

**PROPOSED UMKHOMAZI WATER PROJECT PHASE 1,
POTABLE WATER COMPONENT**

Phase 1 Heritage Impact Assessment

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EXECUTIVE SUMMARY

Background

The current water resources of the Integrated Mgeni Water Supply System (WSS) are insufficient to meet the long-term water requirements of the system. Pre-feasibility investigations indicated that Phase 1 of the uMkhomazi Water Project (uMWP-1), which entails the transfer of water from the undeveloped uMkhomazi River to the existing Integrated Mgeni WSS, is the scheme most likely to fulfil this requirement.

The Mkomazi-Mgeni Transfer Pre-feasibility Study concluded that the first phase of the uMWP would comprise a new dam at Smithfield on the uMkhomazi River near Richmond, a multi-level intake tower and pump station, a water transfer pipeline/tunnel to a balancing dam at Baynesfield Dam or a similar in-stream dam, a water treatment works at Baynesfield and a gravity pipeline to the Mgeni bulk distribution reservoir system, below the reservoir at Umlaas Road. The table below indicates the components of the project:

uMWP-1 Component	Infrastructure	Proponent
Raw Water	1. A new dam at Smithfield on the uMkhomazi River near Bulwer. 2. Water conveyance infrastructure (including a ± 34 km long tunnel and a pipeline) to a balancing dam in the Baynesfield area. Alternatives under consideration for the tunnel alignment and location of the balancing dam.	Department of Water and Sanitation
Potable Water	3. A water treatment works in the uMlaza River valley. 4. A gravity pipeline to the Umgeni Water bulk distribution reservoir system, below the reservoir at Umlaas Road.	Umgeni Water

This report deals with the Potable Water component of the project.

Legislative requirements

Due to the length of the potable water pipeline and alternatives (over 300 m) as well as the size of the proposed Water Treatment Works (WTW) (approx. 21 hectares), the proposed development triggers Section 38 of the National Heritage Resources Act, 1999 (Act No 25 of 1999) that states the following:

“(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length

(c) any development or other activity which will change the character of a site-

(i) exceeding 5 000 m² in extent; or

(ii) involving three or more existing erven or subdivisions thereof must notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Location

The overall project area is situated in the southern part of KZN, in the uMgungundlovu District Municipality (DM). The western part of the project area falls within the Richmond Local Municipality (LM) and the eastern part in the Mkhambathini LM.

The majority of the project area for the Potable Water component is located on privately owned land which is predominantly used for commercial farming and forestry. In the north-eastern part the pipeline crosses the light industrial area of Umlaas Road. The study area includes cultivated farm lands, small holdings, peri-urban development, woodlots, and dense grasslands

Alternatives

Various options to meet the project's objectives have been considered during previous studies which lead to the identification of alternatives to be investigated including alternative sites and route alignments for the project infrastructure. These are tabulated below:

No.	Components		Alternatives
1.	Water Treatment Works		1. Option 1
			2. Option 2
			3. Option 3
2.	Potable water pipeline	Alignment	Option 1
			Option 1A
			Option 1B
			Option 1C
			Option 1D
			Option 1E
			Option 1F
			Link to WTW 2
			Link to WTW 2 Deviation
			Link to WTW 3
	Crossing of Mapstone Dam	Steel Suspension Bridge	
		Conventional Steel Pipe Bridge	
		Pipe Supported on Concrete Piers	
		Pipe Buried in Dam Basin	

Results

Although various archaeological sites occur in the greater Pietermaritzburg and Camperdown areas none were located on the footprint of the area in which the Potable Water component of the project will be located.

During the site visit several significant cultural heritage sites were discovered including the Stead family church and cemetery and Baynesfield Methodist Church and associated cemetery which are all over 60 years and therefore protected by the KwaZulu-Natal Heritage Act and NHRA. Some sites are more directly affected by the proposed infrastructure than others such as the Stead family church and cemetery complex which has two pipelines options situated in very close proximity to it.

Mitigation measures include the realigning of the pipeline routes in order to move the pipelines away from the above-mentioned complex as well as the placing of buffers around most of the identified heritage sites to avoid any impacts that could occur as a result of construction activities.

According to the palaeo-sensitivity map produced by SAHRIS the area falls in the green area which means that there is a moderate risk of fossils occurring there. However, according to the desktop palaeontological assessment undertaken, there are no records of fossils from this region hence no further studies are required in this regard.

In terms of the Water Treatment Works alternatives, Options 1 and 3 are preferred as the proposed location of both are highly impacted by plantations and sugar cane farming respectively. However the alignment of the pipeline link to WTW Option 3 is a concern due to its proximity to the Stead family church and cemetery and possible negative impacts associated with the construction of the pipeline.

Pipeline Route Option 1 is preferred to Options 1A and 1B as the two alternative alignments cross more undisturbed areas than Option 1; alternative Option 1C is preferred on the farm Hopewell as the alignment avoids impacting on chicken houses. Alternative 1D is preferred as it is more a more direct therefore shorter route than Option 1.

The pipeline link to WTW Option 2 runs close to a structure which is believed to be older than 60 years. The pipeline link also crosses large tracts of undeveloped land where unidentified heritage sites could be affected and is not a preferred WTW location nor pipeline link.

Conclusion

It was concluded that the Potable Water component of the uMWP project can proceed as long as the mitigation measures recommended were implemented including the re-alignment of certain pipeline route options to avoid sensitive heritage sites.

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APPENDICES

Appendix 1 – KwaZulu Natal Heritage Regulations, 2012

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ABBREVIATIONS

DM	District Municipality
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
HIA	Heritage Impact Assessment
KZN	KwaZulu-Natal
KZNHA	KwaZulu-Natal Heritage Act
LM	Local Municipality
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
SAHRIS	South African Heritage Resources Information System
SAPS	South African Police Service
uMWP-1	Phase 1 uMkhomazi Water Project
WSS	Water Supply System
WTW	Water Treatment Works

AUTHORS DETAILS

Name	Qualification	Professional Registration
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1. INTRODUCTION

The current water resources of the Integrated Mgeni Water Supply System (WSS) are insufficient to meet the long-term water requirements of the system. Pre-feasibility investigations indicated that Phase 1 of the uMkhomazi Water Project (uMWP-1), which entails the transfer of water from the undeveloped uMkhomazi River to the existing Integrated Mgeni WSS, is the scheme most likely to fulfil this requirement.

The Mkomazi-Mgeni Transfer Pre-feasibility Study concluded that the first phase of the uMWP would comprise a new dam at Smithfield on the uMkhomazi River near Richmond, a multi-level intake tower and pump station, a water transfer pipeline/tunnel to a balancing dam at Baynesfield Dam or a similar in-stream dam, a water treatment works at Baynesfield in the uMlaza River valley and a gravity pipeline to the Mgeni bulk distribution reservoir system, below the reservoir at Umlaas Road. From here, water will be distributed under gravity to eThekweni and possibly low-lying areas of Pietermaritzburg.

The overall uMWP-1 Feasibility Study has been divided into the following three modules:

- Module 1: Technical Feasibility Raw Water
- Module 2: Environmental Impact Assessment (EIA) - Nema Consulting was appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EIAs for the proposed uMWP-1 Raw Water and Potable Water components; and
- Module 3: Technical Feasibility Potable Water.

Table 1: Simplified overview of uMWP-1 Components

uMWP-1 Component	Infrastructure	Proponent
Raw Water	3. A new dam at Smithfield on the uMkhomazi River near Bulwer. 4. Water conveyance infrastructure (including a ± 34 km long tunnel and a pipeline) to a balancing dam in the Baynesfield area. Alternatives under consideration for the tunnel alignment and location of the balancing dam.	Department of Water and Sanitation
Potable Water	5. A water treatment works in the uMlaza River valley. 6. A gravity pipeline to the Umgeni Water bulk distribution reservoir system, below the reservoir at Umlaas Road.	Umgeni Water

This document serves as the Phase 1 Heritage Impact Assessment (HIA) for the proposed uMWP-1 Potable Water component.

1.1 Alternatives

The Potable Water section of the project consists of the components as described in Table 1 above and some of the infrastructure have alternatives that are listed in Table 2 below.

Various options to meet the project's objectives have been considered during previous studies (including the Pre-Feasibility Study), which lead to the identification of alternatives to be investigated as part of the Feasibility Study. This includes the assessment of these options in terms of the alternative sites and route alignments for the project infrastructure.

Table 2: uMWP-1 Potable Water: components and alternatives

No.	Components		Alternatives
1.	Water Treatment Works		1. Option 1 2. Option 2 3. Option 3
2.	Potable water pipeline	Alignment	Option 1 Option 1A Option 1B Option 1C Option 1D Option 1E Option 1F Link to WTW 2 Link to WTW 2 Deviation Link to WTW 3
Crossing of Mapstone Dam		Steel Suspension Bridge Conventional Steel Pipe Bridge Pipe Supported on Concrete Piers Pipe Buried in Dam Basin	

2. LEGISLATIVE BACKGROUND

Due to the length of the potable water pipeline and alternatives (over 300 m) as well as the size of the proposed Water Treatment Works (WTW) (approx. 21 hectares), the proposed development triggers Section 38 of the National Heritage Resources Act, 1999 (Act No 25 of 1999) that states the following:

“(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length

(c) any development or other activity which will change the character of a site-

(i) exceeding 5 000 m² in extent; or

(ii) involving three or more existing erven or subdivisions thereof

must notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

The project may impact on graves, structures, archaeological and palaeontological resources that are protected in terms of sections 33, 34, 35, and 36 of the KwaZulu-Natal Heritage Act (No. 4 of 2008) as well as sections 34, 35, and 36 of the National Heritage Resources Act (NHRA). The sections of the KwaZulu-Natal Act are listed below:

Table 3: Potential heritage impacts

Section	Description	Relevance
Section 33(a) - 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	Several structures including churches that are over 60 years could be damaged by the potable water pipeline route options
Section 35 – Graves	No grave – (a) not otherwise protected by this Act; (b) 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 (2) The Council may only issue	The Stead family graves could be damaged by the pipeline link to WTW Option 3

	<p>written approval once the Council is satisfied that – (a) the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and (b) the applicant and the relevant communities or individuals have reached agreement regarding the grave.</p>	
<p>Section 36 – Archaeological & palaeontological sites</p>	<p>(1) No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without prior written approval of the Council having been obtained on written application to the Council.</p> <p>(2) Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay</p> <p>(4) No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without prior written approval of the Council having been obtained on written application to the Council.</p>	<p>The archaeological impact assessment and the palaeontological desktop assessment will indicate the presence or not of archaeological and fossil sites in the project area</p>

In terms of Section 3 of the National Heritage Act 25 of 1999, heritage resources are described as follows:

- (a) places, buildings, structures and equipment of cultural significance;
- (b) places to which oral traditions are attached or which are associated with living heritage;
- (c) historical settlements and townscapes;
- (d) landscapes and natural features of cultural significance;
- (e) geological sites of scientific or cultural importance;
- (f) archaeological and paleontological sites;
- (g) graves and burial grounds, including—
 - (i) ancestral graves;
 - (ii) royal graves and graves of traditional leaders;

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

Additionally, the requirements of the KwaZulu-Natal Heritage Regulations of 2012 (Provincial Notice No. 40, dated 2 April 2012) will be adhered to.

