

**HERITAGE SURVEY OF THE JOZINI REGIONAL
COMMUNITY WATER SUPPLY SCHEME**

**FOR TRIPLO4 SUSTAINABLE SOLUTIONS (PTY)
LTD**

DATE: 1 AUGUST 2013

REVISED: 19 AUGUST 2013

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INTRODUCTION

“The overall project, initiated by the Umkhanyakude District Municipality, proposes the extension and upgrading of the bulk water treatment and distribution system to the supply area east of Jozini, together with associated distribution and reticulation networks to meet the current and future water needs in the area. This region falls within the Jozini, Umhlabuyalingana and Big 5 local municipalities and has a population of approximately 111 000 people. Phase 1 of the project is aiming to provide safe potable water to approximately 3 600 households.

The proposed scheme would be implemented in multiple phases. The treatment works, pumping capacity and storage will be modular and extended as the developments proceed over time, based on additional demands.

This application is only dealing with Phase 1 of the project. Phase 1, would include the construction of the main bulk pipeline, a 61.5km steel pipeline that will run east from Jozini to Mbazwana, of which 3.5km is rising main, from the Water Treatment works next to the canal and will deliver to the Main reservoir. At that point there will be a gravity line of 58km from the main reservoir to Mbazwana. This area is largely already supplied by the existing Jozini and Ntshongwe - Malobeni Schemes.

The objective of this project is to establish sub-regional bulk potable water source at Jozini and to provide the bulk conveyance infrastructure to convey this treated water to as large a proportion of the region as is feasible. As such, the project boundaries or footprint is quite flexible. As some of the existing schemes in the region are not reliable and the reticulations do not serve all populations, these aspects will be addressed and the current systems refurbished and / or extended where needed.

The project will entail the following:

- Upgrading of the existing bulk supply pipelines (gravity and rising mains), i.e. from Jozini Old Works to Jozini town, and Jozini New Works to Ntshongwe which starts as a 200 mm diameter but reduces to a 160 mm and 75 mm diameter pipe.
 - Installation of new bulk supply pipelines (gravity and rising mains) to link existing schemes
 - Linkages to adjacent schemes and supply areas where practical and effective.
 - Provision of pumping infrastructure (feeder and booster pumping stations) to provide the necessary pressure to the network(s), where required.
 - Upgrading of the existing reservoirs/tanks, such as the 0,2 Ml tanks on the pipeline to Ntshongwe, for incorporation into the greater scheme
- New storage reservoirs/tanks to be provided where these do not exist, or extend where the storage capacity is not sufficient” (Application for Environmental Authorisation 2012)

Umlando was contracted to undertake the Heritage survey for Phase 1 of the project. The location of the line is shown in Figures 1 – 3. The project is abbreviated to JRCWSS.

