragrostis* spp., *Cymbopogon plurinodis, Hyparrhenia hirta, Melinis repens* and *Sporobolus pyramidalis*. Tree species identified along the route included *Clerodendrum glabrum* (Tinderwood), *Dalbergia obovata* (Climbing Flat Bean), *Ficus sur* (Broom Cluster Fig), *Vachellia (Acacia) natalitia*, *Tetradenia riparia* (Ginger Bush) and *Vangueria infausta* (Wild Meddler). Herbaceous plants included *Centella asiatica* (Pennywort), *Gomphocarpus physocarpus* (Hairy Balls), *Helichrysum* sp., *Leonotis leonurus* (Wild Dagga) and *Pteridium aquilinum* (Bracken).

Anticipated impacts and mitigation

The Grassland Biome in South Africa is generally quite severely transformed or degraded, either directly or indirectly, by a number of different human activities, including afforestation, crop agriculture, urbanisation, pollution from industries, such as power stations and pulp and paper mills, mining, extensive livestock production and alien plant infestation. Since both Moist Coast Hinterland Grassland and Dry Coast Hinterland Grassland are also very important in their own right, from a conservation perspective, every effort should be made to avoid actions that may further threaten even the smallest patches of these communities that are intact.

Some unavoidable damage to grasses, forbs and smaller trees will occur with the proposed road upgrade, particularly on temporary detours. It will be the responsibility of the contractor assigned to that particular section of the road to remove gravel from temporary detours once they are no longer needed, to rip the area and to rehabilitate it. Measures to rehabilitate the areas should include some, or all, of the following, depending on the areal extent of the damage.

1. Stockpiled topsoil should be used to reshape verges and be spread over disturbed areas.

2. Brush from alien trees, such as *Eucalyptus* (gum) and *Acacia mearnsii* (black wattle), can be cut and brushpacks laid on the bare soil. Great care should be taken to ensure that *Acacia mearnsii* seeds are not accidentally planted *en masse* during this process.
3. Where possible, grass should be cut from natural veld in the area, preferably when it is seeding, and placed on the surface as a mulch.
4. Tufts of grass can be dug out randomly in the surrounding veld and used to re-plant disturbed areas. However, digging out of the tufts should be spread out over a large area to avoid creating new bare and disturbed areas.
5. Where slopes are steeper, brushpacks may need to be secured with stakes and additional geofabrics may be needed to prevent accelerated erosion.

The purpose of the above measures is to reduce the impact of raindrops and slow down the velocity of running water, thus reducing the risk of erosion. Using the measures described above, re-seeding of grasses will mostly not be necessary as there will either be seeds in the topsoil or in the grass that is used as mulch, and some seeds will be distributed and will germinate naturally from adjacent vegetation. Brushpacking and grass mulch serve to both trap seeds and provide a suitable microhabitat for germination. The only danger, in this instance, is that, because of the high concentration of aliens relative to indigenous vegetation, there is a good chance that alien plants may swamp the emerging indigenous seedlings and aggressive alien plant control will be necessary.

One has to be cautious with buying grass seeds from commercial outlets as the seed mix is often either not appropriate to the area, or the source of the seeds is unknown and thus the genetic integrity of the local plants can be compromised.

Use should be made of the opportunity to create local employment, through both a programme to eradicate alien plants and to do extensive planting of indigenous trees around homesteads.

5.8 Fauna

Grassland is the most important habitat type for threatened birds in South Africa (Barnes, 2000). Not only do the grasslands support the highest number of bird species considered threatened in the region, but many of these are in the highest category of threat (e.g., Wattled Crane and Blue Swallow).

A total of 373 bird species (Gibbon, 1998/99) have been recorded for the quarter degree square through which the D168 runs. Not all of these bird species are likely to be seen or to reside adjacent to the road as many would be associated with forest, wetland or other habitats and the road traverses mainly grassland, with wetlands in the valleys and hillslopes below the road. A total of 135 of the 373 species are usually associated with grassland. A number of those species found within the quarter degree square, 3030AC, are listed as Red Data Species (Barnes, 2000) under the following categories (grassland species marked with asterisks).

1. Regionally Extinct: Egyptian Vulture* (no record found of when they were last seen in the area).
2. Critical: Bittern, Blue Swallow*, Wattled Crane*, Whitewinged Flufftail.
3. Endangered: Bearded Vulture, Blackrumped Buttonquail*, Cape Parrot, Spotted Thrush.
4. Vulnerable: African Marsh Harrier*, Blue Crane*, Cape Vulture*, Corncrake*, Crowned Crane*, Grass Owl*, Ground Hornbill, Lesser Kestrel*, Mangrove Kingfisher, Martial Eagle*, Pinkbacked Pelican, Stanley's Bustard*, Striped Flufftail*, Yellowbreasted Pipit*.
5. Near-Threatened: Black Stork, Blackbellied Korhaan*, Blackwinged Plover*, Broadtailed Warbler*, Bush Blackcap, Crowned Eagle, Halfcollared Kingfisher, Knysna Woodpecker, Lanner Falcon, Marabou Stork, Orange Thrush, Painted Snipe, Peregrine Falcon, Pied Mannikin, Secretarybird*, White Pelican, Yellowbilled Stork.

No known endemic reptiles, frogs or invertebrates are expected to be found in the immediate vicinity of the road (Goodman, 2000). Oribi (*Ourebia ourebi*), the most threatened antelope species associated with grassland in the Province, are not presently found in the area adjacent to the road primarily because of the proximity of rural settlements and the vulnerability of oribi to domestic dogs. Other antelope species likely to be found in the vicinity of the road, particularly in the natural areas, would be other grassland species such as mountain reedbuck (*Redunca fulvorufulu*), common reedbuck (*Redunca arundinum*), steenbok (*Raphicerus campestris*) and grey duiker (*Sylvicapra grimmia*).

Other mammal species likely to be found in the vicinity include the aardwolf (*Proteles cristatus*), antbear (*Orycteropus afer*), black-backed jackal (*Canis mesomalas*), bushpig (*Potamochoerus porcus*), caracal (*Felis caracal*), large-spotted genet (*Genetta tigrina*), white-tailed mongoose (*Ichneumia albicauda*), slender mongoose (*Galerella sanguinea*), porcupine (*Hystrix africaeaustralis*), rock dassie (*Procavia capensis*), scrub hare (*Lepus saxatilis*), serval (*Felis serval*) and striped polecat (*Ictonyx striatus*). It is possible that the conservation-important endemic Dobson's rough-haired golden mole (*Chrysospalax villosus dobsoni*) may also occur.

Anticipated environmental impacts, mitigation and management

As mentioned in Section 5.5, Vegetation, grassland in KwaZulu-Natal is particularly under threat and, as a result, animal species which require grassland habitat are also under threat. The bird species most threatened in grasslands are the Crowned Crane, Wattled Crane, Blue Crane and Blue Swallow. However, no Wattled Crane or Blue Swallow have been recorded in the immediate vicinity of the road. It is unlikely that any bird species will be directly affected by the upgrading of the road, especially because it is an existing road through some transformed areas and no direct destruction of existing habitat will take place as a result of the construction. Oribi (*Ourebia ourebi*) and Dobson's rough-haired golden mole (*Chrysospalax villosus dobsoni*) are the most important grassland mammals in terms of conservation. However, oribi have not been recorded in the area in recent times and the road construction activities are unlikely to affect Dobson's rough-haired golden mole if they are in the area.

The recommendations regarding elimination of alien plants adjacent to the road will have the effect of improving habitat. Since the greatest threat to most animal species is destruction of habitat, improvement of the habitat should therefore provide many grassland species with a better chance of survival. South Africa's endemic bird species are a largely untapped tourist market. With 12 endemic bird species and numerous interesting mammals, South Africa's grasslands are in a strong position to capitalise more on this market, provided that the grasslands are not destroyed.