The Phase I HIA (cultural, archaeological and paleontological) was undertaken to assess the project components and alternatives in order to ascertain whether any heritage resources will be impacted by the proposed development.

3. LOCATION

The project area is situated in the southern part of KZN, in the uMgungundlovu District Municipality (DM). The western part of the project area falls within the Richmond Local Municipality (LM) and the eastern part in the Mkhambathini LM.

The majority of the project area for the Potable Water component is located on privately owned land which is predominantly used for commercial farming and forestry. In the north-eastern part the pipeline crosses the light industrial area of Umlaas Road. The study area includes cultivated farm lands, small holdings, peri-urban development, woodlots, and dense grasslands.

Figure 1 below shows both components of the project (the entire project) whilst Figure 2 shows only the Potable Water component and alternatives.

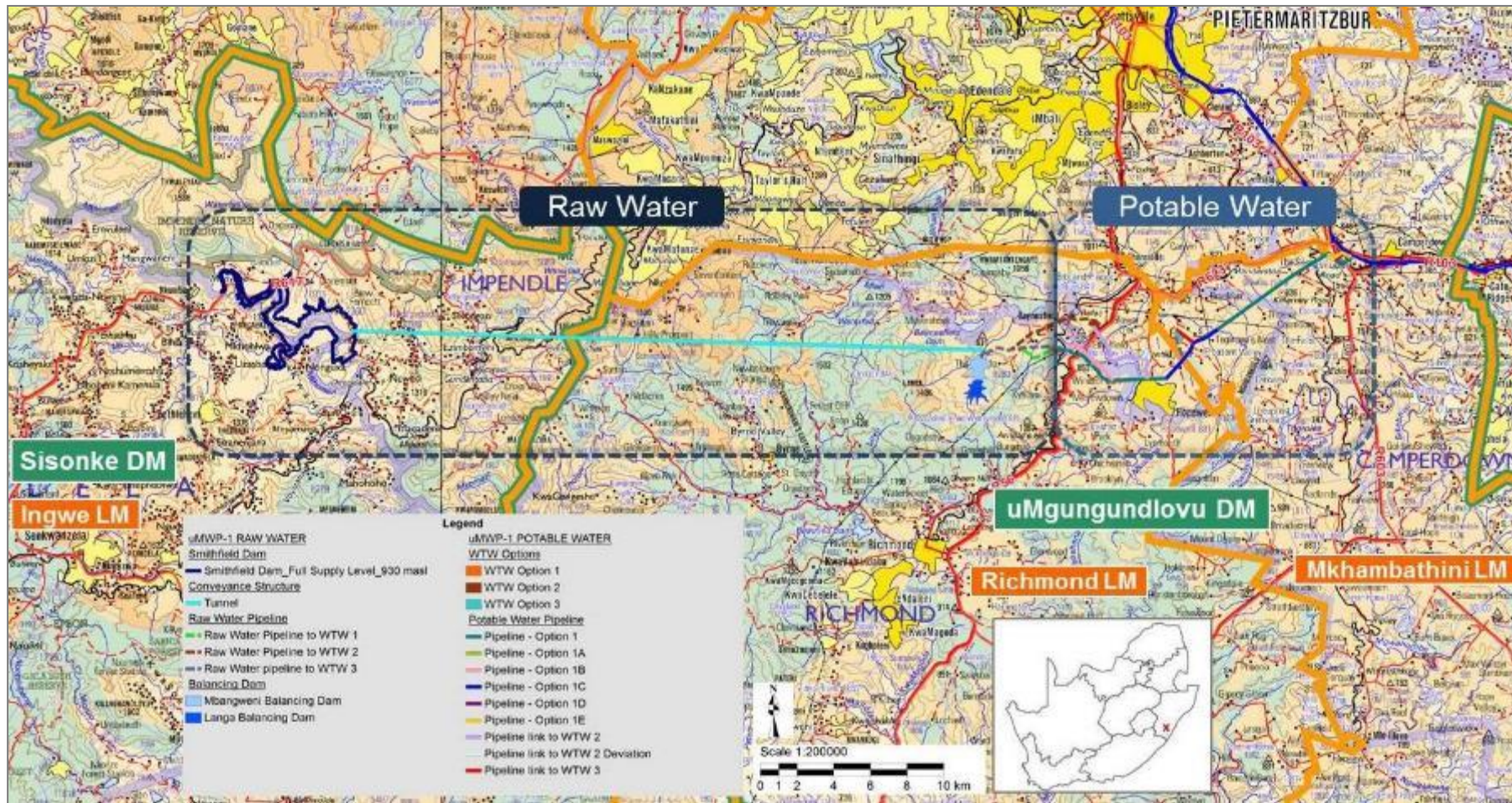


Figure 1: Overall map of all project components of uMWP-1 (not all sub-components are indicated)

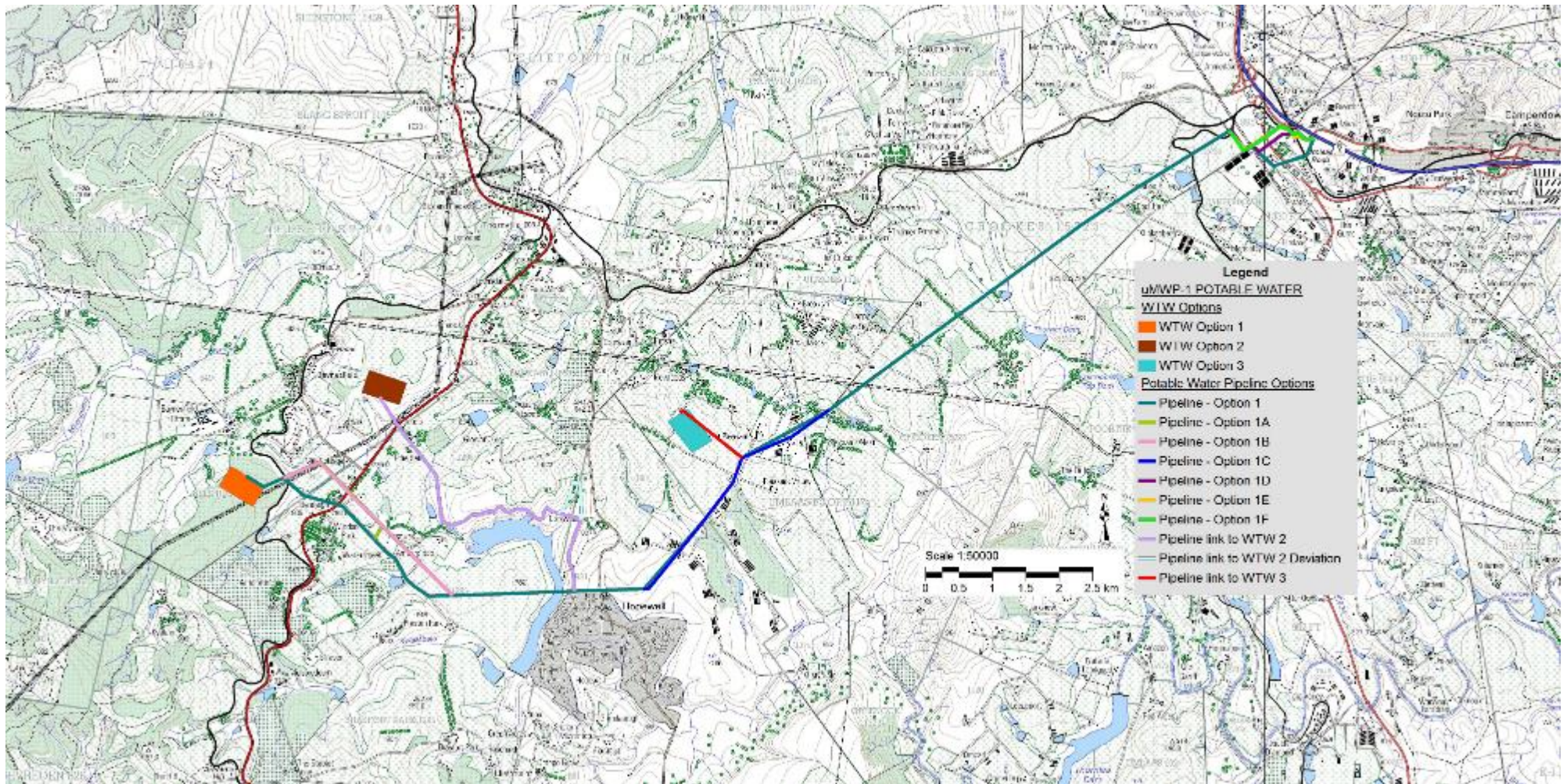


Figure 2: Map of Potable Water components and alternatives

4. TERMS OF REFERENCE (ToR)

- Undertake a Heritage Impact Assessment in accordance with the South African Heritage Resources Act (No. 25 of 1999).
- The identification and mapping of all heritage resources in the area affected, as defined in Section 2 of the National Heritage Resources Act, 1999, including archaeological and palaeontological sites on or close (within 100 m) of the proposed developments.
- Undertake a desktop palaeontological assessment.
- The assessment of the significance of such resources in terms of the heritage assessment criteria as set out in the regulations.
- An assessment of the impact of development on such heritage resources.
- An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development.
- The identification of heritage resources that will be adversely affected by the proposed development.
- Prepare a heritage sensitivity map (GIS-based), based on the findings of the study. Submit shapefiles (Hartebeetshoek 94) to Nema Consulting
- Identify heritage resources to be monitored.
- Comply with specific requirements and guidelines of Amafa aKwaZulu-Natali.
- Develop a Heritage Management Plan.