FIG. 1 GENERAL LOCATION OF THE JRCWSS

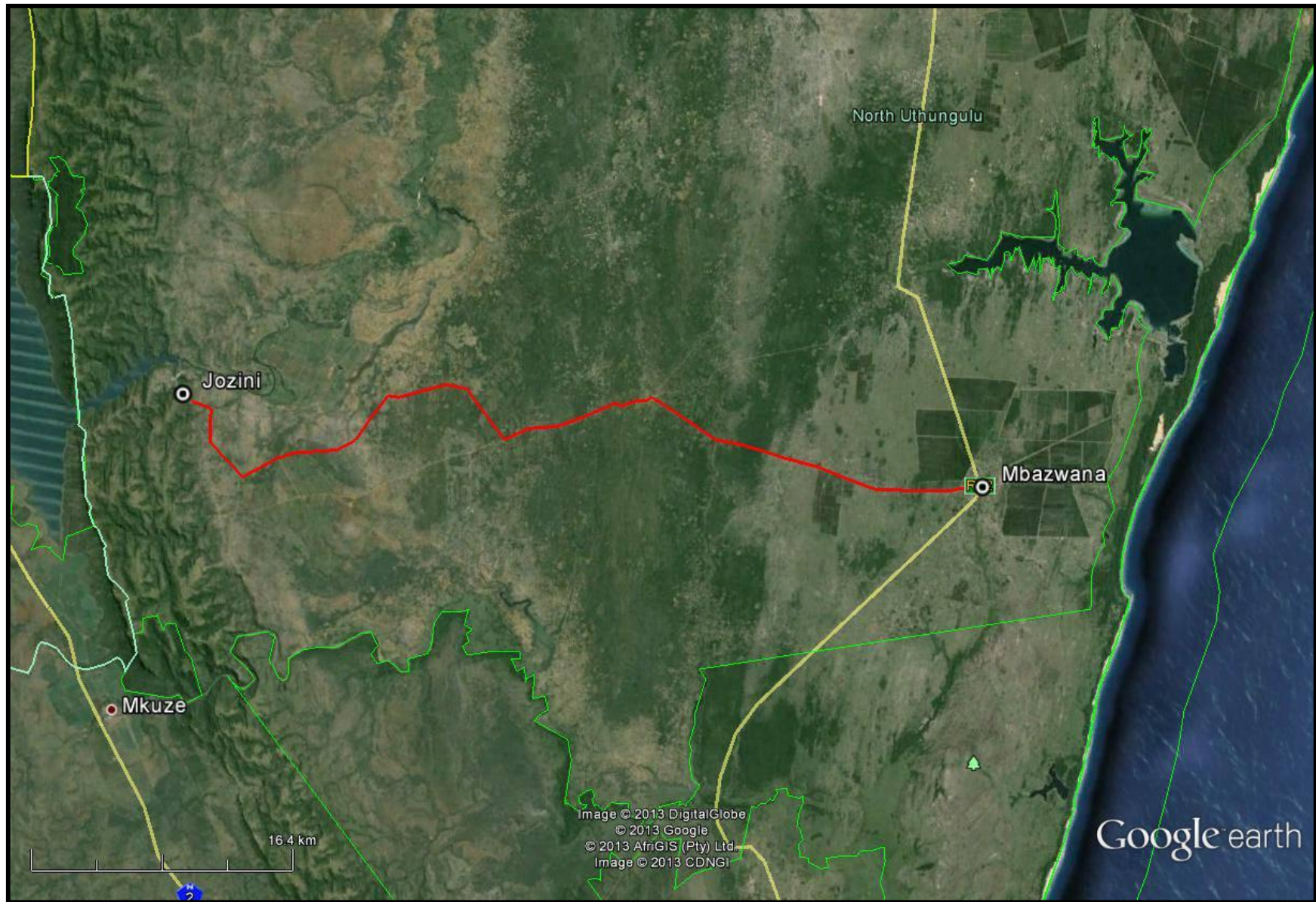


FIG. 2A: AERIAL OVERVIEW OF THE JRCWSS

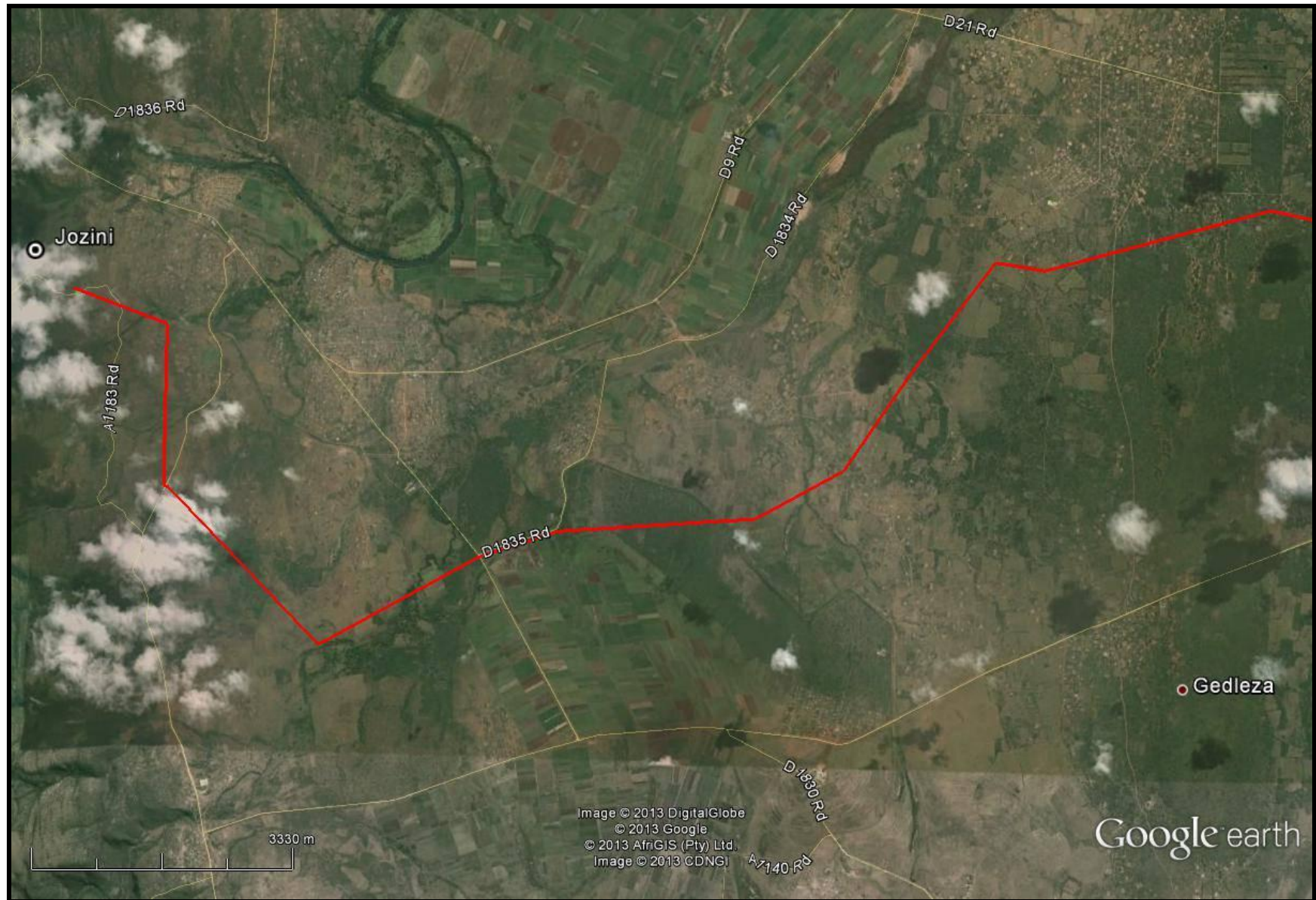


FIG. 2B: AERIAL OVERVIEW OF THE JRCWSS

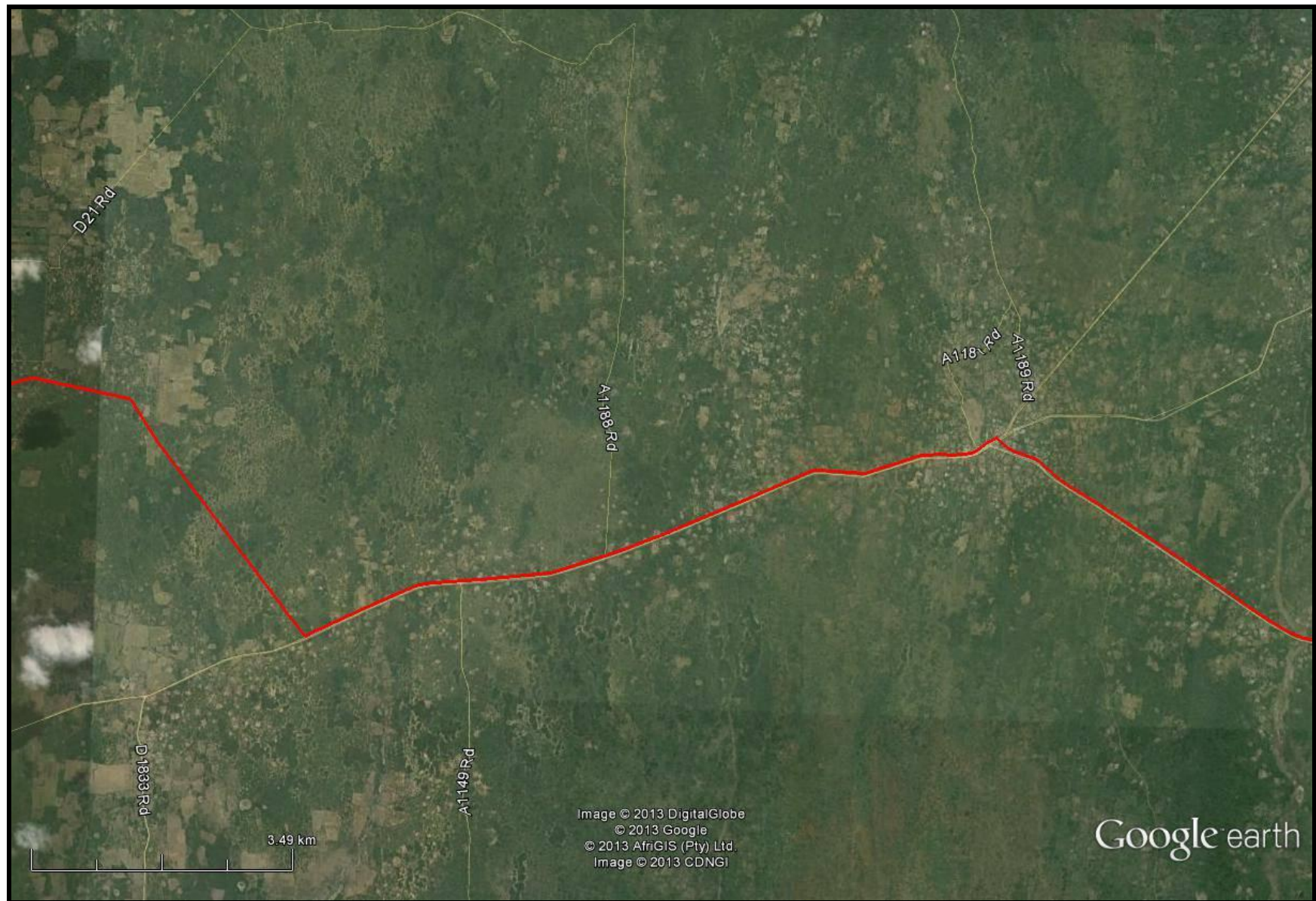


FIG. 2C: AERIAL OVERVIEW OF THE JRCWSS

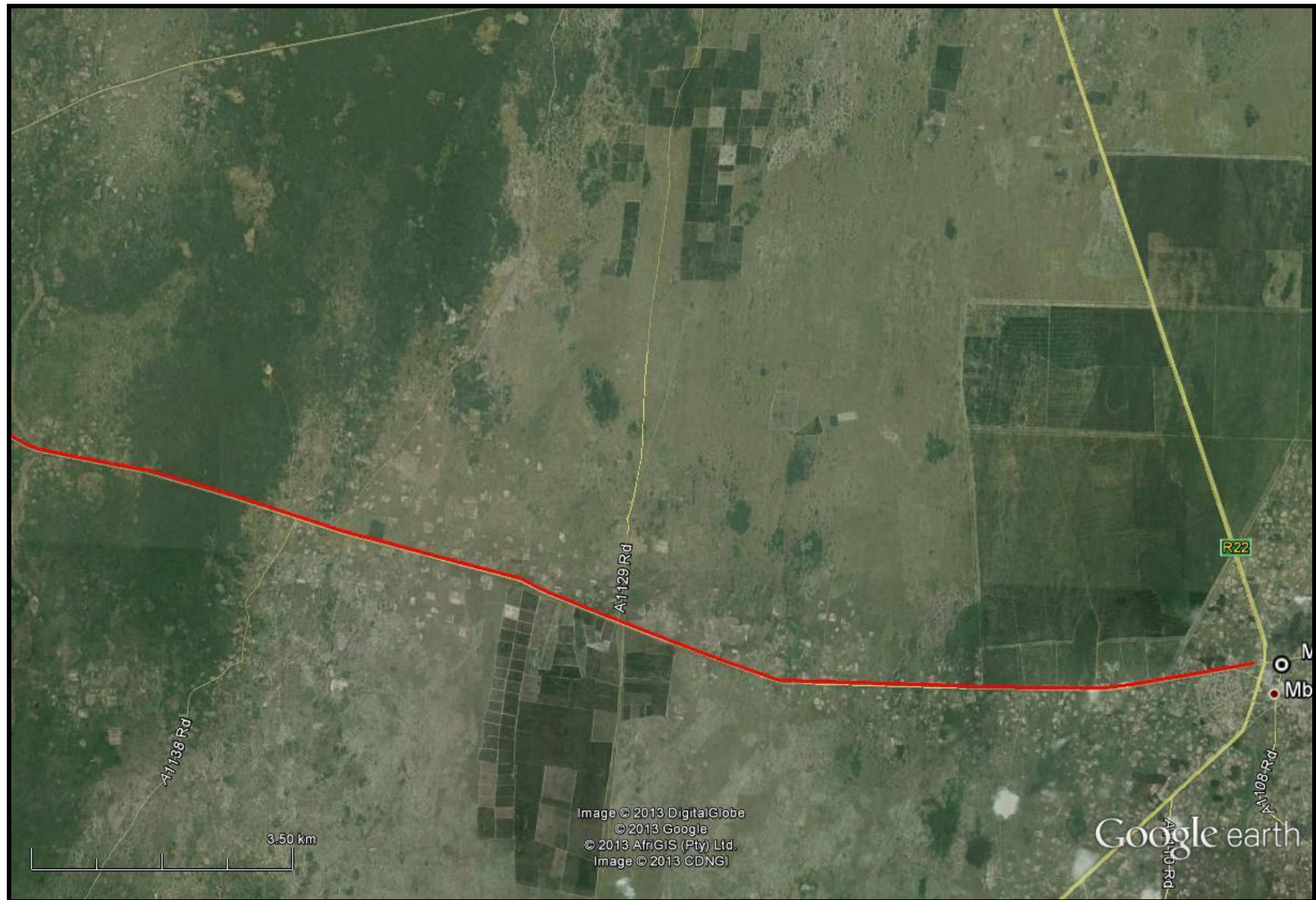


FIG. 3A: TOPOGRAPHICAL MAP OF THE JRCWSS

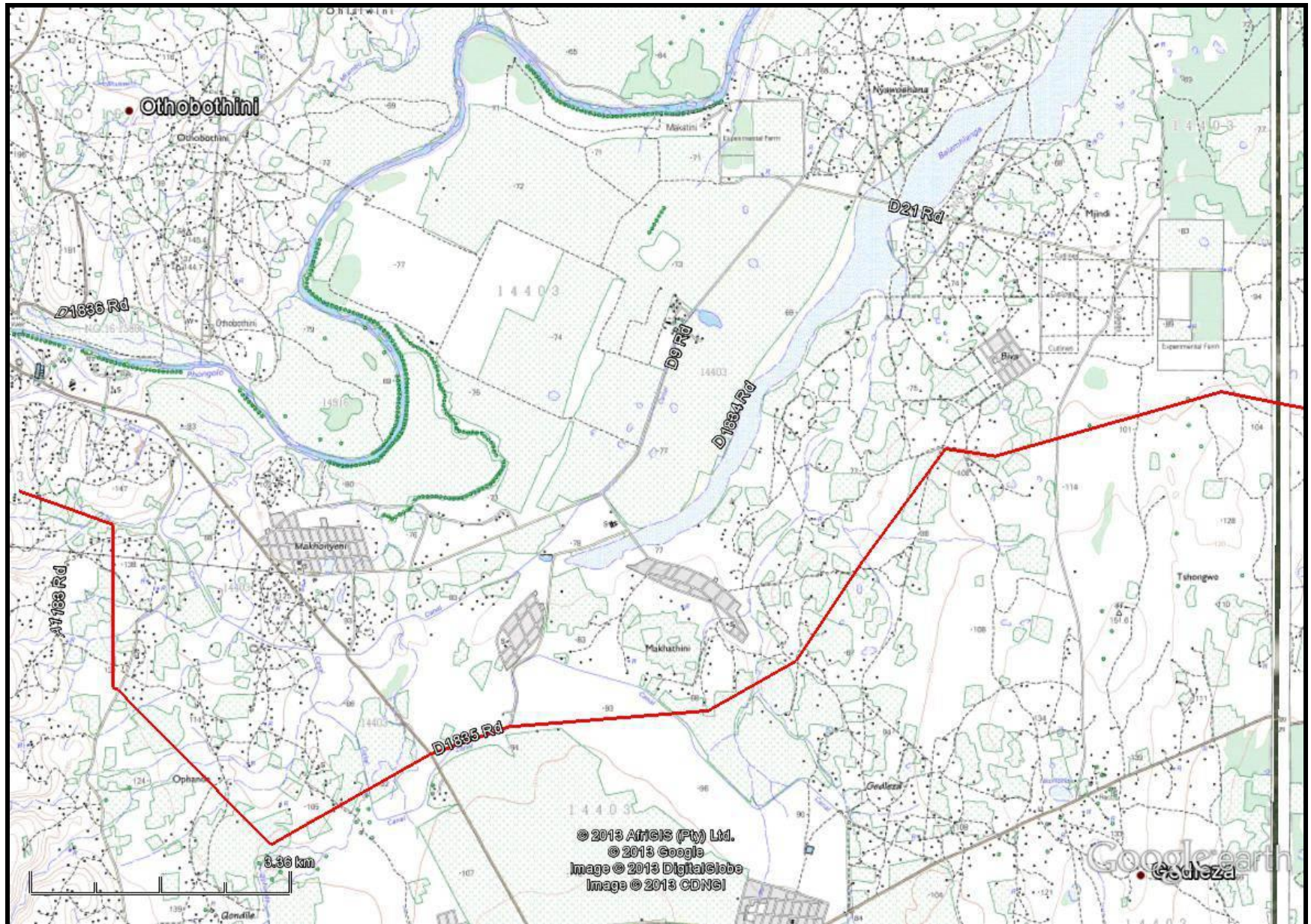


FIG. 3B: TOPOGRAPHICAL MAP OF THE JRCWSS

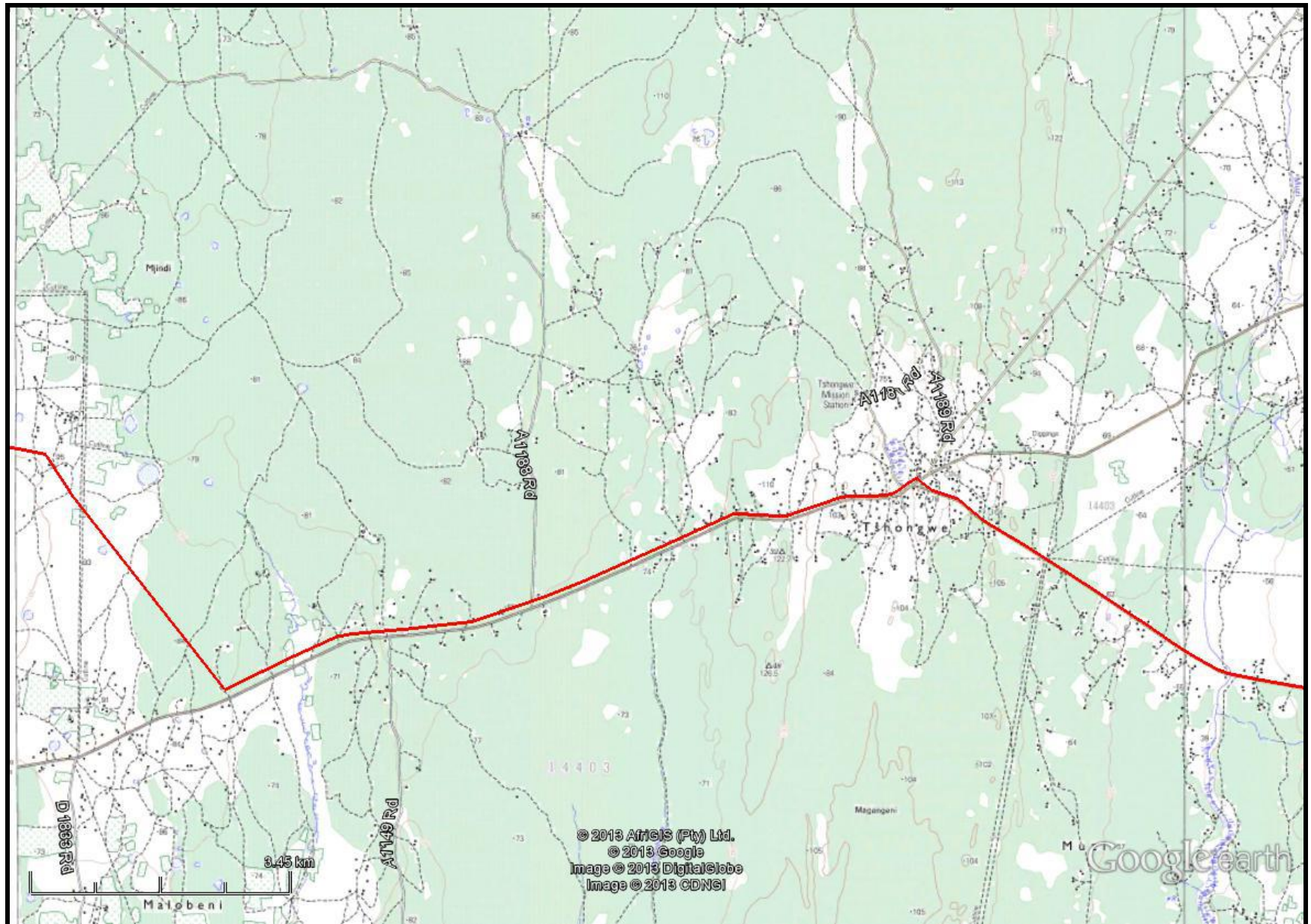
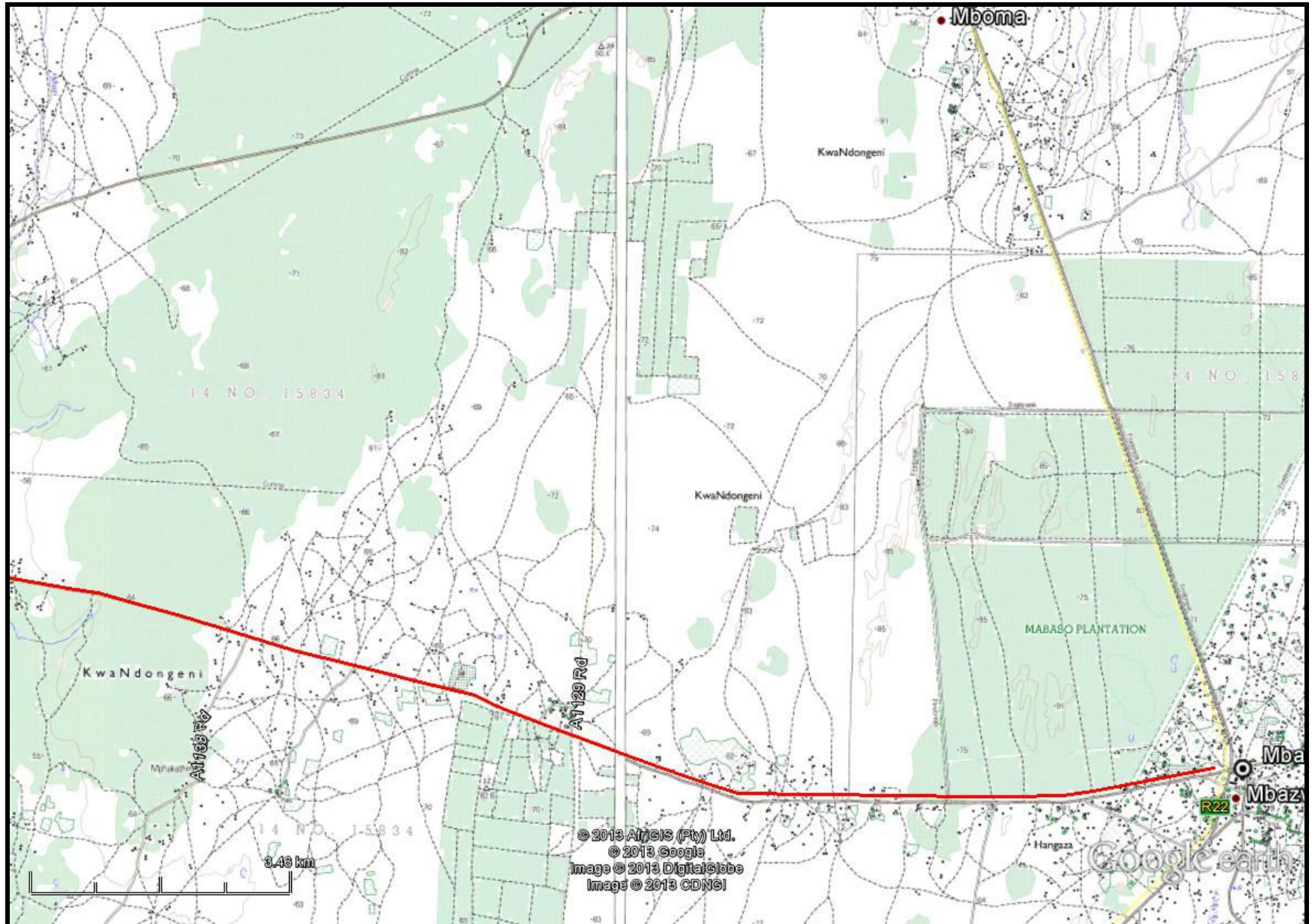