Since District Road D168 is already in existence and the upgrading of the road consists mainly of limited vertical and horizontal realignment and blacktopping of the road, additional impacts to animals are expected to be minimal. Increased speed due to the improved quality of the road is probably the most important risk factor, particularly at night when most road kills of indigenous animals take place, and when domestic cattle and goats stray into the road. If antelope are in the area and they are to cross the road at night, they may become mesmerised by lights and may thus not move off the road in time to avoid a collision. There has probably always been a tendency for people to speed along the road in spite of it being a gravel road and in those circumstances it is more difficult to stop and/or avoid collisions than on a blacktopped road, so in this respect the upgrade will make the road safer. To assist with safety, some form of traffic calming will be necessary where there are high concentrations of pedestrians, such as near schools and clinics.

5.9 Heritage

A first phase Heritage Impact Assessment (HIA) was conducted by Mr Frans Prins of Active Heritage, on 28 June 2016.

This heritage assessment identified three heritage sites adjacent to the road. These include two modern graves (Appendix 2, Photos 6&16) and the ruins of an old trading store. The heritage report recommended that a buffer zone of 20 m must be maintained around the old trading store. Given that the graves are very close to the D168, it would only be practical to maintain a relatively small buffer zone around these graves. Should it not be possible to maintain the integrity of the graves, then a Phase Two Heritage Impact Assessment would need to be conducted. A Second Phase would entail the application for a permit from Amafa and the possible exhumation and reburial of the graves under the auspices of the local community.

Anticipated environmental impacts, mitigation and management
It is unlikely that the road upgrade will have any direct impact on any heritage resources, including the two modern graves found and the trading store. However, buffers, as recommended in the HIA, must be maintained.

The heritage assessment drew attention to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act No. 4 of 2008), which require that operations exposing archaeological or historical remains, as well as graves, should cease immediately, pending evaluation by the provincial heritage agency.

5.10 Services and infrastructure

No services will be required, as all water for construction will be brought in via water tankers. Electricity for power tools, as required, will be supplied by means of portable generators. Portable chemical toilets will be made available to construction staff.

5.11 Socio-economic

The socio-economic impacts of this development will predominantly be positive in that it will provide improved access to the area for residents. A better quality road will be a safer road, particularly in heavy rains, and there will be less dust coming off the road. Although there are reports of some residents already speeding in the area, there may be a tendency to speed more and therefore traffic calming humps should be installed before and after schools, community centres and concentrations of homesteads.

6 ALTERNATIVES

Apart from leaving the existing road as a gravel road, there are no alternatives to blacktopping the road. The horizontal and vertical realignment in certain sections will be done primarily to make the road safer, by eliminating excessively sharp turns and dramatic changes in height of the road. These realignments will serve to "soften" the directional and altitudinal changes for motor vehicles.

7 PUBLIC PARTICIPATION

7.1 Description of public participation process

Newspaper advertisements were published in three newspapers, namely the Mercury (English - Figure 2) and Isolezwe (isiZulu - Figure 3) on 30th June 2016 and the Nix Matters June 2016 issue (local monthly English paper - Figure 4). Public notices in English and isiZulu were also attached outside the Emzansi Engineers site offices (Figure 5) near the end of the first phase of the D168 upgrade, as well as at a community hall a few kilometres down the road (Figure 6).

The KwaZulu-Natal Department of Transport has a number of Public Liaison Committees (PLC's) in place for the African Renaissance Roads Programme. These committees have been created specifically to include Interested and Affected Parties (I&APs) in the ongoing planning and implementation of the road upgrades.

Minutes of the four PLC meetings, at which the upgrading of the District Road D168 was discussed, are attached in Appendix 4: Minutes of PLC Meetings.

7.2 Issues raised by I&APs

To date (September 2016), there has been no response to either newspaper advertisements or public notices. This draft BAR will be submitted to organisations as outlined in section 8.1 and any comments emanating from those organisations will be incorporated into the final BAR.

8 IMPACTS

8.1 Construction phase

A schematic diagram of layers of material used in road construction is given in Figure 1 below. The process in building up these layers is as follows:

- The road is scraped and preliminary shaping is done.
- Topsoil and/or other material is lifted off to stockpile for later use.
- The surface is built up to new grade lines.
- The selected layers are shaped and built up with G8 grade material.
- The C4 layer is created by spreading a layer of cement/lime, mixing it with weathered dolerite (G6 grade) using a grader or harrower and then wetting and compacting. If new borrow pits are needed for this material, the environmental issues with respect to these borrow pits will need to be dealt with in a separate Environmental Management Programme (EMPr) and submitted to the Department of Minerals and Energy.
- The next layer to be added is a crushed tillite or dolerite (blue) rock layer. This layer is also wet and compacted.
- The final layer to be added is a bitumen seal.

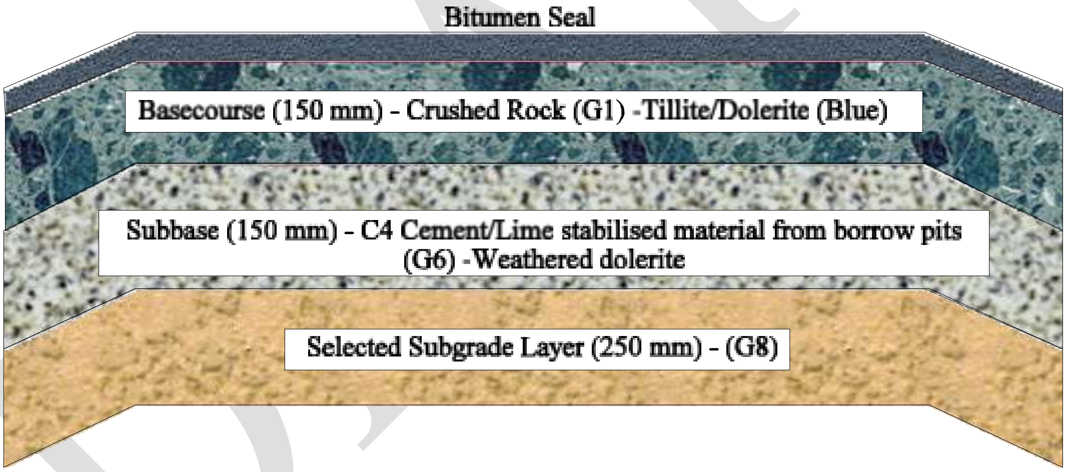


Figure 1: Schematic diagram of road layers

The current width of District Road D168 is approximately 7 m. The upgrade will keep the width of the carriageway at 7 m, with two 3.5 m lanes. If the terrain allows and if the section of road up a hill is long enough, the road will be slightly wider to allow for passing lanes up hills. In places, particularly near the schools, 1 m wide concrete walkways will be constructed on each side of the road in an effort to keep people off the road and so reduce the risk of pedestrian fatalities. To assist with safety, some form of traffic calming will be necessary where there are high concentrations of pedestrians, such as near schools and clinics.

Anticipated environmental impacts, mitigation and management

Anticipated environmental impacts during the construction phase can be divided into two categories – (i) those that result from the actions of construction staff and (ii) those that are a direct result of construction.