5. METHODOLOGY

A survey of literature, including Heritage/Archaeological Impact Assessments undertaken in the surrounding area, was undertaken in order to place the development area in an archaeological and historical context. . A desktop study was conducted of the archaeological databases housed in the KwaZulu-Natal Museum and the available heritage literature covering the greater Pietermaritzburg was consulted.

The published geological and palaeontological literature, unpublished records and databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

A site inspection was undertaken on 4th and 9th of May 2015 where the proposed location options for the WTWs and the various pipeline routes were visited where there was ready access.

Mr. C. Roseveare, on whose land WTW Option 3 is partially situated, kindly took the specialist to site and pointed out the Stead family church and graveyard.

The staff of Baynesfield Estate directed the specialist to the locations of WTW Options 1 and 2 as well as the proposed Balancing Dams (Mbangweni Dam and Langa Balancing Dam) for the Raw Water Component of the project.

6. ASSUMPTIONS, GAPS IN KNOWLEDGE, UNCERTAINTIES

The entire length of the proposed pipeline and deviations were not inspected as much of the pipeline runs through private property. Heritage resources along the sections of pipeline not inspected could be found during the construction phase; however, due to the highly disturbed nature of much of the alignment of the pipeline that runs through intensively farmed vegetable and sugar cane farming and forestry, it is not expected that intact and significant heritage sites will be found.

Visibility was compromised by dense vegetation and well established woodlot plantations in portions the study area.

7. HISTORICAL BACKGROUND OF THE STUDY AREA

7.1 Archaeological

The greater Pietermaritzburg and Camperdown areas are relatively well covered by archaeological surveys conducted by members of the KwaZulu-Natal Museum. The available evidence, as captured in the Museum heritage site inventories, indicates that the greater Pietermaritzburg area contains mostly Early, Middle, and Later Stone Age material. Most of these sites are situated close to water, such as the Mngeni River, Msunduze River, Slangspruit, Foxhill Spruit, and Mkhondeni, as well as in open air context or adjacent to exposed dongas or road cuttings.

These tools were most probably made by early hominins such as *Homo erectus* or *Homo ergaster*. Based on typological criteria they most probably date back to between 300 000 and 1.7 million years ago. The presence of the first anatomically modern people (i.e. *Homo sapiens sapiens*) in the area is indicated by the presence of a few Middle Stone Age blades and flakes. These most probably dates back to between 40 000 and 200 000 years ago. The later Stone Age flakes identified in the area are associated with the San (Bushmen) and their direct ancestors. These most probably dates back to between 200 and 20 000 years ago.

Most of the Early and Middle Stone Age sites were identified by the late Dr Olivier Davies in the 1950's and 1960's. The majority of Later Stone Age sites were located by Dr Farden in the 1960s and 1970's although some has also been identified by Dr Aron Mazel in the 1980's. Later Stone Age Rock Art sites have been reported from the greater Camperdown area as well as from Richmond to the immediate south of the project area. However, none of these occur near the footprint of the project.

The San were the owners of the land for almost 30 000 years but the local demography started to change soon after 2000 years ago when the first Bantu-speaking farmers crossed the Limpopo River and arrived in South Africa. By 1500 years ago these early Bantu-speaking farmers also settled adjacent to the Umngeni River in the greater Camperdown area.

Due to the fact that these first farmers introduced metal technology to southern Africa they are designated as the Early Iron Age in archaeological literature. Their distinct ceramic pottery is classified to styles known as "Msuluzi" (AD 500-700), Ndongondwane (AD 700-800) and Ntshokane (AD 800-900). Most of the Early Iron Age sites in the greater Pietermaritzburg area belong to these traditions (Maggs 1989:31; Huffman 2007:325-462). These sites characteristically occur on alluvial or colluvial soil adjacent to large rivers below the 1000m contour. The Early Iron Age farmers originally came from western Africa and brought with them an elaborate initiation complex and a value system centred on the central significance of cattle.

Early as well as Later Iron Age sites have been located in the 1970's and 1980's and more recent discoveries have also been made. The Early Iron Age sites typically occur on the alluvial and colluvial soils in the large river valleys below 700m above sea level. Some have been located along the Msunduzi River, the Ashburton area, and near Camperdown along the Umngeni River.

Later Iron Age sites occur in similar contexts as well as on ridges or plateaus in the existing grassland. Some impressive Later Iron Age sites occur in the Umngeni River Valley close to Howick as well as in the Ottos Bluff area near Albert Falls Dam.

These sites occupied by Bantu-speaking agropastoralists who arrived in southern Africa after 1000 year ago via East Africa. Later Iron Age communities in KwaZulu-Natal were the direct ancestors of the Zulu people (Huffman 2007). The larger Umngeni Valley in the vicinity of Camperdown area was inhabited by various Nguni-speaking groups such as the Dlanyawo, Nyavu and Njilo, in the beginning of the 19th century (Bryant 1965; Wright 1988). With the exception of the Nyavu who remained fiercely independent most of these communities were incorporated into the Zulu Kingdom of Shaka in the 1820's. After the Anglo-Zulu war of 1879 and the Bambatha Rebellion of 1906 almost all the African people in the study area adopted a Zulu ethnic identity.

7.2 Historical

The Port of Natal was established in 1824 under the leadership of Francis Farewell and Henry Francis Fynn. After 1832, other traders from the Eastern Cape joined the settlement and in 1837 Trekkers from the Cape Colony moved into the Colony. After the death of Piet Retief at Dingane's hand, the Trekkers acted against the Zulu State leading to the establishment of the Republic of Natalia in 1839. However, this state of affairs was not acceptable to the British who then annexed Natal in 1844 (Ballard 1989: 117-122).

According to Ballard (1989: 126), the event that resulted in profound changes in the fledgling Colony was the immigration of white settlers mainly from the British Isles. Between May 1849 and February 1852, nearly 5 000 immigrants arrived in Natal.

A section of the tunnel that forms part of the uMWP Raw Water component crosses an area called Byrne Valley. One of the immigration schemes for white settlers as mentioned above was Joseph Byrne's Emigration and Colonisation Company and most of the Byrne settlers were located near Richmond in Byrne Valley.

Although the hopes of those who had been taken in by the promises of the various settlement companies were seldom realised (the offered land being too small and unsuitable to farm), many of the settlers flourished. Abandoning attempts to make ends meet on the land, they turned to trade and the whole of the Natal-Zululand region rapidly became covered by a

commercial network. By 1855, the establishment of the towns of Richmond, York and Greytown in the Midlands bore witness to the growing economic activity (Ballard: 128-129).

The proposed balancing dam and two of the three potential locations for the Water Treatment Works for the uMWP are found on Baynesfield Estate. According to the website of the Baynesfield Estate (n.d: 1 of 2), Joseph Baynes with his father decided to join the Byrne settlers in 1850 to come to the Colony of Natal. As a result of extensive travelling, Joseph Baynes found the Umlaas valley and he started to buy up land in the valley. Baynes House was built in 1882 as a typical example of a Victorian home. The house, which is a declared heritage site still stands on the Baynesfield Estate together with several associated buildings.

On Baynesfield Estate, Baynes farmed beef and dairy cattle, sheep, horses and pigs. According to the website (n.d: 1 of 2), Baynes started the bacon industry in the Colony of Natal with a bacon factory on the Estate.

After experimenting with various crops, he concentrated on ranching and dairying. He was responsible for popularising Friesland cattle in Natal and he imported pedigree stock from across the world in an effort to enhance the export quality of local beef and to develop a major diary industry (Guest 1989: 317).

He was also the first man to dip cattle and became known as the 'Conqueror of the Tick'. The dip tank is a declared heritage site. Baynes served as Minister of Lands and Works in the Colonial Government and died on 16 July 1925 (n.d: 2 of 2).

Baynesfield Estate is currently used for a number of agricultural activities including forestry, growing of avocados and maize, a meat processing factory and piggeries.

One of the townships close to the project Thornville was an important rail staging post. A township was planned in the 1850's by John Morland, however the plans never came to fruition and in 1913 only had the railway station, a hotel, bacon and ham factory and a few small residences. Today, there is not much more, particularly since the role of the railways has diminished (2015: Online).

The first 'shots' of the Bambata Rebellion took place on the farm Trewergie (now called Driefontein) near present day Baynesfield Estate. The Bambata Rebellion resulted because of discontent amongst blacks in Natal due to the imposition of the poll-tax on all citizens of the

Colony. The burden on black residents was more than other races as they were already pay a hut tax (Gillings 1989: 2 of 18).