FIG. 3C: TOPOGRAPHICAL MAP OF THE JRCWSS



KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008

“General protection: Structures.—

- No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.
- Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- The Council may, by notice in the *Gazette*, exempt—
- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the *Gazette*, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict.—No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places.—
- No grave—
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- 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 Council.
- 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.
- 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.
- 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.
- 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.
- 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.” (KZN Heritage Act of 2008)

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. This databases contains archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (<http://www.vuvuzela.com/googleearth/monuments.html>) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

- 1.1. Organic remains:
 - 1.1.1. Faunal
 - 1.1.2. Botanical
- 1.2. Rock art
- 1.3. Walling
- 1.4. Presence of a cultural deposit
- 1.5. Features:
 - 1.5.1. Ash Features
 - 1.5.2. Graves
 - 1.5.3. Middens
 - 1.5.4. Cattle byres
 - 1.5.5. Bedding and ash complexes

2. Spatial arrangements:

- 2.1. Internal housing arrangements
- 2.2. Intra-site settlement patterns
- 2.3. Inter-site settlement patterns

3. Features of the site:

- 3.1. Are there any unusual, unique or rare artefacts or images at the site?
- 3.2. Is it a type site?
- 3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

- 4.1. Providing information on current research projects
- 4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

- 5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?
- 5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

- 7.1. Does the site have the potential to be used as an educational instrument?
- 7.2. Does the site have the potential to become a tourist attraction?
- 7.3. The educational value of a site can only be fully determined after initial test-pit excavations and/or full excavations.

8. Other Heritage Significance:

- 8.1. Palaeontological sites
- 8.2. Historical buildings

- 8.3. Battlefields and general Anglo-Zulu and Anglo-Boer sites
- 8.4. Graves and/or community cemeteries
- 8.5. Living Heritage Sites
- 8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts.

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. The archaeological database indicates that there are archaeological sites in the general area (fig. 4). Most of these sites date to the Early, Middle and Late Stone Ages, while there are a few Iron Age sites. Only one site occurs within the study area.

No national monuments, battlefields, or historical cemeteries are known to occur in the study area.

The 1st Edition 1969 topographical maps indicate that the area was less populated than the present. Only fifteen settlements were observed along the line route. The locations of these settlements is summarised in Table 1.

TABLE 1: LOCATION OF HUMAN SETTLEMENTS IN 1969

NAME	LATITUDE	LONGITUDE
1	-27.4483889	32.0924996
2	-27.4501946	32.0949805
3	-27.4515584	32.0953747
4	-27.4644662	32.0962780
5	-27.4806705	32.1207894
6	-27.4810408	32.1231488
7	-27.4513000	32.1941232
8	-27.4359636	32.2076365
9	-27.4283186	32.2404237
10	-27.4292884	32.2447718
11	-27.4330187	32.2558198
12	-27.4770370	32.4962215
13	-27.4777132	32.4998043
14	-27.4778360	32.5025896
15	-27.4719941	32.4769318