8.1.1 Possible impacts from the actions of construction staff

Impacts that may result from the actions of construction staff include:

- Owing to the poor aquifer potential of lithologies along the route, the impact of general road construction activities is low. Road upgrading activities do not pose a significant threat. However, localised threats in the form of construction vehicle maintenance, fuel storage and inadequate toilet facilities exist. Accidental spillages on the steep slopes could contaminate large areas of porous soil and could enter adjacent stream channels. The potential for contamination from these non-point sources is higher for surface water than groundwater resources.
- Impacts to wetlands downstream or downslope of the road depends on the nature and effectiveness of the drainage systems put in place during the upgrade. The road is already hardened with gravel, so there will be little or no change in volume of runoff from the road. However, blacktopping may reduce the volume of sediment coming off the road. Improvement of the existing lateral drains and sub-road piped culverts to reduce the energy, volume and velocity of water ultimately entering drainage lines and wetland systems may be a positive spin-off from the upgrade (Appendix 2, Photos 2, 7, 9, 10 and 15).
- Accidental ignition of fires through careless disposal of cigarette “stompies”, from cooking fires or from burning of lime or cement bags. Although fire is an important component of grassland dynamics, unplanned and unseasonal fires can be detrimental to veld condition and can pose a danger to humans and their livestock.
- Littering.
- Defecation in the veld, with risk of disease transmission.
- Accidental spillage or deliberate disposal of the contents of chemical toilets in the veld.
- Because there is significant human settlement along a large proportion of the route, the risk of these impacts is already ever-present and the presence of construction staff is unlikely to increase the risk significantly.

Measures to prevent or mitigate against these impacts include:

- Control over where and how vehicles are re-fueled and maintained to ensure that accidental spillage of fuel, oil and any other chemicals does not occur during construction.
- Improvement in control of water emanating from the hardened road system will include the use of Sustainable Drainage Systems (SUDS), as described in the Wetland Assessment (Malachite, 2016). The principle behind the use of SUDS involve changing the traditional thinking behind drainage systems to encouraging flood waters to infiltrate to groundwater as quickly as possible in the immediate area rather than

channelling it away. Consideration is given to water quality as well as the amenity and biodiversity values of water, thereby improving the hydrological flow entering the receiving environment. The additional spinoff is that the reduction in water volume and velocity will result in a considerably reduced erosion, sedimentation risk and risk of pollutants entering wetland systems.
- No open fires should be allowed on site, unless due care has been exercised to prevent veld fires.
- Facilities should be provided to prevent littering along the route. Although there is some litter along the route, construction staff should be discouraged from littering. The upgrade should be used as an opportunity to educate residents about the benefits of a litter-free environment. Because of the large numbers of pedestrians walking on or adjacent to the road each day, a number of strategically placed permanent litter bins should be provided and serviced regularly.
- An adequate number of chemical toilets for the number of staff on site should be provided within a reasonable distance of each of the major construction activities. These toilets should be properly serviced by a reputable service provider, who must be held responsible for the proper disposal of the contents thereof.

8.1.2 Possible impacts from construction activities

Possible impacts from construction activities include:
- The acquisition and transport of soft-borrow materials from borrow pits.
- Accelerated soil erosion.
- Noise from construction vehicles.
- Increased dust.
- Destruction of plants and plant communities and destruction of animal habitat.
- Spillage of chemicals, oils and fuel, which could contaminate soil, surface and ground water.
- Accidental ignition of fires from accidents in handling of bitumen (see below).
- Disruption to normal traffic flow.

Measures to prevent or mitigate against impacts resulting from construction activities include:

- Environmental issues with regard to acquisition of material from borrow pits will need to be dealt with in a separate EMP.
- The issues with respect to soil erosion have been dealt with in detail in Sections 2.1-2.3.
- Dust and noise are an unavoidable part of construction, but the impacts are short-term and the end result will be a reduction in dust levels.
- Impacts and mitigation with respect to vegetation have been dealt with in Section 2.5.
- Impacts and mitigation with respect to animals have been dealt with in Section 2.6.
- Impacts and mitigation with respect to spillage of chemicals, oils and fuel, which could contaminate soil, surface and groundwater have been dealt with in Section 2.4. If soils do become contaminated, they must be collected and appropriately disposed of off site.
- Disruption to the normal flow of traffic is an unavoidable, but short-term impact.

Sufficient warning should be given to motorists to forestall the possibility of accidents.

- Bitumen, as opposed to tar, will be used. A discussion regarding the use of bitumen follows (from Sabita, 1998).

Bitumen and coal tar are distinct products in terms of chemical composition and engineering properties (or performance characteristics), as well as epidemiology and ecotoxicology related to its use. Bitumen is obtained from the distillation of crude petroleum oil. Coal tar is a condensation by-product from carbonisation of coal during the production of coke. Bitumen water solubility is low and, consequently, concentrations which are likely to be acutely toxic to aquatic organisms are unlikely to occur. The dangers from bitumen can be summarised as:

- Danger from high temperatures: Bitumen is often handled at temperatures above 150EC and is often stored above 100EC, the boiling point of water. If water does come into contact with the hot bitumen, it could result in boil over and possible fire or explosion. There is always a risk of serious burns to humans working with the product. Tanks and pipelines containing hot bitumen and heated by steam, hot oil or LPG burners should be shielded or lagged.
- The health risk from working with bitumen increases with the temperature of the product and arises from burning or inhalation of fumes. Some of the hydrocarbons (Polycyclic Aromatic Hydrocarbons - PAH) in the fumes are considered to be carcinogenic. However, the concentration of PAH in bitumen fumes at normal road application temperatures is extremely low and no studies to date have demonstrated any health risk to workers exposed to these fumes.
- At or below the maximum handling temperature, bitumen will remain below its flashpoint and only some solvent evaporation will take place. However, bitumen cutbacks (thinned down bitumen used for binding of gravel and other purposes) are usually handled at a temperature above the flashpoint of the cutter or solvent and the vapour space above the product is often explosive. For this reason, it is essential that all sources of ignition are kept away from areas where there are likely to be a concentration of flammable vapours. In addition, smoking and naked lights should not be permitted within 15 m of any vehicle when filling or circulating bitumen or changing LPG bottles, and gas burners should be filled with safety nozzles.

Every attempt should be made to ensure worker safety by the provision of safety clothing and through careful handling of the product, as outlined in Sabita (1998). All combustible refuse must be removed from the area and fire-fighting equipment should be on site at all times. Should a fire occur, water should not be used to extinguish it, although water may be used to cool nearby intact tanks. The fire should be extinguished using foam, which should be gradually spread as a blanket over the surface of the burning liquid. Indiscriminate application of foam will not extinguish the fire and if dry powder or CO^2 are used, the fire may reignite, so their use should be followed up with foam.

8.2 Operational phase

Once upgrading of the road is complete, the designated ECO will need to inspect and report to ensure that rehabilitation measures have been adequately carried out and that disturbed areas will not become nurseries for large-scale alien plant infestation.

It is recommended that, for a period of three years after construction is complete, an annual inspection is undertaken to ensure that erosion protection measures are in place and that rehabilitation efforts have been successful. This will include alien plant follow-up.

9 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Field work was conducted over a single day, which included the EAP, Wetland Specialists and Heritage Specialist. The EAP and Wetland Specialists made notes on the plant species and vegetation community condition on site, but vegetation community descriptions were based on published literature, with discussions on animal species likely to be present based on a desktop assessment of published literature and on the EAPs personal knowledge of animal habitats and living requirements. Therefore, neither a detailed, multi-season botanical study nor a detailed study of local fauna was conducted.

The following assumptions apply specifically to the wetland study:

i. The hand-held Garmin eTrex 30x used to delineate wetland, watercourse and riparian boundaries has an accuracy of 3-6 m.

ii. The assessment of the present ecological state (PES) of the identified wetland system was based on field investigation conducted during winter. Site visits should ideally be conducted over differing seasons in order to better understand the hydrological and geomorphologic processes driving the characteristics of the watercourse and the functional integrity of the wetland system.