The first indication of trouble came on 17 January 1906 when Henry Smith, an Umlaas Road farmer was stabbed to death by an employee who admitted at this trial that he resented paying the poll tax and had killed Smith for this reason. On 7 February 1906, the Umgeni Divisional Magistrate was threatened whilst collecting taxes at Henley. The following day, several policemen went to the farm Trewergie to arrest the culprits who had threatened the Magistrate. When they went to the kraal to arrest Mjolo, one of the ringleaders, the police were surrounded and two policemen killed. The next day the Governor of Natal, Sir Henry McCallum proclaimed martial law and various regiments were mobilised (Gillings: 3 of 18).

Two people who took part in the killing of the policemen on Trewergie were arrested on the farm, court martialled and executed. Some days later, 24 more men were arrested, tried and 12 were sentenced to death. On 2 April 1906, the sentence was carried out in a valley on the outskirts of Richmond and the men were buried where they were shot (Gillings: 3 of 18).

After this the rebellion moved north to Bambata, who was a relatively minor chief of the amaZondi who occupied areas in Mvoti, Hanover and Umgeni. When the time came for the amaZondi to pay their taxes, some of the indunas refused to pay and when summoned by the Magistrate, Bambata refused to attend and crossed the Tugela River when police were sent to arrest him. He consulted with King Dinizulu, who allegedly gave tacit support to Bambatha who launched a series of attacks on the forces of the Colonial Government using the Nkandla forest as a base. After many skirmishes, Bambatha was allegedly finally killed at Mome Gorge which is situated north east of Kranskop in June 1906 (Gillings: 3-17 of 18).

8. RESULTS AND DISCUSSION

8.1 Archaeological

Although various archaeological sites occur in the greater Pietermaritzburg and Camperdown areas none were located on the footprint of the area in which the Potable Water component will be located.

8.2 Historical

8.2.1 Water Treatment Works

The proposed potable water treatment plant, namely the uMkhomazi WTW, has been proposed as part of the uMWP-1 to allow for the purification of water that has been transferred via the raw water infrastructure from the uMkhomazi River. The proposed WTW sites had to be located within a specific elevation range in order to meet the requirements for gravity flow.

WTW Option 1:

The proposed site is situated on Baynesfield Estate in a plantation of trees that Baynesfield Estate leases to NCT Forestry Co-operative. The site is situated directly south of the Baynesfield Estate Museum and administration buildings.

The area is highly disturbed by forestry activities including access roads, felling of trees, ploughing of fire-breaks, etc.), therefore the possibility of finding intact significant heritage resources is regarded as very low.



Figure 3: View of plantation where location of WTW Option 1 is proposed

The proposed site of the WTW is situated approximately 850 m south-west of the Joseph Baynes mausoleum which should not be impacted by the proposed project.



Figure 4: Joseph Baynes mausoleum

WTW Option 2

The proposed location for this WTW's is situated on Portion 85 of the farm Nels Rust 849 which forms part of the Baynesfield Estate. Part of the site falls on an area that is used for the growing of maize and sugar cane and a section of the proposed site that is situated closer to the R56 Thornville road falls on undisturbed land.

Although no visible heritage resources were noted during the site visit, the undisturbed nature of sections of the site could result that heritage resources that can be found beneath the ground (archaeological remains, etc.) could be found and damaged or destroyed during construction activities.



Figure 5: Panoramic view of WTW Option 2 with R56 road in foreground

WTW Option 3

The Stead family Church and cemetery were noted during the site inspection of the proposed location of WTW Option 3. Many of the graves are from the 19th Century and the church is older than 60 years. The farm, New Leeds, used to belong to the Stead family. The farm was settled by Mathew and Mary Stead who came with the Byrne Settlers in 1850, but after 5 years moved on to New Leeds from Byrne. The church and graveyard is testimony to the family and following generations including Thomas and Susan who came out in 1861, together with his father, Benjamin and brother Samuel. Other graves in the cemetery include the Thompson's, Cunningham's, Grist Douglas and Pellews

The approximate centre of the cemetery is situated at 29°46'10.71" S: 30°25'10.77" E. The church is situated at 29°46'09.40" S: 30°25'09.30" E. The proposed pipeline link to WTW Option 3 is situated approximately 30m west of the cemetery and church and Pipeline Option 1 is situated approximately 12m south east of the cemetery. The cemetery is overgrown with vegetation.



Figure 6: Grave and headstone of Mary Milne Stead



Figure 7: Grave and headstone of Eleanor Pellen



Figure 8: Stead family church

There is a possibility that the graves and church may be damaged by the construction of the pipeline link to the WTW's therefore it is recommended that a buffer of at least 30 m is placed around the site so that there is no movement or passage of people and vehicles between the church and cemetery and that construction activities are situated a suitable distance away from the area.



Figure 9: View of proposed location of WTW option 3

The location of WTW Option 3 is in an area that is used to grow sugar cane therefore the possibility of finding intact and significant heritage resources is deemed to be low.

8.2.2 *Potable water pipeline options and alternatives*

The gravity pipeline system will transport potable water from the WTW to the Western Aqueduct, which in turn will convey the water to parts of the integrated Mgeni WSS as well as the eThekweni Municipality downstream of the Umlaas Road Reservoir. All the pipelines referred to will be installed below-ground, apart from the section that crosses Mapstone Dam. A 15 m wide permanent servitude will be required together with a further 45 m wide temporary construction servitude. Sections of the different potable water pipeline options were inspected that were accessible.

Option 1:

This option covers a distance of approximately 22 km. Of the 22 km, approximately 2.6 km crosses areas that are undisturbed. The majority of the option crosses areas that are highly disturbed through the cultivation of various crops (sugar cane, maize, and vegetables), battery chicken farms and roads.

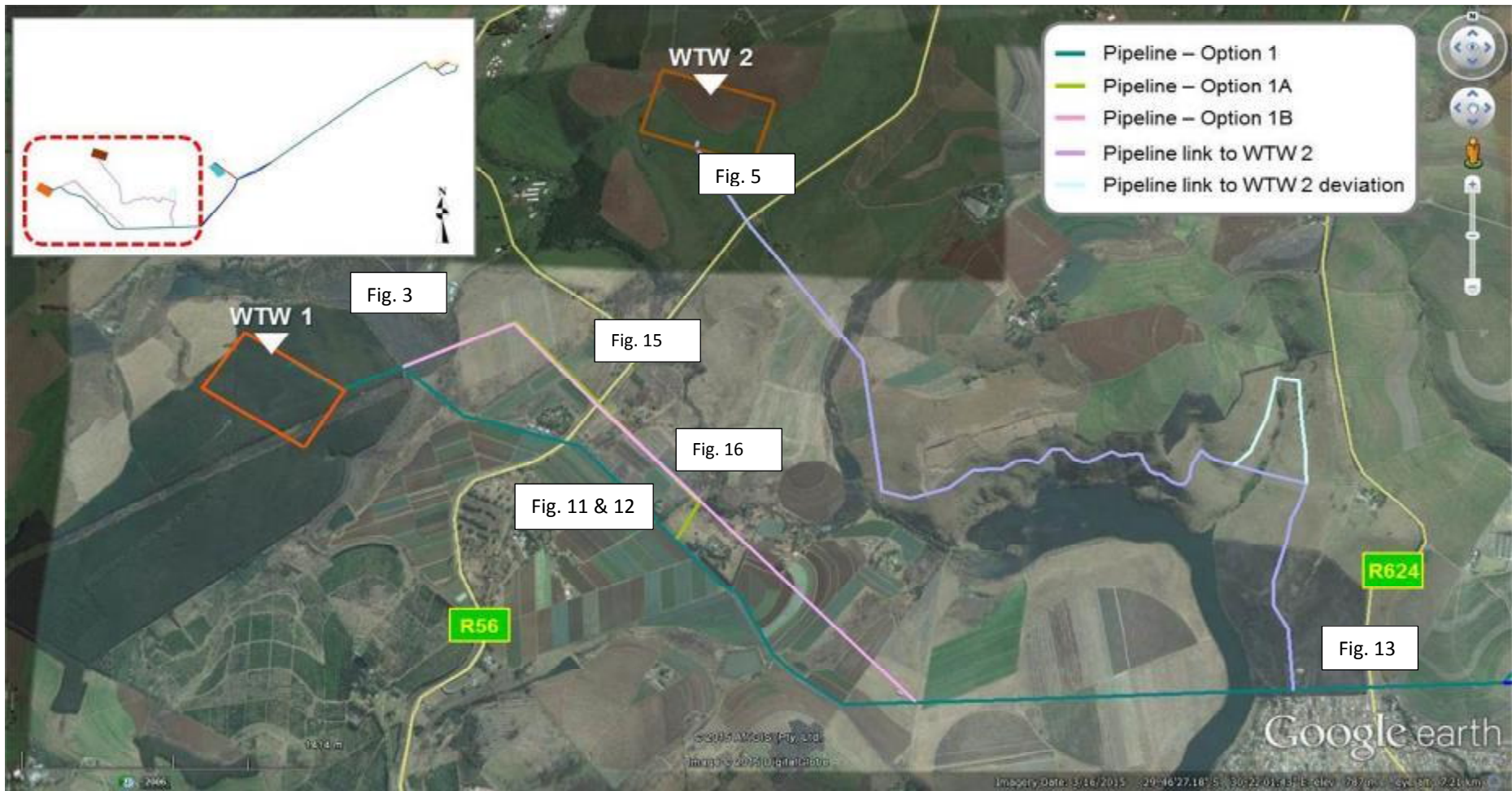


Figure 10: Western section of project area



Figure 11: Section of Route Option 1 located next to D360 road looking towards WTW



Figure 12: Section of Route Option 1 next to D360 road looking in a south easterly direction



Figure 13: Area immediately north of Hopewell where pipeline will be located

At the Hopewell Rainbow chicken farm through which the pipeline could run, the specialist spoke to Marcus (infrastructure manager) by telephone who informed the specialist that the chicken houses had been built between 1960 and 1965. He was aware of the project and thought that one of the chicken houses could be impacted by the pipeline route. The area is highly disturbed and no heritage resources were found.