FIG. 4: LOCATION OF KNOWN ARCHAEOLOGICAL SITES

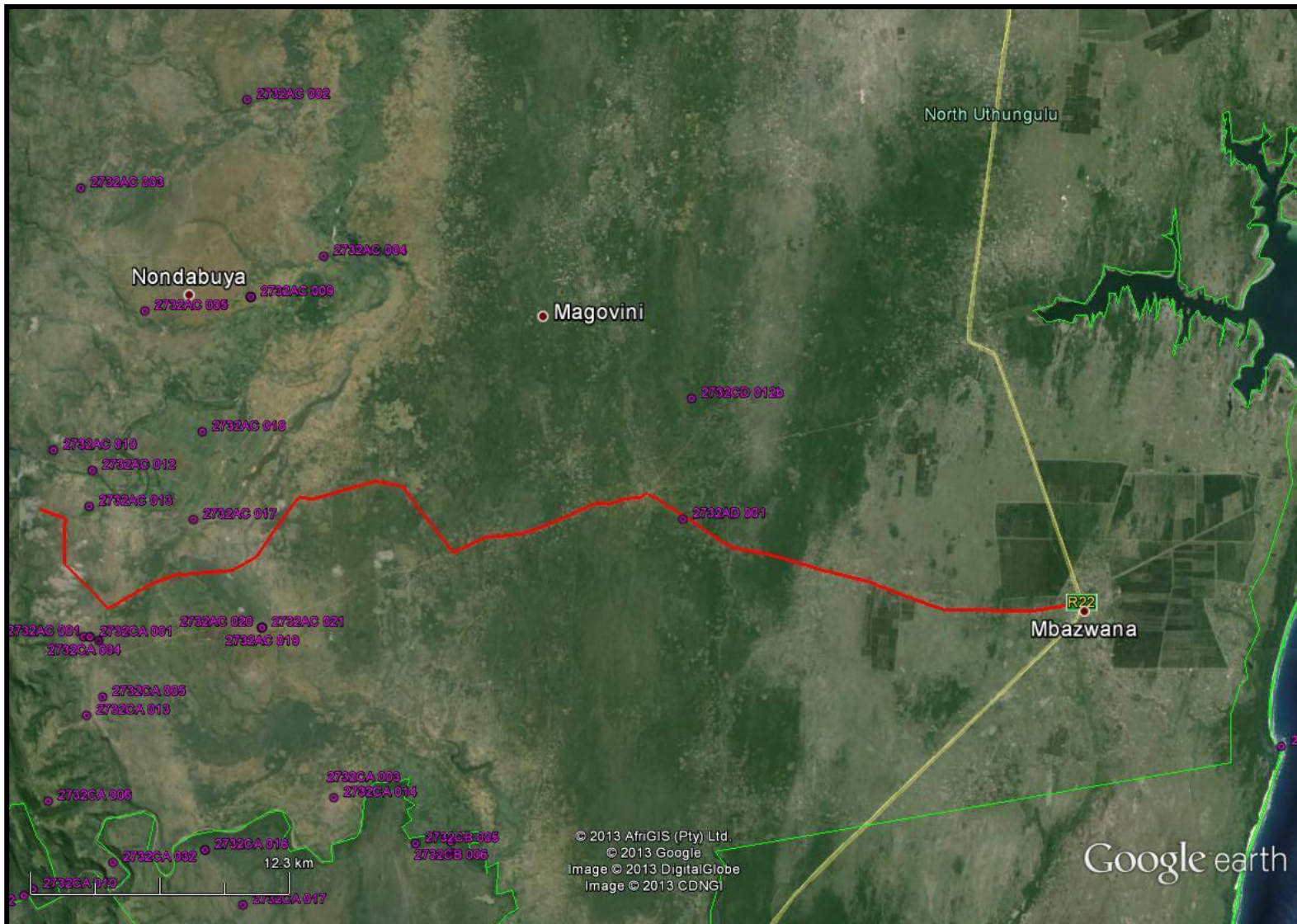


FIG. 5: STUDY AREA IN 1969

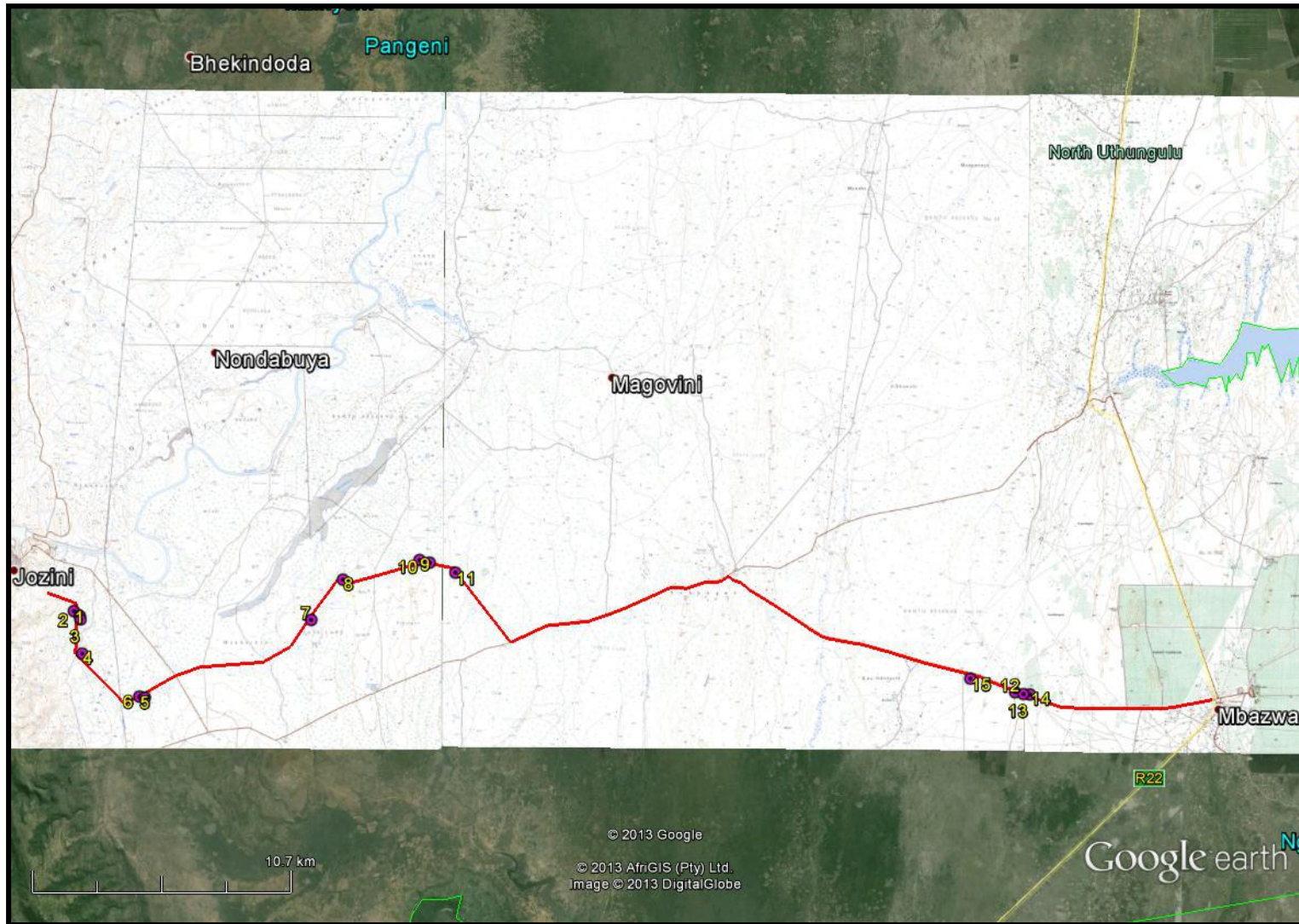


FIG. 6A: STUDY AREA IN 1975

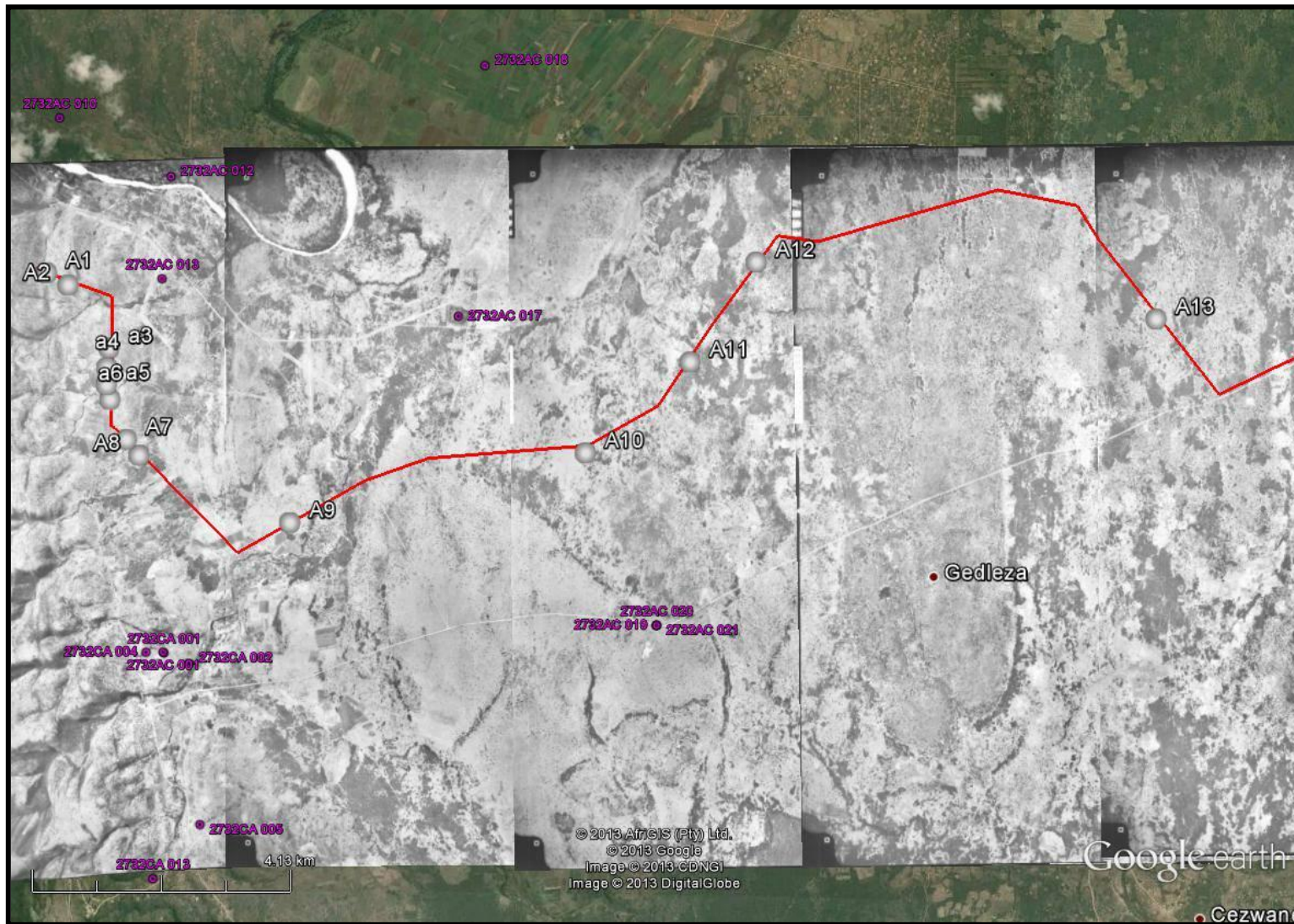


FIG. 6B: STUDY AREA IN 1975



FIG. 6C: STUDY AREA IN 1975



The 1975 aerial photographs for this area indicate that there is an increase in human occupation of the area. By 1975, there are 17 settlements along the line and more outside of the border (fig. 6a-c). Many of these do not occur on the same area as the 1969 settlements. This means that many settlements had disappeared within 5 years. The implication for this is that if any human burials did exist at these settlements, then they will not be visible today. Table 2 summarised the locations of these settlements in 1975.

TABLE 2: LOCATION OF SETTLEMENTS IN 1975

NAME	LATITUDE	LONGITUDE
A1	-27.4423078	32.0823644
A2	-27.4440664	32.0859194
a3	-27.4534322	32.0927976
a4	-27.4563514	32.0924630
a5	-27.4589236	32.0924242
a6	-27.4610804	32.0930220
A7	-27.4670395	32.0958427
A8	-27.4694044	32.0979275
A9	-27.4793568	32.1231976
A10	-27.4688105	32.1728709
A11	-27.4552229	32.1904154
A12	-27.4403099	32.2014847
A13	-27.4485463	32.2688126
A14	-27.4376699	32.3578625
A15	-27.4345576	32.3717320
A16	-27.4591583	32.4255326
A18	-27.4839963	32.5456601
A17	-27.4781599	32.5019347

I used the 2010 and 2012 Google Earth imagery to note settlements near the line. These settlements are occupied or abandoned, yet still showing on the aerial photography. As expected, there is a sharp increase in the number of settlements along the route (fig. 7). Sixty-five settlements occur by 2012, and many of these are not duplicated on previous maps. Table 3 lists the location of these sites.

FIG. 7: LOCATION OF SETTLEMENTS AT 2012

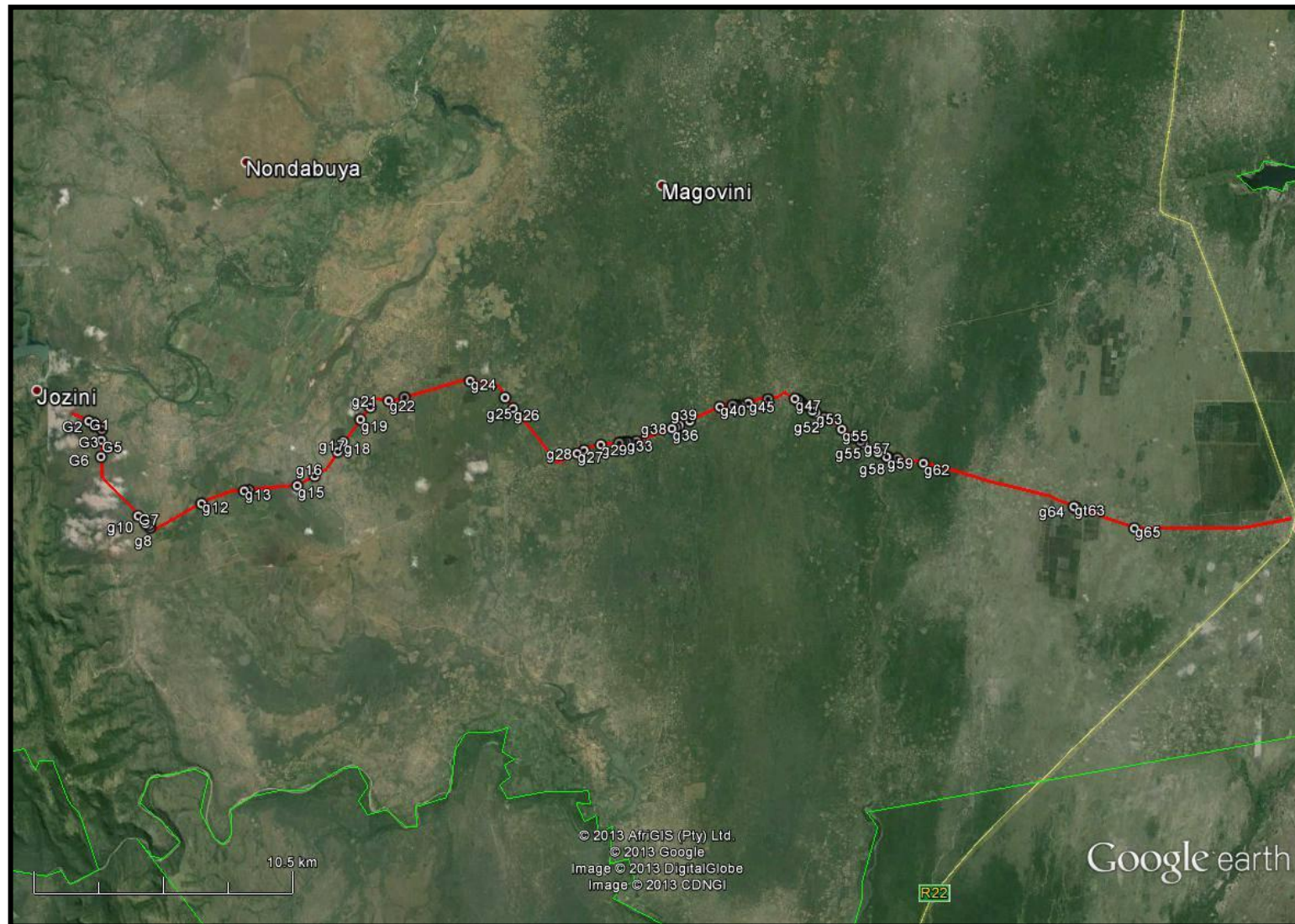


TABLE 3: LOCATION OF SETTLEMENTS AT 2012

name	latitude	longitude		
g1	-27.4442076	32.0878569	g37	-27.4465039 32.3280874
g2	-27.4449128	32.0901105	g38	-27.4458942 32.3294552
g3	-27.4459353	32.0902243	g39	-27.4442674 32.3338026
g4	-27.4471970	32.0932139	g40	-27.4391878 32.3460894
g5	-27.4511690	32.0930390	g41	-27.4385777 32.3513625
g6	-27.4571092	32.0929479	g42	-27.4387612 32.3522014
g7	-27.4786189	32.1082436	g43	-27.4387021 32.3528999
g8	-27.4817157	32.1126137	g44	-27.4388192 32.3545756
g10	-27.4813049	32.1112755	g45	-27.4378442 32.3578176
g11	-27.4827751	32.1131162	g46	-27.4363876 32.3658611
g12	-27.4741834	32.1339604	g47	-27.4362377 32.3768914
g13	-27.4695852	32.1513651	g48	-27.4366780 32.3780965
g14	-27.4693882	32.1531927	g49	-27.4371390 32.3785910
g15	-27.4677198	32.1730853	g50	-27.4376731 32.3793005
g16	-27.4641518	32.1802272	g51	-27.4385099 32.3804141
g17	-27.4553682	32.1896447	g52	-27.4406259 32.3840763
g18	-27.4518351	32.1919557	g53	-27.4411986 32.3854352
g19	-27.4437012	32.1990142	g53	-27.4430662 32.3887081
g21	-27.4392672	32.2030346	g54	-27.4434348 32.3894112
g22	-27.4369149	32.2105849	g55	-27.4472616 32.3960830
g23	-27.4357394	32.2170810	g55	-27.4501159 32.4011054
g24	-27.4297477	32.2438987	g56	-27.4516063 32.4038400
g25	-27.4357848	32.2582085	g57	-27.4523805 32.4049527
g26	-27.4397506	32.2615738	g58	-27.4557580 32.4109309
g27	-27.4560995	32.2876584	g59	-27.4572477 32.4145111
g28	-27.4549576	32.2905616	g60	-27.4574477 32.4150162
g29	-27.4529666	32.2974038	g61	-27.4578307 32.4188896
g30	-27.4522642	32.3048772	g62	-27.4595601 32.4295843
g31	-27.4522818	32.3057537	gt63	-27.4752987 32.4913140
g32	-27.4522008	32.3067691	g64	-27.4757879 32.4922941
g33	-27.4520558	32.3078308	g65	-27.4831216 32.5161584
g34	-27.4519903	32.3086478		
g35	-27.4516599	32.3120567		
g36	-27.4470416	32.3265293		

The historical maps thus allow areas to be noted for possible human remains, and thus marked as sensitive. A 50m sensitivity radius around each site/co-ordinate should be made. Co-ordinates are taken from the approximate centre of the living area and thus include burial areas.

FIELD SURVEY

A field survey was undertaken over two days. The field trip surveyed the location of the line and the end/start point at Jozini. Some areas of the line were not surveyed. These included areas of dense vegetation that did not allow access (see fig. 8) and areas that were obvious wetlands. This did not however amount to much of the line. The line does pass through many agricultural fields, and these have been systematically ploughed over the years. The ploughing activity would have destroyed all human settlements and thus evidence for older burials. In these situations, the edges of the fields were surveyed for artefacts.

The field survey was undertaken for Option 1 only. Option 2 became the preferred option after the survey. Option 2 is dealt with separately in this report.

FIG. 8: VEGETATED AREAS WITH LOW ARCHAEOLOGICAL VISIBILITY



The survey began from the Jozini, or western, side of the line. The construction, or storage, camp had already been fenced off and surface clearance, with some topsoil had occurred before the HIA had started (fig. 9). Isolated stone tools dating to the Late Stone Age (LSA) were observed along the outside of the fence. The tools increased in frequency further downslope; however, they appear to have been washed downhill. These tools were made from quartz or CCS, and consisted of general LSA flakes and irregular cores. These kinds of stone tool scatters occur across the enter line and mostly on hills. While they do occur in the open sands, the artefacts have filtered below the soft sandy surface. I did not classify these as sites, rather as archaeological occurrences” otherwise, much of the line would be a Stone Age site! This is the case for most of the general area as noted in the Natal Museum database, and other surveys (Anderson 2009, 2010, 2011, 2012a-b, 2013). I did note where there were changes to the stone tool types, e.g. the occurrence of Early Stone Age material as opposed to the standards LSA material.

FIG. 9: SITE CLEARANCE BEFORE THE HIA



Table 3 lists the locations of the recorded sites and the locations of two Stone Age scatters. The locations of the sites are shown in fig. 10.