10 ENVIRONMENTAL IMPACT STATEMENT & EAP RECOMMENDATIONS

10.1 Overall impact statement

There is no doubt that upgrading of the District Road D168 will have a number of benefits for the residents of the area. In addition, in spite of there being some negative environmental impacts in the short term, there are environmental benefits in the long term. Gravel roads require constant resurfacing and grading and this requires access to borrow pits at all times. Blacktopping of the road will reduce this requirement to keep the borrow pits open. In addition, there will be a drastic reduction in the amount of dust.

A summary of the impacts, and mitigation thereof, as outlined in the report, is as follows:

1. Owing to the poor aquifer potential of lithologies along the route, the impact of general road construction activities is low. Road upgrading activities do not pose a significant threat. However, localised threats in the form of construction vehicle maintenance, fuel storage and inadequate toilet facilities exist. Accidental spillages on the steep slopes could contaminate large areas of porous soil and could enter adjacent stream channels. The potential for contamination from these non-point sources is higher for surface water than groundwater resources.

2. The most likely impact of the road development is diversion of concentrated storm runoff onto slopes below the road level. At present, the route has numerous lateral drains and sub-road piped culverts, many of which are discharging onto steep slopes and some of are already resulting in erosion that needs to be addressed (Photos 10, 11 and 15). Careful design of drainage and use of Sustainable Drainage Systems (SUDS) will eliminate that risk.

3. Since both Moist Coast Hinterland Grassland and Dry Coast Hinterland Grassland are very important from a conservation perspective, every effort should be made to avoid actions that may further threaten small patches of these communities that may be intact.

4. An alien plant eradication programme and litter disposal programme within the road reserve should be implemented using emerging entrepreneurs. A number of strategically placed, and serviced, litter bins should be provided along the length of the road, for use by the many pedestrians utilising the road.

5. The recommendations regarding elimination of alien plants adjacent to the road are also important to animals. Since the greatest threat to most animal species is destruction of habitat, improvement of the habitat should therefore provide many grassland species with a better chance of survival and enable the community to promote a largely untapped tourist market.

6. Increased speed due to the improved quality of the road is probably the most important risk factor to animals, particularly at night when most road kills of indigenous animals take place and when domestic cattle and goats stray into the road. The proximity of fairly dense human settlements along sections of the road, makes it unlikely that there would be many antelope in the vicinity of the road, but if antelope are in the area and they are to cross the road at night, they may become mesmerised by lights and may thus not move off the road in time to avoid a collision.

7. Increased speed due to the improved quality of the road is probably also the most important risk factor to humans. Provision is being made for pedestrian walkways adjacent to the roads and this will decrease the risk of pedestrian fatalities, particularly at the times when schoolchildren are walking home and at night, when pedestrians often do not take heed of the fact that they may not be visible to motorists. There has probably always been a tendency for people to speed along the road, in spite of it being a gravel road, and in those circumstances it is more difficult to stop and/or avoid collisions than on a blacktopped road, so in this respect the upgrade will make the road safer. To assist with safety, some form of traffic calming will be necessary where there are high concentrations of pedestrians, such as near schools and clinics.

8. The reduction in dust will be an important spinoff from upgrading the road, especially as there are many houses, subsistence gardens, some schools, shops and community centres close to the road.

9. Guidelines regarding the handling of bitumen, outlined in Section 8.1.2 and in Sabita (1998), should be strictly followed and the risk of accidental fires from incorrect handling of hot bitumen should be catered for.

10. The responsibilities of the contractors, in terms of environmental impacts, must be clearly articulated to them and the resident engineer should have the responsibility to check that the contractors are complying with these responsibilities. Contractors should be informed that they are to be held responsible for the behaviour and actions of their staff.

Since District Road D168 is already in existence and the upgrading of the road consists mainly of a vertical realignment and blacktopping of the road, additional impacts are expected to be minimal.

In conclusion, it is recommended that permission be granted for the upgrading of the District Road D168, with due regard for the issues raised in this report.

10.2 Proposed monitoring and auditing

During the construction phase, a Resident Engineer will be appointed by Emzansi Engineering Consultants to oversee the entire road upgrade operation. The Resident Engineer will ensure that the site protection measures and mitigation, highlighted in this report, are implemented so as to safeguard the integrity of the surrounding grassland.

Issues outlined in this report should be considered before any construction activities take place. These activities include the following.

- Site establishment.
- Setting out zone of influence, and consensus of contractors' requirements.
- Marking of banks and detour lines before clearing.
- Clearing and construction, including removal and trimming of trees.
- Rehabilitation of old roads and detours, including clearing and disposal of debris.
- Rehabilitation of road verges.
- Designation of refueling sites where re-fueling only takes place over drip trays and any temporary fuel storage tanks are sufficiently bunded to capture the contents of the tank in case of leakage.

Temporary impact areas, such as road diversions, and the sections of the old road where realignment has taken place, must be rehabilitated using principles as laid out in Section 5.7.

11 REFERENCES

Active Heritage. 2016. First Phase Heritage Impact Assessment of the Proposed Upgrade of District Road D168 near Highflats, KwaZulu-Natal.

Boon, R. 2010. *Pooley's Trees of Eastern South Africa.* Flora and Fauna Publications Trust, Durban.

Brousse-James & Associates. 2006a. Upgrading of District Road D168 for 13.4 km from the intersection with the P68-1: Environmental Scoping Report.

Brousse-James & Associates. 2006b. Upgrading of District Road (EIA/6683): Environmental Management Plan.

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M and Gibson, R.L .2006. The Namaqua-Natal Province. In: Johnson M.R., Anhaeusser C.R. and Thomas R.J. (Eds), *The Geology of South Africa*, Geological society of South Africa, Johannesburg/ Council for Geoscience, Pretoria. 325-379.

Driver, A., Nel, J., Snaddon, K., Murray, K., Roux, D., Hill, L., & Swartz, E. (2011). *Implementation Manual for Freshwater Ecosystem Priority Areas.* WRC Report No. 1801/1/11. Pretoria: Water Research Commission.

Department of Water Affairs and Forestry, D. O. (2005). *A Practical Field Procudure for Identification and Delineation of Wetlands and Riparian Areas* - Edition 1.

Department of Agriculture. *Land type data: Soil and Irrigation Research Institute. Agricultural Geo-referenced Information System*; http://www.agis.agric.za.

Department of Water Affairs and Forestry, 1995. *Characterization and Mapping of the groundwater resources KwaZulu-Natal Province. Mapping Unit 4.* Report Ref.N4314.

Department of Water Affairs and Forestry, 1995. *Characterization and Mapping of the groundwater resources KwaZulu-Natal Province. Mapping Unit 4.* KwaZulu-Natal Hydrogeological Map

Council for Geoscience. 2002. *Unpublished geological 1:50 000 field sheet, 3030 AC Highflats*. KwaZulu-Natal office, Pietermaritzburg.

Geological Survey. 1988. *1:250 000 geological series, 3030 Port Shepstone*. Department of Mineral and Energy Affairs, Pretoria.

Fey, M. (2010). Soils of South Africa: Their distribution, properties, classification, genesis, use and environmental significance. Cambridge University Press: Cambridge, UK.

Groundwater Resources of the Republic of Southern Africa, Sheet 2, 1995.

Gibbon, G., Maclean, G. and John Voelcker Bird Book Fund. 1998/99. *Roberts' multimedia birds of Southern Africa, Version 2.1*. South African Birding cc.

Goodman, P.S. 2000. *Determining the conservation value of land in KwaZulu-Natal. Biodiversity Division - KwaZulu-Natal Conservation Service*. Ezemvelo KwaZulu-Natal Wildlife, Pietermaritzburg.

Groundwater Consulting Services. 1995. *KwaZulu-Natal groundwater characterisation and hydrogeological mapping programme. Report on the groundwater resources and hydrogeology of Unit 4*. Department of Water Affairs and Forestry, 73 pp.