Figure 14: View of Hopewell Rainbow chicken farm with pipeline position indicated

Where the route option passes the pipeline link to WTW 3, the pipeline is situated approximately 12m south east of the cemetery. It is recommended that the pipeline is moved a substantial distance from the cemetery and church complex. See Fig. 24 below that indicates the close proximity of the pipeline to the cemetery.

Option 1A

Pipeline route Option 1A splits from the route Option 1 on the Farm Nels Rust 849 to continue in a north-eastern direction alongside a power line servitude. It then turns south-easterly to cross over cultivated land and fallow land.

Just before crossing the R56, it is situated about 170 m south west of St. Johns Church (Baynesfield Methodist Church) and graveyard. The church and some of the graves in the cemetery are over 60 years and the church and cemetery are of heritage significance. The church and cemetery are situated at 29°46'22.06" S: 30°21'35.10" E.

After crossing the R56, the route crosses through vacant land parallel to the D360 (approximately 200m to the northeast), before turning south-west to meet with the Option 1 pipeline route alongside the D360.



Figure 15: St Johns Church (Baynesfield Methodist Church) and graves

Option 1B

This option follows the same route as Option1A but carries on running parallel to the Option 1 and the D360 road for a further 1.4 km before joining Option 1 as this Route Option turns to the

north east. No heritage resources were found but it should be noted that the undisturbed areas were densely vegetated which limited visibility.



Figure 16: Area through which Route Options 1A and 1B cross

Option 1C

Route Option 1C is a refinement of the pipeline Route Option 1 to minimise the impacts to existing chicken houses on Portion 43 of the Farm Hopewell 881 and Portion 20 of the Farm Umlaas Poort 1174 (see Fig. 14 above and Figs. 17 and 18 below). Both deviations cross areas that are impacted by previous and current sugar cane and chicken farming and the possibility of finding intact heritage resources along the routes is low.

However, it is recommended that the deviation on the Farm Hopewell (Fig. 17) is used to avoid impacting on the chicken houses.



Figure 17: Google Earth image of Route Option 1C indicated in orange



Figure 18: Google Earth image of Option 1C indicated in orange (Farm Umlaas Poort)

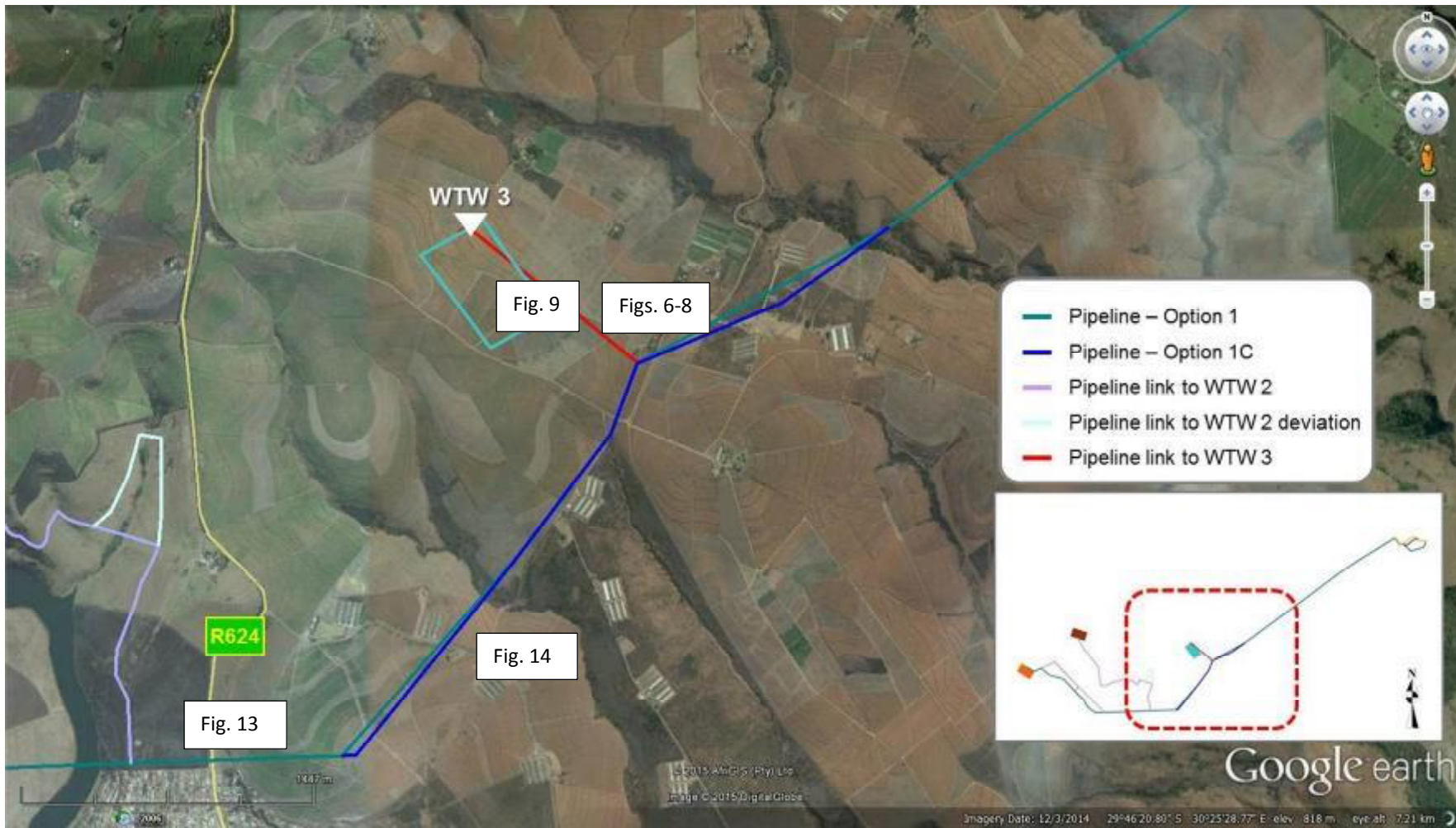


Figure 19: Central section of project area

Route 1D

This route occurs towards the end of the project at Umlaas Road where this Route Option deviates from the Option 1 alignment to minimise the impacts to existing chicken houses on Portion 0 of the Farm 30, as well as to avoid disruptions to traffic on the D125 road. The area is relatively undisturbed but no heritage resources were identified.



Figure 20: North easterly view along Route Option 1D with R603 in foreground

Route 1E

This option initially follows alignment Option 1D, but then deviates from this route to avoid impacts to Erven 34, 35 and 2-28 Umlaas Road which are earmarked to be developed for mini-factories and/or warehouses. It then links up again with route Option 1D after these properties.

Route 1F

This option closely follows the route alignment of Option 1E with very little difference apart from a slight deviation close to the N3. As with Option 1E, this route avoids impacts to Erven 34, 35 and 2-28 Umlaas Road which are earmarked to be developed for mini-factories and/or warehouses.



Figure 21: Google Earth image of Options 1D and 1E (orange and turquoise lines) at Umlaas Road

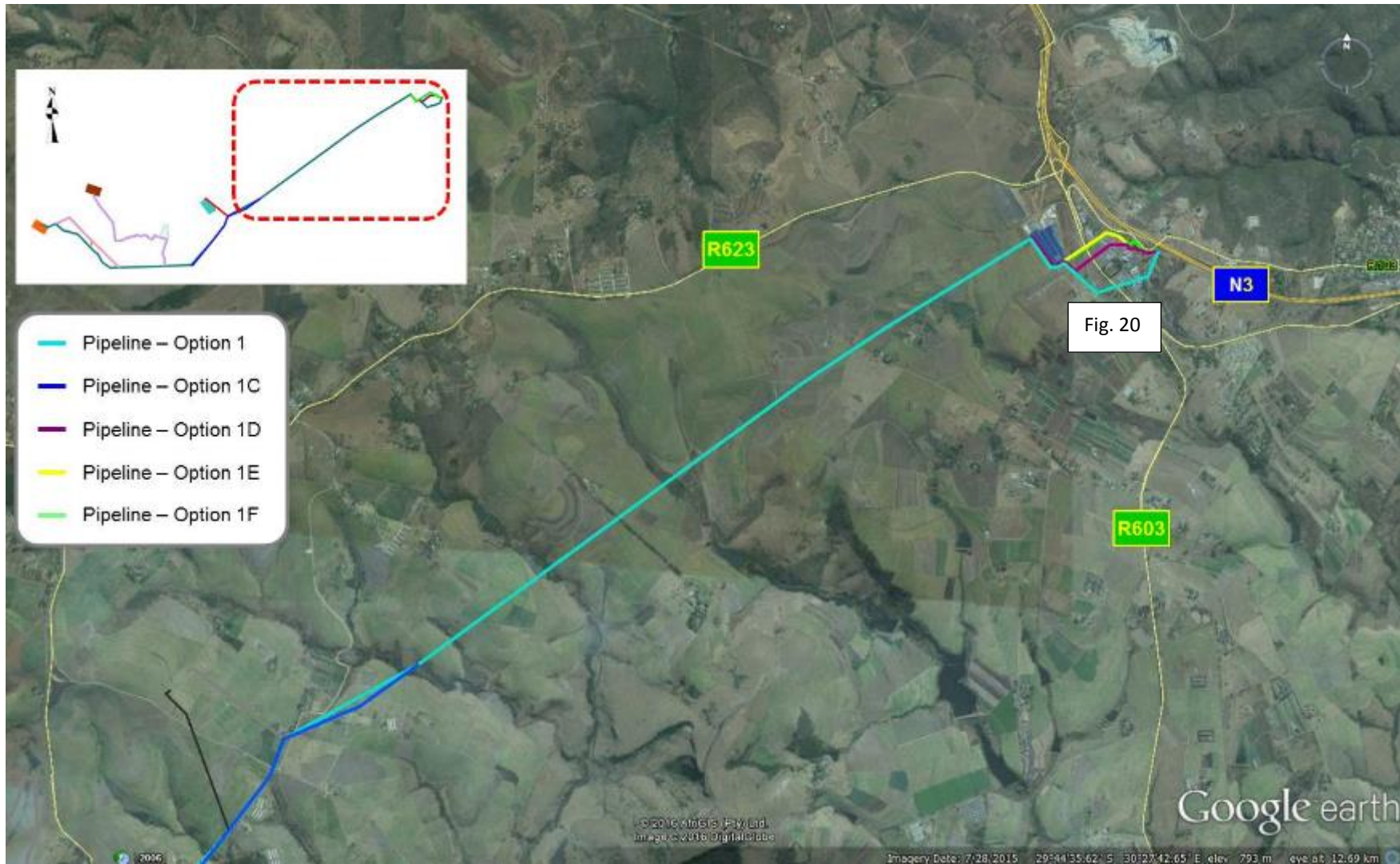


Figure 22: Eastern section of project area

Pipeline link to WTW 2

From the WTW 2, the pipeline travels in a south-eastern direction over vacant land and crosses a power line servitude, watercourse and the R56 (Fig. 5). It then continues over vacant land passing within 50 m of an old building/structure that appears to be no longer used but is over 60 years and is therefore protected by section 34 of the NHRA. The position of the structure is: 29°46'00.98"S 30°22'06.13E.