TABLE 3: LOCATION OF RECORDED SITES

NAME	LATITUDE	LONGITUDE	DESCRIPTION
ESA1	-27.4636900	32.1796720	Ephemeral scatter of ESA stone tools
LSA1	-27.4425180	32.0848350	Ephemeral scatter of LSA stone tools
JZ1	-27.4480420	32.0926760	Settlement with graves
JZ2	-27.4470490	32.0929430	Graves
JZ3	-27.4650470	32.0941650	Graves
JZ4	-27.4309410	32.2425740	Recent Grave
JZ5	-27.4305340	32.2350550	Recent Graves

LSA1

This area consists of a scatter of LSA stone tools that have been exposed by the tracks and or bush clearance. It is not a high concentration of tools; however, there is one tool every 5m and it is spread over a wide area (fig. 11). The stone tools are made on CCS, quartzite and quartz and include chunks, (utilised) flakes, irregular cores and one bipolar core. The tools are the standard LSA stone tools normally located in the area.

I do not classify the scatter as an archaeological site per se, rather as an occurrence of stone tools.

Significance: The site is of low significance as the material is in a secondary context and ephemeral.

Mitigation: No further mitigation is required.

FIG. 10: LOCATION OF RECORDED SITES DURING THE SURVEY.

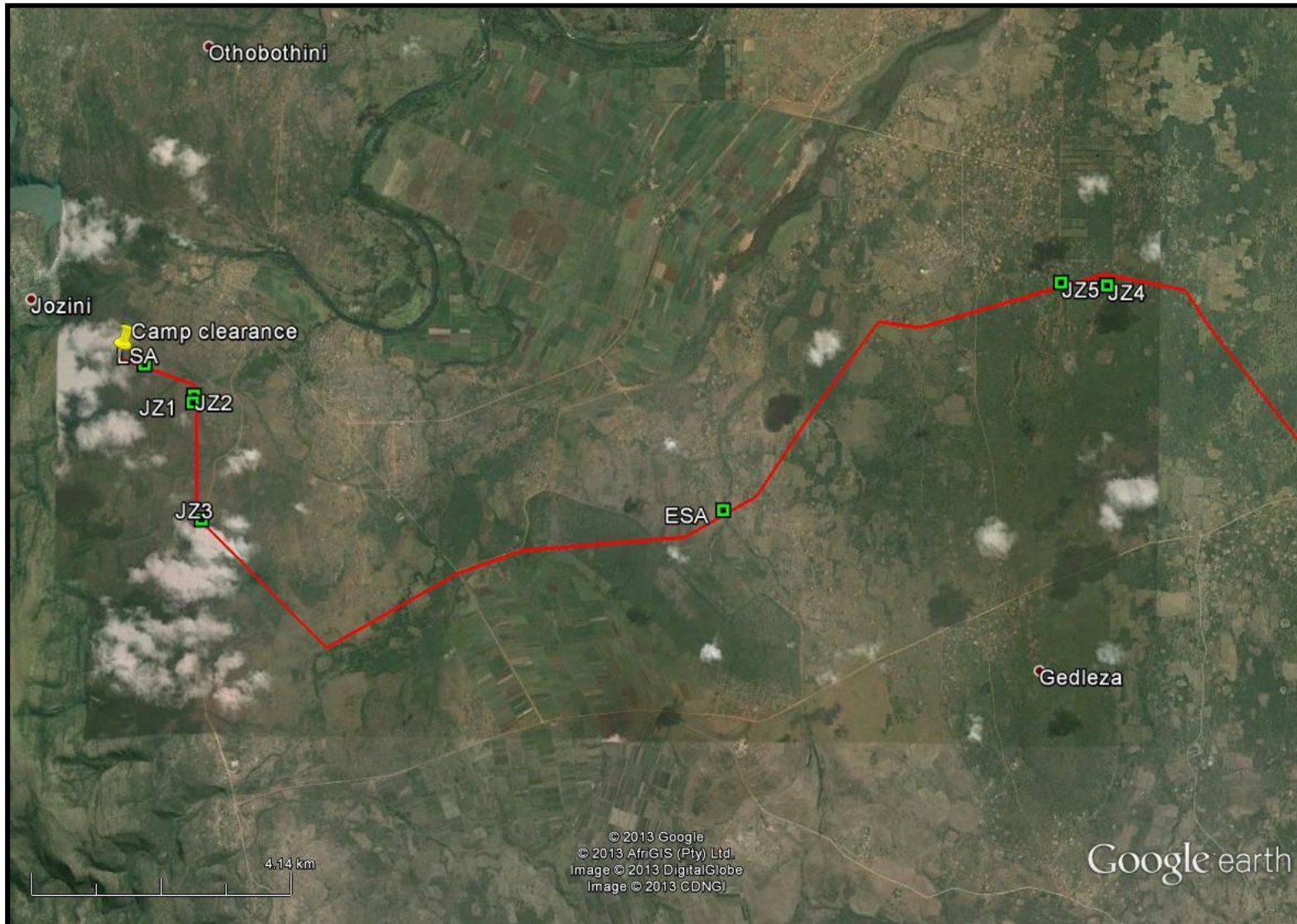


FIGURE 11: GENERAL LOCATION OF THE LSA SCATTER



ESA1

ESA1 occurs in a flat area at the edge of an agricultural field and a river. The tools appear to be ~10cm below the surface, judging from the erosion gully. The stone tools consist of one cleaver and two choppers over a 15m distance. As with LSA1, this is an occurrence of artefacts and not a site *per se*. The location is shown in figure 12.

Significance: The site is of low significance as the material is in a secondary context and ephemeral.

Mitigation: No further mitigation is required, as these tools fall under Option 1.

FIGURE 12: LOCATION OF ESA1



JZ1

JZ1 is a group of four graves within a settlement (fig. 13). The graves occur within 50m of the line; however, they are fenced off and within the fencing of the settlement.

An access road may pass near the graves.

Significance: The graves are of high significance.

Mitigation: No mitigation is required as the graves are already fenced off and demarcated.

FIG. 13 GRAVES AT A SETTLEMENT AT JZ1



JZ2

JZ2 consists of two graves 27m west of the line (fig. 14). The graves are in the bushes and are unmarked: only the cairns are visible. There is no settlement directly associated with the graves.

Significance: The graves are of high significance.

Mitigation: All graves within 50m of a development need to be clearly demarcated before construction begins. A fence needs to be placed around the graves with a 5m buffer between the graves and the fence. No development may occur within 20m of the grave. The pipeline servitude may need to be moved ~10m to the east to meet the 20m buffer.

FIG. 14: GRAVES AT JZ2



JZ3

JZ3 is a cemetery of 6 – 10 graves near the P236 (fig. 15). The cemetery is probably associated with the settlement to the north. The cemetery is 40m to the north of the pipeline servitude and will not be directly affected by the pipeline.

Significance: The cemetery is of high significance.

Mitigation: The cemetery will need to be clearly demarcated before construction begins. I would suggest that the south, east and west sides of the cemetery are demarcated as these are the only areas of potential impact during construction phase. These areas are potential turning points for heavy machinery and thus require the mitigation.

FIG. 15: CEMETERY AT JZ3



JZ4

JZ4 is a settlements with a grave ~140m south of the line and beside an existing track (fig. 16). The settlement is not visible anymore; however, the grave is clearly visible. The grave is also different to those recorded at JZ1 – 3, in that stones are not used for cairns. At this site, the remains are placed inside the grave that is filled up with sand. Wooden poles are placed over the excavations and more sand is placed on the poles. A wooden pole fence then surrounds the grave. This type of grave architecture is important to note, as it may be the norm for the sandy areas along the pipeline. If this were the case, these types of graves would not be visible after 10-15 years, unless they are regularly maintained. Thus, there will be no means of identifying older graves, unless done so by the community.

Significance: The grave is of high significance.

Mitigation: No mitigation is currently required, as the grave will not be affected.

FIG. 16: GRAVE AT JZ4



JZ5

JZ5 is a recently abandoned settlement after 2011 (according to Google Earth map). The settlement is 38 – 100m north of the line. Several features of the settlement still exist but are in ruin. In front of the existing, ruin is a feature that looks similar to the grave at JZ4 (fig. 17). If this is a grave then it is older than the one at JZ4. The possible grave is a collapsed wooden structure with the entrance area missing.

Significance: The site is of high significance

Mitigation: The grave will be 75m from the line and thus does not require mitigation. However, this grave and that at JZ4 should be used as examples of graves in the area. Construction crew should be taken to these graves and as part of a sensitivity exercise.

FIG. 17: POSSIBLE GRAVE AT JZ 5



PALAENTOLOGY

The palaeontology of the area can be divided into six formations:

1. The Zululand Group
 - a. Makatini Formation
 - b. Mzinene Formation
2. Muzi Formation
3. Berea Formation
4. Yellowish Redistributed Sand
5. Blown Sand

Zululand Group

“Both the Makatini (Km) and Mzinene (K mz) formations of the Zululand Group are known to contain Cretaceous aged marine fossils and the fossils have been recorded from several places close to the development footprint (MacRae, 1999). The Makatini Formation contains large fossil logs that are pervasively drilled by *Teredo* wood boring organisms (Johnson et al, 2006). Interfingering fine-grained sediments contain bored fossil tree trunks, smaller plant fragments and marine invertebrates. Palaeo-environments are interpreted as mainly braided rivers that emerged from the foot of a steep escarpment, flowing eastwards onto a narrow coastal plain where they merged with tidal flats (Johnson et al, 2006).

The Mzinene Formation consists of glauconitic siltstone and sandstone with a rich invertebrate fauna, including bivalves, gastropods, ammonites, nautiloids and echinoids. *Lithophaga*, i.e. bored concretions, are common. Fossil logs, bored by *Teredo* are frequently found in the formation (Johnson et al, 2006). The palaeo-environment is interpreted as shallow-marine.

Muzi Formation

Root casts have been described from this formation in the study area and the fact that the argillaceous sand is interpreted as a sedimentary deposit in shallow wetland environments increases the possibility of finding plant remains or impressions of plant remains in this unit when deeply excavated. The clayey nature and mottled appearance with root-like structures leads to the interpretation of a swamp or vlei deposit for this unit (Wolmarans and Du Preez, 1986). No other fossils are described from this unit.

Berea Formation

No fossils have been recorded in the red sands of the Berea Formation. It is unlikely that fossils will be encountered during the development.

Yellowish Redistributed Sand

No fossils have been recorded from this sandy unit in the study area and the chances of finding fossils are low.

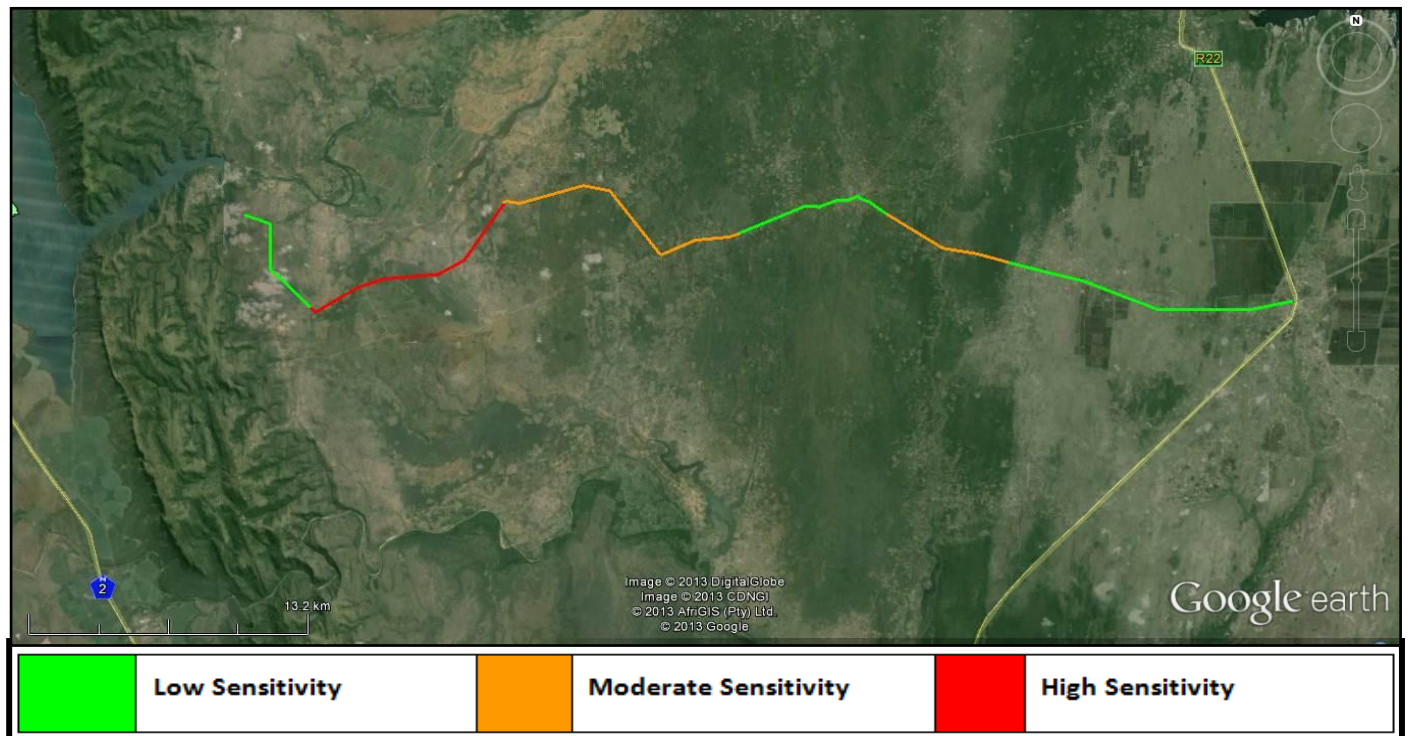
Blown Sand

No fossils have been recorded from this sandy unit and the chances of finding fossils in this unit are low” (PIA desktop report – Appendix A).

Some of these are sensitive to palaeontological remains and this is shown in figure 18.

Significance: The areas highlighted in orange and red are sensitive and may contain significant palaeontological finds.