Kruger, G.P. 1983. *Terrain morphological map of Southern Africa*. Soil and Irrigation Research Institute (SIRI). Department of Agriculture, Pretoria.

Malachite Specialist Services. 2016. Wetland Impact Assessment: Upgrade of D168, Umzumbe Local Municipality, KwaZulu-Natal.

Midgley, D.C., Pitman, W.V. and Middleton, B.J. 1994a. *Surface water resources of South Africa 1990; Volume VI Book of Maps and Appendices, Drainage Regions U, V, W, X, Eastern Escarpment*. Water Research Commission.

Midgley, D.C., Pitman, W.V. and Middleton, B.J. 1994b. *Surface water resources of South Africa 1990; Volume V Book of Maps and Appendices, Drainage Regions M, N, P, Q, R, S, T, Eastern Cape*. Water Research Commission.

Middleton, B.J, and Bailey, A.K., 2008. Water resources of South Africa, 2005 study (WR2005), Executive summary, Version 1.

Msadala, V., Gibson, L., Le Roux, J., Rooseboom, A., Basson, G.R., 2010. Sediment yield prediction for South Africa: 2010 Edition. Water Research Commission. WRC Report No. 1765/1/10.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (eds). (2006). Vegetation Map of South Africa, Lesotho and Swaziland, edn 2, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria.

Ndebele, S. 2001. Address at the turning of the sod of African Renaissance Main Road 235 by the Minister of Transport, KwaZulu-Natal. June 2001.

Rooseboom, A., Verster, E., Zietsman, H.L. and Lotriet, H.H., 1992. The development of the new sediment yield map of Southern Africa, Water Research Commission, Report No. 297/2/92.

Scott-Shaw, C.R. & Escott, B. KwaZulu-Natal Vegetation Type Description Document for Vegetation Map 2011: Kznveg05v2_011_wll.shp.

Soil and Irrigation Research Institute (SIRI), Department of Agricultural Technical Service (1977). Soil classification: a binomial system for South Africa.

Thomas, R.J., Marshall, C.G.A., Watkeys, M.K., Fitch, F.J. and Miller, J.A. 1992. K-Ar and $^{40}Ar/^{39}Ar$ dating of the Natal Group, southeast Africa-a post Pan-African molasses? *J.Afr. Earth Sci.*, 15: 453-471.

Thomas, R.J. 1988. 1:250 000 geological series, 3030 Port Shepstone. Department of Mineral and Energy Affairs, Pretoria.

Vegter, J.R., 1995. An explanation of a set of National Groundwater Maps, Water Resource Commission.

12 APPENDICES

Appendix 1: Maps

Appendix 2: Photos

Appendix 3: Public Participation

Appendix 4: Minutes of PLC Meetings

Appendix 5: Wetland Assessment Report

Appendix 6: Heritage Impact Assessment

Appendix 7: Declaration by Specialists

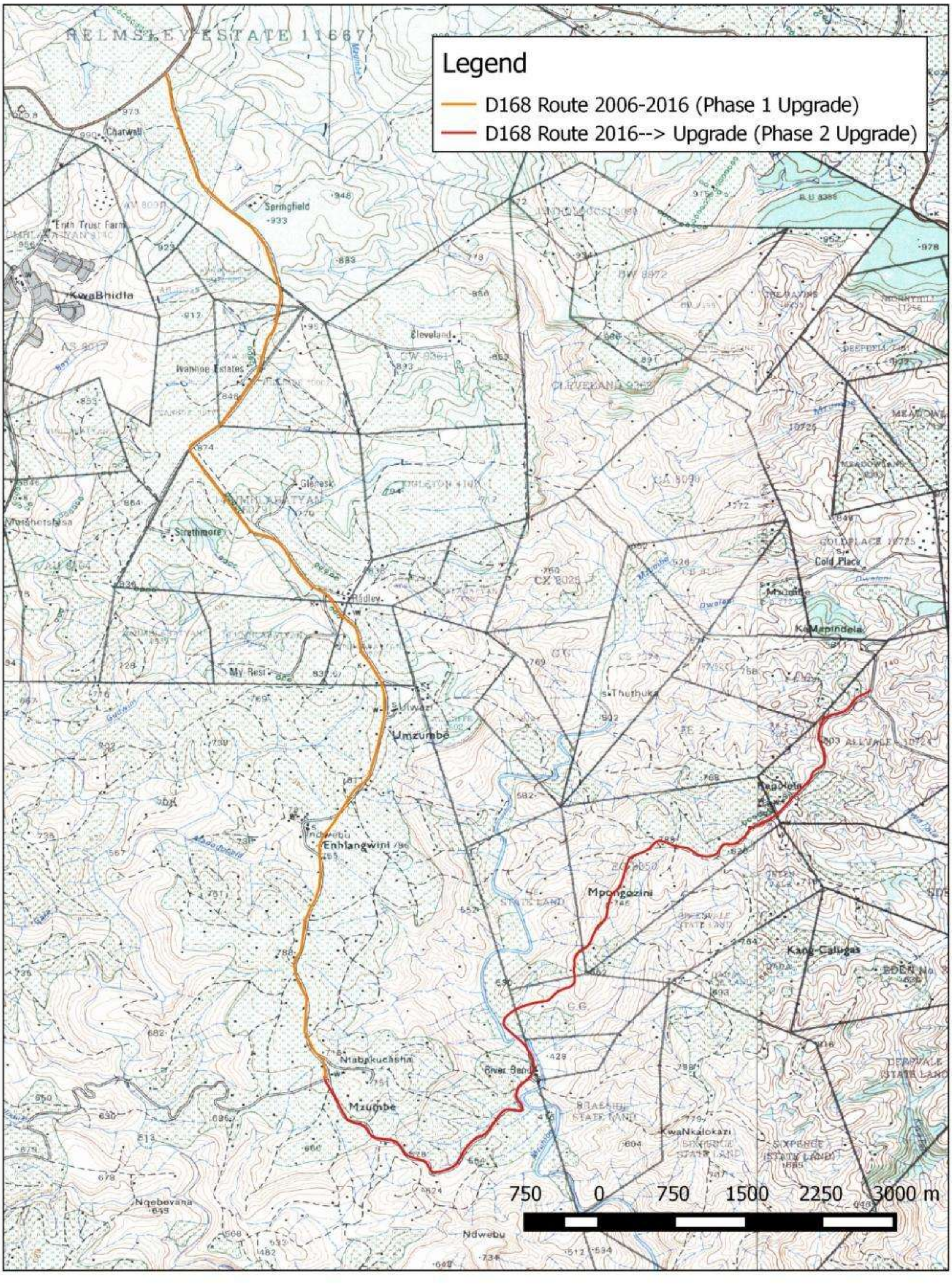
Appendix 8: Land Type Data Sheets

Appendix 1:

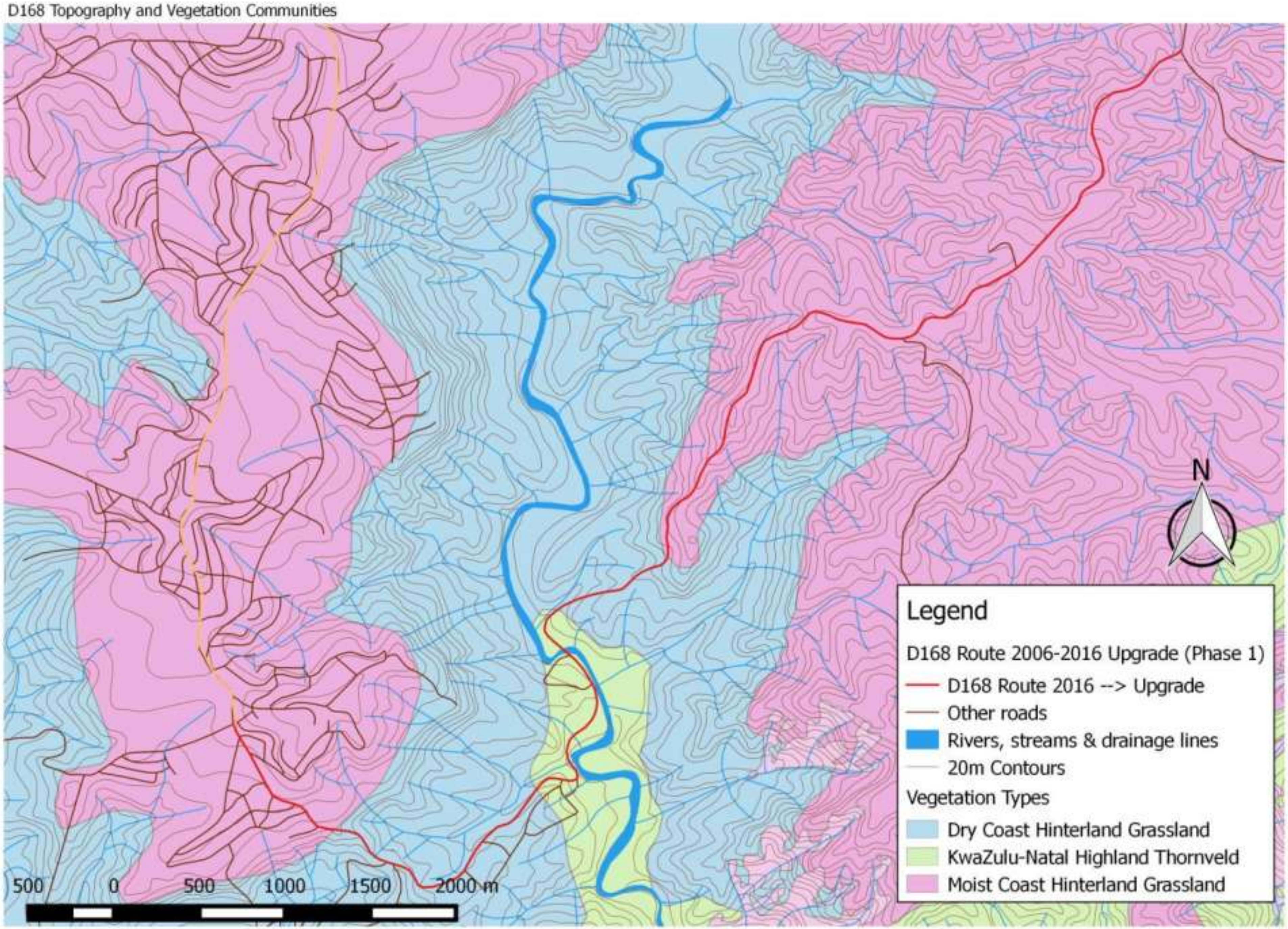
Maps

Map 1: Location of D168 (Extract from 3030AC & AD).
Map 2: D168 Topography and Vegetation Communities.
Map 3: D168 Google Earth Image.
Map 4: Geology along a portion of the District Road D168 which is proposed for upgrade.
Map 5: Land Types along a portion of the District Road D168 which is proposed for upgrade.

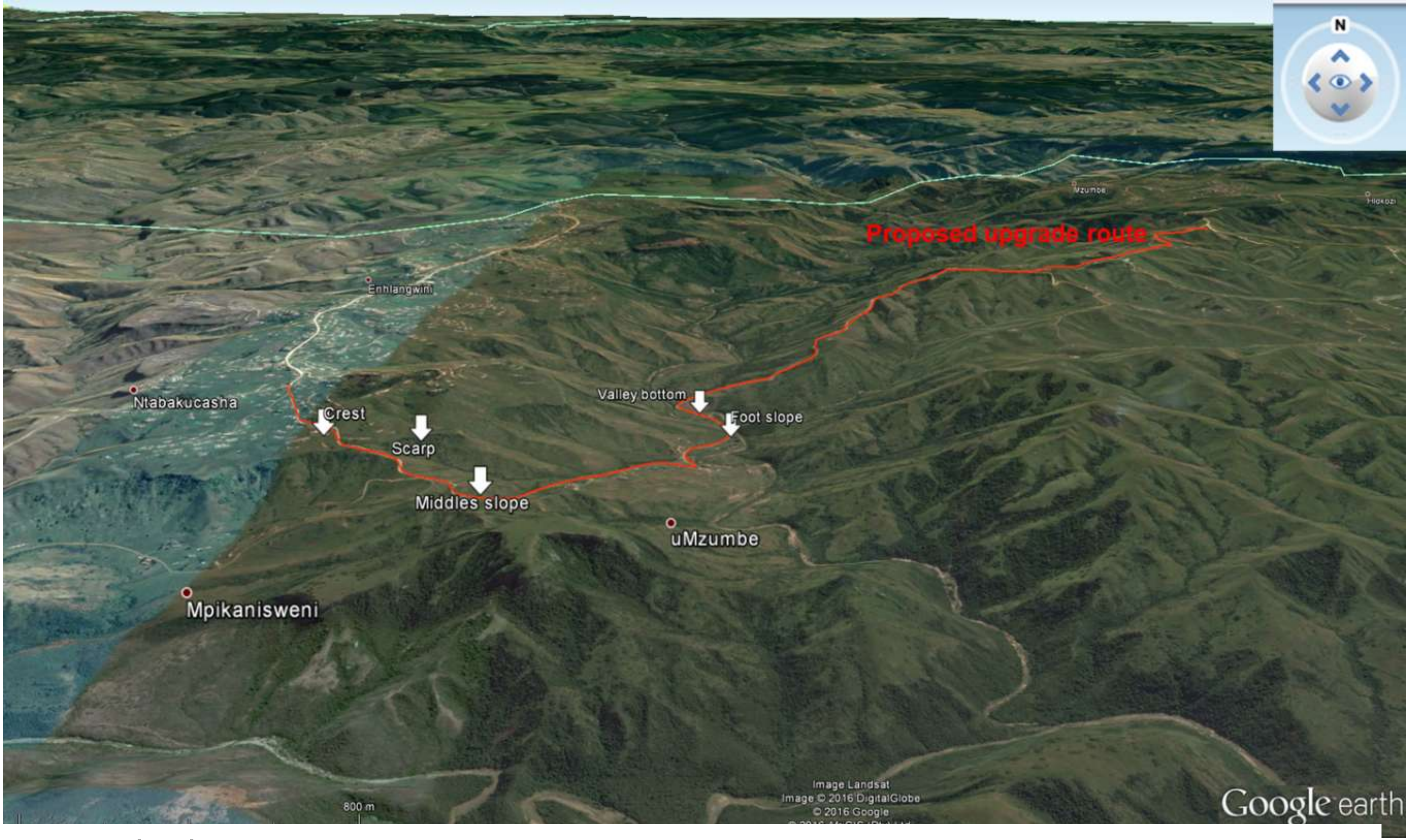
D168 - Location of first and second phase of road upgrades (Extract from 3030AC)