The route crosses cultivated land and another watercourse. The route then travels in a predominantly eastern direction around the northern circumference of Mapstone Dam and then continues to the east of the dam until it connects to Route Option 1. The area around the dam is in pristine condition with a possibility of cultural heritage resources been found during the construction of the pipeline.



Figure 23: Structure situated south-west of pipeline link WTW2

Pipeline Link to WTW 2 Deviation

The deviation to the pipeline link to the WTW Option 2 site makes provision for crossing the watercourse that flows into the Mapstone Dam in an area where the gradient is less steep. This area is undisturbed and care should be taken if this option is selected as there is a possibility of finding heritage resources in this area.

Pipeline Link to WTW 3

The pipeline link to the WTW 3 travels from the plant in a south-eastern direction through a sugarcane plantation (see Figure 9) until it connects with the Route Option 1.

Conventional steel pipe bridge:

The second option is to construct a steel pipe bridge. The bridge will be supported on concrete piers that sit within the dam basin. The concrete piers in turn may require a piled foundation. Piling and the construction of concrete piers will have to take place under submerged conditions.

Pipe supported on concrete piers:

A third option is to construct the pipeline on concrete piers. The pipeline will be supported on concrete piers and will span the distance between each pier. It has been calculated that piers will be required every 20 metres. Each pier may require a piled foundation.

Pipe buried in Dam basin

The fourth option proposed is to lay the pipe on the floor of the dam basin. One way would be to drain the dam and lay the pipe in a conventional manner in a trench dug through the dam basin. The trench would be relatively shallow and would be backfilled with concrete instead of soil in order to protect the pipe coating and to secure the pipe.

The other method is to construct the pipeline on the surface of the dam by allowing it to float on the dam surface during the welding process. Once welding is completed, the pipe will be filled with water which will cause it to sink onto concrete cradles prepared for seating the pipeline. Precast concrete cradle 'caps' could then be lowered into position to secure the pipe in position and prevent movement.

The western side of the dam is cultivated whereas the eastern side is undeveloped but close to Hopewell township. Construction on the eastern side of the dam could lead to the unearthing of unidentified heritage sites therefore the dam crossing structures that have limited impact on the banks of the dam are the preferred option.

8.3 Palaeontological

The project area lies in eastern margin of the Karoo Basin, in the Pietermaritzburg Formation and Dwyka Subgroup in particular, which are of early Permian Ecca age and Late Carboniferous respectively. These sediments are known to include fossil plants associated with the coal flora. The distribution, however, is patchy. Plants of this age include Glossopteris leaves, cordaitalean leaves, ginkgophytes, ferns, sphenophytes, lycopods.

According to the palaeo-sensitivity map produced by SAHRIS the area falls in the green area which means that there is a moderate risk of fossils occurring there and a desktop study is required. There are no records of fossils from this region on the ESI database or published (Anderson and Anderson, 1985; Plumstead, 1969).

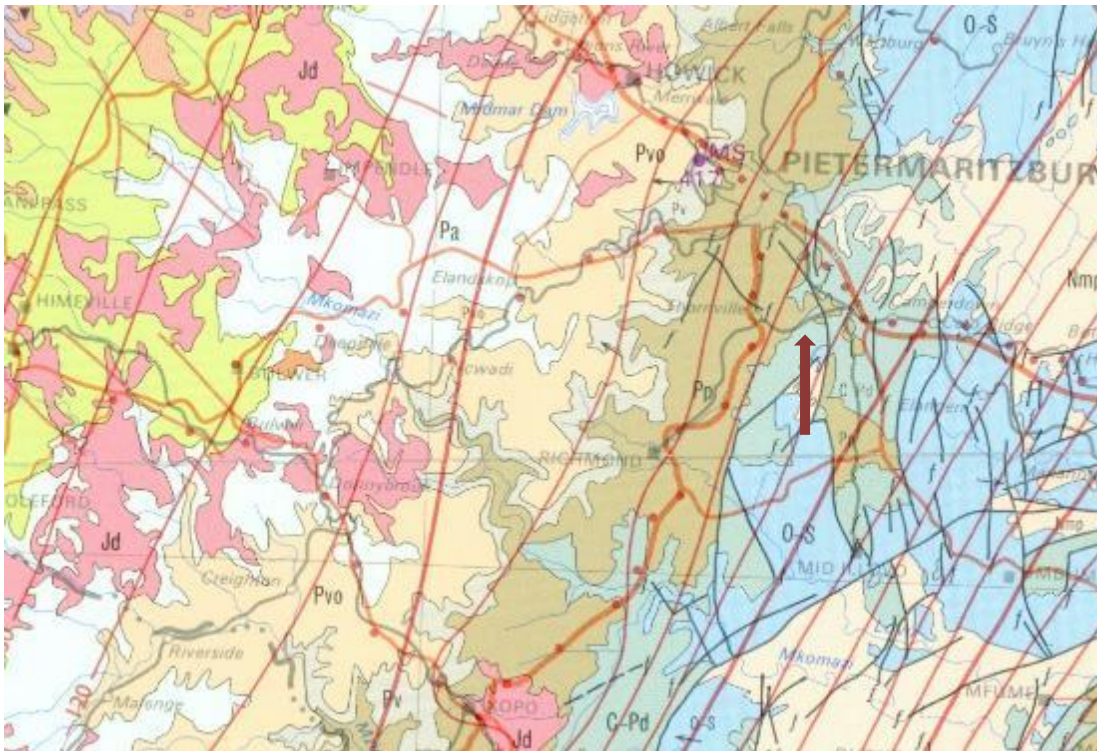


Figure 25: Geological map of area between Baynesfield & Camperdown in the general project area

Table 4: Explanation of symbols

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Last ca 20 Ma
O-S	Natal	Quartzitic sandstone, arkose, shale	Ordovician, Silurian
Jd	Jurassic dykes	Intrusive dolerite	Jurassic ca. 180 Ma
Pvo	Volksrust	Shale	Permian 300-250 Ma
Pa	Adelaide & Estcourt	Mudstone, sandstone	Permian 300-250 Ma
Pp	Pietermaritzburg	Shale	Permian 300-250 Ma
C-Pd	Dwyka	Tillite, sandstone, mudstone, shale	Carboniferous-Permian

No further palaeontological impact assessment is required for the potable water component because there are no records of fossils from the area. If, however, fossil plants are discovered during any excavations, a professional palaeontologist must be called to rescue them (after obtaining the appropriate AMAFA permit).