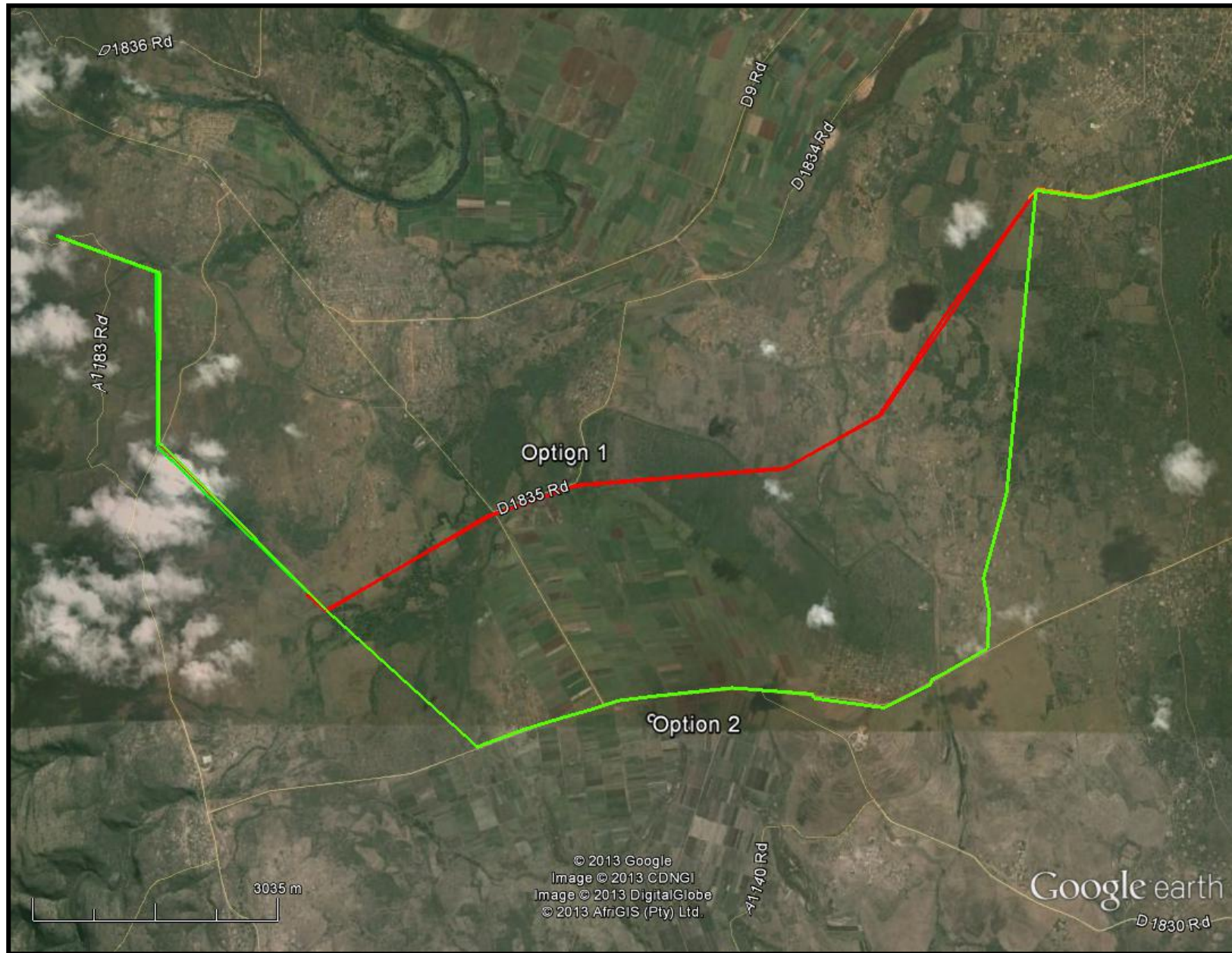
Mitigation: A Phase 1 palaeontological survey may be required before construction begins, and may require monitoring during construction.

FIGURE 18: PALAEOLOGICAL SENSITIVITY MAP.

PIPELINE OPTION 2

Subsequent to the survey, the route option was changed for environmental reasons. The route change occurs on the western side of the line only, where it now follows an existing road servitude (fig. 19). Option 1, in this area, consisted of 11km of pipeline through agricultural fields and undisturbed land. Option 2 consists of 15km of pipeline, of which 7km occurs next to the road reserve. The remaining 8km of Option 2 occurs through mostly heavily disturbed agricultural fields. About 2km of pipeline in Option 2 occurs in dense vegetation and this would have remained unsurveyed in the first place due to the low archaeological visibility.

FIG. 19: ROUTE OPTION 2 OF THE JRCWSS



Changes to a line would normally be resurveyed, however, in this case I do not believe any new information would be gained. This is especially important when time and financial constraints occur on a project. The environment is very similar to Option 1 in terms of archaeology and palaeontology, i.e. agricultural fields, and sandy areas interspersed with dense vegetation and wetlands. The archaeological artefacts would thus consist of isolated stone tools in secondary contexts as noted on the initial survey.

Human remains, in this area, will be similar to those observed on other parts of the route. That is, only very recent burials will be visible. Older settlements with potential human remains can be plotted from historical maps, as per normal desktop study. Table 4 and Figure 20 indicate the location of the settlements in 1969, 1975, and 2010 and 2013. Most of the sites occur in areas that are still occupied, and thus these people would be able to locate ancestral remains if they do occur near the line. The areas where the line passes through agricultural fields have been ploughed for several years, and could have disturbed human if they occurred there. It must also be noted that the high humidity and acidic soils are not conducive to the preservation of organic remains, unless the means have been treated, e.g. buried underneath or near shell middens. This has been our experience working with over 400 sites on the Eastern Seaboard. The palaeontological results would remain the same, as it is in the same environment.

It is for this reason that we would support the 15km of Option 2 that was not surveyed, to be exempt from a field survey, with a desktop study being sufficient.

FIG. 20: HUMAN SETTLEMENTS ALONG OPTION 2

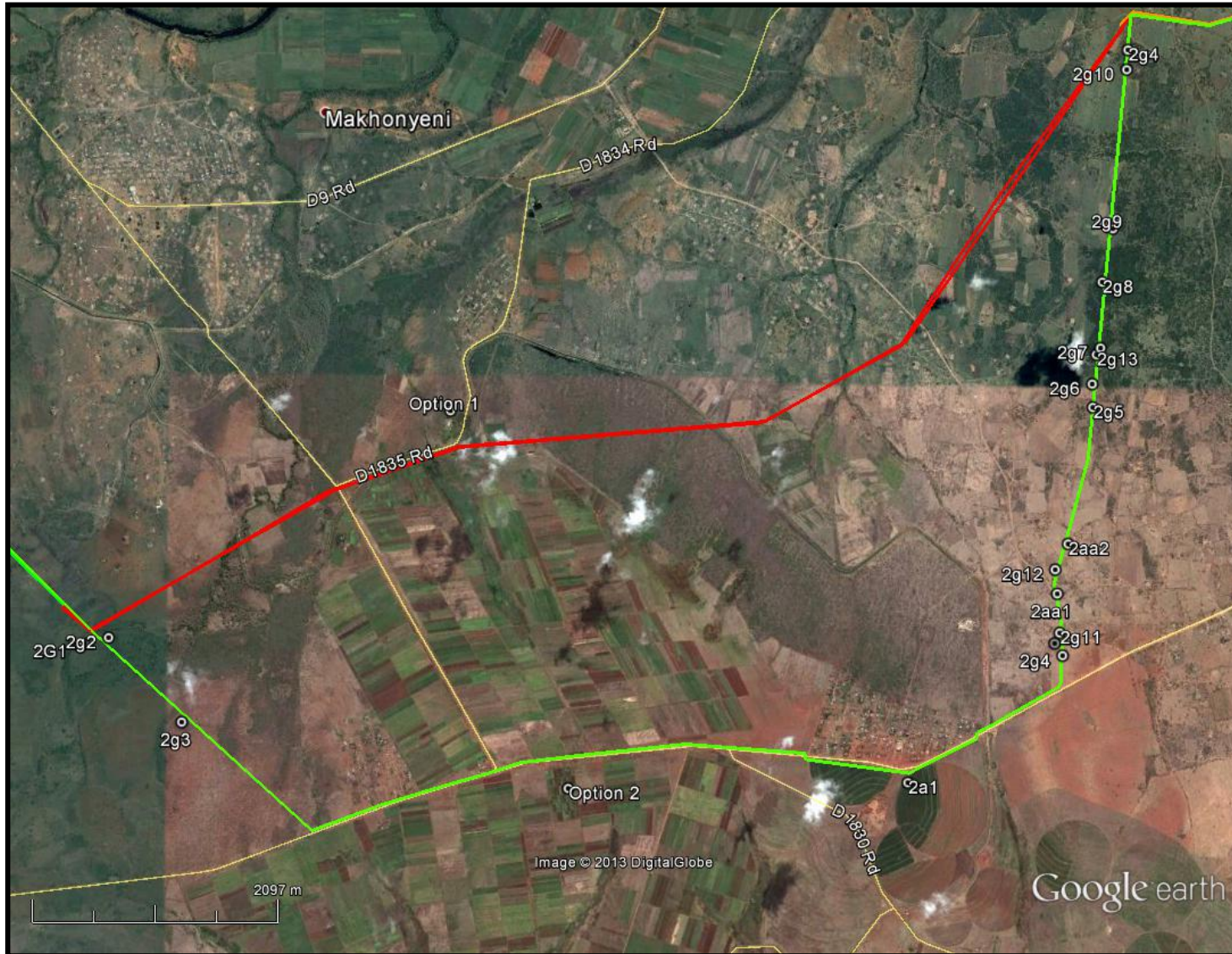


TABLE 4: LOCATION OF SETTLEMENTS ALONG ROUTE OPTION 2¹

NAME	LATITUDE	LONGITUDE
2g1	-27.485081185	32.113709905
2g2	-27.484387283	32.116161434
2g3	-27.490886196	32.122523288
2g4	-27.485769124	32.199050957
2g5	-27.466636869	32.201664535
2g6	-27.464838020	32.201614539
2g7	-27.462061984	32.202332538
2g8	-27.456980167	32.202484964
2g9	-27.452859261	32.203415365
2g10	-27.440585292	32.204631706
2g11	-27.484021786	32.198800583
2g12	-27.479146558	32.198416493
2g13	-27.462578663	32.201973742
2g14	-27.439058511	32.204748789
2a1	-27.495559722	32.185603461
2a2	-27.484828101	32.198367129
2aa1	-27.481006674	32.198588350
2aa2	-27.477161384	32.199532398

MANAGEMENT PLAN & DISCUSSION

There are three main heritage issues pertaining to this project: local community graves, archaeological Stone Age sites and paleontological sites.

Archaeology

The archaeology of the area is, in general, a continual scatter of stone tools. These tools date from the Early Stone Age, Middle Stone Age, and Late Stone Age, although no Middle Stone Age artefacts were noted during this survey. These stone tools tend to be in a secondary context due to disturbances by field ploughing, settlements and/or housing projects, roads and natural colluvial action. These artefacts have been displaced through natural movements in the soft sandy areas. Other surveys in the general area (Anderson 2009, 2010, 2011, 2012a-b, 2013) have noted a similar pattern, and these artefacts are of low significance. Sampling will not further the understanding of the archaeology of the

¹ Prefix 2 = Option 2. 'a' = 1969 topographical map; 'aa' = 1975 aerial photographs; g = Google Earth maps 2010 and 2013,

area, unless these sites were in a primary context such as a cave. It is for this reason that I do not believe further mitigation is required. These are not sites *per se*, rather occurrences of individual stone tools across the landscape, and thus permits should not be required.

Palaeontology

Segments of the line vary from low to high in palaeontological sensitivity. All areas demarcated as having medium to high palaeontological sensitivity may require a Phase 1 Palaeontological Impact Assessment before construction occurs. Some areas may also require a palaeontologist to be on site during construction.

Human Remains

The main concern for this project is unmarked human graves. The desktop study notes several areas that have the remains of settlements that will probably have human graves. These human graves are, however unmarked and thus not possible to record without community participation. The public participation process should include these areas to confirm if members of the public can claim ancestral remains to these areas, and/or indicate where the remains were interred. These areas should then be demarcated with a 20m buffer zone from the pipeline.

All settlements noted in the desktop study should have a 50m buffer placed around them and noted as areas of high sensitivity that may yield human remains.

If graves are uncovered during the course of the pipeline then certain processes need to be followed. In terms of the National Heritage Resources Act (No. 25 of 1999), and KZN Heritage Act of 1997 and 2008, state those graves older than 60 years (not in a municipal graveyard) are protected, as well as all unclaimed recent graves. Only a registered undertaker should handle human

remains younger than 60 years or an institution declared under the Human Tissues Act. Anyone who wishes to develop an area where there are graves older than 60 years is required to follow the process described in the legislation (section 36 and associated regulations). The specialist will require a permit from the heritage resources authority:

- Determine/ confirm the presence of the graves on the property. Normally the quickest way to proceed is to obtain the service of a professional archaeologist accredited to undertake burial relocations. The archaeologist will provide an estimate of the age of the graves. There may be a need for archival research and possibly test excavations (permit required).
- The preferred decision is to move the development so that the graves may remain undisturbed. If this is done, the developer must satisfy SAHRA/KZN Heritage that adequate arrangements have been made to protect the graves on site from the impact of the development. This usually involves fencing the grave (yard) and setting up a small site management plan indicating who will be responsible for maintaining the graves and how this is legally tied into the development. It is recommended that a distance of 10-20 m is left undisturbed between the grave and the fence around the graves.
- If the developer wishes to relocate or disturb the graves:
 - A 60-day public participation (social consultation) process as required by section 36 (and regulations - see attachment), must be undertaken to identify any direct descendants of those buried on the property. This allows for a period of consultation with any family members or community to ascertain what their wishes are for the burials. It involves notices to the public on site and through representative media. The archaeologist, who can explain the process, may do this but for large or sensitive sites, a social consultant should be employed. Archaeologists often work with undertakers, who rebury the human remains.