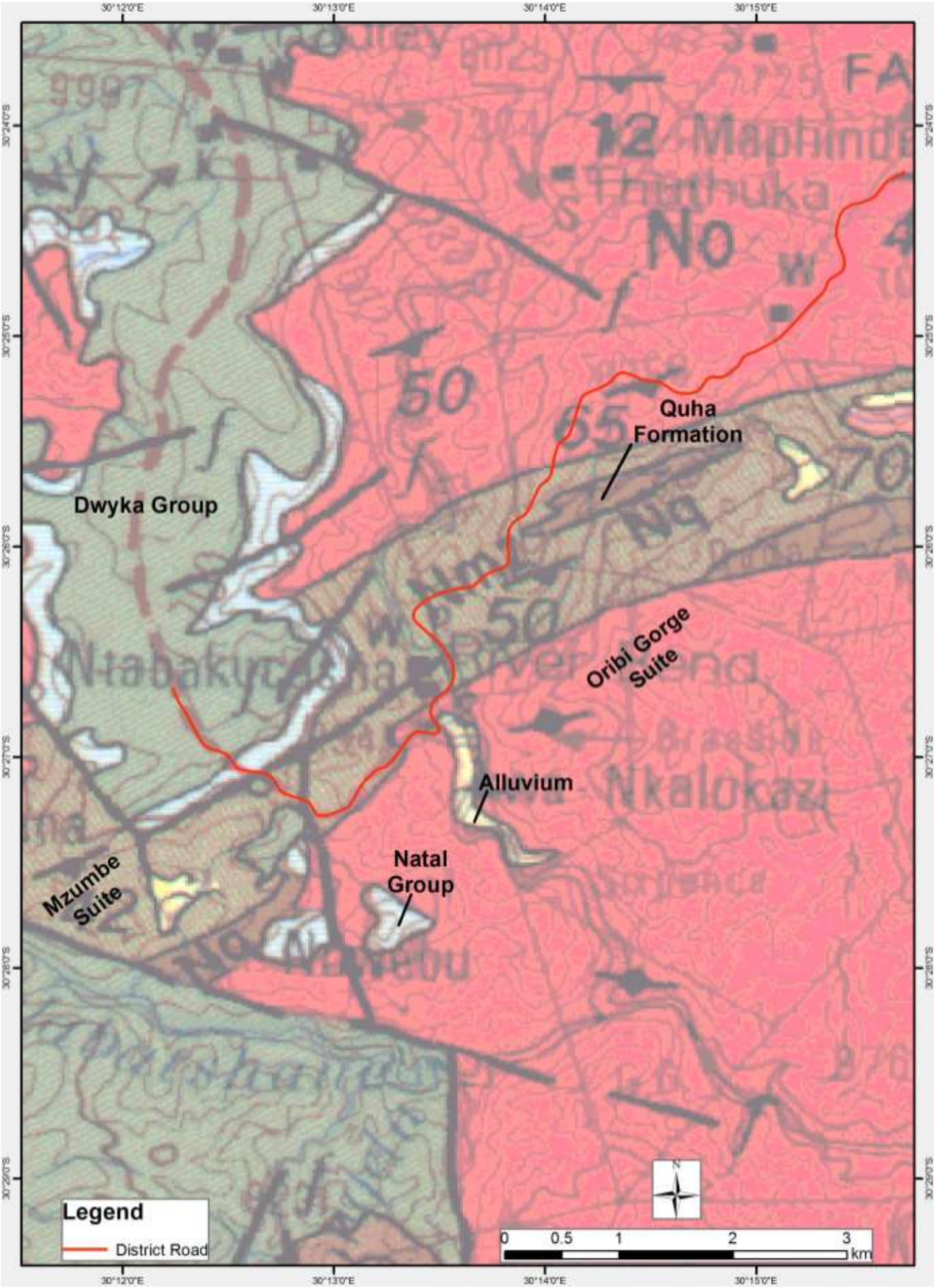
Map 1: Location of D168 (Extract from 3030AC & AD).



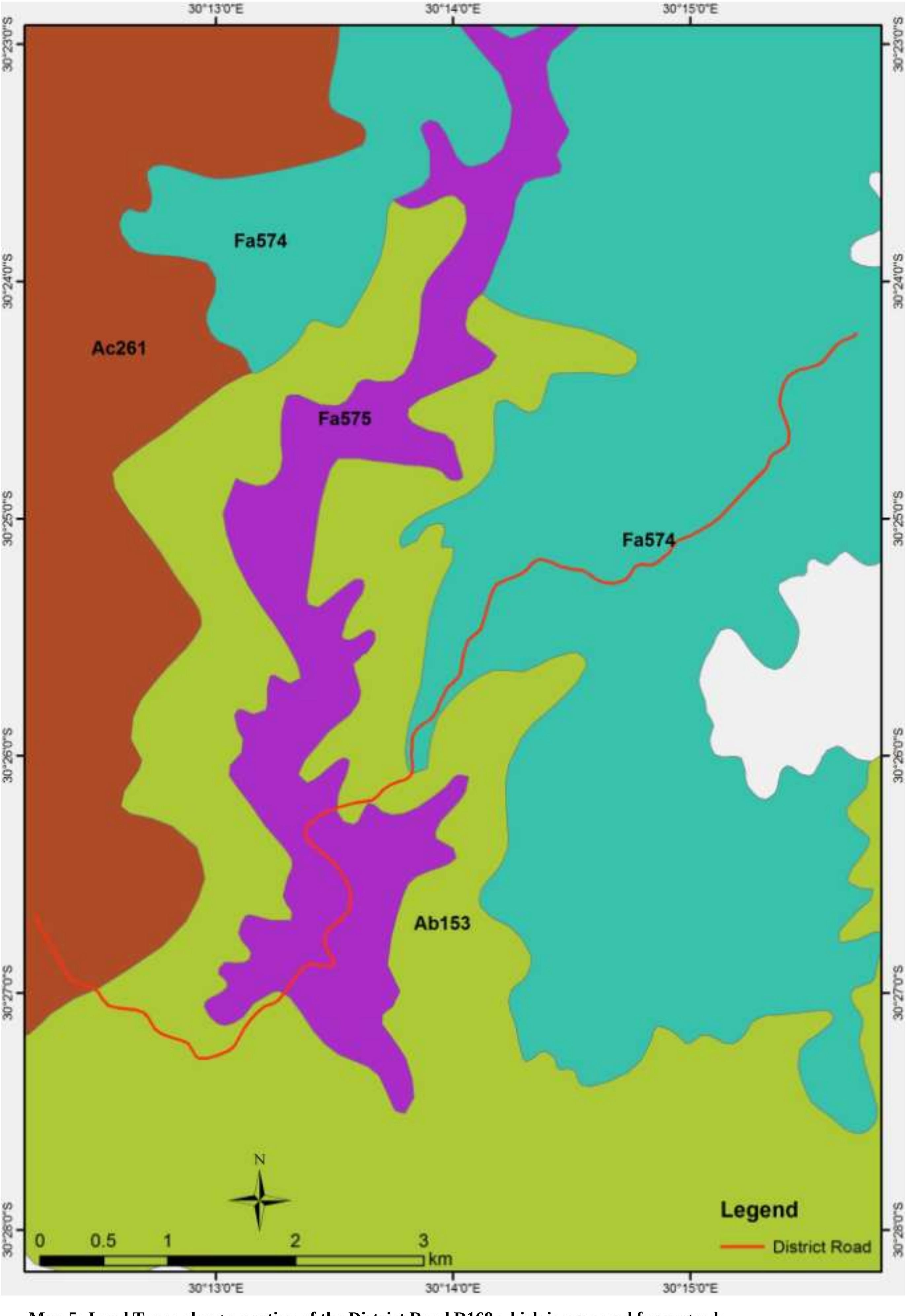
Map 2: D168 Topography and Vegetation Communities.



Map 3: D168 Google Earth Image.



Map 4: Geology along a portion of the District Road D168 which is proposed for upgrade.



Map 5: Land Types along a portion of the District Road D168 which is proposed for upgrade.

Appendix 2:

Photographs

Note: The photos presented were taken sequentially from the end of the upgrade, working towards the beginning. A georeferenced Google Earth kmz file has been created which allows one to view every photograph taken on the route on Google Earth and in the location in which it was taken.

Photos of public notices are included in Appendix 3.

Photo 1: View of D168 road going westwards from end point of upgrade towards beginning.