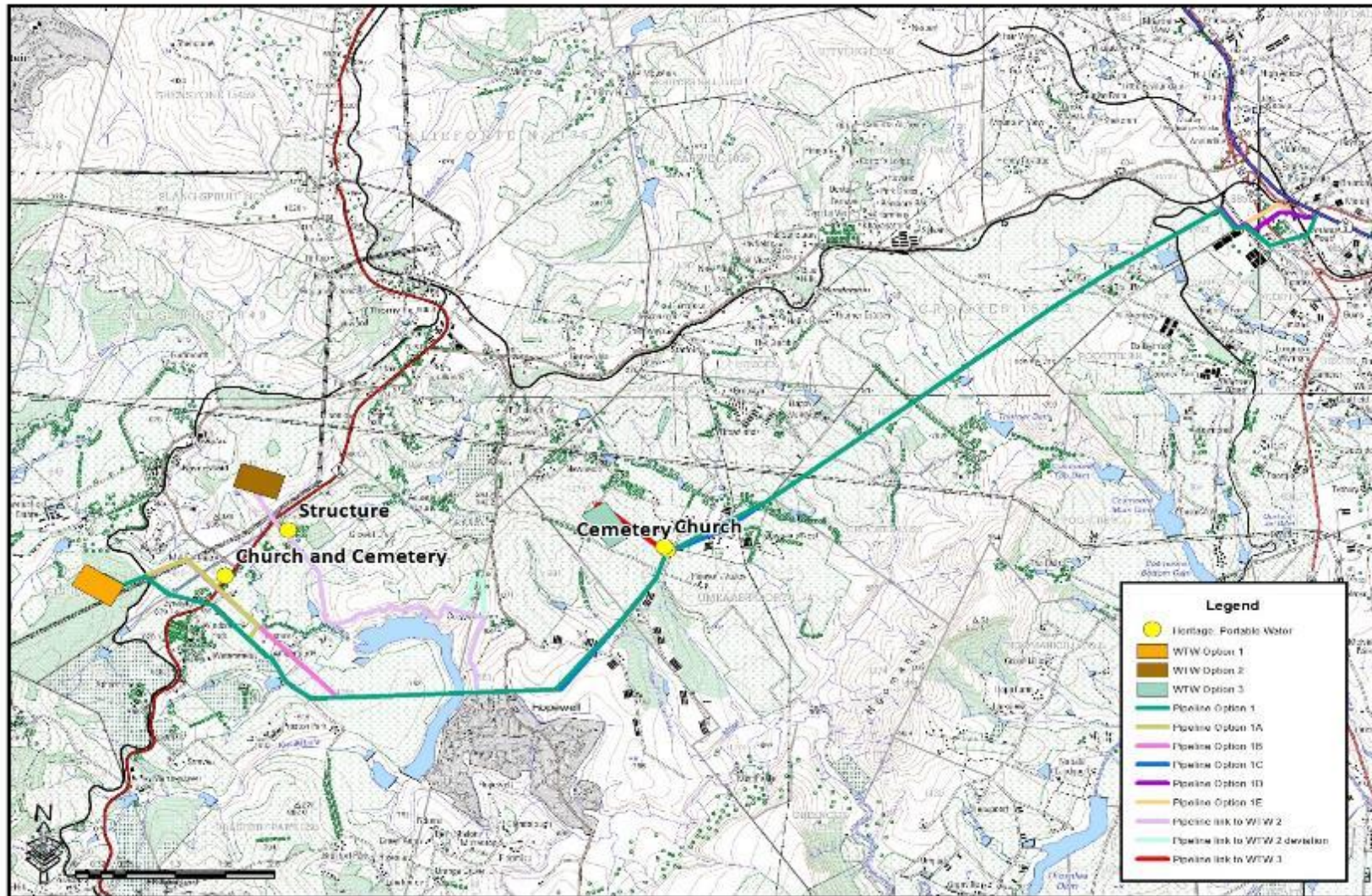


Figure 26: Heritage sensitivity map

9. IMPACT ASSESSMENT METHODOLOGY

The EIA quantitative impact assessment will focus on the direct and indirect impacts to heritage resources associated with the project. All impacts have been analysed with regard to their nature, extent, magnitude, duration, probability and significance as described below:

Nature (/Status)

The project could have a positive, negative or neutral impact on the environment.

Extent

- Local - extend to the site and its immediate surroundings.
- Regional - impact on the region but within the province.
- National - impact on an interprovincial scale.
- International - impact outside of South Africa.

Magnitude

Degree to which impact may cause irreplaceable loss of resources.

- Low - natural and social functions and processes are not affected or minimally affected.
- Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term - 0-5 years.
- Medium term - 5-11 years.
- Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

- Almost certain - the event is expected to occur in most circumstances.
- Likely - the event will probably occur in most circumstances.
- Moderate - the event should occur at some time.
- Unlikely - the event could occur at some time.
- Rare/Remote - the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance and degree to which it can be mitigated.

- 0 – Impact will not affect the environment. No mitigation necessary.
- 1 – No impact after mitigation.
- 2 – Residual impact after mitigation.
- 3 – Impact cannot be mitigated.

Table 5: Impact Assessment: Water Treatment Works

Environmental Feature		Cultural heritage	
Relevant Alternatives & Activities		Water Treatment Works	
Project life-cycle		Construction & operational phases	
Potential Impact		Proposed Management Objectives / Mitigation Measures	
<ul style="list-style-type: none"> • Destruction or damage to cultural heritage sites including graves, buildings older than 60 years, etc. • Damage/destruction of Stead family church and cemetery near WTW 3 	<p>1. During construction, if any heritage resources are found (chance finds) the following protocol must be followed:</p> <ul style="list-style-type: none"> a All work must stop in the vicinity of the find b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage c Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. d Depending of what is found and the significance thereof, the specialist will advise on the way forward. e If the resource needs to be removed/altered/destroyed then the necessary permit/s must be obtained from Amafa f Only once the specialist gives the go-ahead can work commence in the area g Under no circumstance can heritage material be destroyed or removed from the site h Should any remains be found that could potentially be human remains then the SAPS must be contacted 		
	<p>2. The Stead family cemetery and church must have a 30 m buffer around it to avoid any impacts by the construction of the pipelines</p> <p>3. All buffer areas must be respected especially in terms of the pipeline link to WTW Option 3 which could impact on a cemetery and church that are significant heritage sites protected in terms of the NHRA and KwaZulu-Natal Heritage Act.</p> <p>4. Buffer areas must be barricaded off with highly visible danger tape or other method so that the buffer area is clearly visible to all construction personnel</p> <p>5. Permanent fencing around the Stead family church and cemetery must be considered by the Applicant in order that operational activities such as maintenance and repair of the WTW and pipeline do not impact on the heritage resources</p>		

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	- negative	Local	Medium	Short-term	Likely	3
After mitigation	-	Local	Low	Short-term	Unlikely	1

Table 6: Impact Assessment: Potable Water Pipeline Options: Option 1

Environmental Feature	Cultural heritage	
Relevant Alternatives & Activities	Potable Water Pipeline Route Options and Alternatives: Option 1	
Project life-cycle	Construction & operational phases	
Potential Impact	Proposed Management Objectives / Mitigation Measures	
<ul style="list-style-type: none"> • Destruction or damage to cultural heritage sites including graves, buildings older than 60 years, etc. 	1. During construction, if any heritage resources are found the following protocol must be followed:	
		<ul style="list-style-type: none"> a All work must stop in the vicinity of the find b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage c Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. d Depending of what is found and the significance thereof, the specialist will advise on the way forward. e If the resource needs to be removed/altered/destroyed then the necessary permit/s must be obtained from Amafa prior to the action decided upon. f Only once the specialist gives the go-ahead can work commence in the area g Under no circumstance can heritage material be destroyed or removed from the site h If remains are found that could potentially be human remains, then the SAPS must be informed
<ul style="list-style-type: none"> • Damage or destruction of Stead family cemetery 	<ol style="list-style-type: none"> 1. It is recommended that pipeline Option 1 be moved further away (south-eastwards) from the Stead family cemetery to avoid impacting on the graves that are of heritage significance and protected by section 36 of the NHRA. 2. It is not recommended that application is made to remove the graves as the graves and church are closely linked. 3. A proposed buffer area of 30m around the cemetery and church must be implemented. The 30 m buffer area must be barricaded off with highly visible danger tape or barricading so that the buffer area is clearly visible to all construction personnel 4. Permanent fencing around the Stead family church and cemetery must be considered by the Applicant in order to ensure that operational activities such as maintenance and repair of the pipeline do not impact on the heritage resources 	

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	-	Local	Medium	Short-term	Likely	3
After mitigation	-	Local	Low	Short-term	Unlikely	1

Table 7: Impact Assessment: Potable Water Pipeline Options: Options 1A, 1B, 1C, 1D, 1E and 1F

Environmental Feature	Cultural heritage
Relevant Alternatives & Activities	Potable Water Pipeline Route Options and Alternatives: Option 1A; Option 1B, Option 1C, Option 1D, Option 1E and Option 1F
Project life-cycle	Construction & operational phases
Potential Impact	Proposed Management Objectives / Mitigation Measures
<ul style="list-style-type: none"> • Destruction or damage to cultural heritage sites including graves, buildings older than 60 years, etc. • Damage to St. Johns Church and cemetery (Methodist Church of Baynesfield) 	<p>1. During construction, if any heritage resources are found the following protocol must be followed:</p> <ul style="list-style-type: none"> a All work must stop in the vicinity of the find b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage c Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. d Depending of what is found and the significance thereof, the specialist will advise on the way forward. e If the resource needs to be removed/altered/destroyed, then the necessary permit/s must be obtained from Amafa f Only once the specialist gives the go-ahead can work commence in the area g Under no circumstance can heritage material be destroyed or removed from the site h If remains are found that could potentially be human remains, then the SAPS must be informed <p>2. The construction of either Option 1A or Option 1B must not impact on the church and cemetery which are significant heritage sites that are protected by the NHRA.</p> <p>3. A proposed buffer area of 15 m around the church grounds must be implemented. The 15 m buffer must be barricaded off with highly visible danger tape or other method so that the buffer area is clearly visible to all construction personnel</p>

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	-	Local	Low	Short-term	Unlikely	3
After mitigation	-	Local	Low	Short-term	Remote	1

Table 8: Impact Assessment: Pipeline Link to WTW 2

Environmental Feature	Cultural heritage
Relevant Alternatives & Activities	Potable Water Pipeline Route Options and Alternatives: Pipeline link to WTW 2
Project life-cycle	Construction & operational phases
Potential Impact	Proposed Management Objectives / Mitigation Measures
<ul style="list-style-type: none"> • Destruction or damage to cultural heritage sites including graves, buildings older than 60 years, etc. • Damage or destruction of protected structure 	<ol style="list-style-type: none"> 1. If WTW 2 is chosen as the preferred site, once it is decided which of the alignments are to be used, a heritage specialist must be appointed to undertake a follow-up assessment of the alignment especially in the area immediately north of Mapstone dam and the watercourse to ensure that no heritage sites will be impacted by construction activities. 2. During construction, if any heritage resources are found the following protocol must be followed: <ol style="list-style-type: none"> a All work must stop in the vicinity of the find b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage c Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. d Depending of what is found and the significance thereof, the specialist will advise on the way forward. e If the resource needs to be removed/altered/destroyed, then the necessary permit/s must be obtained from Amafa prior to the action recommended f Only once the specialist gives the go-ahead can work commence in the area g Under no circumstance can heritage material be destroyed or removed from the site h If remains are found that could potentially be human remains, then the SAPS must be informed 3. The construction of the pipeline link must not damage the structure located at 29°46'00.98"S/ 30°22'06.13E. 4. It is recommended that if WTW 2 is selected, a 15m buffer be placed around the structure to avoid any construction activities impacting on the site. 5. The 15 m buffer must be barricaded off with highly visible danger tape or other method so that the buffer is clearly visible to all construction personnel

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	-	Local	Medium	Short-term	Unlikely	3
After mitigation	-	Local	Low	Short-term	Remote	1