- If as a result of the public participation, the family (where descendants are identified) or the community agree to the relocation process then the graves may be relocated.
- The archaeologist must submit a permit application to SAHRA/KZN Heritage for the disinterment of the burials. This must include written approval of the descendants or, if there has not been success in identifying direct descendants, written documentation of the social consultation process, which must indicate to SAHRA's satisfaction, the efforts that have been made to locate them. It must also include details of the exhumation process and the place to which the burials are to be relocated. (There are regulations regarding creating new cemeteries and so this usually means that relocation must be to an established communal rural or formal municipal cemetery.)
- Permission must be obtained before exhumation takes place from the landowner where the graves are located, and from the owners/managers of the graveyard to which the remains will be relocated.
- Other relevant legislation must be complied with, including the Human Tissues Act (National Department of Health) and any ordinances of the Provincial Department of Health). The archaeologist can usually advise about this.

Since this is a lengthy process, I suggest that the 50m boundary amongst all sites noted in the desktop study is enforced, and the pipeline is rerouted accordingly. An exception would be with those graves in existing settlements that already have fencing.

CONCLUSION

A heritage survey was undertaken for the JRCWSS. The pipeline starts in the Lebombo Mountains and goes eastwards over the Makitini Flats towards Mbazwana. The line thus covers various geological formations and environmental systems, which result in a rich and diverse heritage area. The heritage survey consisted of a two desktop studies and a field survey. The Palaeontological desktop study noted that there were several geological formations along the pipeline. Some of these formations would contain palaeontological features that may be significant. A Phase 1 palaeontological survey may be required to determine the full significance of these areas.

The second desktop survey used various maps to locate human settlements in the area at different times. This was undertaken since settlements disintegrate at a rapid rate after they have been abandoned. Often human graves do not consist of cairns, but organic material and these decompose rapidly if not taken care of. The desktop study located 115 human settlements near the line and suggested that these are marked as sensitive area for potential human remains.

The field survey noted that the area had extensive scatters of stone tools. However, these stone tools were in secondary contexts and did not occur frequent enough to be classified as sites; rather has occurrences. The survey also noted human graves near the line; however, the line will directly affect none of these.

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Appendix A

Palaeontological Impact Assessment

**DESKTOP PALAEOLOGICAL
ASSESSMENT OF
JOZINI REGIONAL COMMUNITY WATER
SUPPLY SCHEME - PHASE 1,
KWA-ZULU NATAL**

**FOR
Umlando**

DATE: 24 July 2013

By

Dr Gideon Groenewald

Cell: 082 469 4696

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EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the Jozini Regional Community Water Supply Scheme – phase 1. The overall project, initiated by the Umkhanyakude District Municipality, proposes the extension and upgrading of the bulk water treatment and distribution system to the supply area east of Jozini, together with associated distribution and reticulation networks to meet the current and future water needs in the area. This region falls within the Jozini, Umhlabuyalingana and Big 5 Local Municipalities and has a population of approximately 111 000 people. Phase 1 of the project is aiming to provide safe potable water to approximately 3 600 households.

This report only deals with Phase 1 of the project. Phase 1, would include the construction of the main bulk pipeline, a 61.5km steel pipeline that will run east from Jozini to Mbazwana, of which 3.5km is rising main, from the Water Treatment works next to the canal and will deliver to the Main reservoir. At that point there will be a gravity line of 58km from the main reservoir to Mbazwana. This area is largely already supplied by the existing Jozini and Ntshongwe - Malobeni Schemes.

The study area is underlain by rocks of the Jurassic, Cretaceous, Tertiary and the Quaternary periods, including the Jurassic Jozini Group of volcanic rocks, the Cretaceous sedimentary Zululand Group, the Quaternary argillaceous Muzi Formation and Quaternary red, sandy Berea Formation as well as Quaternary, redistributed and windblown sand deposits.

There is a possibility that fossils could be encountered during excavation of Zululand Group bedrock and argillaceous sand of the Muzi Formation within the development footprint. Fossils found would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting

of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

Areas underlain by the Zululand Group are allocated a high palaeontological sensitivity, with medium sensitivity allocated to the areas underlain by the Muzi Formation. The rest of the study area is allocated a low palaeontological sensitivity rating due to either the rocks being of igneous character, or the geological units being of mostly a windblown sandy nature.

It is recommended that:

- A Phase 1 palaeontological impact assessment must be done for areas with a moderate to high sensitivity ratings for the occurrence of fossils.
- The EAP of the project team should be made aware of the possible occurrence of fossils. If any fossils are recorded during initial field visits, a trained palaeontologist must be notified to assess the finds.

INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the Jozini Regional Community Water Supply Scheme – phase 1. The overall project, initiated by the Umkhanyakude District Municipality, proposes the extension and upgrading of the bulk water treatment and distribution system to the supply area east of Jozini, together with associated distribution and reticulation networks to meet the current and future water needs in the area. This region falls within the Jozini, Umhlabuyalingana and Big 5 Local Municipalities and has a population of approximately 111 000 people. Phase 1 of the project is aiming to provide safe potable water to approximately 3 600 households.

The proposed scheme would be implemented in multiple phases. The treatment works, pumping capacity and storage will be modular and extended as the developments proceed over time, based on additional demands.

This report only deals with Phase 1 of the project. Phase 1, would include the construction of the main bulk pipeline, a 61.5km steel pipeline that will run east from Jozini to Mbazwana, of which 3.5km is rising main, from the Water Treatment works next to the canal and will deliver to the Main reservoir. At that point there will be a gravity line of 58km from the main reservoir to Mbazwana. This area is largely already supplied by the existing Jozini and Ntshongwe - Malobeni Schemes.

The objective of this project is to establish sub-regional bulk potable water source at Jozini and to provide the bulk conveyance infrastructure to convey this treated water to as large a proportion of the region as is feasible. As such, the project boundaries or footprint is quite flexible. As some of the existing schemes in the region are not reliable and the reticulations do not serve all populations, these

aspects will be addressed and the current systems refurbished and / or extended where needed.

The scheme aims to supply water from the Phongolo River, stored in the existing Jozini Dam, the capacity of which is currently not fully utilised. A 2009 water resources analysis indicated that releases from Jozini Dam could be increased from 9,15m³/s (791Mℓ/day) to 14,1m³/s (1218Mℓ/day) without failure.

Except for the Lebombo Mountain range, which ends south of Jozini, the region is mostly flat and situated below 100 m amsl.

The project will entail the following:

- Upgrading of the existing bulk supply pipelines (gravity and rising mains), i.e. from Jozini Old Works to Jozini town, and Jozini New Works to Ntshongwe which starts as a 200 mm diameter but reduces to a 160 mm and 75 mm diameter pipe.
- Installation of new bulk supply pipelines (gravity and rising mains) to link existing schemes
- Linkages to adjacent schemes and supply areas where practical and effective.
- Provision of pumping infrastructure (feeder and booster pumping stations) to provide the necessary pressure to the network(s), where required.
- Upgrading of the existing reservoirs/tanks, such as the 0,2 Mℓ tanks on the pipeline to Ntshongwe, for incorporation into the greater scheme

- New storage reservoirs/tanks to be provided where these do not exist, or extend where the storage capacity is not sufficient.

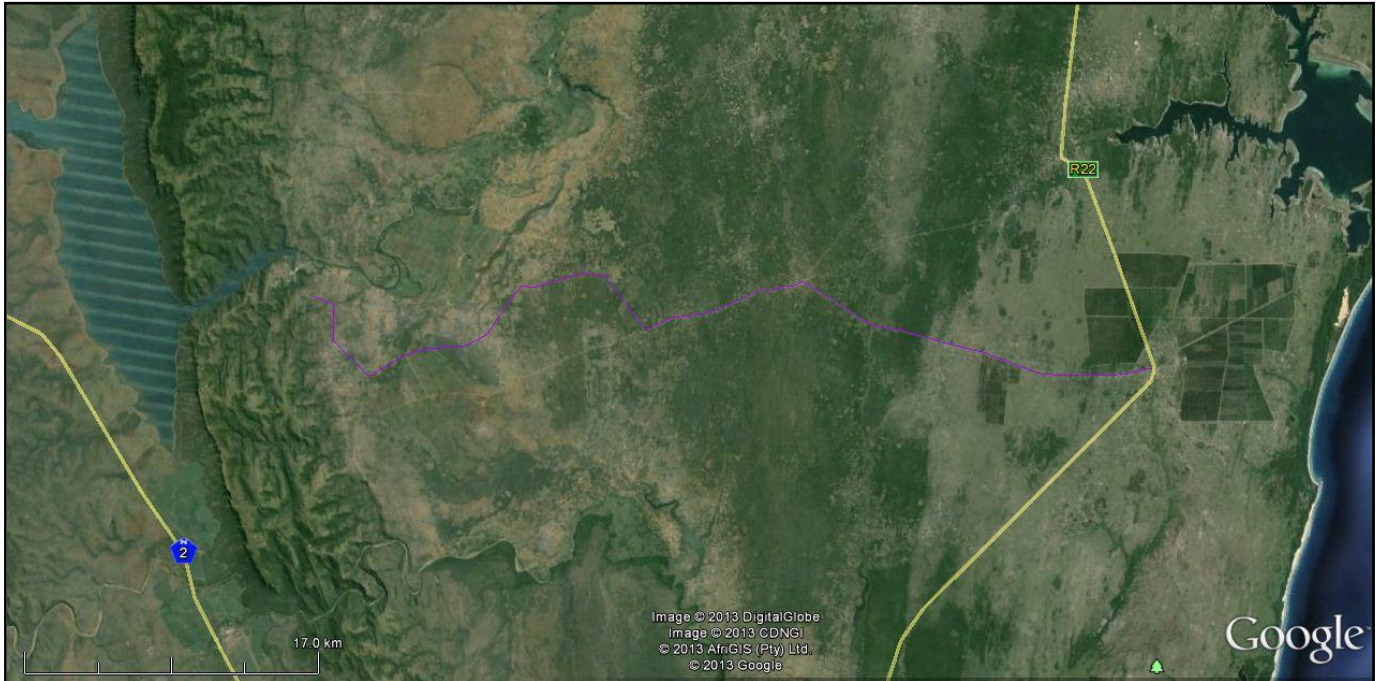


Figure 1 Locality of the Jozini Regional Community Water Supply Scheme – phase 1

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

METHODOLOGY

Following the "SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps and Google Earth imagery. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

The key assumption for this desktop study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and, without supporting field assessments, may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

GEOLOGY

The study area is underlain by rocks of the Jurassic, Cretaceous, Tertiary and the Quaternary periods, including the Jozini Group of volcanic rocks, the sedimentary Zululand Group, the argillaceous Muzi Formation and red, sandy Berea Formation and younger redistributed and windblown sand deposits (Johnson et al, 2006).

Jozini Group

The western section of the study area is underlain by Jurassic aged rocks of the Jozini Group that consists primarily of a sequence of rhyodacite and alternating bands of flow breccia (Figure 2).

Zululand Group

Towards the east the Jozini Group is overlain by Cretaceous aged rocks of the Makatini (Km) and Mzinene (K mz) formations of the Zululand Group (Figure 2). The Makatini Formation consists mainly of conglomerates, grit, sandstone and siltstone, whereas the Mzinene Formation consists of marine glauconitic siltstone with shelly and concretionary horizons.

Muzi Formation

Further towards the east the Quaternary Muzi Formation (Qm), an argillaceous sand, underlies the footprint of the development (Figure 2). This formation is again encountered towards the eastern extension of the study area.

Berea Formation

The Quaternary Berea Formation (Qbe), consisting of red dune cordon sand, underlies a short central section of the development close to Tshongwe (Figure 2).

Yellowish Redistributed Sand

A central section of the development is underlain by Quaternary aged yellowish redistributed sand (Qs) (Figure 2). This sandy unit also covers small areas in the most eastern part of the development area.

Blown Sand

Most of the eastern part of the study area is underlain by Quaternary aged wind-blown sand (Figure 2).