Photo 2: Example of erosion on D168 due to inadequate dispersion of water from road surface.

Photo 3: Wetland below D168. Note good basal cover of grass just below road, but poorer basal cover between the homestead and the cattle in the valley.

Photo 4: D168 passing through rural homesteads.

Photo 5: D168 passing through rural homesteads.

Photo 6: Modern grave directly adjacent to the D168.

Photo 7: Erosion and alien plants next to road in the more "built-up" section.

Photo 8: Proximity of rural homesteads to the D168.

Photo 9: D167 going down steep hill past rural homesteads – drainage is a problem here.

Photo 10: Erosion on D168 due to inadequate water dispersion.

Photo 11: Outflow from drainage under the road that has not been designed to allow dispersion of water energy.

Photo 12: D168 running past rural homesteads.

Photo 13: Existing low-level bridge over Mzumbe River. Bridge is quite new and will probably remain as is.

Photo 14: Quarry face directly adjacent to Mzumbe River. Top is unstable and will most likely collapse with big rain. Stream running under road and into the river in background left.

Photo 15: Stream running under D168 and into Mzumbe River adjacent to quarry face shown in Photo 14. Note erosion around gabions.

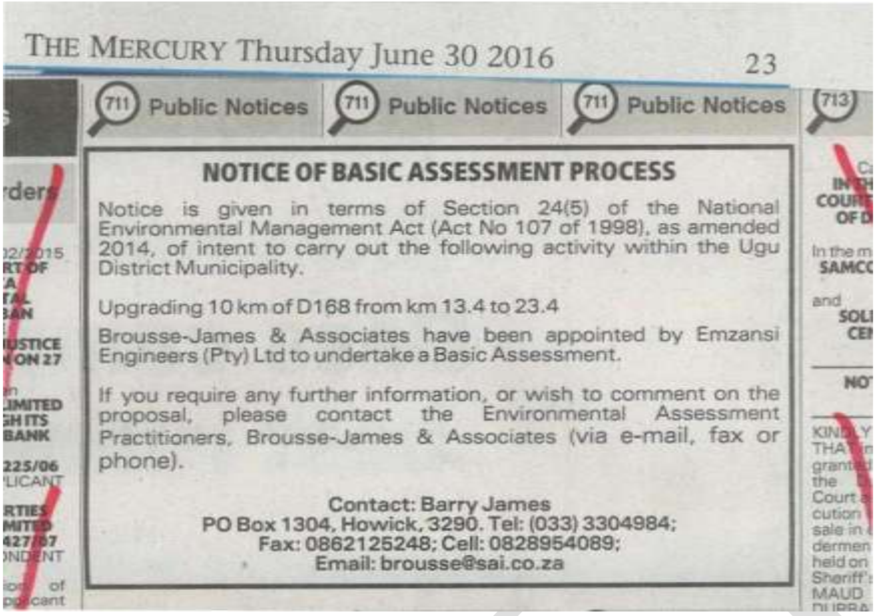
Photo 16: Modern grave close to D168 (see Heritage Report).

Photo 17: Panoramic photo of terrain around D168 showing rolling hills and scattered rural homesteads.

Photo 18: Panoramic photograph of less disturbed terrain around D168.

Appendix 3:

Public Participation



THE MERCURY Thursday June 30 2016 23

Public Notices

NOTICE OF BASIC ASSESSMENT PROCESS

Notice is given in terms of Section 24(5) of the National Environmental Management Act (Act No 107 of 1998), as amended 2014, of intent to carry out the following activity within the Ugu District Municipality.

Upgrading 10 km of D168 from km 13.4 to 23.4

Brousse-James & Associates have been appointed by Emzansi Engineers (Pty) Ltd to undertake a Basic Assessment.

If you require any further information, or wish to comment on the proposal, please contact the Environmental Assessment Practitioners, Brousse-James & Associates (via e-mail, fax or phone).

Contact: Barry James
PO Box 1304, Howick, 3290. Tel: (033) 3304984;
Fax: 0862125248; Cell: 0828954089;
Email: brousse@sai.co.za

Figure 2: Mercury Advertisement, 30th June 2016.

52 ISOLEZWE, ULWESINE, JUNI 30, 2016

Isolezwe

Legals & Tenders

ISAZISO SESICELO SESIGUNYAZO SEZEMVELO
(NOTICE OF BASIC ASSESSMENT PROCESS)

Lapha kunikelwa isaziso ngaphansi kwesigaba somthetho 24(5) kaZwelonke wokuqondiswa nokuphathwa kwezemvelo umthetho we 107 ka 1998, owalungiswa 2014, ngenhloso yokwenza lomsebenzi wokuthuthukiswa komgwaqo ngaphansi kukaMasipala Ugu (Ugu District Municipality).

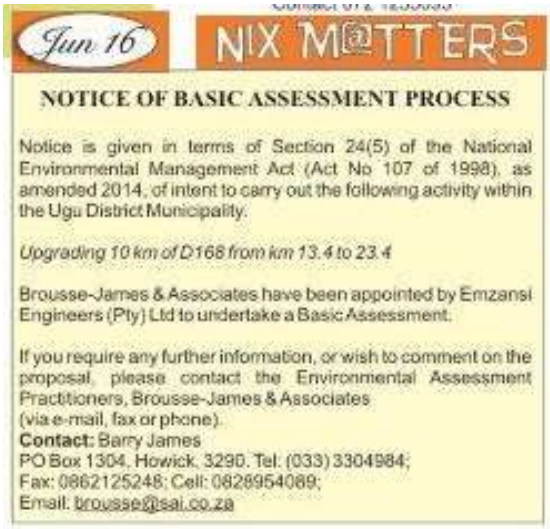
Ukuthuthukiswa Komgwaqo u D168 kusuka ku km 13.4 kuya km 23.4 (10km)

Brousse-James & Associates uqashwe wu Emzansi Engineers (Pty) Ltd ukwenza lesicela sisegunyazo sezemvelo (Basic Assessment).

Uma ufisa olunye ulwazi olubanzi ngaloludaba, noma unombono, sicela uxhumane ne Environmental Assessment Practitioners, Brousse-James & Associates (via e-mail, fax or phone).

Contact: Barry James
PO Box 1304, Howick, 3290. Tel: (033) 3304984;
Fax: 0862125248; Cell: 0828954089;
Email: brousse@sai.co.za

Figure 3: Isolezwe Advertisment, 30th June 2016.



Jun 16

NIX M@TTERS

NOTICE OF BASIC ASSESSMENT PROCESS

Notice is given in terms of Section 24(5) of the National Environmental Management Act (Act No 107 of 1998), as amended 2014, of intent to carry out the following activity within the Ugu District Municipality.

Upgrading 10 km of D168 from km 13.4 to 23.4

Brousse-James & Associates have been appointed by Emzansi Engineers (Pty) Ltd to undertake a Basic Assessment.

If you require any further information, or wish to comment on the proposal, please contact the Environmental Assessment Practitioners, Brousse-James & Associates
(via e-mail, fax or phone).
Contact: Barry James
PO Box 1304, Howick, 3290. Tel: (033) 3304984;
Fax: 0862125248; Cell: 0828954089;
Email: brousse@sai.co.za

Figure 4: NIX Matters Advertisement, June 2016 issue.

Figure 5: English and Zulu public notices on fence outside Emzansi D168 site office.

Figure 6: English and Zulu public notices on pole outside community hall on D168.

Appendix 4:

Minutes of PLC Meetings

Appendix 5:

Wetland Assessment Report

Insert Wetland Assessment Report here.

Appendix 6:

Heritage Impact Assessment

Insert Heritage Impact Assessment here.

Appendix 7:

Declarations by Specialists

Appendix 8:

Land Type
Data Sheets

Insert Land Type Data Sheets here.