Table 9: Impact Assessment: Pipeline Link to WTW 3

Environmental Feature		Cultural heritage	
Relevant Alternatives & Activities		Potable Water Pipeline Route Options and Alternatives: Pipeline link to WTW 3	
Project life-cycle		Construction & operational phases	
Potential Impact		Proposed Management Objectives / Mitigation Measures	
<ul style="list-style-type: none"> • Destruction or damage to cultural heritage sites including graves, buildings older than 60 years, etc. • Damage or destruction of Stead family church and cemetery 	1. During construction, if any heritage resources are found the following protocol must be followed:		
	<ul style="list-style-type: none"> a All work must stop in the vicinity of the find b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage c Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. d Depending of what is found and the significance thereof, the specialist will advise on the way forward. e If the resource needs to be removed/altered/destroyed then the necessary permit/s must be obtained from Amafa prior to the action recommended. f Only once the specialist gives the go-ahead can work commence in the area. g Under no circumstance may heritage material be destroyed or removed from the site h If remains are found that could potentially be human remains, then the SAPS must be informed 		
		2. It is recommended that the pipeline link be moved further away (south-westwards) from the Stead family cemetery and church to avoid impacting on the heritage resources that are of heritage significance and protected by sections 34 and 36 of the NHRA.	
		3. A proposed buffer area of 30m around the cemetery and church must be implemented. The 30 m buffer area must be barricaded off with highly visible danger tape or other method so that the buffer area is clearly visible to all construction personnel	
		4. Permanent fencing around the Stead family church and cemetery must be considered by the Applicant in order to ensure that operational activities such as maintenance and repair of the pipeline link does not impact on the heritage resources	

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	-	Local	High	Short-term	Likely	3
After mitigation	-	Local	Low	Short-term	Unlikely	1

Table 10: Impact Assessment: Crossing of Mapstone Dam

Environmental Feature	Cultural heritage
Relevant Alternatives & Activities	Potable Water Pipeline Route Options and Alternatives: Crossing of Mapstone Dam
Project life-cycle	Construction & operational phases
Potential Impact	Proposed Management Objectives / Mitigation Measures
<ul style="list-style-type: none"> Destruction or damage to cultural heritage sites including graves, buildings older than 60 years, etc. 	<ol style="list-style-type: none"> Once it is established which technique is to be used for crossing the dam, a heritage specialist must go to site prior to construction to assess the impact on the banks of the dam. During construction, if any heritage resources are found the following protocol must be followed: <ol style="list-style-type: none"> All work must stop in the vicinity of the find The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. Depending of what is found and the significance thereof, the specialist will advise on the way forward. If the resource needs to be removed/altered/destroyed, then the necessary permit/s must be obtained from Amafa prior to the action recommended Only once the specialist gives the go-ahead can work commence in the area Under no circumstance may heritage material be destroyed or removed from the site If remains are found that could potentially be human remains, then the SAPS must be informed

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	-	Local	Low	Short-term	Moderate	3
After mitigation	-	Local	Low	Short-term	Unlikely	1

Table 11: Impact assessment: Archaeology

Environmental Feature		Archaeological Sites and Artefacts	
Relevant Alternatives & Activities		WTWs, pipelines, etc	
Project life-cycle		Construction & operational phases	
Potential Impact		Proposed Management Objectives / Mitigation Measures	
<ul style="list-style-type: none"> • Destruction or damage to archaeological sites and artefacts 		<p>6. During construction, if any archaeological resources are found (chance finds) the following protocol must be followed:</p> <ul style="list-style-type: none"> a All work must stop in the vicinity of the find b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage c Amafa must be informed and a registered heritage specialist must be appointed to undertake an assessment of the find. d Depending of what is found and the significance thereof, the specialist will advise on the way forward. e If the resource needs to be removed/alterd/destroyed then the necessary permit/s must be obtained from Amafa f Only once the specialist gives the go-ahead can work commence in the area g Under no circumstance can archaeological material be destroyed or removed from the site h Should any remains be found that could potentially be human remains then the SAPS must be contacted 	

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	-	Not applicable	Not applicable	Not applicable	Unlikely	0
After mitigation	-	Not applicable	Not applicable	Not applicable	Unlikely	0

Table 12: Impact assessment: Palaeontology

Environmental Feature	Palaeontology	
Relevant Alternatives & Activities	Potable water component – WTW and pipelines	
Project life-cycle	Construction phase	
Potential Impact	Proposed Management Objectives / Mitigation Measures	
<ul style="list-style-type: none"> Destruction or damage to fossils unearthed during construction process 	<p>1. During construction, if any fossils are found (chance finds) the following protocol must be followed:</p> <p>a All work must stop in the vicinity of the find</p> <p>b The Contractor or ECO must be informed and the find barricaded off to prevent further interference or damage</p> <p>c Amafa must be informed and a registered palaeontologist must be appointed to undertake an assessment of the find.</p> <p>d Depending of what is found and the significance thereof, the specialist will advise on the way forward.</p> <p>e If the fossils found need to be removed, the necessary permit/s must be obtained from Amafa before removal takes place.</p> <p>f Only once the specialist gives the go-ahead can work commence in the area</p> <p>g Under no circumstance may fossils be destroyed or removed from the site</p>	

	+/- Impact	Extent	Magnitude	Duration	Probability	Significance
Before mitigation	- negative	Local	Medium	Short-term	Unlikely	3
After mitigation	-	Local	Low	Short-term	Remote	1

10. COMPARISON OF ALTERNATIVES

Table 13: Comparison of options – Water Treatment Works

Components	Alternatives	Order of preference 1 (most preferred) to 3 (least preferred)	Motivation
Water Treatment Works	1. Option 1	1	Area is heavily impacted by plantation of trees
	2. Option 2	3	Proposed area is less disturbed than Options 1 and 3
	3. Option 3	2	Area is heavily impacted by sugar cane farming; less preferred than 1 due to potential impact of pipeline link on protected heritage sites

Table 14: Comparison of options: Potable Water Pipeline Alignments

Components	Project Area	Alternatives	Order of preference 1 (most preferred) to 3 (least preferred)	Motivation
Potable water pipeline - Alignment	Western Area	Option 1	1	Much of the pipeline crosses disturbed areas; routing of the pipeline needs to be adjusted to avoid Stead family cemetery
		Option 1A	2	Crosses more undisturbed areas than Option 1 increasing risk of impacting unidentified heritage sites
		Option 1B	2	Crosses more undisturbed areas than Option 1 increasing risk of impacting unidentified heritage sites
	Central Area	Option 1	2	Very close to chicken houses
		Option 1C	1	Further from chicken houses
	Western Area	Option 1	3	Longest option; increased risk on heritage resources
		Option 1D	2	Longer than 1E hence increasing risk of impacts on heritage resources
		Option 1E	1	Straighter option, shorter distance reduces risks on heritage resources
		Option 1F	1	Very similar to 1E hence is also a preferred option

Table 15: Comparison of Options – Potable Water Pipeline Crossing of Mapstone Dam

Components	Alternatives	Order of preference 1 (most preferred) to 4 (least preferred)	Motivation
Potable water pipeline – Crossing of Mapstone Dam	Steel Suspension Bridge	3	A 20 metre allowance on either side of the dam is required which could lead to impacts on heritage resources
	Conventional Steel Pipe Bridge	2	Concrete piers have to be situated outside 1:100 year flood line therefore at least one pier per bank will need to be built on the banks of the dam (Fig. 65 of DEIAR)
	Pipe Supported on Concrete Piers	3	Concrete supports have to be situated 20 m apart; according to Fig. 67 of DEIAR, at least 3 concrete supports will be required on the western bank and one on the eastern bank
	Pipe Buried in Dam Basin	1	Limited impact on land especially if welding is done on surface of dam and pipe sunk to basin

11. CONCLUSION

The area in which the Potable Water component of the uMWP is proposed is, in most part, highly disturbed with various agricultural activities (sugar cane-, maize-, vegetables, timber, chicken farming), together with residential areas (Hopewell), existing roads, etc.

During the site visit several significant cultural heritage sites were discovered including the Baynesfield Estate (museum and other buildings) and the Stead family church and cemetery. Some sites are more directly affected by the proposed infrastructure than others but all have been indicated on the heritage sensitivity map. Recommendations / mitigation measures have been provided in the Tables 4 – 9 to avoid impacting on these sites.

In terms of the WTW's, Options 1 and 3 are preferred as the proposed location is highly impacted by plantations and sugar cane farming respectively. However the alignment of the pipeline link to WTW Option 3 is a concern due to its proximity to the Stead family church and cemetery and possible negative impacts associated with the construction of the pipeline.

Pipeline Route Option 1 is preferred to Options 1A and 1B as the two alternative alignments cross more undisturbed areas than Option 1; alternative Option 1C is preferred on the farm Hopewell as the alignment avoids impacting on chicken houses. Alternative 1D is preferred as it is more a more direct therefore shorter route than Option 1.

The pipeline link to WTW Option 2 runs close to a structure which is believed to be older than 60 years. The pipeline link also crosses large tracts of undeveloped land where unidentified heritage sites could be affected and is not a preferred WTW location nor pipeline link.

Although various archaeological sites occur in the greater Pietermaritzburg and Camperdown areas none were located on the footprint of the area in which the Potable Water component will be located.

According to the palaeo-sensitivity map produced by SAHRIS the area falls in the green area which means that there is a moderate risk of fossils occurring and a desktop study is required. There are no records of fossils from this region according to the desktop palaeontological assessment undertaken for this component of the project. Therefore, no further assessment is required for the potable water component because there are no records of fossils from the area.

If, however, fossil plants are discovered during any excavations, a professional palaeontologist must be called to rescue them.

From a heritage perspective, the project can proceed as long as the recommended mitigation measures are taken into account including the alteration of some pipeline routes to avoid impacting on sensitive heritage sites.

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