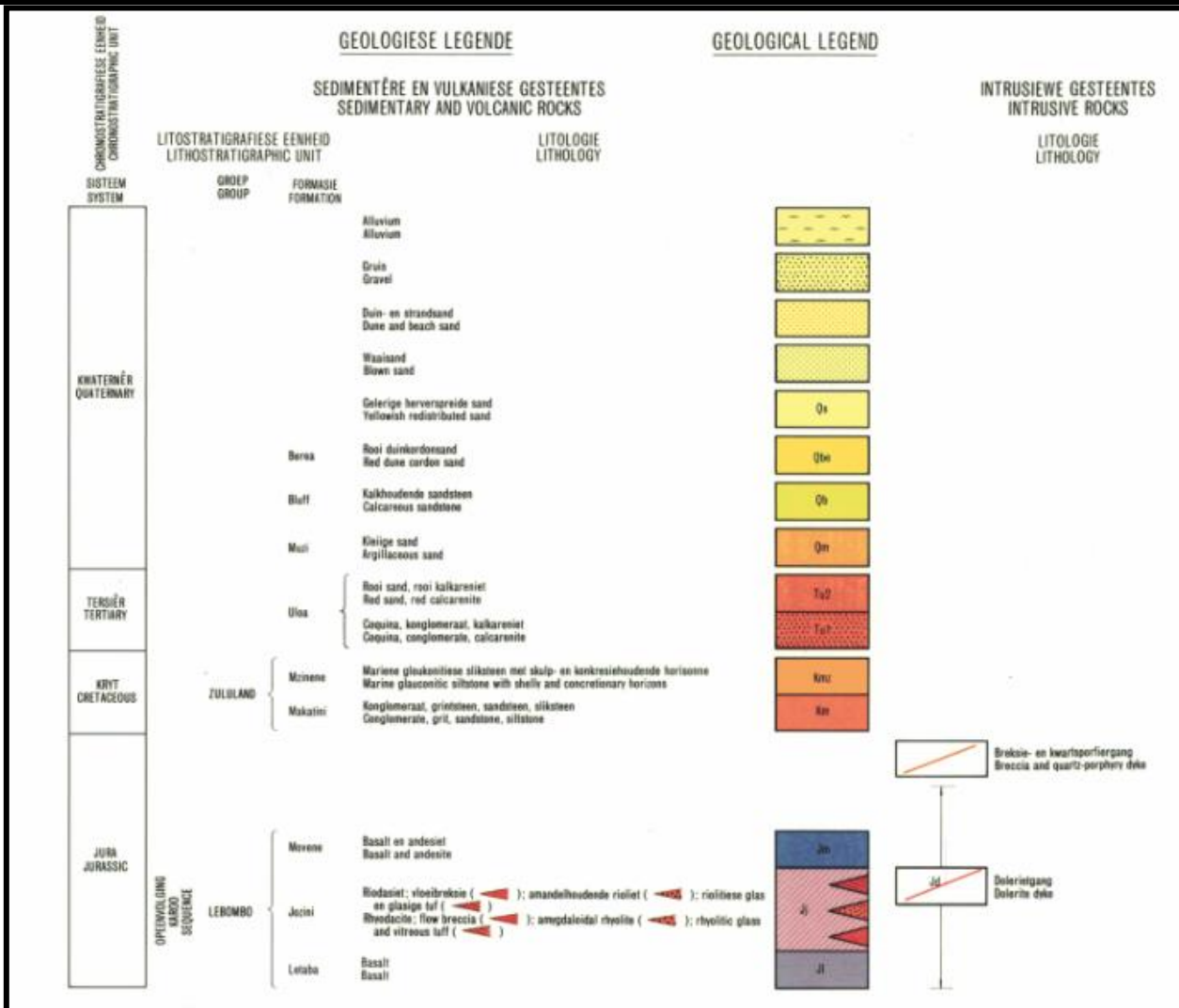
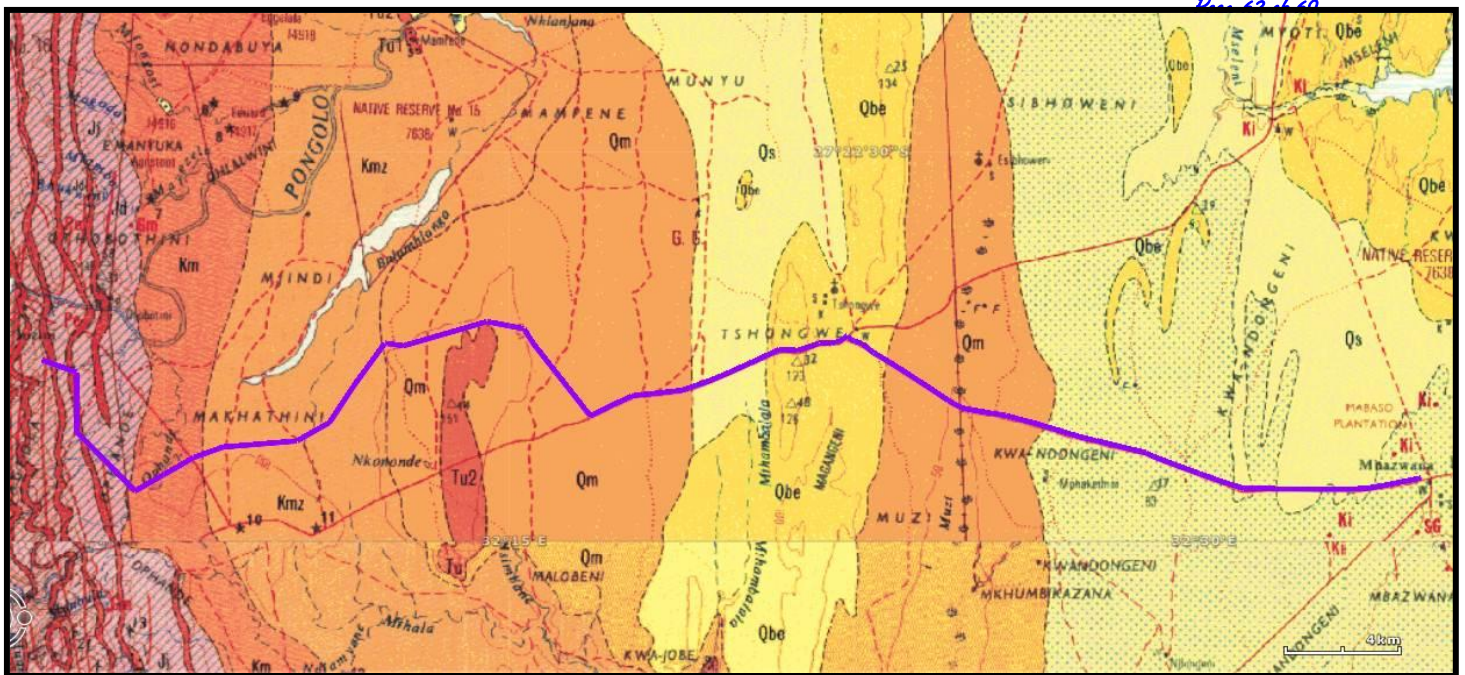


Figure 2 Geology of the study area (2632 Kosi Bay)

PALAEONTOLOGY

Jozini Group

Due to the igneous nature of the rocks in this Group it will not contain fossils.

Zululand Group

Both the Makatini (Km) and Mzinene (K mz) formations of the Zululand Group are known to contain Cretaceous aged marine fossils and the fossils have been recorded from several places close to the development footprint (MacRae, 1999). The Makatini Formation contains large fossil logs that are pervasively drilled by *Teredo* wood boring organisms (Johnson et al, 2006). Interfingering fine-grained sediments contain bored fossil tree trunks, smaller plant fragments and marine invertebrates. Palaeo-environments are interpreted as mainly braided rivers that emerged from the foot of a steep escarpment, flowing eastwards onto a narrow coastal plain where they merged with tidal flats (Johnson et al, 2006).

The Mzinene Formation consists of glauconitic siltstone and sandstone with a rich invertebrate fauna, including bivalves, gastropods, ammonites, nautiloids and echinoids. *Lithophaga*, i.e. bored concretions, are common. Fossil logs, bored by *Teredo* are frequently found in the formation (Johnson et al, 2006). The palaeo-environment is interpreted as shallow-marine.

Muzi Formation

Root casts have been described from this formation in the study area and the fact that the argillaceous sand is interpreted as a sedimentary deposit in shallow wetland environments, increases the possibility of finding plant remains or impressions of plant remains in this unit when deeply excavated. The clayey nature and mottled appearance with root-like structures leads to the interpretation

of a swamp or vlei deposit for this unit (Wolmarans and Du Preez, 1986). No other fossils are described from this unit.

Berea Formation

No fossils have been recorded in the red sands of the Berea Formation. It is unlikely that fossils will be encountered during the development.

Yellowish Redistributed Sand

No fossils have been recorded from this sandy unit in the study area and the chances of finding fossils are low.

Blown Sand

No fossils have been recorded from this sandy unit and the chances of finding fossils in this unit are low.

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews. The palaeontological significance is summarised in Table 2.

Table 2 Palaeontological significance of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Jozini Group	Rhyodacite and alternating bands of flow breccia JURASSIC	None		Low sensitivity
Zululand Group (Makatini and Mzinene Formations)	Conglomerates grit, sandstone and siltstone. Marine glauconitic siltstone with shelly and concretionary horizons CRETACEOUS	Large fossil logs drilled by <i>Toledo</i> . Plant fragments and marine invertebrates. Rich invertebrate fauna, including bivalves, gastropods, ammonites, nautiloids and echinoids. <i>Lithophaga</i> , i.e. bored concretions		High sensitivity
Muzi Formation	Argillaceous sand QUATERNARY	Root casts		Medium sensitivity
Berea Formation, Yellow redistributed sand and windblown sand	Red and yellow wind blown sand QUATERNARY	None		Low sensitivity

There is a possibility that fossils could be encountered during excavation of Zululand Group bedrock and argillaceous sand of the Muzi Formation within the development footprint. Fossils found would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a

highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

MANAGEMENT PLAN

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 above.

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. Due to the relative abundance of fossils recorded from these units, areas underlain by the Zululand Group is allocated a high sensitivity for palaeontology, with a medium sensitivity allocated to the Muzi Formation. Areas underlain by the Jozini Group, Berea Formation and other windblown sand deposits are allocated low sensitivity ratings (Figure 3).

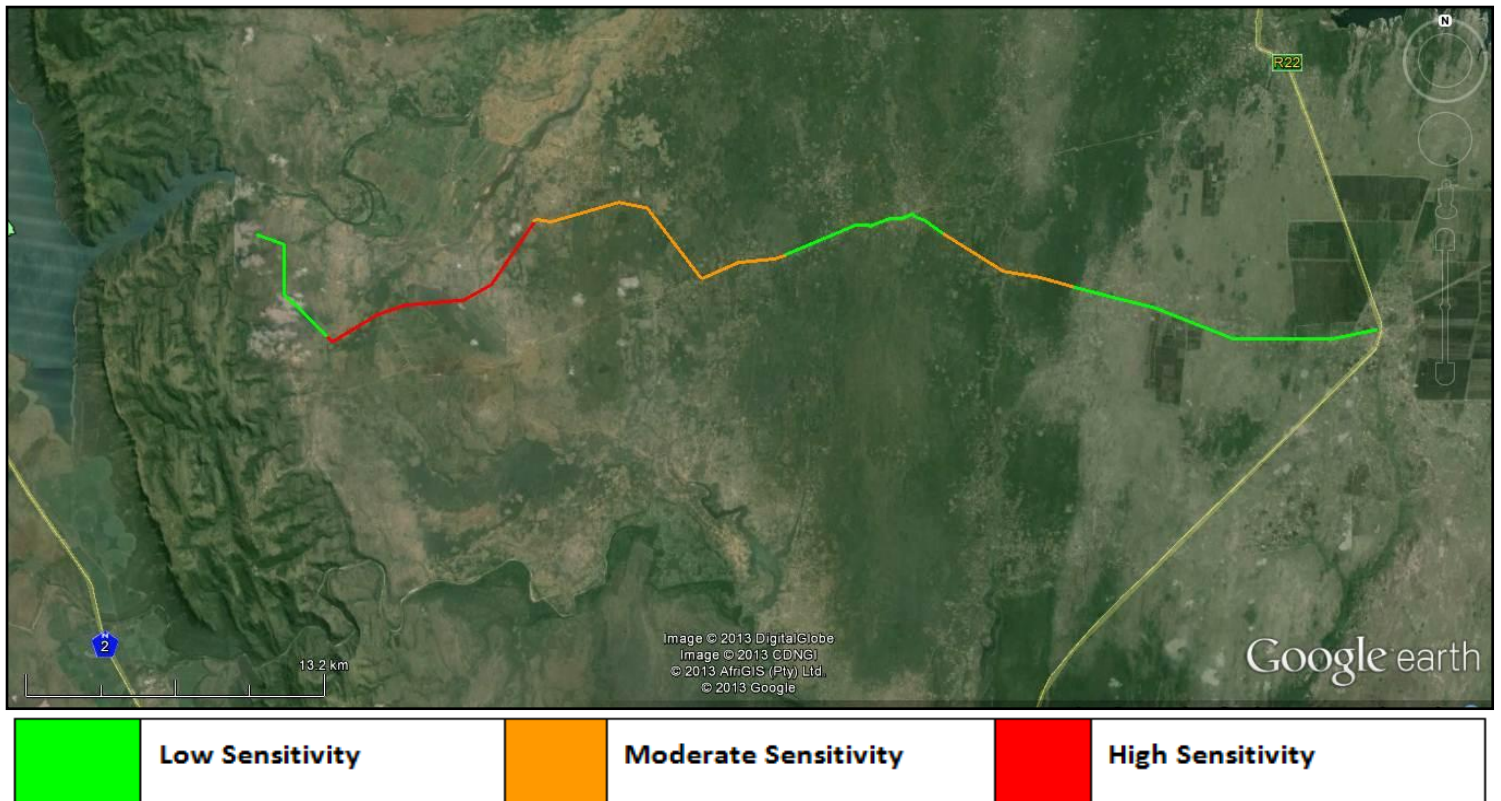


Figure 3 Palaeosensitivity of the study area

CONCLUSION

Rocks that vary from Jurassic to Quaternary in age underlie the study area of the proposed Jozini Regional Community Water Supply Scheme – phase 1. Areas underlain by the Zululand Group are allocated a high palaeontological sensitivity, with medium sensitivity allocated to the areas underlain by the Muzi Formation. The rest of the study area is allocated a low palaeontological sensitivity rating due to either the rocks being of igneous character, or the geological units being of mostly a wind-blown, sandy nature.

It is recommended that:

- A Phase 1 palaeontological impact assessment must be done for areas with a moderate to high sensitivity ratings for the occurrence of fossils (Figure 3).
- The EAP of the project team should be made aware of the possible occurrence of fossils. If any fossils are recorded during initial field visits, a trained palaeontologist must be notified to assess the finds.

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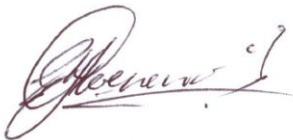
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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



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Geologist